In Brief...
GAS PROCESSORS ASSOCIATION EUROPE
Vol 27 Issue 2 August 2011

GPA Europe at GasTech 2011

GasTech is a major international Conference and Exhibition which this year held its 25th event in Amsterdam. GPA Europe was invited by the organisers, dmg::events, to arrange a workshop session to illustrate the activities of European gas companies in the business and technology arena and to demonstrate the skills and experience available to the industry. Our scope was to organise a day of technical presentations as part of a themed event, designated: *Centre of Technical Excellence* (CoTE).

By participating in GasTech, GPAE were also afforded the opportunity to have an exhibition booth to specifically present the activities of the Association to those attending the exhibition. The Management Committee enthusiastically supported this opportunity, seeing it as a positive way to raise the profile of the Association by having a platform at a major event. The Programme Committee quickly drew up a plan to cover all aspects of the industry and a selection of 12 papers was made, each one being presented by one of our members.

So it was in late March that Anne and Sandy once more loaded up their car and set off for Amsterdam for the second time this year, having only just returned from our February conference. They arrived in good time to set up the booth and ensure that all those on the ManCom who had volunteered their services knew when and where to appear to take their part in representing the Association.

It was a great surprise to find that the designated venue for the CoTE events was an unscreened area in the corner of the main exhibition hall. It became clear, during the first two days, that there were a lot of distractions and many of the other companies organising events were having difficulties securing an audience.

So it was with some trepidation that Sandy, Justin Hearn and John Sheffield opened the GPAE contribution on Wednesday, the third day. But the seats soon filled up and our presenters lived up to their formidable reputation and the audience stayed. Even after lunch the people returned and the seats filled up again, with several people looking over the barriers. By 4 pm, when Adrian Finn drew the workshop to a close, it was clear that GPA Europe had scored a major success. More than 100 people had attended the event during the day and the organisers, dmg::events, were well satisfied with the contribution from the GPAE team.

John Sheffield welcomes the delegates

Anne and Sandy in the booth, also had a successful time and several new members signed up to join us and many more expressed interest in the range of services available through membership of GPA Europe. This has encouraged ManCom to support participating in the 26th GasTech event to be held in London in October 2012. The timing of this major event will require us to reschedule our Annual Conference to May 2012 and cancel an event in September. The perceived success of this event has also caused us to evaluate other ways in which we might be able to raise our profile. But more of that later!

John Sheffield

Standing room only at GasTech 2011 in Amsterdam

View from the Top

OPPORTUNITY OUT OF ADVERSITY?

On 11th March 2011 the world woke up to the news that Japan had been hit by a devastating earthquake. Measuring 9.0 on the Richter scale, it toppled buildings and created havoc in the countryside of Honshu Island. To compound the destruction, a tsunami, caused by the shifting of the tectonic plates, then swept ashore and destroyed many coastal towns and villages in the north-east of the country.

The tsunami destroyed the power supply to the cooling pumps circulating water through the core of the Fukushima nuclear power plant. Pictures of explosions in the reactor housing and venting of radioactive steam were broadcast all around the world, eliciting old memories of Three-Mile Island and Chernobyl.

These events could not have occurred at a worse time for governments around the world. Politicians in many countries have accepted that the current uncontrolled burning of hydrocarbon fossil fuels is unsustainable and environmentally damaging.

GPA Chairman David Weeks

Legislation to reduce carbon emissions has been introduced within the EU and in other countries and there is growing public acceptance that global warming is a real problem that must be tackled to secure the future.

As the single largest industrial contributor to CO_2 emissions, the power generation sector has become the initial and prime target on the road to de-carbonised economies. As older coal-fired power stations are earmarked for retirement, a policy keystone for many countries was acceptance of the need for, and the re-emergence of, nuclear power into the future energy mix.

Events at Fukushima may cause a rethink of the nuclear power direction by governments under pressure from vocal and adverse public opinion. So, how might the power gap caused by the retirement of aging coal-fired power plants be bridged if nuclear power is off the agenda?

Gas!!

One industry's misfortune is another's opportunity.

Through the courage, tenacity and determination of its population, Japan will surely rebuild itself and its economy better and stronger than before. Whether the nuclear rebuild proves as resilient remains to be seen.

David Weeks, M W Kellogg Ltd

Academic Membership Drive

GPA Europe is always keen to attract engineers who are only just joining the industry, and where better to start than making contact with students whilst they are still at University? These people are the future of gas processing in Europe and their new blood will revitalise the GPA Europe. We would like to publicise the gas industry and expose students, those involved in post-graduate research and their lecturers, to the GPA Europe.

Currently GPA Europe offers Academic membership at the very attractive price of £100 per year to institutions of this type, but the take-up has not been as strong as we would have liked. This is partly due to the transient nature of academic life, but GPA Europe is keen to enhance this membership area by interesting the more permanent staff of academic institutions in taking on membership. A clear benefit for such members is the access to valuable papers and members' discounted rates for attendance at conferences, where academics and students can make contact and expand their network of professionals in the Natural Gas Processing Industry.

So this is where we need your help. We are trying to build up a list of the best people to contact within Universities and Colleges. We will then approach them to take up academic membership.

If you are a representative of an academic institution in Europe, or you know of such individuals, please contact Sandy Dunlop at the GPA Europe Administration Office with details and we will be in a position to discuss the benefits and advantages of taking up Academic membership. Please email admin@gpaeurope.com or phone +44 (0) 1252 625 542.

New Young Professionals Group

GPA Europe is planning to create a special Young Professionals group.

The aim of this group is to give young professionals (in the first 10 years of their career) networking opportunities with other professionals in the gas processing industry. It also provides a platform for young professionals to attend and participate in the highly sought after GPAE conferences.

The Group is created by young professionals for young professionals. It aims to create a yearly event that contains a strong technical training course chosen by the group as well as networking sessions as part of a wider GPAE event. The idea is to provide a series of lectures or a tailored training course that suits young professionals dealing with the gas processing industry. The training element of the event will specifically appeal to graduate engineers as it will offer a great opportunity to further enhance technical competencies and aid with professional accreditation.

Please do join the GPAE Young professionals groups in both Facebook and Linkedin and start making the 2012 event your event.

http://www.facebook.com/groups?/GPAEYP?ap=1

http://www.linkedin.com/groups?/GPAE-Young-Professionals-3979?072?gid=3979072&trk=hb_side_g

For Further information please get in touch with Soufyane Teffahi (teffs0@bp.com) or through Facebook and Linked-in URLs above. Further Contact points and information will appear on the GPAE website over the next few months and more information will be announced at the GPAE Annual Conference in Prague on 21 - 23 September 2011.

Remember, if you are a Young professional in the Gas Processing industry, this is your opportunity to influence the future of Gas Processing in Europe.

GPA Europe Technical Conference, Amsterdam

The first GPAE conference of 2011 kicked off with a meeting in Amsterdam to review subjects of great importance for the ongoing integrity of gas processing plants: Operations, Maintenance, Reliability and Safety. It was with great pleasure that the morning session opened with a presentation by Jannes Regterschot of Shell Global Solutions International B.V. entitled *A journey towards Operational Excellence*. The presentation introduced Shell's approach to Global Asset Management Excellence, which they term GAME, and how it applies in Gas processing plants.

The presentation introduced Gas-GAME in the context of aligning and improving the relationship between People, Processes and Tools and ensuring these are aligned across locations through the use of tools, systems and procedures. He introduced the interrelationship between the Shell control framework, management systems, HSSE standards and AIPS (Asset Integrity & Process Safety) which is documented in manuals. To help the audience to understand, he used an illustration comparing an aircraft with an LNG facility, reviewing the comparable roles and tasks in each. AIPS is implemented through the 11 modules of Gas-GAME using acronyms, some of which are broadly familiar. It is clear that Shell believes the structured approach to implementing these is key to achieving "GAME" and Jannes then took us through some examples in greater detail. One he focussed on out of the 11 modules is ESP (Ensure Safe Production), ensuring that we know the safe limits of the plant and operate within them at all times.

Jannes Regterschot

Tom Milne

Tom Milne of Petrofac gave a very topical presentation, *Gulf of Mexico Major Hazard Assurance Review Using the Bowtie Methodology.* Regulation is requiring us to implement ALARP, whereby Major Accident Hazard Risks must be demonstrated to be As Low As Reasonably Practical, but how can this be measured to ensure compliance and convince the regulator? Tom took us through some of the famous safety incidents of recent years and summarised the offshore regulations applied in the UKCS for Major Accident Hazards. As an interesting aside, Tom, based on his experience in the coal industry, gave us the origins of the term ALARP before quickly taking us back to the methodology which is the "bowtie" approach. Using some worked examples we began to get a better informed "feel" for probabilities and the relationships between threats and consequences via prevention barriers, identification of the top event and mitigations. Petrofac demonstrated the impressive tools they have in working this through to a credible case for the regulator. All the talk of "Swiss Cheese" took us to the coffee break with its own selection of Dutch savouries and coffee.

