



# In Brief...

GAS PROCESSORS ASSOCIATION EUROPE

Vol 23 Issue 2

August 2007

## EUROPE ABOUT TO JOIN THE RANKS OF LNG EXPORTERS

The start-up of the Hammerfest LNG plant at Melkøya in northern Norway is now entering its final phase. Final testing of the gas liquefaction plant is presently underway before start-up.

Several tests are now being carried out before it can begin production of liquefied natural gas (LNG). With the aid of LNG supplied by ship, the pressure will be increased in parts of the facility. The pressure increase will take place incrementally in the carbon capture, gas dehydration and mercury removal systems and, finally, in the cooling system for LNG production. The wellstream from the Snøhvit field is now present in the pipeline as far as the slug catcher - the first treatment stage at the Melkøya plant.

The Snøhvit project realises Europe's first and world's northernmost export facility for liquefied natural gas (LNG) with production and landing of natural gas from the Snøhvit, Albatross and Askeladd fields in the Barents Sea. The gas flows to the receiving and processing plant on Melkøya island outside Hammerfest in northern Norway. The field development solution consists of remotely-operated subsea installations and pipeline transport to land via the world's longest multiphase pipeline (143km). CO<sub>2</sub> captured at the plant will be reinjected into the offshore Tubåsen sandstone formation, which is between 45 and 75 metres thick and lies somewhat deeper than the gas formations. Annual LNG shipments of 4.1 million tonnes will take place by special carriers to markets in Europe and the USA.

Source [www.statoil.com](http://www.statoil.com)

Sigbjørn Svenes



*Hammerfest LNG Plant Melkøya*

*Photo Courtesy of Statoil (Eiliv Leren)*



*"Arctic Princess" LNG Carrier*

*Photo Courtesy of Statoil*

# View from the Top

Looking back, it was a very good first half of 2007 for us and I see with great pleasure that the GPAE has strengthened its place within the Gas Processors community. Members are up since last year, and since the introduction of the new membership scheme we have now 11 premier corporate members.

'In Brief', as you have it in front of you, is once again a professional magazine with special thanks to Nick Amott, our Editor. Looking at the number of hits we count on our renewed website, I conclude that also our website is a great success, with special thanks to Don Cooney.

Our conferences remain our main means of sharing technical information as well as creating networking opportunities. Thanks to our programme committee and the efforts of Don Cooney, we have had two very successful conferences this year, one in Paris and one in Teeside, and I am sure that the people who were at the conferences agree with me. In spite of our busy schedules, which I am sure we are all suffering from, attendance of both conferences exceeded expectation.

In Paris the meeting was preceded with a knowledge session on molecular sieves by Peter Meyer and Franck Charrier of CECA SA Paris, and was very well attended. The knowledge sessions in general are a great success, aimed for the younger engineers among us. You may, however, have noticed with me that gas process engineers get grey younger and younger. I see this as a very positive side effect (and I do not mean the colour of the hair of course) of what we intended; apparently there is a need for refresher sessions for quite a number of seasoned process engineers. You can be sure that we will continue to organise very interesting knowledge sessions with the high quality that you can expect from us.

I attended the GPA Annual Conference in San Antonio in March of this year, where I chaired the session "worldwide developments". The Conference was once again a good one with generally good quality papers.

Technology and its advances have always been high on our agenda and they will remain there also in the future. But it is also my impression



*GPA Europe Chairman  
Ed Bras*

that we, as Gas Processors Association Europe, have given less attention to the drivers of technology. For instance, high-energy prices may open up remote developments that require novel technologies and the climate change discussion triggers the development of Carbon Dioxide based technologies. Our industry is very often reacting to societal/market forces and it is my belief that the GPAE could play an important role in putting our gas processing work in a wider context if we would focus also on those underlying trends. Most of us work in multi-disciplinary teams and you know what I mean. This could also create a spin off by attracting other disciplines related to gas processing to our conferences and make these events even more interesting. Mind you, we may find that many of these people were in the past gas-processors themselves.

Some of these possible themes that spring to mind are:

- Climate change discussion. Quite some years back the world decided to ban certain refrigerants that were very harmful to the environment. The discussion on climate change has been gaining momentum ever since. Certainly the ratification of the Kyoto agreement by a large number of countries triggered in many companies the formulation of policies on "Green House Gas Emissions". "The inconvenient Truth" of Al Gore and the "Live Earth" event on 07/07/07 are merely signs that society

wants a voice in the discussion. R&D efforts increased and new technologies are emerging as a consequence, and energy efficiency efforts are stepped up not only to increase profits, but also to make the facilities "greener". The current climate discussion takes the handling of GHG a step further and the capture of Carbon Dioxide is confronted, on a serious scale. This results in a series of very interesting technological solutions. Carbon Dioxide trading could again open up some novel (technological) solutions in places where one would not expect it.

- Sour gas reservoirs have been mentioned several times and I expect to see significant advancements in relation to dealing with very sour gasses. I am confident that novel technological solutions will emerge in this area in the near future.

- Emerging new players in the energy markets and existing players in new markets will also trigger technological developments that interest us gas processors. As an example I mention Russia, with its enormous gas reserves, where most of these reserves require development in a rather hostile environment, which will trigger some interesting advancements in Arctic technology. Also in the US, where a possible future shortage of gas triggers the development of LNG Terminal solutions, or perhaps new technologies aimed at reduction of energy consumption may be taken on. China and its enormous coal reserves will trigger developments in cleaner coal based technologies.

There is a huge number of other interesting areas, where developments take place that would certainly be worthwhile to discuss among us, e.g. safety, liberalisation of the gas markets, deep reservoirs, tar sands, Methane trapped on sea beds, etc.

It is my aspiration to put gas processing in a wider context, and if you have an idea that we could adopt, come and talk to me or anyone else from the management or programme committee. I would like to thank you all for your continued support of the GPAE and I look forward to meeting you at one of our conferences.

