



IN BRIEF

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GAS PROCESSORS ASSOCIATION EUROPE

SCOT ULTRA

IMPROVED SCOT PROCESS, A RESULT OF 50 YEARS OF DESIGN AND OPERATION EXPERIENCE

By Lydia Singoredjo, Shell Global Solutions, Amsterdam, Netherlands

Introduction

The requirement to meet ultra-low SO₂ emission standards, such as even lower than World Bank limits, is becoming more and more prevalent for new natural gas developments and/or certain regions. At the same time, more complex, sour gas fields are being developed as sweet fields become depleted. Considering greenfield and brownfield applications in the refining industry, the need for robust operation in terms of H₂S resilience is becoming more explicit, as compliance to local stringent SO₂ emission regulations is high on the priority list.

Next to meeting the increasingly exacting SO₂ emission limits, proposed technology should also satisfy the requirement of lowest life cycle cost.

Since its invention in the 1970s, Shell Claus off-gas treating (SCOT*) technology has been successfully applied more than 300 times to meet sulphur emissions targets worldwide.

Shell Global Solutions has utilised its extensive knowledge and experience of designing and operating these SCOT plants since the 1970s to hone the technology for this purpose, leading to SCOT ULTRA.

SCOT ULTRA process can provide improved operation and lower the operating cost of both existing and new facilities. Both goals can be achieved by implementing the high-performance Criterion C-834 catalyst, which allows operation at lower temperatures, and combining it with the jointly developed Shell-Huntsman JEFFTREAT ULTRA family of solvents - high selective solvents. The differentiating feature of these solvents is the capability to maintain high H₂S absorption at higher temperatures with improved CO₂ slip, thereby making this solution very applicable for (seasonal) warmer climates, where typically refrigeration would be required to deliver solvent performance.

SCOT ULTRA Process

Shell Global Solutions developed the SCOT ULTRA process (Figure 1, see page 2), which offers a step change in the performance of the well-established line of SCOT processes. It features the highly selective JEFFTREAT ULTRA family of solvents, which were developed jointly between Shell and the Huntsman Corporation. This line of solvents can achieve a substantial improvement in the reduction of H₂S from the Absorber in the SCOT plant as well as provide an improvement in the selectivity of the solvent for H₂S over CO₂. The JEFFTREAT ULTRA family of solvents offers several advantages over conventional MDEA in revamp applications. For example, the higher selectivity means that it can achieve a deeper H₂S removal specification as well as reduce the impact of CO₂ circulation in the SCOT off gas recycled back to the Claus Thermal Reactor.

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SCOT ULTRA Advantages

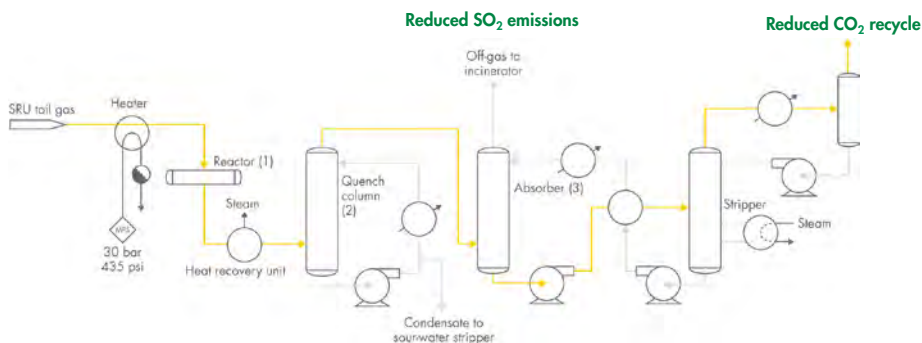


Figure 1. SCOT Ultra line-up and benefits (highlighted in green)

The technology also features the new Criterion Catalyst and Technologies C-834 catalyst, which provides a high activity at low temperatures, further adding value by improving the conversion of organic sulphur compounds, which if not converted will lead to higher SO₂ emissions from the facility. The catalyst has been designed to provide exceptionally high activity at low operating temperatures, compared to current industry standards. Being able to operate the Tail Gas Treating Unit (TGTU) at a low temperature allows the operators to extend the cycle length of the unit as well as reduce energy consumption by using steam reheating instead of inline burners. The crucial component of the catalyst though is its ability to provide improved hydrolysis and hydrogenation performance, resulting in increased destruction of organic sulphur compounds such as COS, which are found in higher concentrations in the tail gas from SRUs due to the processing of more contaminated acid gas streams in gas plants and refineries. In addition, the catalyst also offers a potential low pressure drop, which is a key parameter for TGTUs as most often there is not a lot of excess pressure available for these units.