Due to a change in the afternoon session Chairman, (thanks Brian for taking over at short notice) our conference sponsor, ABB, was able to switch papers so that Brian Hudson could present without having to introduce himself! Brian's paper, *Managing Integrity & Reliability on Ageing Assets Onshore/Offshore,* took us through a structured and holistic methodology to support the extension of asset life beyond the original facility design life.

Brian Hudson

In the UK and world-wide, the issue of extending design life beyond the nominal 20 or 25 years that we are familiar with is an exponentially increasing problem, and whilst the nuclear industry has a high profile in this respect, the Oil & Gas Industry assets must also be subject to a similar rigour. Brian took us through ABB's approach to formalising the vulnerabilities and Process Safety risks. Issues such as corrosion, equipment obsolescence, and changes in equipment duties, fluid properties and production profiles with time need to be reviewed. The paper then discussed the approaches

Dave Weeks rouses the troops

GPA Europe Technical Conference, Amsterdam

of regulating bodies including Norway and the UK and how they approach this topic. The UK Health and Safety Executive under their Key Programmes (KP) initiatives are introducing KP4 which addresses ageing and life extension, so this overview was of acute benefit to many in the audience. Brian closed out his presentation with a worked case study example for a North Sea installation which had been in operation for 25 years and an extension for a further 30 years was being sought.

Next up was Lee Robins of Tracerco who presented *The use of On-line Scanning and Tracer Technology to Diagnose Operating Problems in Separators, Scrubbers and Contactor Vessels*. One of Tracerco's technologies is the application of non-intrusive diagnostic techniques based on radioisotope scanning and tracers. Put simply, this technology allows you to "look inside" equipment such as vessels, pipes and towers to "see/visualise" what is going on. This is clearly a very valuable trouble shooting asset in understanding performance issues such that measures to resolve the problems can be conceived. Lee gave some test case examples from a separator, a TEG contactor and a turbo expander inlet scrubber. These examples, along with comprehensive pictorial back-up, helped us all to recognise the potential benefits in plant operation.

The final paper of the morning was presented by Neil Wragg of GL Noble Denton and entitled *OPTAGON™: Pushing the Boundaries - Can RAM Modelling techniques be applied to more complex operations?* The short form of the paper, in answer to Neil's question posed in the title, is - Yes! However, he kindly took us through a primer on RAM and why it is needed along with the causes of early failure of systems/equipment. OPTAGON™ was then introduced as their Monte Carlo simulation tool used in RAM analysis. The meat of the presentation though was around applying RAM techniques to more complex operations, in this case an unsteady state, cyclical process. The case in point was, of course, very pertinent to our industry, being an underground nitrogen storage facility to support LNG ballasting. The cyclical nature of the process was explained in some detail before applying the RAM technique. OPTAGON™ was used as a high fidelity tool which captured the true varying (cyclical) unavailability rather than a false average unavailability which a less sophisticated tool would yield. In particular the impact of low frequency - high impact equipment failures such as a compressor train were reviewed and the complexities of the impact revealed.

With the conclusion of the morning session, the meeting adjourned for lunch. Again we would like to thank Brian Hudson for stepping into the breach at the last moment as the afternoon session Chairman.

Nick Amott

Speakers and Chairs

Lee Robins

Neil Wragg

The afternoon session opened with a paper by Jim Tonge of Centrica Storage Ltd, where he described *The Challenges of Underground Gas Storage from an operator's perspective* as faced and responded to in the changes of the Rough Field and Easington terminal into a Storage and Export Facility. This covered not only the need to satisfy rapidly fluctuating customer needs, often on a daily basis, but also the need to develop the case to support further investment. In addition he emphasised the importance of getting the basics right, not only in terms of operational performance but also for managing ageing assets at optimum levels and maintaining a culture aligned to high performance with people competency development.

GPA Europe Technical Conference, Amsterdam

Jim Tonge

Tim Shaw

Chris Flower

Paul Stockwell

The second paper was presented by Chris Flower of ABB: *Process Safety Assurance of onshore & offshore Gas Processing*. This addressed the issues associated with managing and achieving Process Safety Assurance on gas plants globally. He presented a comprehensive overview of the methodology requirements to achieve assurance. Through case reviews of four recent assurance studies, he demonstrated the pitfalls and consequences of failing to address the issues through the project process and the ensuing difficulties presented for retrospective verification.

The third paper, by Tim Shaw of Costain Energy and Process, co-author Robert Beresford, reviewed *The Buncefield Enquiry Findings and Costain's Approach to Best Practice in Integrity Level Assessment*. This reviewed the findings of the Buncefield Incident and related these to best practice in Integrity Level Assessment in line with IEC 61508 and IEC 61511. Tim gave an excellent summary of the IEC 61511 process, covering SIL (Safety Integrity Levels), Risk Graphs and LoPA (Layers of Protection Analysis).He described the Costain Life Cycle approach and described its advantages in terms of reduced time, effort, repetition and regulatory compliance.

The afternoon was brought to a close by a paper presented by Paul Stockwell of IMA Ltd, *Improving Process Efficiency by Better Measurement*. He opened by reviewing the impact of measurement accuracy in reducing wastage and increasing productivity through improved reliability, emphasising the relationship between improved operator confidence in the measurements and the ability to run the process nearer to acceptable limits. He reviewed the technology comparing the performance of probes with TDL based systems, (Tunable Diode Laser; *you can tell this was a technical presentation: Ed*) demonstrating the clear benefits of the TDL based systems. He reviewed the issues and solutions associated with measuring water vapour in CO_2, Hydrogen Sulphide in Natural Gas and Oil in Water, finishing with a review of the practical issues in achieving accurate measurement including materials and software improvements.

Brian Hudson

Knowledge Session, Amsterdam

Application of Coalescing and Filtration for the Protection of Critical Process Equipment

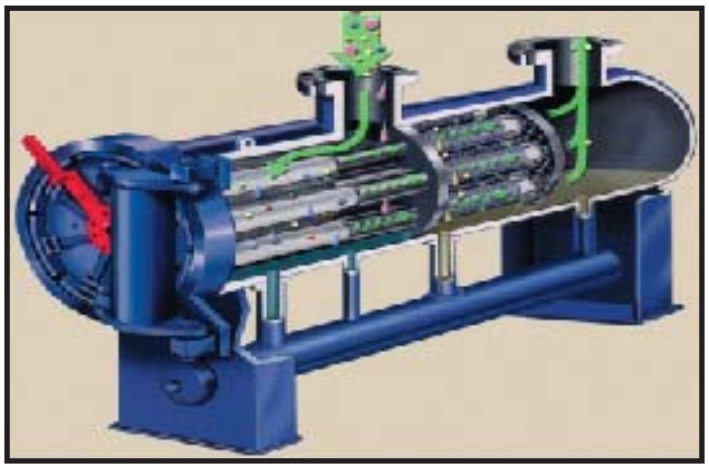
To complement the Operations, Maintenance and Reliability theme of the February Conference, the Friday morning session was an informative and practical Knowledge Session on Coalescing and Filtration given by PecoFacet. This was presented by Allen Walker, Vice President for Global Capital Sales from the PecoFacet Houston office and Martin Copp, Business Development Manager, Europe, Middle East and Africa.

The session opened with a refresher on the basics of filtration sieving, impaction and diffusion and how these are used within various types of filter media to remove the smallest particles, less than 1.5 micron. It was explained that 99.5% removal efficiency of 0.3 micron is difficult to achieve as this diameter falls below what can be achieved with sieving and impaction and above that where particles can be removed by diffusion. A wide particle size distribution is difficult as this will block a screen quickly. These issues have led to the development of a range of element types and multiple filtration stages within a unit. These are best tailored to the contaminant properties.

Allen Walker

Martin Copp

Knowledge Session, Amsterdam



The design and operation of the PecoFacet Gemini Coalescer for liquid droplet and solids removal from a gas stream was explained and later demonstrated. Applications include main line transmission, processing, storage, fuel gas, NOx reduction and compressor discharge.

By suitable choice of the filter elements, these coalescers can handle pipeline liquids, low surface tension liquids, fouling, sticky and critical service. However, there are always aspects to watch when specifying a filtration service that may affect performance. Examples include: (1) Avoid having the gas near the dewpoint when entering a filter since the pressure drop may cause additional liquids to condense; (2) Solids and liquids often occur in slugs, not continuously; (3) Chemicals used in pipelines can adversely affect coalescing ability due to build up of surfactants; (4) Black Powder is shear sensitive (will shatter on hitting barrier) (5) Select the filter media for iron sulphides to minimise fire some will just smoke/smoulder, others will flame.