*Ed Bras (Chairman)  
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# Technical Meeting, Paris, France

After a fascinating Knowledge session the previous day, the following morning session kicked off with a paper presented by David Haynes, (co-author Antony Kane) from Advantica, entitled, *LNG Liquefaction Plant Design - The Implications of Gas Quality*. The paper focussed initially on the various LNG gas liquefaction plants and markets and how LNG liquefaction plant design was about matching gas turbines to the volume of LNG produced with gas treatment (quality) as a secondary concern and the performance/integration of the utility systems as an afterthought. The US and UK as LNG markets have been going through a re-emergence, especially focussing on the use of more difficult gases for use as liquefaction plant feedstock, which gives rise to a reassessment of the traditional approaches to LNG Plant design. Due to the very lean gas/LNG compositions allowed in the UK/US, there is a requirement for removal of several low level contaminants which can have a fundamental impact on the design of the liquefaction plant and even influence gas turbine selection. David's paper examined these issues and some of the possible solutions. There was a lively question and answer session following.

Next, Fluor's US team gave a presentation on *A New Integrated NGL Recovery / LNG Liquefaction Process* by John Y Mak, (Co-authors Dick Nielsen and Curt Graham). However, as John was recovering from an illness, Fluor UK's own Editor in Chief of In-Brief Magazine, Nick Amott, stepped into the hot-seat and acquitted himself with an excellent presentation on behalf of his American colleagues.

In the case of LNG import into N America and some European markets, the 'C2+' hydrocarbons have to be



*The Paris Conference Presenters and Chairmen*

removed to meet domestic pipeline gas heating value specifications.

In conventional LNG liquefaction plants, NGL recovery is typically limited to the removal of the heavier hydrocarbons to prevent freezing during the liquefaction processes and high ethane and propane recovery are not required. NGL recovery units are typically installed upstream of the LNG liquefaction plants as standalone units.

This paper presented an integrated NGL recovery/LNG liquefaction concept that is an alternative to the typical standalone NGL recovery plant that is included in an LNG liquefaction facility. The patented Fluor® CryoGas TCHAP (Twin Column High Pressure Absorption Process) NGL recovery process was demonstrated as ideal for integration with LNG liquefaction plants.

Nick went on to show that by comparing the Fluor CryoGas process to stand-alone plants, the Fluor integrated plant can reduce LNG liquefaction energy consumption by

about 9% (from some 355MW to 325MW) whilst the process can recover from 2% to 75% of the ethane in the feed gas and maintain 99%+ propane recovery. After stepping into the hot-seat, Nick's presentation was well received with a warm round of applause and some detailed questions focussing on the actual cost advantages of having an integrated plant (from a hardware viewpoint).

Next, Eric Demangel of CECA presented *LNG Storage Construction - Vibration Of Perlite And Reperliting* - and followed with one of the most fascinating presentations for a long time. Why? As it featured a 'film' of the whole exercise - which highlighted the dexterity, skill (and dangers) of actually performing the tasks being described.

Eric started by discussing some of the constructions of LNG tanks, their size (many engineers often do not realise the size of such tanks 80m diameter and 40m high), their designs and how they are insulated. Eric also mentioned some of the packing designs and limitations



*David Haynes*



*Nick Amott*



*Eric Demangel*

# Technical Meeting - Paris, France



*Eric takes us through the procedure*

when you are getting to the top of the tank wall, just under the 'roof'. The insulation of an LNG tank with expanded Perlite will be complete and effective only if the vibration associated with this filling is carried out carefully. Between the "abounded" state and the compacted state, the variation of density of the Perlite can be 40 to 50%. Under the action of its own weight, the Perlite in place takes a more or less stable arrangement and its density in the insulation space can vary. Therefore, after completion of filling the tank with insulation, a vibration of the bed of Perlite is required to stabilise it.

Eric discussed that CECA had developed its own processes of vibration and regularly revises and improves them where possible and in accordance with customer requests and the evolution of the technologies available. Eric then 'wowed' the

audience by playing a series of 'film clips' showing the:

- Installation of the perlite injectors
- Inerting of the perlite storage tank and the piping
- Injection of the perlite
- End of the refill
- Disassembling of the perlite injectors

After a short coffee break, the presentations continued with Michael Wilkes of ConocoPhillips presenting *Update on ConocoPhillips Optimized Cascade LNG Process*. Michael noted that during the last twelve months, four new units have come on stream using the ConocoPhillips Optimized Cascade LNG process. These units had been installed in the world's largest LNG liquefaction trains in operation, combining the lowest green field LNG facility capital cost, and the first LNG liquefaction facility to utilize aero-derivative gas turbines for primary drivers. The units are among the most thermal efficient LNG liquefaction facilities built to date.

Michael covered the recent developments in LNG liquefaction technology including LPG recovery integrated with LNG liquefaction (in a manner similar to Fluor's), standardization to lower unit costs, aero-derivative turbine experience, gas turbine power augmentation and flashing liquid expanders. Following the presentation, the questions flowed freely focussing on the new units being 'licenseable' and the next projects where ConocoPhillips are looking at implementing their Process. Michael highlighted that Conoco were going to larger and larger LNG trains such as those in Qatar, Nigeria and Asia Pacific.

Finally, the morning session was closed



*Session Chairman Paul Seccombe takes on Charles Aznavour!*

out by Shell Global Solutions' Andreas Knoll, who presented *Recent Start-Up Experiences With LNG Terminals - Altamira LNG Regas Terminal*. His presentation focussed primarily on Shell 'Flawless Start-up Initiative' (FSI) - a Company corporate strategy for all new or upgraded plants. Part of the FSI is to ensure the shortest time from commissioning and testing to 'Ready for Start Up' (RFSU). As a result, Andreas detailed the approach to cool down of the plant, the issues behind this process, the success factors and the lessons learned.

Although the concept of 'starting up' is to 'cool down' amused many of the attendees, Andreas led the audience through the technicalities of the process (import of cold LNG from a tanker moored at the jetty) and the durations (actual cool down was almost 48 hours from +25°C (ambient) to ~-160°C).



*Michael Wilkes*



*Andreas Knoll*



# Technical Meeting - Paris, France

Andreas then took us through the success and lessons learned factors. Simply, mechanical completion is only the very first step in the RFSU process and to 'Get it right first time' was absolutely imperative due to the implications of the process (time to cool down and begin to 'send out'), as well as factors such as a demurrage (tanker moored at the jetty for 8 days). Key to the Project was an Integrated Commissioning Team with each member focusing on a particular aspect of the FSI, namely: tightness, cleanliness, prototypes, testing, integrity, experience, etc. One of the items that caused SGS some problems was that of instrumentation being 'out of range' which prompted this Conference Chairman to ask the obvious question 'Why didn't you have a Control System Check and Operator Training System' where you could have done all the pretesting in a remote environment and definitely 'Get it right first time'!