The new SCOT ULTRA process could be particularly valuable for operators tasked with meeting more stringent SO₂ emissions, without installing new technology. The combination of the new C-834 catalyst with the family of JEFFTREAT ULTRA solvents, brings a reduction of COS in the outlet of the reactor together with the H₂S content in the off gas from the SCOT absorber to extremely low values. The combination of the two effects results in a lowering of the overall SO₂ emissions from the incinerator and stack that are typically installed downstream of a TGTU. The key components that make up the SCOT ULTRA process have already been deployed successfully and operated commercially, and

offer potential performance advantages in both green and brownfield applications. For the latter scenario, the simple replacement of the existing SCOT catalyst with C-834 together with a simple swap of solvent can improve the performance while the original plant design can be maintained.

Implementing these two changes not only potentially reduces the overall emissions from the facility; it also potentially provides the benefit of lower operating cost to the operator, as a dramatic reduction in circulation rate of the solvent can be achieved as well as lower operating temperatures for the SCOT Reactor. In addition, due to the enhanced formulation of the solvent, lean amine cooling may not be required at facilities in (seasonal) warmer climates, which makes the requirement for refrigeration unnecessary. It should be mentioned that SCOT ULTRA line-up does not require the inclusion of a water-wash.

This paper analyses four different case studies, looking at the benefits in terms of the potential for reduction in both capital and operating costs associated with the installation of the SCOT ULTRA technology.

Benefits of C-834 Catalyst

One of the primary benefits of the installation of the C-834 catalyst is the improved performance with respect to COS hydrolysis and hydrogenation in low temperature TGT applications. A key drawback of the recent development of the Low Temperature TGT applications, is the limitation that this has put on the ability to deal with COS in the tail gas of the Claus plant upstream. With the C-834 catalyst, there is a step change reduction in residual COS from the TGT reactor, thereby reducing the overall SO₂ emissions. This is clearly presented in Figure 2, where the COS concentration in the outlet of the TGT reactor is shown to be reduced from 40 ppmv to 20 ppmv at lower operating temperatures. As the

conventional solvents used in TGT units are not able to absorb COS, this can be considered to be a direct reduction in overall SO₂ emissions.

CRITERION SCOT CATALYSTS

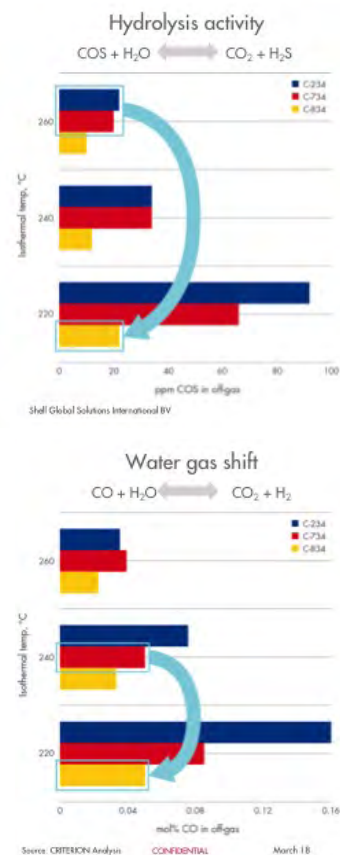


Figure 2. Improvement in water gas shift and COS hydrolysis performance with C834 catalyst (source: Criterion Analysis)

An additional feature of C-834 is the improved performance for the water gas shift reaction at lower temperatures, e.g. Fig. 2 shows comparable CO conversion, relative to C-734, at 20°C lower temperature.