An overview of the technologies used in a wide range of filtration services was then discussed and illustrated with examples including:

- Gas Filtration - Removal of Bulk Liquids; Solids; Solids and Liquids and Mists
- Liquid Filtration Technology
- Removal of Solids from Liquids
- Removal of Liquids from Liquids
- Adsorption of Dissolved Chemicals from Liquids

Having outlined the various filtration and coalescing methods, it is apparent that to make an adequate selection, it is necessary to know what you need to remove. For new designs, this can only be based on previous experience. For troubleshooting existing plant operations, PecoFacet use isokinetic sampling and laser particle size analysis as tools to identify contaminants present and correct removal technology to be employed. These methods were described and photographs of the PecoFacet portable test facilities were included in the presentation.

The Knowledge Session presentation was concluded with a series of case studies illustrating how by correct analysis and identification of the problem, suitable filtration / coalescing equipment could be specified and installed at the correct location thus increasing the efficiency, operating lifetime and reliability of plant. One example given was of contamination of Molecular Sieve Beds when a new field was brought on-line resulting in continuous regeneration of the system. By installation of a new filter / coalescer vessel to capture the hydrocarbon aerosols, bed performance returned to normal for a capital cost of some 60% of the bed replacement cost.

In plant design it is important to consider both the capital and operating cost of correctly designed filtration equipment. A poor design will impact operations efficiency and possibly affect safety by increasing the frequency of breaking hydrocarbon containment.

The highlight of the Knowledge Session was the practical demonstration of the working model of the PecoFacet Filter / Coalescer vessel. With water and air and the improvised assistance of a hotel vacuum cleaner, the model adequately illustrated where the liquids went on passing through the vessel.

The GPA would like to thank Allen Walker and Martin Copp and PecoFacet for this interesting and informative Knowledge Session. The presentation is available for GPA members on the GPA Europe Website, www.gpaeurope.com and contains some excellent photographs in the section on Case Studies of 'contaminants' found in processing facilities.

Lorraine Fitzwater

Martin Copp explains the Filter Coalescer Model

So that's how it works!

Gastech Centre of Technical Excellence (CoTE)

GPA Europe had been invited by the organisers of GasTech to present a workshop on Gas Processing. This was introduced by John Sheffield, who welcomed the audience and outlined the role of GPA Europe. The morning session was chaired by Justin Hearn and the afternoon session by Adrian Finn.

The first paper was by David Haynes (GL Noble Denton) whose paper, T*he role of LNG in Europe's Gas Supply,* traced the history of natural gas consumption in Europe and showed how the demand has grown dramatically in recent years. For many years now Europe has been dependant on natural gas supplied by pipeline from some local indigenous sources but principally from Russia and the North Sea. Now both the local on-shore and North Sea are in decline and whilst the recent push to develop new sources from shale gas reserves will go some way to fill the gap, with the growth in demand the 'hole' to be filled grows ever larger. There is also the issue of security of supply and the wish of many consumers to have several potential secure sources of gas. Is this a developing opportunity for LNG imports from many sources in the Atlantic Basin and Middle East to fill the supply gap? The past 10 years have seen the development of many LNG import terminals by gas suppliers, gas distributors and merchant operators. The paper reviewed these developments and looked to the potential future opportunities and initiatives.

There followed a paper presented by Martin Mayer of CB&I which looked at the *Challenges of building South America's first LNG Liquefaction Facility*. It was on 18th June 2010 that the first LNG cargo was shipped from the Peru LNG facility at Pampa Melchorita, South America's first LNG Liquefaction plant designed and constructed by CB&I at the lowest cost of any LNG export facility of its era. The presentation highlighted some of the challenges of constructing Peru's largest ever industrial project, including the impact of the remote location on labour supply, logistics and the need to create a totally self-sufficient facility and addressed the particular challenges posed by the unique characteristics of the jobsite including the site elevation and high seismicity.

The LNG Session was brought to a close with a paper from David Healey of APCI, which reviewed the *LNG Liquefaction Technologies from peak shaving to the largest base load plants*. Air Products provides technologies for small LNG plants ranging in size from 100 tonnes/day, through 1000 tonnes/day, up to the largest base load LNG plants of 22,000+ tonnes/day capacity. The technologies used employ Nitrogen (N_2) recycle refrigeration, Single Mixed Refrigerant (SMR), Precooled Mixed Refrigerant (C3MR or HFCMR), Dual Mixed Refrigerant (DMR) and the largest capacity APX™ cycles. The paper described the selection of the technology appropriate to individual applications with respect to capital and operating costs and compared the process efficiencies of the technologies. He described the work on FLNG applications and selection of appropriate technology and process equipment selection for the technologies with regard to heat transfer and refrigeration machinery.

John Hargreaves of Production Services Network (PSN) opened the

David Haynes

Martin Mayer

David Healey

Gastech Centre of Technical Excellence (CoTE)

John Hargreaves

second session with a paper dealing with *Carbon Capture, the Second Tranche* which defines the Commercial and Regulatory drivers. The challenges associated with carbon sequestration and managing the increased gas concentration in the associated gas during continued EOR production were illustrated with reference to recent projects. He posed the question 'where next?' as the Government has developed a sponsorship competition and there is European money now available. Additionally, there are tax exemption schemes and financial encouragement in the form of the updates to the ETS due out in 2013 and there is new legislation on CCS acreage passed through parliament recently. The technical challenges still remain but there are more players and interested parties.

The next paper, presented by Tim Snyder, Smart Signal Corporation, looked at *Predictive Analytics* to drive the effectiveness of condition monitoring so as to improve the availability of gas processing plant. The paper described the predictive analytics modelling philosophy around rotor dynamics, thermodynamics and heat transfer.

Several case studies showed the work processes of event detection, diagnostics, collaboration and information consolidation. The extension of predictive analytics is predictive diagnostics which combines detection with the context of how equipment operates. Equipment operators can extend run times and maintenance intervals by using predictive analytics as a foundation. The observations, diagnoses and feedback will then roll up into a total asset management system and bridge major gaps that occur in many reliability programmes. Predictive diagnostic methodologies enable equipment owners to extend run times and to decrease maintenance with confidence.

The morning session was brought to a close with a paper on *Gas/Liquid Separators* presented by Dmitry Siminov, Sulzer ChemTech. He noted that the rapid development in the gas industry during recent years has meant that designers and manufacturers of gas/liquid separators face an increasing challenge to meet performance requirements.Existing generic, industry standard design methods for gas/liquid separators often do not meet these new requirements, particularly in the large new gas fields which are located in the Arctic regions. Production and transportation of large gas volumes in severe climatic conditions require the application of state-of-the-art, compact, high efficiency equipment, and is particularly important on offshore platforms. Considering gas production processes it is evident that low temperature separation units are applied more and more instead of conventional glycol dehydration units. Efficiency of separation equipment will have a significant influence on operational stability as well as the costs of gas production and subsequent transport to market from the North. The paper showed industrial experience in solving different separation problems in Russia. The result of tests on new separation devices was presented including some at high pressure conditions in a natural gas system.

Frank Vergunst

The afternoon session was opened with a paper entitled *Sweet Energy from Sour Gas* presented by Frank Vergunst of Frames Gas Processing. He noted the importance of removing acid gas components before transportation to the final customer to minimise the potential for excessive corrosion in piping and equipment resulting in huge operational costs. Furthermore sour gas can cause emission problems during the treatment of gas related to the environment. Sour gas adds stress to the total integrated system and thus puts heavy strain on sustainable value. Many of the current sweetening processes are large, expensive and require frequent servicing. He described the Vitrisol process developed by Frames in partnership with Procedé that is 100% selective for H_2S removal, even in very high concentrations. The resultant level of H_2S in the gas is 1ppm and the product is elemental sulphur.

Tim Snyder

Dmitry Siminov

Gastech Centre of Technical Excellence (CoTE)

Maria Barrio

Continuing on the theme of acid gas removal, Maria Barrio of SINTEF presented a paper entitled *Acid Gas Removal without the damaging effect on the Environment in Off-shore Applications*. Recent statistics from World Energy Outlook show that about 43% of the remaining natural gas resources contain CO_2 and H_2S. Acid gas removal is necessary in order to reach sales gas specifications. The most widely used technologies are currently based on the use of physical and/or chemical absorption processes. The chemicals used for these processes are in many cases classified RED according to the Norwegian offshore classification of chemicals and need to be phased out. In addition, the energy requirements for regeneration are large. Membranes are used in some cases, but their separation performance is not optimal and they are often not suited for offshore applications because of a large footprint. The objective of the project "A GREEN SEA" is to identify, mature and evaluate new technologies and concepts for acid gas removal avoiding CO_2 emissions to air and avoiding the use of harming chemicals. The research project started in June 2009 with four oil & gas companies as partners and is focused on defining the requirements and evaluating alternatives. The current status of the work was presented.