*Paul Seccombe*

Suitably fortified by a three-course buffet lunch, the delegates returned to the conference at 2 o'clock. Unfortunately, Hedayat Omidvar from NIGC, Iran, was unable to attend the meeting. As a result, it was decided to run an uninterrupted four-paper session, with the coffee and cake break at the end, as a reward for the delegates' tenacity.

Steve Robertson, manager for oil and gas research activities at Douglas Westwood, kicked off the afternoon session giving a wide-ranging presentation, co-authored by Charles Conrad Uy, on *Trends and Developments in the LNG Sector*. Central to his theme was the growing,



*Steve Robertson*



## *Reviewing the morning's presentations*

market-driven demand for LNG, as domestic gas supplies in the large North American and European markets continue to decline.

Increasing energy demand in developing countries such as China and India is already underway, and is set to continue. One estimate expects world energy demand to increase 71% by 2030. Against this background has been the peak in crude oil production, which, by 2000, had already occurred in 52 countries, including the US and UK. "Peak Oil" is a controversial theory, and other estimates prefer a date later than 2030. Higher oil prices will, however, stimulate more offshore E&P activity, securing work in this sector.

What about natural gas? In 2003, 93% of gas was transported by pipeline. By 2025 this will fall to 69%, as LNG is expected to grow to 26% of all transported gas. Following LNG's humble beginnings in the 1960s, the last 5 years have seen a 42% increase in global LNG capacity from 132 million tonnes per year to 188 mmtpa in 2006. The main factors driving this growth are a continuing growth in world demand, strong import demand from gas poor countries, producers' desires to monetise their gas reserves, and more cost-effective means of producing LNG through improved technology. The importance of the expanding LNG carrier market was highlighted, with few shipyards capable of producing these expensive, complex ships, around 200 of which are currently in operation. The \$16.5 billion CAPEX associated with building the 65.8 mmtpa LNG capacity from 2002-06 (excluding upstream costs), will be dwarfed by the projected \$42.8 billion to be spent between 2007-

11 increasing the world LNG capacity, particularly in Africa and the Middle East. This will inevitably lead to a great deal of work for companies actively involved in designing and constructing LNG plants, LNG carriers and the import terminals.

The second paper, entitled *Cross Industry Partnerships in LNG* was given by GPAE stalwart, John Sheffield of John M Campbell and Co. LNG import terminals require energy to regasify the low temperature LNG to ambient temperature, prior to export via a gas pipeline. This energy is normally provided by seawater or by combustion of part of the gas, and in a few cases by the use of waste heat. Even more rarely, the cold energy present in the LNG is put to useful purpose, such as increasing gas turbine efficiency by cooling the inlet air. In a modern LNG terminal, with a capacity



*John Sheffield*

# Technical Session - Paris, France

of 10 Bcma, the cold energy is around 200 MW, which can be regarded as the heat that needs to be provided or the cooling potential which may have value to a 'partner' on the other side of the battery limit. Evidence from Japan, which has the greatest density and development of LNG terminals, indicates that once the LNG terminal is in operation, other industries move 'next door' to utilise some of this cold energy for their own business.

John reviewed many different options for more effective use of this 'cold' energy which have varied success in application. These include:

- Use the heated cooling water stream from a nearby power station, with a temperature around 20°C, to feed Open Rack Vaporisers.
- In India, it is proposed to pump glycol solution from a coal fired power station to the LNG terminal and cooled to -15°C in Shell & Tube Vaporisers.
- Fluxys have cleverly managed to adapt a Submerged Combustion Vaporiser as an exchanger to use a water flow heated by water heat from a turbine.
- Shell & Tube Vaporisers have been used in Puerto Rico to chill the inlet air to a power generating turbine, giving a 1% increase in efficiency for every 1°C reduction in temperature, an approach which works well in tropical locations.
- Several Japanese terminals have exported cold energy to frozen fish plants, ice rinks, ice makers, and C12 / C14 isotope separation units for medical use. These applications were all added after the LNG terminal was constructed, and all take only a fraction of the terminal's total cold duty.
- Air separation is another possibility.



*Justin Alexander*

However, the plant may be too large for the local market, unless nitrogen is used to ballast the NG to pipeline specification.

- Integration of LNG heating with power generation.
- Extraction of LPG from 'rich' LNG to make the grid specification, particularly in the US.

In summary, there are many potential opportunities for synergy between an LNG terminal and other local businesses, provided that both the terminal and a potential partner can operate independently of the other. Such grassroots schemes are difficult to conceive, except where there are already potential partners operating in the vicinity. There should be many future opportunities, but, no matter how elegant or innovative the engineering solution, a creative

commercial solution will be required before a project can be realised.

The third paper of the session, *A new 95% Ethane Recovery Process for LNG Receiving Terminals*, was presented by Justin Alexander from Fluor's Camberley office. The main author of the paper, John Mak (co-authors M Gilmartin & I Zhang), from Fluor's office in California, could not attend the meeting due to illness. When LNG is imported to the US and Europe, it must meet strict pipeline specifications for heating value. For example, typical North American pipeline heating value specifications range from 1000 to 1075 Btu/scf. Fluor's new Cryogas™ process has been conceived as a means of controlling the heating value of pipeline gas derived from imported LNG, with the production of ethane and LPG for sales. It utilizes the refrigeration in LNG for NGL fractionation and re-liquefaction of the resulting residue gas to form a lean LNG that meets all US pipeline specifications. The Cryogas LNG conditioning unit can recover over 95% of the ethane and 99% of the propane in the LNG, and can operate in either an ethane recovery or an ethane rejection mode.

The development of the LNG "spot" market, where terminals can now receive cargoes from many different sources in the LNG world, with widely varying heating values, will need to be supported by a Btu conditioning facility. There are two methods for controlling the heating value of pipeline gas derived from imported LNG. In one dilution option, higher heating value gas from LNG re-gasification is blended with a lower heating value natural gas. Dilution with nitrogen is another option. However, this requires a dedicated source of nitrogen, and the amount which can be added may be limited by Wobbe Index considerations. The second method for controlling heating value is to extract C<sub>2</sub>+ hydrocarbons from natural gas, but would require high power consumption. The Cryogas process, specifically developed for LNG receiving terminals, is a non turbo-expander based process that can achieve high NGL recovery with significantly less power consumption. The total power consumption for the LNG conditioning unit for a 2,000 MMscfd re-gasification terminal is about 3 to 4 MW. The total heating requirement for the LNG regasification / Btu conditioning facility is the same, with or without the LNG conditioning unit in operation.