SCOT ULTRA Economical Assessment

In addition to meeting more stringent emission regulations and having enhanced destruction of organic sulphur compounds, operators can also benefit from lower operating costs when using a SCOT ULTRA line-up. The SCOT reactor can be run at a lower temperature, which gives the opportunity to prolong cycle length and reduce energy consumption by using indirect heating instead of line burners.

A significant reduction in solvent circulation rate, combined with improved H₂S removal performance at higher temperatures, is achieved in the SCOT absorber through the highly selective solvent JEFFTREAT ULTRA, which facilitates much lower energy requirements, that translates into reduced

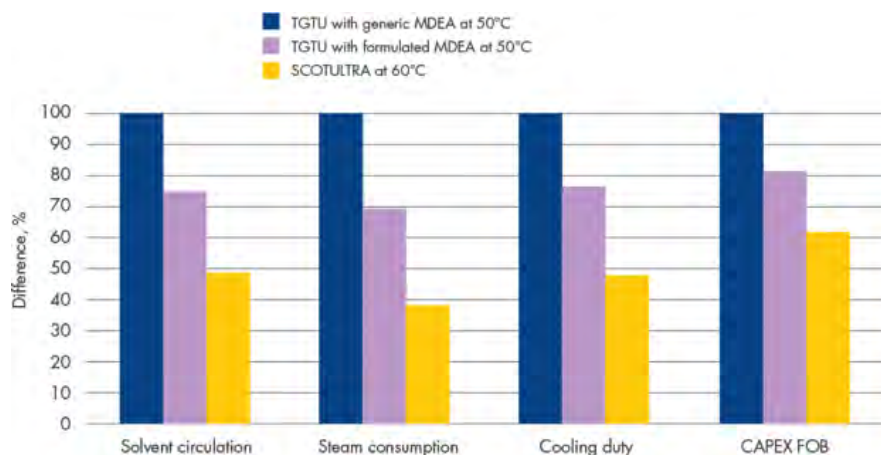


Figure 3: Relative operating expenditure for a generic amine TGTU (at 50°C) compared with SCOT ULTRA (at 60°C) technology; (source: Shell Analysis)

steam, cooling and power costs.

To quantify the benefits, the impacts on capital and operating expenditure for the SCOT section through using the SCOT ULTRA process is shown in Figure 3. A TGTU with a generic MDEA solvent, and a TGTU with a formulated MDEA solvent operating at 50°C, are compared with SCOT ULTRA technology at a 60°C solvent temperature. In this scenario, the solvent circulation rate can be reduced by 50% with the SCOT ULTRA technology compared with a TGTU using a generic MDEA solvent.

SCOT ULTRA Operational Benefits

The recycle stream from a SCOT unit can have a substantial effect on the operating temperature in the Thermal Reactor of an SRU. This is mainly caused by insufficient CO₂ slip in the SCOT absorber with DIPA or generic MDEA as the solution. In cases where ammonia destruction is a concern or where a substantial amount of BTEX is present in the acid gas to the SRU, this could lead to substantial operational problems such as plugging of the process piping and equipment with ammonium salts in the case of ammonia, or severe fouling of the catalyst beds in the case of BTEX. The industry accepted minimum operating temperatures for the destruction of ammonia and BTEX are 1260°C and 1065°C respectively. The recycle gas stream from the SCOT Regenerator can have a substantial effect on these temperatures and with the installation of the JEFFTREAT ULTRA suite of solvents, the selectivity of the absorption of H₂S over CO₂ can be improved in such a manner that there is a positive impact on the temperature in the Thermal Reactor. This is particularly of interest in applications with relatively high CO₂ content, where the

reduction of CO₂ in the recycle gas can substantially improve this temperature if the CO₂ slip is maintained high.

Figure 4 shows the differences in estimated performance of DIPA, MDEA relative to JEFFTREAT ULTRA. Clearly, at a significantly lower solvent circulation deeper treat can be achieved at higher CO₂ slip with JEFFTREAT ULTRA.