The final paper in the session was presented by Gauthier Perdu of Prosernat and presented *Solutions for the Treatment of Highly Sour Gases*. An amine based process is the most common technology being used for the removal of acid gas components. The costs, both CAPEX and OPEX, related to these processes increase significantly with the content of the acid gases to be removed, mainly because of increased solvent circulation. Solutions have been developed in order to mitigate these cost increases.

Within the family of amine based processes, these solutions include solvent selection, improved/tailor made process configuration and use of high solvent loading. Many of these solutions have been experienced over the years, with the AdvAmine™, amine based process technologies. Nevertheless for the treatment of natural gases containing very high amounts of acid gases (several tens mol%), alternative technologies have been developed. The Sprex™ process is an illustration of such alternative technology.

This has been developed jointly by Total, IFP Energies Nouvelles and Prosernat, initially for the pre-treatment of natural gases containing high H_2S amounts and more recently also for gases containing high amounts of CO_2, in a modified process configuration. Economic studies presented in the paper show that a combined use of Sprex with amine based processes can result in significant cost savings, when compared with amine based treatment only. *John Sheffield*

Ron Subris, Technology Manager UOP, presented *Integrated Pretreatment Systems for Hg, Acid Gas & H_2O Removal for FLNG*. Gas pretreatment for LNG includes removal of Hg, acid gas and water and

Gauthier Perdu

Ron Subris

UOP has widespread experience in applying technologies for removal of these contaminants. FLNG presents some new challenges when compared to onshore plants, with greater focus on plot size and weight, a premium on reliability and the need to cater for vessel movement, all leading to alternative process solutions to those encountered onshore. Examples included the use of semi-permeable membranes for bulk removal of carbon dioxide upstream of physical solvent (Selexol) to reduce the carbon dioxide level sufficiently for LNG (with amine as an alternative for lower carbon dioxide partial pressure). Membranes are more tolerant to motion effects and this approach reduces thermal energy duty at the expense of higher power consumption. Use of molecular sieve adsorption to remove carbon dioxide (as well as dehydrate the gas) was discussed for carbon dioxide levels up to 2%. This avoids having a solvent system, but energy loads for thermal regeneration of molecular sieve are high for large gas flows.

Peter Meyer, Business Development Manager CECA, presented *Mercaptans Removal with Molecular Sieve – Options and Reality*. Removal of mercaptans by molecular sieve was shown to be a well-established technology (by examples) but as alternative adsorbents are optimal for different species there are opportunities for process optimisation. Typical mercaptan removal schemes for propane and butane products from NGL fractionation were discussed and compared with gas phase removal. Mixed beds of two or three adsorbents were highlighted, especially for

Gastech Centre of Technical Excellence (CoTE)

Peter Meyer

combined dehydration and removal of heavier mercaptans. Denser sieve provides increased mass for a given volume and therefore greater adsorption capacity, longer cycle times and smaller equipment for thermal regeneration. It can be especially effective in retrofits and debottlenecking. Features of good plant design were noted such as regeneration gas treatment and regeneration temperature optimisation with examples of modern, robust designs.

The final presentation of the day was by Burkard Schlange, Manager Power, Shell Upstream International on *Gas as Destination Fuel; Future CCS for Gas Power* (co-authors Wilfried Maas and Yasaman Mirfendereski). Using natural gas for power generation rather than coal reduces CO_2 emissions by half but carbon capture is still essential to meet agreed climate change emissions reduction targets. A technoeconomic evaluation was presented on CCS for natural gas-fired combined cycle gas turbines (CCGT) based on using amine solvent technology for carbon capture. The challenges due to low carbon dioxide partial pressure, high oxygen content (leading to solvent degradation and corrosion), integration of capture plant with the power plant and utilities integration were all discussed. Analyses of Levelised Cost Of Electricity (LCOE) and capture costs (US$/ton CO_2) were presented for natural gas and coal (both with and without CCS), nuclear and wind showing the attractiveness of a natural gas CCGT with CCS (Source UK DECC, Mott McDonald). The need for prompt deployment of CCS demonstration projects (to validate and quantify key elements of the technology) was noted and opportunities for potential cost reduction were highlighted.

Adrian Finn

Burkard Schlange

Best Paper 2010

GPA Europe has great pleasure is announcing the Best paper award for 2010 to Christian Streicher for his paper presented at the November AGM/Technical session. The paper, entitled *Development of Technologies for CO_2 Capture from Flue Gases,* was very strong technically, and presented innovation and research results in Christian's inimitable style on behalf of Prosernat and IFP. Christian has the opportunity to present his paper at the US GPA annual Convention. Congratulations Christian.

2011 Annual General Meeting and Technical Meeting 24 November - London

Call for Papers

The 2011 Annual General Meeting and Technical Meeting will be held at the Marriott Hotel, Marble Arch, London, on 24 November 2011.

In addition to the AGM for the Gas Processors Association, Europe, the day will include a Knowledge Session in the morning and a series of themed papers for the Technical Meeting after the AGM in the afternoon.

The theme for this year's Technical Meeting is

"COMPACT GAS PROCESSING TECHNOLOGIES"

This can imply either very small scale or compact equipment where the process is intensified. The scope also includes conversion processes as well as physical processing at low temperature. It is recognised that at small capacity the implications of heat in-leak to low temperature processes, or other factors, which in large plants would have little effect, can in small plants considerably impact the overall efficiency. However, with the advent of smaller gas fields, offshore processing and a general need to intensify processing will make such design challenges more significant in the future.

Offers of papers considering all aspects of this subject are sought, including a Knowledge Session which will discuss in some detail appropriate aspects of design for small capacity.

Please send your offers to the GPA Europe Administration Office before 31 July 2011 including Title of the Paper, a short abstract (100 words maximum) and the names of the author and presenter. Submissions should be sent to:

Sandy Dunlop, Executive Administrator, GPA Europe
admin@gpaeurope.com Fax: +44 (0) 1252 786 260

Gastech 2011 - An Overview

Justin and David welcome visitors to the stand

This is the first time that GPA Europe has taken part in a trade fair as an exhibitor, and I think I can confidently confirm that it was an excellent, though tiring, effort which enabled GPA Europe to increase its exposure to the Gas Processing population of Europe.

In 2010, Don Cooney had been approached by dmg::events, the organisers of the GasTech Conference and Exhibition to support an innovative development to present papers free within the GasTech exhibition area as well as in the Conference proper. These "Centres of Technical Excellence" (CoTE) would run throughout the four days of the Exhibition and GPA Europe was to be given the opportunity to select and manage the presentation of as many papers as we wanted during a day within a theatre style area of the Exhibition. In exchange for the work involved, GPA Europe was provided with a shell scheme exhibition area where we could bring the benefits of the GPA Europe to attendees at the Exhibition.

I've been involved in lots of exhibitions over the years, but in the past all I had to do was turn up and speak to people on the stand. I am in awe of those hundreds of people in all sorts of organisations who have to design, develop, order and plan the set -up of the stand and then manage the attendance at the stand to get the best out of the facility. In our case all this was added to the issues of setting up and managing the papers and presenters for the CoTE.

However, everything having been prepared, Anne and I set off from Disley with a car full of In Briefs, posters and advertising literature and drove through the Channel Tunnel to Amsterdam to arrive the day before the Exhibition set-up to prepare for the week. Exhibition set-up is a very busy time the day or so before the Exhibition opens when hundreds of stands are being built, cranes and cherry-pickers are rolling around the floor, tradesmen are hurriedly completing major stands and exhibitors are unpacking demonstrations and equipment - not the safest of environments and you have to be on your toes to watch out for pick-up trucks coming from all directions. However, by the middle of the afternoon of 20 March we were ready to roll on the Monday morning.

Exhibiting is a bit like war without the bullets and gore - 90% boredom and 10% mad panic speaking to visitors, describing the GPA Europe and our activities to people who had never heard of the Association and interesting them in membership, attendance at conferences and presenting papers. Whilst Anne and I were on the stand most of the time, I must express sincere thanks to those volunteers who came along and helped us out by speaking to visitors and generally ensuring that the stand was occupied at all times, in particular, David Weeks, Justin Hearn, Matthew Humphrys, Loic Barthe and if I have missed anyone who helped, please forgive me and accept our thanks. It was particularly important to have help on 23 March while the papers were being presented in the CoTE - as reviewed already.