*Those tough questions from the floor*



# Technical Meeting - Paris, France



*Brian Songhurst*

The final paper was presented by Brian Songhurst, of e+p (Energy and Power) consultants, on the subject: *Floating LNG - are we ready to leap the final hurdle?* Brian neatly pre-empted his presentation with his first slide, an image of a barge-based LNG plant taken in Louisiana in 1967! The history

of the floating LNG concept is not new, having been around for 35 years. However, despite many studies, nothing has so far moved into FEED. Real progress was made when, in 2005, the "Sanha" SBM FPSO began operations offshore Angola. With an LPG storage capacity of 135,000m<sup>3</sup> and a daily processing capacity of 6,000m<sup>3</sup>, the Sanha is the largest LPG hull ever built and the first floating production facility built to combine all LPG processing and export functions onboard the same unit.

So far, the floating LNG project studies have attempted too much, inasmuch as they had too many features, too many unit operations, sometimes deepwater-capable, and are thus onshore LNG plants put onto a floating platform. However, the LNG industry has a risk-averse culture, and so far the major producers have decided that they can get a better return on their investment, at a lower risk, from an onshore LNG development. Brian outlined the following as factors in developing this approach:

- Critical to success will be the selection of the right liquefaction

process. For offshore applications, a simple, robust process will be advantageous, even at the expense of capacity and efficiency.

- Optimising space is essential.
- The availability of cooling water to reduce the need for fin-fans.
- Smallest plant footprint possible.
- Modular onshore construction.

Most concepts to date have combined the process, support platform and LNG storage in one structure, to which the shuttle tanker docks. An alternative would be to have a separate LNG storage module. Such a concept would work best in shallower water with lower wave heights. Offshore West Africa would therefore make a good location for the first FLNG. Such a project, with a capacity of 1 mmtpa, LNG, would cost around \$700 million, and could be built in 3+ years, using a generic liquefaction process. So who will build the first FLNG? The right company would focus on marginal offshore gas fields, would accept risks and be nimble and non-prescriptive, open minded, and have a strong "can-do" culture. Brian assured us that such companies do exist! *Justin Hearn*

# Knowledge Session - Paris, France

The Knowledge Session entitled *Molecular Sieves in Gas Processing*, was presented by CECA SA. The session was well attended by approximately 70 engineers, and preceded the Technical Conference on "LNG and Associated Gas Treating". The Knowledge Session was split into two parts. The first part, presented by Peter Meyer, provided a technical overview of molecular sieves and their application to gas processing. The second part, presented by Franck Charrier, provided guidance on increasing the lifetime of molecular sieves.



*Peter Meyer & Franck Charrier of CECA*

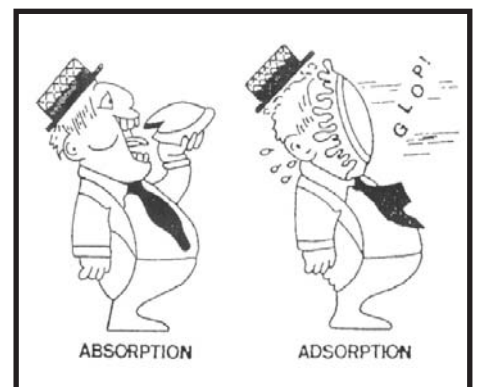
In his overview of molecular sieves, Peter described the types of molecular sieves available and explained how molecular sieves are produced. Peter also explained which molecules are adsorbed by which molecular sieves. The application of molecular sieves to gas processing was then discussed, and general design recommendations were shared. The application of molecular sieves was then demonstrated using two case studies, the first being a debottlenecking study, followed by a study that investigated the influence of regeneration pressure.

Franck followed on from Peter by covering design rules to be followed to help ensure a long life for the molecular sieve. These rules included important design criteria such as the fluid velocity through the bed and the setting of the adsorption time per cycle. Franck went on to share guidelines for operating molecular sieve units, with particular attention paid to careful operation of the unit, especially with regards to the

feed composition (eg avoiding liquid carry-over and monitoring for poisons) and maintaining stable operating conditions. Franck finished off by emphasising the importance of regularly monitoring the performance of molecular sieve units.

The Knowledge Session ended with a question and answer session. Peter and Franck knowledgeably answered the many questions, usefully allowing the audience to learn more from the presenters' experience.

*Justin Alexander*



*CECA's alternative explanation of the difference between Absorption and Adsorption*

# Spring Conference - Teesside, UK

The morning session kicked off with Jonathan Pickering of Apix Consulting Ltd presenting a paper on how px Limited, a power generation gas processing operation and maintenance operator, embarked on a behavioural safety scheme in 2006 to develop safety as a core value within its business. The group includes approximately 150 employees working in operations and maintenance at the px plants of Teesside Power Station, Grangetown, and Teesside Gas Processing Plant, Seal Sands, both near Middlesbrough.

The 'behavioural safety' approach was chosen after accident rates had decreased through improved systems, technical controls and training but was then seen to plateau. Apix Consulting and px Limited embarked on the scheme in 2006 after the key elements to designing an effective behavioural programme were considered. The paper identified the 6 key elements or "Core values", on which the programme was based, namely 1) Top management commitment 2) Middle management involvement 3) Safety performance focused supervisors 4) Employee involvement and active participation 5) Positive perception of safety systems by the workforce 6) Constant review of working practices. The paper and subsequent debate reinforced the message that the lowest standards managers and supervisors exhibit is the highest standard they can expect from their staff - negative behaviours are far more damaging than positive behaviours are helpful.



Jonathan Pickering



Chairmen and Presenters at the Teesside Conference

The second paper of the session, presented by Brian Hudson of ABB Engineering Services, described *Risk Based Maintenance - An extension to Risk Based Inspection (RBI)*. It explained how assessing, understanding and managing risk is now a key part of any maintenance policy, strategy or decision-making process. Risk assessment is often an integral process in satisfying legislation, achieves world-class performance benchmarks, or at least can be seen to be following best practice. Applying risk management techniques to the inspection of pressure systems (RBI) provides numerous and well-documented success stories. However, the application of RBI principles to other equipment, such as rotating machinery, electrical, instrument,

control and civil engineering assets is less common, and less well documented.