	DIPA	MDEA	JEFFTREAT ULTRA
H ₂ S in treated gas, ppmv	621	611	240
Relative solvent circulation rate, %	100	102	57
H ₂ S in recycle gas flow, mol/s	32.5	65.4	76.4
CO ₂ slip, %	47	79	88
SRU flame temperature, °C	1,180	1,245	1,265

Figure 4: Estimated performance of JEFFTREAT ULTRA, relative to DIPA and MDEA

(source: Shell Analysis)

Thermal Oxidizer on Hot StandBy

One final item that could be considered for the installation of SCOT ULTRA to improve the overall emissions of the facility, is the potential to reduce the Total Residual Sulphur to a level where incineration of the off gas from the Absorber is no longer a requirement. With the combination of the C-834 catalyst and the JEFFTREAT ULTRA suite of solvents, it is possible to achieve a H₂S concentration in the off gas from the absorber below 10 ppmv, which in a lot of jurisdictions can be vented directly to atmosphere. In this case, there is no longer a requirement to operate the Thermal Oxidizer and hence the unit can be kept in hot standby operation only, which results in substantial fuel gas savings to the facility. The Thermal Oxidizer can remain in this mode of operation for extended periods and only in cases where the H₂S content from the absorber does not meet the requirements of less than 10 ppmv, the off gas would be routed to the Thermal Oxidizer for processing.

Conclusion

Operators, in both the oil and gas industry, face major challenges in meeting both plant robustness and environmental regulation while maintaining cost effectiveness and operability of their facilities. Through the development of the SCOT ULTRA technology, a new option is available for installations in both greenfield and brownfield applications that will improve the bottom line and provide options for better margins with respect to environmental regulations.

Greenfield Installation	Brownfield Installation/ Revamp
Smaller equipment including the absorber height	Solvent swap is possible to significantly reduce H ₂ S and organic sulphur species from the SCOT Absorber
Ability to meet the more stringent specification without the requirement of a chiller section	Improved margin due to unit flexibility of processing more sour crudes or higher CO ₂ containing sour gas streams
Smaller Plot Space requirements	Lower OPEX due to lower steam, cooling and power consumption as a result of the lower circulation of solvent compared to conventional solvents
Lower OPEX due to lower steam, cooling and power consumption as a result of the lower circulation of solvent compared to conventional solvents	Reduced catalyst fill costs
Flexibility in processing sour crudes and ability to deal with mercaptans	Complying to future stringent emissions legislations in existing units with no or minimal equipment modifications.

With the SCOT ULTRA process, Shell has unlocked a step change for conventional SCOT performance. The installation or conversion to the SCOT ULTRA technology can help operators meet more and more stringent emissions regulations, even with highly challenging and highly contaminated feeds. In most situations there is no requirement to modify equipment with the conversion. In most scenarios, the SCOT ULTRA installation can be done via only a solvent and catalyst swap, without even the requirement to install a water wash to reduce solvent losses. The new option is an improvement of an existing, well established and proven technology and as such can be considered to be fundamentally de-risked.

* SCOT is a trademark owned by the Shell group of companies

** JEFFTREAT is a registered trademark of Huntsman Corporation or an affiliate thereof in one or more, but not all countries

*** Criterion Catalysts & Technologies LP (Criterion) is a wholly owned affiliate of CRI/Criterion Inc. and an affiliate of the Shell Global Solutions network of companies

GULF OPPORTUNITIES FOR MEMBER COMPANIES

GPA Europe Chairman Steve O'Donnell on the joint GCC/GPAE Oman Conference

Just recently I attended the joint conference in Oman between GPA GCC and GPA Europe. The event was held at the prestigious Shangri-La Barr Al Jissah Resort & Spa just outside of Muscat and was superbly organised and extremely well attended.

Firstly, I would like to extend my personal congratulations to the Chairperson of GPA GCC, Ms. Wadha Al-Khateeb and to all of the team for making this one of the most memorable and enjoyable conferences that I have attended. They have set the bar very high and have provided us here in GPA Europe with something to aspire to.

Secondly, I would like to thank those European companies who provided sponsorship for this event and for allowing both the presenters and delegates the time and resources to participate.

The only slight disappointment was that we were unable to attract more delegates to the conference from Europe as this was certainly the place to learn first-hand from the vast array of operating experiences and to be able to network with almost all of the leading operators in the GCC region under one roof.