By Thursday afternoon, however, the visitor numbers had dropped to a trickle and we were able to pack up slightly earlier and managed to clear our gear out of the show area before the break-down crews arrived for the big stands. This was important as it saved us being trapped within the show area for an hour or so as riggers took down high level equipment!

GasTech was over for another year and we'd had a very successful week. I do not think there were many people visiting the stand who did not have a real interest in what the GPA Europe was all about. We have secured at least three or four new members directly as a result of exhibiting and we have been able to raise the profile of the GPA Europe within our industry. Will we do it again? Yes I think so, and managing it will be easier in future as we learned lots of lessons, but it is hard work although ultimately a successful use of our time.

Sandy Dunlop

I'm sure this is where I put the spare key!

GPAE Conference May 2011, Copenhagen

The morning session was kicked off by Rick Peters from Cameron Process Systems' Houston office. His paper, *The key to a successful membrane project – the right pre-treatment system*, co-authored by Ankur Jariwala, focused on the design of pre-treatment systems for membranes, as many contaminants commonly found in natural gas can significantly degrade their performance.

Membranes are gaining wider industry acceptance for the bulk removal of CO_2 from natural gases. Efficient operation of membrane systems is sometimes critical for several onshore and offshore production units.

However, membranes are susceptible to loss of performance and even damage from a wide variety of contaminants in the gas stream, including heavy hydrocarbons, glycol liquid or mist, lube oil, corrosion inhibitors, iron sulphide-type particulates and even water. In addition, mercury and H_2S removal must often be incorporated into membrane system designs.

The most common types of membranes in use for bulk CO_2 removal are glassy polymers such as cellulose acetate and triacetate materials. These have the advantage of processing the hydrocarbon gas with minimum pressure drop, reducing compression requirements and permeating the CO_2 at low pressure. These materials are hydrophilic, making them resistant to intermediate hydrocarbons, but they have an affinity to absorb water and alcohols which can reduce CO_2 permeation rates. Polyamide membrane types are hydrophobic and are not affected by water but have a low tolerance to C6+ hydrocarbons, making upstream hydrocarbon dewpointing essential.

Time to focus - the Conference gets underway

Membranes are typically used when the inlet gas CO_2 concentration is above 15%, typically resulting in a treated gas with below 5% CO_2. Low levels of CO_2 in the ppm range are not practical, so in many applications a hybrid system is used, consisting of a membrane unit followed by an amine unit. For clean, lean gases it may be possible to operate a membrane unit with only filtration, dehydration and temperature control. However, for systems with more contaminants, further pre-treatment is necessary. Among these steps will be inlet (liquid) separation, contaminant removal beds (mercury), dehydration, and hydrocarbon dew-pointing. Contaminants such as nitrogen, helium, hydrogen, oxygen and even H_2S are not harmful to membranes. For this reason, consultation with the membrane manufacturer about the necessary pre-treatment processes for a particular feed gas is highly recommended.

The second paper, *Improved hydrocarbon condensate dehydration performance – diagnostics and solutions*, was presented by Olivier Trifilieff, from Pall Europe. The co-authors were Thomas Wines and Fabrice Daire. Hydrocarbon condensate separated from natural gas carries varying concentrations of impurities such as water, salts and solids. The deleterious effects of these contaminants can result in costly damage to the condensate stabilisation plant and export pipeline if not properly managed. Typical problems are off-spec condensate, sub-optimal plant performance, and maintenance issues such as corrosion and fouling of equipment. Many of these problems can be averted by improving the condensate dehydration or "dewatering" step.

Field surveys often demonstrate that water carry-over from the existing separators can be significant. Dehydration is often made more difficult by the formation of stable condensate / water emulsions, usually caused by inhibitors that lower the interfacial tension. Olivier explained that various technologies are commonly available to eliminate water from unstabilised condensate. However, gravity settlers, knock-out vessels with mesh pads and electrostatic desalters all suffer from various fundamental disadvantages. The preferred technology for this application would have the ability to

Rick Peters

Olivier Trifilieff

separate potentially stable emulsions, and should also have low investment and operating costs, as well as good maintainability.

The use of high efficiency polymeric cartridge coalescers, in a vertical or horizontal orientation, is often a cost effective means to dewater condensate precisely due to their ability to separate difficult emulsions. Their specially formulated polymeric coalescing medium does not suffer from the same loss of efficiency, or "disarming", as do glass fibre cartridges. The coalescers operate without chemicals or utilities, which keeps the operating costs low. The ability of the fine, fibrous coalescer material to combine the finely dispersed droplets into larger drops will also trap particles, eventually leading to increased pressure drop and plugging. In case the particulate contamination is problematic, the coalescer cartridge life can be extended significantly by placing a particulate pre-filter upstream. Olivier concluded his presentation by discussing coalescer sizing considerations and showing a couple of successful case histories.

Taking us up to the coffee break was Marion Seiersten from the Institute for Energy Technology, Kjeller, in Norway. Her paper, co-authored with Jon Kvarekvål, Arne Dugstad and Gaute Svenningsen, was entitled, *Iron sulphide formation in low H_2S fields*. These are often more challenging than high H_2S fields as they are often not developed to handle iron sulphide solids.

The main source of iron sulphide in gas production systems is the corrosion of carbon steel pipelines. Marion highlighted the many problems caused by iron sulphide in gas production systems, which include sludge formation, often in combination with heavy hydrocarbons. These deposits can provide protection for bacteria and hinder the effectiveness of biocides. Small sulphide particles with large specific surface areas can often render scale inhibitor treatments ineffective, leading to mineral scale deposition, as well as contributing to poor quality produced-water.

Marion and her co-authors have performed experiments to measure the solubility of iron sulphide at conditions realistic for multiphase pipelines and separators, and where MEG was used as a hydrate inhibitor. In addition, they used the MultiScale software, with an MEG module, to predict sulphide precipitation at the same conditions. The experiments indicated that the software gives conservative estimates, ie the calculated iron solubility is lower than the experimental results. She explained that the chemistry of iron sulphide formation was highly complex, and iron sulphide, despite our preconceptions, was rarely "FeS". Its formation depended upon many factors, such as the H_2S : CO_2 ratio, the pH and the system pressure. Interestingly, iron sulphide precipitation increases when the reservoir pressure decreases, and often there is more precipitation in LP separators than those at higher pressure.

In addition, the various types of iron sulphide are far less soluble than iron carbonate, and they will form preferentially when the H_2S : CO_2 ratio is as low as 1 : 2000 – 10000, depending upon the temperature and total pressure, as $FeCO_3$ becomes less soluble with increasing temperature. Crucially, the particle size of the formed sulphides is much smaller than the carbonate, being below 1µ, whereas the carbonate particles were typically around 10µ. This illustrates the difficulty of removing iron sulphide by filtration or even centrifugation. There are effective scale inhibitors that can solve the problem but high concentrations are usually required.

Marion Seiersten

Research applied to our industry

Following the well-catered coffee-break, we returned, refreshed, to listen to Bruno de Jonckheere from UOP in Belgium talk about *Mercury removal from gaseous and liquid hydrocarbons*. The paper was written by Neil Eckersley, UOP USA. Bruno explained that Mercury (Hg) is a naturally-occurring element found in small but measurable concentrations in many oil and gas fields around the world. Mercury is most often detected in its elemental form although it does exist in organic compounds. Due to advances in detection techniques, Hg can now be accurately measured down to single digit nanogram levels in the case of gases, and ppb levels in the case of liquid hydrocarbons.

The removal of mercury is important for several reasons:

- Braised aluminium heat exchangers are susceptible to corrosive attack

Bruno de Jonckheere

- Product streams contaminated by mercury fetch lower prices
- Many refinery and petrochemical catalysts are poisoned by mercury
- Hg is toxic and should be removed on health and safety grounds.

In recent years, Hg levels in natural gas have increased from around 30 to 40 μg/Nm^3 to above 1,000 μg/Nm^3 in the Pacific rim region.

In contrast to the old impregnated carbon technology, UOP's GB range of non-regenerable transition metal sulphide can handle saturated gas upstream of the acid gas removal unit. Hydrogen sulphide is also removed. UOP's new technologies are suitable for both gas and liquid streams. When spent, the bed is sent for reprocessing, where the Hg is removed by vacuum distillation and the metals are smelted and sold back to the market. This makes the removal of mercury environmentally responsible.