The paper showed a number of examples and case studies of how a top-down approach, using focused qualitative and semi-quantitative assessment models can rapidly build a picture of risk (likelihood and consequences), review current mitigation (management of the risk), and identify immediate actions that can be taken to improve risk management and increase reliability. This approach gives faster assessments than a detailed bottom-up approach and yields easier understanding throughout the organization and quicker implementation. An interesting case study on a group of gas processing plants in SE Asia, built between 1984 and 2006, showed how the top down approach (site risks, then unit risks then operations, and so on to the necessary level of detail), revealed the key criticality of common flare and blowdown systems.

Brian described how the technique could be used for new plants, using typical / historic data to pre-define training needs, spares policy, maintenance policy and contracts and routines. The debate following the paper showed consensus that maintenance considerations are rarely given enough consideration during design.

Dr Peter Stockwell of PS Analytical Ltd (PSA) stepped in at short notice to present the third paper of the session, after the paper "Lessons Learned



Brian Hudson



# Spring Conference - Teesside, UK



*Peter Stockwell*

from the Texas City Incident”, had to be withdrawn by BP. Peter's paper was entitled *The Use of Atomic Fluorescence (AFS) for Mercury Determination in the Petrochemical Industry*.

The question “Why Measure Hg in Natural Gas?” was answered with reference to the explosion in Algeria caused by mercury attack on an aluminium heat exchanger, about 7 or 8 other serious mercury-related problems since, the danger posed to catalysts and the environmental / health issues posed by mercury's toxicity. Some of the problems with accurately analyzing for mercury were discussed and PSA's Sir Gallahad AFS system was introduced as a proven dependable method down to 0.1ng/m<sup>3</sup> for offline and online measurement. The paper went on to look at the equipment needed for on-line measurement, including the automatic sampling system to explosion-proof standards, multistream sampling and auto-calibration. The difficulties in getting a precise mercury mass balance were discussed, due to factors such as sample variation, speciation (and changes in speciation with time) and mercury plating out on metal surfaces. Nevertheless the PSA system has been proven on natural gas, condensate, naphtha and Syngas and a case study was used to show how accurate analysis quantified a mercury problem and subsequently proved that the PURASPEC absorbent system installed solved the problem.

Continuing the analytical theme, Paul Stockwell of IMA Limited, described how the *Tunable Diode Laser (TDL)*



*Paul Stockwell*

system to monitor water vapour, carbon dioxide and hydrogen sulphide is providing higher on-line accuracy, lower maintenance, and resistance to contamination. It is the first technique to monitor the gas itself, rather than monitoring a reaction or a change on the surface of a sensor hence combining accuracy with improved speed of response. The principle depends on the excitation of the water molecules at a specific wavelength with concentration determined by the level of light energy absorbed by that vibration. The paper described how TDL Absorption Spectroscopy only takes a few seconds to adjust to new low moisture levels in contrast to traditional systems that can take 6 - 8 hours before the system settles.

The SpectraSensors TDL analyser was launched 7 years ago and is



*Lee Robins*

currently being used on critical measurement in the natural gas and nuclear power industry. The paper illustrated the progress made with this non-contact method in natural gas applications, including increased path length systems to measure down to 1 ppm, and gave details of why moisture measurement is important to help avoid internal corrosion and blockages arising from hydrate formation. The explosion at Carlsbad New Mexico in August 2000, when a 49' section of a 30" pipeline was ejected, killing 20 people, graphically illustrated the effect of internal corrosion in an underground pipeline. The results of field trials were also presented showing how the technology compares with other techniques.

In the final paper of the session by Lee Robins of Tracerco, *On-Line*



*Time for coffee and a chat*



# Spring Conference - Teesside, UK



*Don Cooney asks 'Who stole the cakes?'*

*Tracerco Diagnostics™ Process Investigation Techniques in the Oil and Gas Industry*, Lee described the use of various non-intrusive diagnostic techniques, based on radioisotope scanning and tracing technology. The techniques effectively allow us to 'look' through vessel and pipe walls and provide the operator with accurate on-line knowledge of process conditions and the integrity of internals. They are ideal for troubleshooting purposes, and as a method of gaining accurate information prior to a planned shutdown.

Low level gamma-rays are used for on line non-intrusive investigations because they pass through material, such as steel and process fluids, and are attenuated by that material directly in proportion to its density and thickness. By measuring the relative attenuation of the transmitted gamma rays, accurate information can be inferred on the material that they have passed through. The range of radioisotope techniques use either Sealed Source Scanning techniques



*Sib Akhtar*

or Unsealed (injected) Tracing techniques and both were illustrated using results from recent diagnostic projects.

Sealed sources can be used to scan vessels and pipelines to identify such things as integrity of internals, levels and interfaces, scale and hydrate build-up, distillation column problems, liquid distribution in packed beds, slugging and other process anomalies. Unsealed radioisotope tracers, which can be in the form of gas, liquid or solid can be injected into a process on line. The tracer will follow the process material, and can be monitored by sensitive radiation detectors placed externally on vessels and pipelines. Flow rates and residence times (hence potential bypassing) can be measured. Also exchanger and valve leaks and flow mal-distribution in vessels can be identified.

Very little preparation is needed on site to carry out these services, for example there is no need to remove lagging from vessels or pipelines, and results are available immediately. As a rapid-response troubleshooting technique, mobilization on-shore or offshore can be within a couple of days for most locations in the world, although the techniques also prove their value for planned pre-turnaround studies which can allow more accurate and detailed planning for critical path repair work.

*Matthew Humphrys*

Following an excellent lunch where delegates were able to catch up with old acquaintances as well as making many new ones, all returned to the conference room re-energised after being fed and watered to hear the five papers which made up the afternoon session.