It was very interesting and enlightening to listen to the opening remarks from Ms. Wadha Al-Khateeb and the key-note speeches firstly from His Excellency Eng. Salim Nasser Al-Aufi the Undersecretary, Minister of Oil & Gas, Sultanate of Oman and secondly from Mr. Harib Al-Kitani, CEO, Oman LNG. It was refreshing to discover that the problems and issues that we face in Europe are very similar to those faced in the Gulf region and that the geographical area really doesn't seem to make much difference.

It is clear that the use of natural gas is incredibly important to the energy balance



Steve O'Donnell

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for the Gulf region and will continue to be so for the foreseeable future. It is interesting that the future developments could largely depend on LNG and this should provide a huge range of opportunities for our member companies.

I believe that there is a wealth of knowhow within our membership and this knowledge

and experience would be greatly appreciated by our friends in the Gulf chapter. Perhaps we in GPA Europe could become the conduit by which this information flows and I'm sure we could all benefit from the rewards.

I was also privileged and honoured to be asked to be a panellist for the panel discussion which took place at the start of the conference together with a few of the key important voices in the region including: His Excellency Eng. Salim Nasser Al-Aufi, Undersecretary, Minister of Oil & Gas, Sultanate of Oman; Mr. Harib Al-Kitani, Chief Executive Officer, Oman LNG; Mr. Sabeur Mansar, VP - Commercial & NBD, Shell International; and myself. The panel session was very professionally moderated by Dr. Syham Bentouati, NAFAS International LLC.

The session was entitled; The Gas Market - A Look Ahead. During the session the delegates were provided with access to an app. that enabled them to ask questions and also to be able to vote on the questions to bring the most popular or important to the top. It was then the Moderator's job to put those questions to a member of the panel that she thought was best positioned to respond. This was very successful and certainly something that we in GPA Europe would very much like to emulate.

The theme of the conference was: Achieving Efficient and High Performance Gas Processing. It was preceded by a two-day workshop that dealt with Gas Conditioning & Dewpoint Control, Filtration & Separation and Fundamentals of Process Safety.

In total there were around 480 delegates split within two Halls that were simultaneously presenting the papers. The choice for which of the sessions to attend was left entirely to the delegates and this

appeared to have run without any significant issues. This is somewhat similar to that of GPA Midstream but on a smaller scale.

One significant difference between this conference and those provided by GPA Europe was the sponsorships. There were several levels of sponsorship available ranging from the highest, Platinum to the lowest, Bronze. All of the sponsors were provided a dedicated space within an exhibition area for their stand. It was great to see several European companies take-up this opportunity and I am keen to discuss with them the benefits that they perceived from this opportunity.

If we are to continue to develop our organisation and try to increase the numbers attending our conferences I wonder if this format would help. I would be very pleased to discuss this with you, our members to ascertain if this is something that the management committee should pursue.

With respect to what is happening with GPA Europe, we will all miss Sandy and Anne Dunlop who have taken well-deserved retirement after seven years in their role, but I'm sure you will join me in welcoming our new Executive Administrator Malcolm Harrison ably supported by Helen Cozens to the "Team".

In a growing digital age, social media is becoming more and more important to keep customers engaged and informed. Social media is a conversation, we have started the discussions and we now would like to hear from you.

To keep in touch with us at GPA Europe, connect with us on LinkedIn@gpa-europe-ltd and follow us on Twitter @GPAEurope. Connecting with us couldn't be easier - you will now find social media links in all our emails and documents.

We are currently providing you with up to date information on our services as well as sponsorship and advertising opportunities. If there is anything else you would like from us, let us know. We aim to increase our social media presence and would like our members' input to what we are providing.

If there is anything further that you would like us to do or if you have any suggestions for improvements to our systems then please come and discuss this either with any member of the management team, or with Malcolm and Helen, or with myself.

OBITUARIES

With much regret we inform members of the recent deaths of three longstanding and much admired GPA Europe members.