As more gas containing high concentrations of Hg is processed, and as gas processing plants themselves become more flexible, operators are demanding safe, reliable and effective Hg removal technologies in order to achieve the sales gas specifications and protect the integrity of the asset. The accurate measurement of various Hg species in various process streams is key to selecting the most appropriate removal technology. A number of analytical techniques are available to measure Hg down to ppb levels and it is important that the plant operators consider how Hg is measured in order to remove it to ultra-low levels. Bruno concluded his presentation with an overview of three gas plant applications where UOP's GB technology was implemented.

A tricky point

The final paper of the morning session was delivered by Vince Atma Row, entitled, *The impact of mercury on gas processing plant assets and its removal*. The paper was co-authored by Matthew Humphrys. Almost all hydrocarbons contain mercury (Hg). In the case of natural gas and NGLs it is likely to be present in the elemental form. In crude oil it may also be present as organometallic and particulate Hg. The concentration varies from 450 – 5000 μg/Nm^3 in Germany to less than 0.01 μg/Nm^3 in parts of the US and Africa, but despite the lower concentrations, the gas volumes in some LNG plants are huge, and this can lead to the potential import of over 500kg/ year Hg per train.

Hg readily attaches to metal surfaces and will adsorb and chemisorb into steel. The mechanisms of Hg adsorption are not fully understood but are thought to involve diffusion of elemental mercury into steel grain boundaries. The amount of Hg that steel can hold is a function of both metallurgical and process factors, and the level typically increases to an equilibrium level over time. The adsorption is partially reversible, should the system conditions change. The main danger to aluminium comes from amalgam corrosion and liquid metal embrittlement (LME). It is possible to estimate where the mercury flows within a typical LNG plant and Vince presented a diagram showing the distribution.

Hg adsorption on steel surfaces can be subject to "mercury lag", which often causes the results of stem drill tests to suggest artificially low Hg concentrations. To avoid expensive retrofits, especially offshore, it is recommended to design the Hg removal facilities for the likely contamination rather than the measured concentration. Upstream retrofits will immediately reduce the concentration of Hg in the gas, which will then be lower than the mercury concentration on the pipe walls. This will lead to the Hg desorbing back into the gas, establishing a new equilibrium. This can cause a significant delay in cleaning up the

Attentive listeners

Vince Atma Row

GPAE Conference May 2011, Copenhagen

gas, especially in long steel pipelines. Johnson Matthey produces a range of fixed bed adsorbents, under the PURASPEC brand name, that are used on both liquid and gaseous hydrocarbon streams, including dry and saturated gas streams. One recent development is a new PURASPEC adsorbent to remove ionic Hg from aqueous streams, where regulatory limits are becoming much stricter. Like other JM adsorbents, it has been engineered to be reprocessed using an auditable and environmentally acceptable route. *Justin Hearn*

The first paper after lunch was presented by Howard Secker (Co-author V Zafirakis) of Grace, entitled *Adsorbent Solutions for Removal of Mercaptans and other Compounds.* The paper described how molecular sieves can provide a solution for sulphur compound removal from natural gas and NGL, especially if very low outlet specifications are required. The presentation began by explaining the principles of molecular sieve adsorption and how the crystal structure can be altered so that the molecular sieve selectively adsorbs specific sulphur based compounds. Howard then went on to describe the application of molecular sieves for sweetening and how the technology can be supplied as a stand-alone package, or as a polishing unit within a combination of gas treating processes.

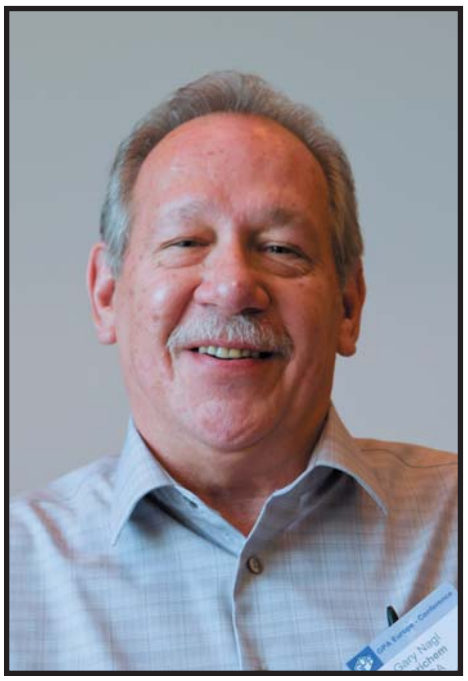
Howard Secker

Peter Carnell

The second paper of the afternoon was presented by Dr Peter Carnell (co-author Sebastien Grizard) of Johnson Matthey Catalysts entitled *Do Catalysts Provide the Only Practical Route for the Ultra-Purification of Hydrocarbons?* to which the conclusion of the paper was - Yes, if very high purification levels are to be met. The presentation began by summarising the use of physical processes such as solvent wash and fixed bed adsorption which are used for bulk removal of contaminants. However the paper went on to explain that there is a growing market for the ultra-purification of gases within the chemical and electronic industries. This can only be achieved by the use of chemical rather than physical reaction. Ultra-purification can be carried out with single bed absorbent (mercury removal using mixed metal sulphides), or may require a two-stage process in which the impurity is first converted to a more reactive compound before removal (mercaptans removal by conversion to hydrogen sulphide and then removal in a fixed bed metal oxide absorbent).

A Unique Syngas Cleanup Scheme presented by Gary Nagl of Merichem was the third presentation before the delegates broke for coffee. The presentation described how Merichem has developed a process to treat Syngas that has been produced

Chat over a coffee



Gary Nagl

GPAE Conference May 2011, Copenhagen

Les Alberts

Sylvain Vovard

by the gasification of coal to a total sulphur content (COS, CS_2, and H_2S) and a hydrogen cyanide content of less than 0.1 ppm. The scheme involves two-stage hydrolysis followed by liquid redox (using LO-CAT) after each hydrolysis stage. The treated Syngas is to be used for acetic acid production.

After coffee the delegates returned to the hall to listen to the final two presentations of the day. The first of these was entitled *Micromachined Gas Chromatography Benefits Gas Plants* and was presented by Les Alberts (co-author Lyudmyla Zarytska) of SEALA services. The presentation described developments in portable gas chromatography in comparison to on-line measurement.

A number of applications related to oxygen, carbon dioxide, hydrogen sulphide and trace sulphurs were presented to demonstrate the capability and performance of micromachined gas chromatography.

The final paper of the day was presented by Sylvain Vovard (co-authors Christian Bladanet and Craig Cook) of Technip, entitled *Nitrogen Removal on LNG Plants - Select the Optimum Scheme*. The presentation began by describing the commonly used processes for nitrogen removal in LNG plants, these being the Single Column Process, Double Column Process and the simple End Flash. It then went on to describe three proprietary nitrogen removal processes that Technip had developed for LNG service.

The Conference concluded with first a summary of the afternoon session by the session Moderator, and then a closing speech by the current Chairman of GPA Europe, David Weeks. The delegates retired before sitting down to an excellent Conference Dinner.

Simon Crawley-Boevey

Knowledge Session - Copenhagen

Grant Johnson and Tim Eastwood of Costain Energy & Process prepared a very informative presentation discussing the issues to be considered and the equipment involved in the processing of natural gas to remove nitrogen and showed a number of examples of nitrogen rejection plants. The presentation discussed why nitrogen has to be removed, what technology options are available, what pre-treatment is necessary for cryogenic processing, the important issue of power consumption and machinery selection and discussed the equipment utilised. The presentation concluded with a discussion of a variety of applications of nitrogen rejection.

Nitrogen is found in gas fields throughout the world, with predominant areas including Midwest USA, North Africa, Europe (in particular some southern North Sea areas and Irish Sea), and increasingly is being found in gas offshore Australia. In some cases, nitrogen is deliberately injected into oil fields to improve productivity and thus appears later in the associated gas, increasing in content over time.

The inert nature of nitrogen means that in most cases it has to be removed to ensure that the gas specification is acceptable to burners in customer countries (although Tim did point out that in Netherlands Groningen gas with some 15+ mol % nitrogen is piped directly to consumers set up to accept the gas). Nitrogen also causes a problem in increased size of compression systems, excess production of flash gas in LNG production and is a problem in cases where natural gas is used as a petrochemical feedstock.

Grant went on to discus the various technology options available to separate nitrogen from methane,

Grant Johnson

Tim Eastwood

How it works

including membrane separation, pressure swing adsorption (PSA) and cryogenic separation. Membrane separation is viable for capacities up to around 20 MMSCFD of feed gas with nitrogen content up to 20 mol%. The technology can be appropriate for wellhead applications and is simple to construct and operate, but recovery can be relatively low at 90% as methane is lost to the permeate gas. PSA systems operate by adsorbing nitrogen on specially adapted molecular sieves. Capacities are generally in the range up to 10 MMSCFD with up to 50 mol% nitrogen in the gas. Product gas is produced with low pressure drop, although optimal fed pressure is relatively low at less than 10 bar. Recovery of methane is again relatively low, with methane lost to the waste nitrogen stream. The technology is suited to small scale applications, and, in addition to natural gas, could be considered for applications such as landfill gas and coal-bed methane.