The opening paper was by Dr Sib Akhtar of MSE Consultants, entitled



*Conference setting*

*Determining the Real Performance of Centrifugal Compressors Operating in Oil and Gas Facilities*. This paper drew on Sib's own experiences, within a career spanning more than 30 years, to help explain the reasons behind low performance of centrifugal compressors operating within production facilities when compared to their original designs. By presenting real case studies, Sib was able to highlight that internal leakage was one of the main causes for the unexpected loss of performance. Typically a factory test is at low pressure where leaks are considered negligible; however a field test is conducted at normal operating conditions where leakage rates can be substantial. This paper concluded that field testing required a different methodology to factory testing and that the concept of "volumetric efficiency" adapted from piston compressors could prove useful to overcome the issue of leakage and offer more comparable efficiencies. Although this type of performance disparity is not a new



*Rachel McKenna*



# Spring Conference - Teesside, UK

phenomenon, with the current climate of high fuel prices driving plants to run at maximum capacities, it certainly warrants much closer attention.

The next paper, *'Cradle to Grave' in Action - Sulphur and Mercury Removal at BP CATS Facility*, was given by Rachel McKenna of Johnson Matthey Catalysts. This paper dealt with the PURASPEC fixed bed technology which has been used for removal of these contaminants from natural gas to meet the National Transmission System (NTS) specifications. The unit discussed was based at the Seal Sands Terminal in Teesside which receives up to 1.6 BSCFD of natural gas from 7 offshore fields via the Central Area Transmission System (CATS). One of the most interesting aspects of the paper discussed by Rachel was the close working relationship fostered between the two parties. This created improvements in product performance, operational safety, reliability and environmental impact which not only benefited this partnership but the gas processing industry as a whole. This approach, which is known as the "cradle to grave" philosophy, looks beyond merely supplying the absorbent, it looks at the complete life cycle in order to continuously improve the overall product package.

Following the theme of gas specifications for the NTS system, Grant Johnson of Costain Oil, Gas & Process, presented a paper co-authored with Adrian Finn and Terry Tomlinson entitled *Gas Conditioning for Gas Storage Installations*. Grant highlighted that this topic is becoming more and more

important as increasing quantities of gas will need to be imported into the UK to accommodate the rising demand as our own stocks diminish. Estimates show that by 2020 up to 90% of our gas supplies may need to be imported and presently we only have storage capacity for 4% of annual consumption, which may not be sufficient to cope with peak demand. The use of depleted hydrocarbon reservoirs or purpose-built salt caverns as possible solutions to this problem were discussed; however this type of storage does have drawbacks with the presence of water and heavier hydrocarbons leading to the gas being off specification. The paper addressed this by giving an unbiased and concise overview of the available technologies for meeting the required water and hydrocarbon dew points, letting the audience form their own conclusions.

After a small pause for coffee the session concluded with two interesting and informative papers describing the gas facilities we were to visit the following morning. The first paper, *Teesside Gas Port - A New Way to Deliver Re-Gasified LNG*, was presented by John Baldwin of Excelebrate Energy. This presentation first dealt with their development of the "Energy Bridge" LNG regasification and delivery system which uses purpose-built LNG tankers for the transportation and vaporization of LNG through specially designed offshore receiving facilities. A key feature of the tanker's design was its flexibility to discharge its cargo via three different systems, including a high pressure manifold to allow delivery directly into a gas pipeline.

The second half of the presentation focused on the development of the Teesside Gas Port which is the world's first dockside regasified LNG receiving facility and is capable of receiving 600 MMCFD of gas. This plant also includes pressure control and nitrogen blending facilities to ensure that virtually any LNG received can be stabilized to meet NTS specifications. Despite all the hurdles involved in developing and integrating this new technology, the facility was brought on line in just twelve months, which is quite an achievement. The terminal has already received its first cargo and is sure to become an integral part of the NTS in years to come.

Seamlessly following on from this talk was a presentation dealing with *The Teesside Gas Production Plant (TGPP)* given by facility manager Stewart Mortlock who has 15 years' experience at the site. Stewart gave a concise overview of how the two train plant can process up to 800 MMCFD of natural gas from the North Sea via the Central Area Transmission System (CATS), which is approximately 10% of the total UK gas supply. As the natural gas feed, which is in the dense phase at approximately 110 bar, is unsuitable for our transmission system, this facility processes the gas to remove the water and natural gas liquids to ensure the correct specification is met. These liquids, which amount to 600,000 tonnes per year, are separated into propane, butane and condensate and sent to liquid storage. Aside from the NTS, this facility also supplies the Teesside Power Station and a number of industrial customers to help ensure that demand is always met.

*Stuart Ball*



**Grant Johnson**



**John Baldwin**



**Stewart Mortlock**

# Site Visit - Teesside

About 40 eager engineers entered the two buses taking them to see the PX operated assets in the industrial area of Seal Sands by the River Tees. The tour covered the GasPort LNG import facility, the Teesside Gas Processing Plant (TGPP) and the Rolls-Royce Trent Viking Power Plant.

The GasPort may have looked the least impressive LNG receiving terminal ever seen, but the concept is exciting due to its simplicity, enabling LNG import virtually anywhere where deepwater port facilities and a nearby gas distribution network are available. The concept is based on Excelerate Energy's Energy Bridge™ fully self-contained LNG tankers where regasification takes place on board the ship. The Teesside GasPort is operated by PX on behalf of Excelerate Energy, receiving its first (and so far only) cargo in February 2007. The onshore facilities consists of a single high pressure (un)loading arm to receive the LNG already regasified onboard, along with the required emergency release couplings and mooring systems installed on the former crude jetty. The main part of the plant is the gas metering and blending station where fiscal metering is performed and gas quality is controlled and maintained

before entering the UK grid. Nitrogen from a nearby BOC Ltd plant is used for blending.

Across the River Tees PX also operates the Teesside Gas Processing Plant. During our visit, one of the two 400 MMSCF/d process trains were shut down for scheduled maintenance. The TGPP is processing gas from the dense phase Central Area Transmission System (CATS) to ensure natural gas quality suitable as feed to the 1875MW Teesside Power Station, or for general distribution in the national transportation system. The two processing trains, engineered by Costain, both produce liquid propane, butane and condensate, and the plant operating philosophy is to maximize liquid production. With the flare system made up of two enclosed ground flares, the plant landmarks are the fractionation columns. The first process train is based on gas expansion by Joule-Thompson valves and is the primary source for the Teesside Power Station while the newer second process train uses an expander/brake compressor scheme to optimize the energy consumption and liquid production. Processing around 10% of the UK gas consumption, regular deliveries are a key performance indicator for PX, and plant design

and operating procedures ensured the flexibility of delivering natural gas to any customer from each processing train.