Bob Czarnecki

Bob Czarnecki died on 22nd July 2017 at the age of 67 after battling cancer for a number of years. Bob joined Petrocarbon Developments in Manchester in 1972, having gained a B.Sc. in Chemical Engineering from the University of Bradford. He was initially involved in low temperature gas plant design before spending the mid 1970s commissioning several cryogenic facilities in Poland. In the 1980s he was a highly respected member of a team working on low temperature natural gas processing plants and spent time successfully commissioning in Australia.



In 1988 Bob moved to Granherne as Process Technical and Engineering Consultant continuing his passion for gas processing. Bob joined Petrofac in 2001 as a Process Technology Director and Technical Authority for process design of oil and gas process facilities. His role expanded over the years to include Technical Assurance covering other areas outside of Gas Processing. Bob was a member of the GPAE Management Committee for a number of years and a regular attendee at our conferences. His technical capability in gas processing was exceptional and truly world class and he spent much time training and mentoring others. He was hugely respected throughout the business and is greatly missed by his family and colleagues.

Lorraine Fitzwater

Peter Carnell

Dr Peter Carnell died on 10th January 2018 at the age of 81. After gaining BSc and PhD degrees in Chemistry at Southampton University and a postdoctoral year in Iowa, Peter had a long and very productive career with ICI based at Billingham, Teesside. This included three years seconded to AE&CI, Modderfontein, South Africa in the 1960's followed by time as the first manager of ICI's Methanol 2 plant which was then, at 1100 tonnes/day, the world's biggest. Peter will probably be best remembered, however, as the driving force behind ICI, now Johnson Matthey's, worldwide gas processing business which features the Puraspec™ range of fixed bed absorbents for removal of traces of H₂S and mercury from hydrocarbons. Peter led this business from its creation in 1986 until his official retirement in 1998, and then continued as a valued consultant to JM until he suffered a serious stroke a week before Christmas 2017. He was a respected and well-liked mentor to less-experienced colleagues and will be much missed by his family, friends and colleagues.



David (Dave) Alexander Healey

Members will be extremely sad to learn that Dave Healey died on 10th January 2018 after a short illness. Dave had been active in the GPA for many years and had been an active member of the Programme and Management Committee for the past 15 years. Dave graduated with a degree in Chemical Engineering from the University of Newcastle and joined Air Products after graduating. He started as a process engineer with Air Products and progressed through operations and commissioning, holding positions in Engineering Services and Commissioning and becoming Manager of Process Technology before joining the Business Development department for Air Products' industrial gas technologies, concentrating solely on LNG and Hydrocarbon Processing. He was the European representative of the LNG team.



Dave's friendly warm style greatly encouraged the young engineers who attended the GPA events and with his wife Lyn, he attended some of more memorable conferences over the years. He will be fondly remembered by all who know him and our sympathies go out to Lyn and his children, Ruth, Rachel and Peter and their families.

GPA EUROPE ANNUAL CONFERENCE BUDAPEST, 13-15 SEPTEMBER 2017

CONFERENCE KNOWLEDGE SESSION - 13 SEPTEMBER 2017

Getting full use out of the GPSA Engineering Data Book: An Introduction to the Week-Long Training Class



Budapest speakers and moderators

Moderated by Simon Crawley - Boevey, BHGE

The Budapest conference began on the Wednesday afternoon with a Knowledge Session presented by Sjoerd Hoogwater of AECOM, who is a member of the GPSA Editorial Review Board which is responsible for the publication of the GPSA Engineering Data Book. The four-hour workshop was developed to showcase the importance and utility of the GPSA Engineering Data Book and presented a sampling of the content directly from GPA Midstream's week-long class to introduce the scope of the full training course for this well-known resource. The purpose of the full length training course is firstly to understand what information is provided in the Data Book and to learn how it applies to the natural gas industry. Course delegates are also given the opportunity to interact, working through classroom problems to build comprehension of how to use the detailed information and shortcut methods in the Data Book. An understanding of how to apply the Data Book for the daily gas processing/midstream job functions of Design Engineer, Facilities Engineer and Operations is also given.



Sjoerd Hoogwater, AECOM

Beyond being introduced to the content of the GPSA Engineering Data Book, the audience benefitted from several full-length modules from the training course, as the presenter dived into specific and realistic problems that might be encountered every day on the job, when designing or troubleshooting facilities and/or equipment.