Cryogenic fractionation provides a considerably higher hydrocarbon recovery, as the high relative volatility between methane and nitrogen enables high purity of both methane product and nitrogen waste streams. Fractional distillation however, has to be conducted at low temperatures - similar to those in an LNG plant, therefore careful attention to heat integration and minimisation of thermodynamic losses is required. Methane recovery of 99.9% is achievable with high purity nitrogen waste available for rejection to atmosphere. Economies of scale mean that most major gas field developments have selected cryogenic separation as the most cost effective solution to the problem of methane nitrogen separation.

Grant described a number of process options for cryogenic methane-nitrogen separation, based on both single and double column configurations and also the most recent processes incorporating an upstream pre-separation column. Full details of each are available in the presentation available on the GPA Europe website, but there follows a brief discussion of the benefits and drawbacks of each option.

The single column, while having limited flexibility and requiring a methane heat pump system, can produce waste nitrogen at relatively high pressure making it a useful application where this may be of value eg for oil field injection. The column operates at 28 bar limited by the critical pressure of nitrogen and operates with an overhead temperature of around -150°C. Energy consumption can be reduced at the expense of a more complex heat pump system, which will impact on capital cost and operability.

The double column process is based on the classical air separation double column wherein the condenser for a high pressure column provides the reboil of the lower pressure final separation column operating at just above atmospheric pressure. The process is highly efficient and where nitrogen concentration is greater than 25 - 30 mol% in the feed gas, high hydrocarbon recovery with low energy consumption is feasible. A drawback to the process is that the relatively low temperature levels encountered means that the process has a low tolerance for CO_2 and this must be removed from the feed to below 50 ppm. Methane liquid from the low pressure column is pumped to around 10 bar for evaporation in the feed cooling train, meaning that product gas recompression is relatively straightforward.

A pre-separation column can be used where nitrogen levels are lower than the 25 mol% required to operate a double column process and particularly for plants of such a size that a single column approach is not economical. The pre-separation column processes the feed gas to provide a suitably high nitrogen content feed to a double column process or similar. A significant proportion of the methane product can be produced from the bottom of

Copenhagen Conference Speakers and Moderators

Knowledge Session - Copenhagen

the pre-separation column at relatively high pressure. The column, operating at warmer temperatures, also increases tolerance to CO_2 in the feed gas. The process is flexible to operate over a wide range of feed gas compositions, making it particularly suitable for applications where nitrogen levels will increase over time such as EOR or pressure maintenance operations. The high purity of the methane product can also enable a relatively large proportion of feed gas to bypass the nitrogen rejection process, while achieving an acceptable nitrogen level in the product, which enables equipment size to be reduced.

As with all cryogenic processes it is important to review and assess the impurity levels in the feed to ensure that materials are removed or handled in the low temperature process. CO_2 content is a particular consideration as it has very limited solubility in hydrocarbons at the temperatures required for nitrogen rejection. Heavy hydrocarbons also have the potential to solidify in the coldest sections of the process and may also require removal, either upstream or in a partial condensation step in the cryogenic process. Mercury removal is important to protect the aluminium equipment in the cryogenic section. Costain also drew attention to the need to consider the presence of incondensable helium in the design.

The process design carefully considers the demands for refrigeration provided by evaporating product methane at various temperature levels and the associate power requirements for product gas recompression. Other considerations include the optimisation of hydrocarbon recovery and final product quality. The designer seeks to produce methane at optimal pressure levels considering the product compressor and the most effective configurations

Conference setting in Copenhagen

Cryogenic Nitrogen removal uses equipment familiar to low temperature gas processors, including brazed aluminium heat exchangers, can-type or submerged motor-type cryogenic pumps and fully welded "cold box" equipment, typically with trayed columns. Transition joints are used to connect aluminium equipment to stainless steel piping. Gas turbo expanders are rarely used in nitrogen rejection plants as they typically target let down of liquid rather than vapour streams. Liquid turbines can be appropriate in certain applications and may be considered for retrofit.

Costain then went on to discuss a number of operational plants from the first facility built by them in Poland in 1975, through facilities in Tunisia, UK, Pakistan and most recently in Mexico. Capacity of up to 600 MMSCFD is feasible in two trains, dictated by the maximum transportable cold box size equivalent to around 300 MMSDCDFD of feed gas.

The presentation finished with a review of the application of nitrogen rejection integration in LNG production facilities where effective integration into the cold LNG process is required to minimise the impact of flashing nitrogen on LNG production. They also discussed the application of low temperature nitrogen rejection to associated gas from nitrogen injection either for enhanced oil recovery or pressure maintenance facilities. These latter applications are impacted by a varying feed gas composition and the demands of a robust solution to ensure long term effective production of high quality natural gas product. Finally the potential for integration of nitrogen rejection with NGL recovery for reduction of capital cost and compression power was discussed, as was the potential for recovery of helium which is in many cases associated with high nitrogen natural gases.

Sandy Dunlop

GPA Europe Annual meeting - Prague

Our annual conference is being held in Prague this September. Bookings are still available for what is an excellent technical programme. Along with the opportunities to network and update yourself on current technical issues and innovations, the Prague setting is unique and may entice your partner to join us. Applications can be made on-line via the GPAE website. We look forward to seeing you!

Welcome to our New Members

PREMIER

GE Oil & Gas ESP Limited

GE Oil & Gas ESP Ltd supply high pressure Surface Pumping Systems for Gas Processing Plants, UGS/Cavern Storage, Water Injection, CO_2 injection, general refinery applications, pipeline boosting and enhanced geothermal systems. The pumps are suitable for a wide range of fluids, from Crude Oil through to Lean Amine, Dense phase CO_2, LNG and Water.

LEVEL 1

Evonik Industries AG

Evonik Industries is a modern industrial group based in Essen (Germany). Its operations are bundled in the Chemicals, Energy and Real Estate Areas. The Group has more than 34,000 employees and reported sales of around €13 billion in 2010. The Chemicals Business area bundles Evonik's global specialty chemicals with more than 100 production and distribution locations in some 30 countries around the world. Evonik is already one of the world's largest specialty chemicals corporations with leading positions in many market segments. This strong position is based on decades of experience, unique technology platforms in process and applications technology, market-driven research and development, modern innovation management and exceptionally well-qualified employees on all five continents. Evonik Degussa (Chemicals Business area) is now stepping into the sour gas (e.g. CO_2, H_2S, COS) separation market offering new high-performance absorbents for various applications in the natural gas and synthesis gas industry. These activities are based on several decades of experience in the specialty amines business and allows for the tailoring of optimized absorbent formulations to meet special customer demands and help to drastically reduce operational expenditures of the separation process.

Huntsman Corporation, Belgium/USA

Huntsman is a global manufacturer and marketer of differentiated chemicals. Its operating companies manufacture products for a variety of global industries, including chemicals, plastics, textiles, paints and coatings, agriculture and hydrocarbon treating among others. Huntsman manufactures a wide range of amine based solvents for sour gas and sour liquids treatment complemented with professional technical support for performance evaluation, plant operations and troubleshooting worldwide.

MOL Group

MOL Group is one of Central Europe's leading international oil and gas companies with operations in 40 countries in Europe, the Middle East, North Africa and CIS member countries. It employs over 32,000 people worldwide. The company's market capitalisation exceeded $14bn by the end of April 2011. MOL Group's Upstream operation has many decades' experience in hydrocarbon production, presently conducting exploration activities in 13 countries and production in seven more, worldwide. The Group operates five refineries in Hungary, Slovakia, Croatia and Italy. MOL Group also owns a network of over 1,600 filling stations in Central & South Eastern Europe. Through FGSZ, its 100%-owned member company, it operates a 5,800 km long high pressure gas pipeline system in Hungary. MOL Group Petrochemicals is among the top ten polymer market players in Europe, supplying plastic processing plants.

LEVEL 2

g3baxi partnership ltd, UK

g3 is an employee owned oil, gas and energy consultancy providing services to oil and gas operators, energy companies, engineering contractors and consultants. Our main areas of activity are oil and gas technology (flow assurance, feasibility/concept studies, field development, process consultancy, acquisition/project/operations support, brownfield modifications, offshore tie-ins, piping/layout/structures, safety and safety management), and renewables (technologies and emissions reduction strategies).