The third stop of this tour, well orchestrated by PX, was the Viking Power Plant situated just across the parking lot for the TGPP. The Viking Power Plant is owned by Rolls-Royce and consists of a 50 MW Trent gas generator/turbine set with power generation. PX is operation and maintenance manager of this peak load power plant which is on call based on half-hourly nominations in the power market. The power sales are run by Rolls-Royce Power Ventures while PX performs any on-site daily operations and maintenance. The system is set up to be supervised from the TGPP control room while control can be taken either from the power plant local control room or from Rolls-Royce themselves. Although the Viking Power Plant is on standby for half-hourly power nominations, it is never run for less than two hours when called upon and typically runs for 5 000 hr/year. Finally, GPA Europe wishes to express its thanks to PX for receiving us and preparing a programme and lunch package well received by the participants.

*Sigbjørn Svenes*



*Excelerate Teesside GasPort*



*The PX Gas System*

*Photo courtesy PX*



## Companions' Tour - Teesside

Woollies, waterproofs and walking shoes; we were braced for a day out in the North York Moors! Fortunately none of the aforementioned was needed.

An hour's drive from Yarm, and first stop, was a visit to Riveaulx Abbey. Today the setting of the Abbey is peaceful and inviting, but in 1131, when a group of French Cistercian monks were despatched to find a suitable site on which to build a new community, things were very different. However, this was just the sort of challenge on which they thrived. Enough remains of all the buildings to give a clear impression of what monastic life was like all those centuries ago.... They had our deepest sympathy and our thoughts turned to lunch.

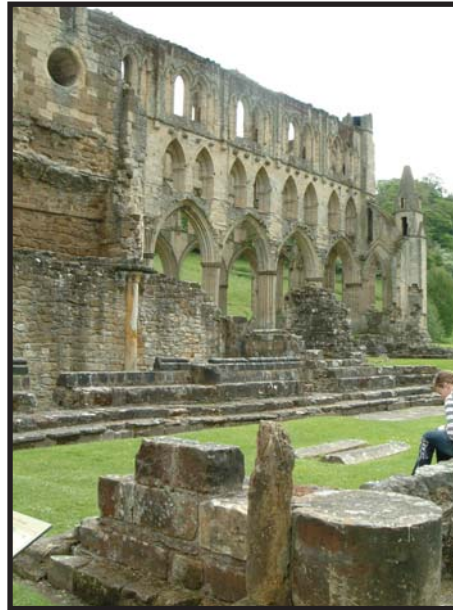
Not far from the market town of Helmsley we headed for The Star Inn, Harome, a Michelin starred gastro pub. We wondered momentarily what might be on the lunch menu back at Tall Trees but after feasting our eyes on the menu at The Star Inn, decided it was definitely the best place to be. We were not disappointed and left with a "twinkle" in our eyes.

In the afternoon we journeyed on over the North Yorkshire Moors admiring the dramatic scenery and chatting about everything from gardening to grandchildren before starting our descent down into Whitby. We headed for the harbour and the beach before diving into a Tea House for a proper pot of tea.

Day Trippers Yeah! *Wendy Cooney*



*Transport to the Hotel from Whitby!*



*Views of Riveaulx Abbey*

## Dinner

The Conference Dinner took place away from the Tall Trees Hotel, where the attendees had been "captive" all day. The Crathorne Hall Hotel, our dinner venue, is approached via a long drive, past meadows and under arches of oak trees. It is one of Yorkshire's finest country houses and was privately owned until 1977. The house has played host over the years to royalty, lords and ladies and diplomats; in fact HM The Queen Mother, Sir Winston Churchill and Harold McMillan (the RT Honourable Earl of Stockton OM. PC) have all been guests over the years. It was now the turn of GPA Europe Conference Delegates to join this veritable list of dignitaries. The weather was very kind to us, sunny, albeit a little on the chilly side, but this was North Yorkshire! Welcome drinks were taken on the front lawn, taking in beautiful views of the Leven Valley, the River Leven and the Yorkshire Moors.

We tried to give our overseas guests a typical tasting of British Fare and on the menu was Pimms as the welcome drink, fish from Whitby as the starter and roast sirloin of Yorkshire beef with Yorkshire pudding as the main course. The comment was made (by a very recent past Chairman from Norway, no prizes for guessing who) that he always thought that puddings should be eaten with a spoon and not a knife and fork and this may have caused a little confusion to other overseas guests as well. However, as they say, the proof of the pudding is in the eating and when the photographs were taken after the main course all the plates were clean. Guests obviously wanted their conventional "pudding".

Our sincere thanks go to Johnson Mathey who contributed sponsorship towards the Conference Dinner and also to our other sponsors, ABB Engineering Services, for the Welcome Reception, Apex Consulting for the Conference Binders and px (TGPP) who sponsored the buses used on the site visit.

*Don Cooney*



# GPAE Golf Tournament - Eaglescliffe Golf Course

The gods smiled on us for once and provided glorious sunshine for the first GPA GOLF OPEN for four years. Numbers were a little low, but nonetheless the eight participants assembled in a variety of dress, (did someone really play in black wedding shoes?) eager to compete once again.

Colin Woodward (retired) sported a mere 4-coloured shirt this time, a sign of mellowing in old age. Following a light lunch of Teesside ale and sarnies, we ventured out. The course was a pleasure to play: interesting, difficult in places, impossible in others and beautifully kept. Some of those with manual trolleys promised to save up for the motorised version as soon as possible, as the sun and long course took their toll.

Rhys Jones of Aspentech presented the winner's trophy to Steve Murray of Atkins, who managed a commendable 32 Stapleford points. 2nd was Brian Marshall (26) and 3rd Colin Woodward (25). Steve's comment on winning the trophy for the 4th time centred more around how he was going to get the cut glass bowl home in one piece rather than crowning glory! Hope it made it, Steve.

The longest drive on the 14th was won by Brian Marshall sporting only a modest 3 iron, outriving those with titanium faced, computer designed Big Berthas by some 15 yards (see, it does work if you hit the sweet spot). Colin Woodward took the nearest the pin on the 17th, stopping just 12 yards from the flag. Further Teesside water was consumed sitting in the sun before we all returned to the conference hotel for the welcome drink.