The Knowledge Session was based on a typical NGL plant and began with an introduction to product specifications before moving on to an in-depth overview of Fractionation that included an example problem demonstrating how to size a distillation column for trays and packing. Having discussed the fundamentals of column sizing the presenter then covered the sizing of the other critical equipment including separators, pumps, and heat exchangers before finishing up with control valves and flow measurement devices.

The session chairman thanked the presenter and then Sandy Dunlop, GPA Administrator, ended the session by inviting the audience to attend the Welcome Reception in the evening.

GPA EUROPE ANNUAL CONFERENCE BUDAPEST, 13-15 SEPTEMBER 2017

TECHNICAL CONFERENCE – MORNING SESSION 14 SEPTEMBER 2017

Moderated by Nick Amott, Fluor UK

The first formal session of the conference kicked off on the Thursday morning with an opportunity for the session chairman to set the scene. In the few days before our meeting, the Offshore Europe conference held in Aberdeen had provided the opportunity for senior industry executives to contribute their perspectives as Ben Van Beurden of Shell talked about “the changing landscape”. “Renewables are knocking at the door in terms of cost competitiveness” said Bob Dudley of BP as they are moving from a majority oil producer to natural gas as a “lower carbon fuel”. Van Beurden went on to comment that “the world needs renewables but this produces electricity which is less than 20% of the world’s overall energy system.” Electric cars will not be the answer for all the planet’s transportation needs. The “transition to a low carbon economy will take a generation to happen”. This is not my generation, the session chair commented but our children’s. Gas is acknowledged to be a key player in this next generation’s future. There followed five excellent technical presentations revolving around some key aspects of our gas processing industry.



Gerald Vorberg, BASF

Meeting Sulphur Emissions Specifications: Tail Gas Treatment Fundamentals and How to Optimise a “Vintage” Tail Gas Treatment Unit

In the first presentation Gerald Vorberg from BASF, on behalf of co-authors Thomas Ingram also from BASF and Pamela d’Anterroches, Stefan Below and Sebastian Kordes from BP, gave a very practical and experience-based discussion on how to improve SRU operation in *Meeting Sulphur Emissions Specifications: Tail Gas Treatment Fundamentals and How to Optimise a “Vintage” Tail Gas treatment Unit*. The presentation took us on a journey assessing real life operation of the BP Gelsenkirchen refinery SRU’s with a SCOT based TGTU and the findings and measures taken to improve operation as well as meeting tighter specifications. It was an excellent example of real life operating data helping fundamental understanding of TGTU MDEA solvent improvements.



Heath Burns, Nexo Solutions

Surfactant Contaminants in Feed Gas Stream to Amine Units: The Hidden Factor

Keeping on the theme of improvements to amine solvent systems (such a core “work horse” in our industry), Heath Burns of Nexo Solutions presented his paper *Surfactant Contaminants in Feed Gas Stream to Amine Units: The Hidden Factor*, with co-authors David Engel and Scot Williams. These guys spend so much of their time trouble-shooting problems in operating plants that you knew the material and experience they presented would be worthwhile. Why are surfactants present at all, where do they come from, what is the impact and how do we solve the issues that arise? The paper and presentation was full of important background information to educate and inform those involved in both design, specification, supply and operation of amine systems. A “must read”

GPA EUROPE ANNUAL CONFERENCE BUDAPEST, 13-15 SEPTEMBER 2017

TECHNICAL CONFERENCE – MORNING SESSION 14 SEPTEMBER 2017



Conrad Scranton and Olivier Ducreux, Axens

Cost-Effective Solutions for H₂S and Light Organic Sulphur Removal on a Wide Variety of Gases

The first session of the day closed out with a paper presented as a “double-hander” by Olivier Ducreux and Conrad Scranton of Axens. Conrad has brought the AxTrap dry media product into the Axens portfolio and the two described this through their paper *Cost-effective solutions for H₂S and light organic sulphur removal on a wide variety of gases*. Complementing the sulphur removal technology discussions of amines, the debate of dry based solid adsorbents or “scavengers” for removal of sulphur compounds has several players in the market and this presentation provided detailed information about this new product line from Axens. Some great papers and engaging presentations meant that the brain cells needed some coffee - fuelled respite and a chance to catch up with colleagues and discuss the day so far.