IHRDC

A worldwide leader in training and competency development for the international oil and gas industry for 40 years, IHRDC presents highly interactive oil and gas instructional programmes; offers four innovative e-Learning series covering E&P, O&M, an Introduction to the Oil and Gas Industry, and Business Skills and works with companies to develop world-class employees with IHRDC's Competency Management System.

Johnson Controls Inc

York by Johnson Controls is one of the world's leading manufacturers of refrigeration and gas compression equipment used in the natural gas processing and chemical/petrochemical industries. York designs and manufactures customized, heavy-duty refrigeration and compression systems, built around the Frick and Sabroe screw and York Turbomaster centrifugal compressors lines.

Tracerco

Tracerco is a world leading industrial technology company providing unique and specialized diagnostic and measurement solutions to the Oil, Gas and Petrochemical industries. Tracerco's non-intrusive process diagnostics technologies are used by our customers every day to determine the realtime, on-line conditions in a process system and diagnose a wide range of production problems using sophisticated tracer and advanced measurement technology. The power of the technology is in its ability to "see through" vessel walls, allowing our customers to determine what is happening inside a particular process system without the need to shut down, essentially providing insight onsite. Operators can visualise process flow and distribution; determine the mechanical integrity of vessel internals; detect carryover, leaks and blockages; and optimise operational parameters or determine the cause of other problems. This allows them to investigate the integrity of critical plant units to avoid production losses, avert environmental or safety incidents and increase throughput at minimum cost.

LEVEL 3

Gamma Business Solutions Ltd

Gamma Business Limited has been established since April 2010 We have two products for Energy Sector (LNG Plus) and Automotive (DMS Plus). We also provide tailor-made software solutions. We are most experienced on Energy Sector. Our LNG product is running on BOTAS Turkey LNG Plant. Please visit http://www.lngplus.com for further information and visit http://www.gammabs.com for the company.

MEMBERSHIP DRIVE

Our recent "membership drive" and presence at GasTech 2011 is reaping many new members for the Association. In addition to the above new members, the following have joined since our last publication and are welcome to submit an introdution to their company:

- Dow Oil & Gas Europe
- Gas Technology Centre NTNU (NB this is the new title for SINTEF and incorporates the NTNU academic membership)
- National Grid
- OMV E&P GmbH
- Procede

Other new members are currently in the pipeline.

FORTHCOMING EVENTS

2011

21st - 23rd September
Marriott Hotel, Prague, Czech Republic
28th Annual Conference
- Knowledge Session
- Technical Sessions
- Conference Dinner

24th November
Marriott Marble Arch, London
Compact Gas Processing Technologies + AGM
- Knowledge Session
- AGM
- Technical Meeting

2012

22nd - 24th February
Scandic Hotel, Antwerp, Belgium
Rotating Machinery

23th May - 25th May
Hotel Palace, Berlin, Germany
29th Annual Convention

8th - 11th October
GasTech
GPA Europe Centre of Technical Excellence

November
Marriott Marble Arch London
AGM and Technical Meeting

CONTACT DETAILS GPA ADMIN OFFICE

GPA Europe,
132 Chantry Road,
Disley, Stockport,
Cheshire SK12 2DN,
United Kingdom

T: +44 (0)1252 625542
F: +44 (0)1252 786260

E: admin@gpaeurope.com
W: www.gpaeurope.com
Contacts:
Sandy and Anne Dunlop

GPA EUROPE

CORPORATE MEMBERS

This listing of current Corporate Members represents the status as at the end of June 2011. In addition there were 280 active individual members

Corporate Level 1 PREMIER (39)

Amines & Plasticizers Ltd	**India**	**M-I Swaco Production Technologies**	**UK**
Atlas Copco Energas GmbH	**Germany**	**National Grid**	**UK**
BASF SE	**Germany**	**Offshore Design Engineering Ltd**	**UK**
Bechtel Ltd.	**UK**	**OMV E&P GmbH**	**Austria**
BG Group	**UK**	**Pall Europe**	**UK**
BP	**UK**	**PECOFacet**	**UK**
Compressor Controls Corporation	**UK**	**Perenco UK**	**UK**
Costain Oil, Gas & Process Ltd	**UK**	**Petrofac Engineering Ltd**	**UK**
Dow Oil and Gas Europe	**Switzerland**	**Shell Global Solutions Int BV**	**Netherlands**
EON Ruhrgas AG	**Germany**	**SIME**	**Italy**
ExxonMobil North Sea Production	**UK**	**SINTEF**	**Norway**
Fluor Ltd.	**UK**	**Snamprogetti SpA**	**Italy**
Foster Wheeler Energy Ltd.	**UK**	**South Hook LNG**	**UK**
Gassco AS	**Norway**	**Statoil ASA**	**Norway**
GDF SUEZ	**France**	**Technip France**	**France**
GE Oil & Gas ESP Ltd	**UK**	**Tehran Raymand Consulting Engineers**	**Iran**
GL Industrial Services UK Ltd	**UK**	**Total**	**France**
Jacobs Engineering	**UK**	**Vopak LNG Projects**	**Netherlands**
Lurgi GmbH	**Germany**	**WorleyParsons**	**UK**
M W Kellogg Ltd	**UK**		

Corporate Level 1 (26)

ABB Engineering Services	UK	Johnson Matthey	UK
Air Products Plc	UK	Kellogg Brown & Root	UK
Alfa Laval	Sweden	Koch-Glitsch	UK
Amec Group Ltd.	UK	MOL Hungarian Oil and Gas Co.	Hungary
Cameron Systems Ltd	UK	NORIT Nederland BV	Netherlands
CB & I Ltd	UK	SAZEH Consultants	Iran
CB&I Lummus	Netherlands	Siirtec - Nigi S.p.A.	Italy
CECA SA	France	Sulzer Chemtech Ltd.	Switzerland
Chevron	UK	Taminco	Belgium
ENI Div E&P	Italy	Techint S.p.A.	Italy
Evonik Industries	Germany	Tecnimont KT	Italy
Grace GmbH & Co. KG	Germany	TNO Energy	Netherlands
Huntsman Corporation	Belgium	Wintershall Holding Gmbh	Germany

Corporate Level 2 (53)

BASF Catalysts Germany	Germany	Maxoil Business Solutions	UK
Bryan Research And Engineering	USA	Mott MacDonald	UK
Chart Energy and Chemicals Inc	UK	Oil & Gas Systems Limited	UK
Criterion Catalysts & Technologies LP	USA	Optimus Services Ltd	UK
Danfoss A/S Oil and Gas	Denmark	P S Analytical	UK
E & P Consulting	UK	Peerless Europe Ltd.	UK
E.I.C. Cryodynamics Division	UK	Penspen Ltd.	UK
Enerflex (UK) Ltd	UK	PGNiG SA	Poland
Escher Process Modules BV	Netherlands	Pietro Fiorentini	Italy
Exterran (UK) Ltd	UK	Procede Group BV	Netherlands
Fives Cryo	France	Process Systems Enterprise Ltd	UK
Flex LNG Management Ltd	UK	Prosernat	France
Frames Process Systems BV	Netherlands	Purvin & Gertz Inc	UK
g3	UK	Refrigeration Engineering	Australia
GDF Suez E&P Deutschland GmbH	Germany	Rotor-Tech, Inc	USA
Granherne Ltd.	UK	SBM Offshore Gusto MSC	Netherlands
Hamworthy Gas Systems	Norway	Siemens Nederland NV	Netherlands
Heatric	UK	SPT Group	UK
IHRDC	Netherlands	Teesside Gas & Liquids	UK
IMA Ltd.	UK	TGE Gas Engineering GmbH UK Branch	UK
Inprocess Technology & Consulting Group, S.L.	Spain	Tracero	UK
ISG	Italy	Twister BV	Netherlands
Iv-Oil & Gas	Netherlands	UOP N.V.	Belgium
John M. Campbell & Co.	USA	VTU Engineering GmbH	Austria
Johnson Controls (Process Division)	UK	Weir LGE Process	UK
Kanfa Aragon AS	Norway	WinSim Inc	USA
M.S.E. (Consultants) Ltd.	UK	Zeochem AG	Switzerland
		Zeta-pdm Ltd	UK

Corporate Level 3 (12)

Gamma Business Solutions	UK	O&GBISS BA	Belgium
Infochem Computer Services Ltd	UK	OAG Energy Consulting Ltd	UK
Kirk Process Solutions	UK	Optimized Gas Treating	USA
Matrix Chemicals BV	Netherlands	Rowan House Ltd	UK
McMurtrie Limited	UK	Sofia Papadopoulou	UK
MPR Services	Netherlands	Softbits Consultants Ltd	UK

Academic Level (1)

University of Surrey	UK

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