*The 2007 Golf Tour*



*Rhys Jones, of tournament sponsor Aspentech, presents the winners with their prizes. From L to R - Overall Winner Steve Murray, Colin Woodward, Nearest Pin and Brian Marshall, Longest Drive.*

Our thanks to Aspentech, who once again were sponsoring the tournament, providing the catering and prizes for the players. We will hold the tournament again next year as we will be in the London area for

our May meeting, so a special venue will be arranged as it's our 25th Anniversary. We look forward to seeing you then.

*Brian Marshall*

## OBITUARY

### Yahia Abul-Ela



It is with much sadness that we inform you of the passing of Yahia Abul-Ela.

Yahia was a partner in Barela International, a corporate member company of the GPA, and representatives of Mafi-Trench turbo-expanders in the UK and Western Europe.

Barela Intl. became members of the GPA 18 months ago and Yahia was a

strong supporter of our seminars and conferences.

Yahia will be missed by many members and our condolences go to his wife and family.

*Geoff Barrow, Colleague*

*The photograph to the left shows Yahia with Christine Etherington and Ron Coultrup at the recent Paris Conference.*



## Call for Papers

### Papers are invited for GPA Europe's future meetings for 2008

February: Amsterdam, Holland  
May: S E England, UK  
September: Paris, France  
November: London, UK

Offers, abstracts, papers and other details should be sent to the Programme Committee Chairman:

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Petrofac Engineering Ltd  
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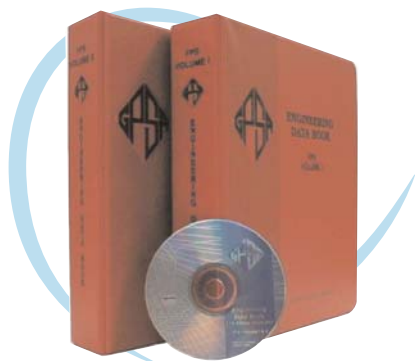
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Taminco is all about amines. The production and marketing of amines and derived molecules are the core business of the company. The true meaning behind the company name (The AMINE Company) synthesizes its strategy: striving to become the most dedicated player in the field of amines and derivatives its 3 business units comprise: Methylamines & Derivatives, Life Sciences and Higher Amines & Specialties

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CD-adapco is a leading global CAE enterprise providing a full spectrum of computationally-based engineering solutions. Its core product is the technology-leading CFD software, STAR-CD. However, the scope of activities extends beyond CFD software development to encompass a wide range of CAE engineering services in CFD and FEA, and the transfer of technology via expert systems. Main locations are in New York, London and Yokohama. providing local CFD software support, training and CFD/CAE consultancy and engineering services.

#### DtEC Site Services Ltd

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#### M. S. E. (Consultants) Ltd, Carshalton, UK

MSE (Consultants) Ltd is an independent engineering consultancy serving operators and contractors in the oil and gas industries. Services include feasibility studies as well as conceptual and engineering design. They advise on the modification of existing infrastructures and their integration with new processing equipment. To complement their technical capabilities, MSE also has the expertise to assess projects in the wider commercial, financial and corporate context.

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Purvin & Gertz is an international energy consulting firm providing services to the crude oil, petroleum refining, natural gas, LPG, NGL and power generation industries. Founded in 1947 they provide consulting services which include business analysis, strategic planning, merger and acquisition assistance and third-party services including independent engineering services for project finance, business and facility valuations, litigation and insurance support. They offer multi-client studies and subscription services for analysis of short-term and long-range trends in supply, demand, trade, prices and margins in all aspects of the energy business.

#### QuantityWare, Bruschal, Germany

QuantityWare's founders all have extensive previous experience in the field of consulting in the mySAP ERP market. Together, they can call on almost forty years of experience working within SAP R/3 systems environments. The main areas of expertise gathered within the company are centred on technical basis, technical programming and applications programming (from R/2 onwards) in mySAP ERP systems environments. Team members have been involved with the design, programming and delivery of the mySAP Oil & Gas product, as well the product's technical implementation at many sites around the globe.

#### Twister BV, Rijswijk, The Netherlands

Twister BV offers innovative gas processing solutions for the global gas processing industry which can play an essential role in meeting many challenges. Delivering innovative gas processing modules based on Twister™ technology, which do not require chemicals, have no emissions to the environment, do not use rotating equipment, significantly reduce size and weight of gas processing modules, enable innovative low cost substructures, enable unmanned operation thereby improving personnel safety resulting in both capital and operating cost savings in the order of 25% of the total project cost.

#### Vetco Aibel, Bergen, Norway

Vetco Aibel is a leading provider of services, products and technologies to the global upstream oil and gas industry. A multicultural company with over 100 years of experience in core business areas and more than 7000 employees and with a reputation for innovation, flexibility and operational efficiency, their dedication to meeting customers' needs is matched only by an equal commitment to integrity, safety and environmental sustainability.

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## FORTHCOMING EVENTS

**September 26th - 28th 2007**  
**BONN Germany - Residential**  
**GPA Europe Annual Conference and Dinner**  
**Sessions on Techno / Commercial Issues, SIL Assessment, GTL Technologies and CO2 Capture**  
**Site visit to Siemens Facility, Duisberg**

**November 22nd 2007**  
**London, UK - Non Residential**  
**Knowledge Session, AGM and Technical Meeting**  
**Sessions on Major Hazard Evaluation and HSE Issues**

**February 20th-21st 2008**  
**Amsterdam, The Netherlands - Residential**  
**Knowledge Session, Technical Conference and Dinner**  
**Sessions on Early Production Facilities and Gas Treating**

**May 14th - 16th 2008**  
**SE England - Residential**  
**Technical Conference and Dinner**  
**Sessions on LNG Issues**  
**Site Visit to Isle of Grain**  
**Possible Annual Golf Tournament (to be arranged)**

**September 24th - 26th 2008**  
**PARIS, France - Residential**  
**GPA Europe 25<sup>th</sup> Annual Conference and Dinner**  
**Next 25 Years of Gas Processing**  
**Where are we going?**  
**Keynote Speeches by top Industry Personnel, Q & A and Technical Sessions**

**November 22nd 2008**  
**London, UK - Non Residential**  
**Knowledge Session, AGM and Technical Meeting**

**For more details on all of these events, please visit our website**

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# GPA EUROPE

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This listing of current Corporate Members represents the status as at July 2007. All companies are UK based unless otherwise stated. In addition to this there are nearly 200 Individual Members.

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