Nikola Vukoje, NIS and Gatot Joyowardoyo, BASF

Operational Experience of High Pressure Acid-gas Capture Technology (HiPACT)

Reconvening after the break we were introduced to Nikola Vukoje who works for NIS, the petroleum industry of Serbia and part of Gazprom. Nikola's co-author and speaker was Gatot Joyowardoyo of BASF. The paper was titled *Operational Experience of High Pressure Acid-gas Capture Technology (HiPACT)*. Nikola introduced us to his company NIS, the gas production context in Serbia and specifically the Elemir gas processing plant. This unit which was commissioned in 2014 and successfully signed off in 2015 performs as a CO₂ capture unit processing natural gas. It has performed well using the licensed technology and proprietary solvent blend and so the paper presented operational results and experience. Nikola closed out the paper by sharing a few of the operational experiences and lessons, again so important for fellow plant designers and operators which makes these papers of such value to GPA Europe members.



Paul Terrien, Air Liquide

Streamlined Natural Gas Treatment by Membranes

So, how to round off a morning of excellent papers on gas treating? The best way is to bring in another technology approach for CO₂ removal this time using membranes. Paul Terrien of Air Liquide performed this task, representing co-authors Pascal Marty, Ed Sanders, Sandeep Karode and Yong Ding as he presented *Streamlined Natural Gas Treatment by Membranes*. Paul needed to educate (or remind) us of the wide variety of fundamental membrane material types, polymeric, glassy, rubbery and their individual and unique characteristics.

It is clear therefore that in some circumstances for CO₂ removal a combination might be required so Paul took us through the options and methodology to decide on which to use in various combinations. It was a bewildering series of permutations but clearly there is expertise and knowledge available and Paul offered Air Liquide's view on this through PEEK-Sep™ and MEDAL PIX technology and the needs for auxiliary but critically important adjunct equipment to protect and keep the units functional over an acceptable lifetime.

Phew! An excellent start to the conference in beautiful Budapest whilst we broke off for some lunch and catch-up with colleagues and new found friends.

Nick Amott, Fluor UK

GPA EUROPE ANNUAL CONFERENCE

BUDAPEST, 13-15 SEPTEMBER 2017

TECHNICAL CONFERENCE – AFTERNOON SESSION 14 SEPTEMBER 2017

Moderated by Myrian Schenk, Jacobs

In the beautiful Budapest city, we started our afternoon session with five interesting papers. Three papers around acid gas removal and two relating to safety issues in the LNG industry.

Size the Acid Gas Removal Units of Floating Facilities at the Tightest

Claire Weiss from Total presented a paper entitled *Size the Acid Gas Removal Units of Floating Facilities at the Tightest*. The paper was written in collaboration with Thomas Maubert, also from Total and Pascal Alix and Manel Fourati, IFP Energies Nouvelles and Gauthier Perdu and Clément Salais, PROSERNAT.

Claire started by setting the scene, as some gas reserves cannot be unlocked without a strategy of development based on floating production facilities. The Acid Gas Removal Units in these floating units, by their size and critical role, would impact the overall project design and/or later the plant performance. The paper explained the work completed during the development phases of a joint research development program by Total, IFPEN and Prosernat. The presentation illustrated practical cases, which indicate how costs can be controlled advantageously by optimum but safe design of the AGRU columns. The research done now simplifies the work of Pre-FEED and FEED phases and the sizing of the floating columns in a very fast one-through process.



Claire Weiss, Total and Gauthier Perdu, PROSERNAT

Immobilized Amines for Biogas and Sour Gas Processing

After Claire, we got into the world of *Immobilized Amines for Biogas and Sour Gas Processing* with Peter Hauwert from Frames. As an R&D Engineer, he is also involved in the Institute for Sustainable Process Technology (ISPT), a Dutch public-private collaboration research institute, where he works on immobilized amines for removing CO₂ and H₂S from biogas and natural gas. Peter's co-authors were S Sutanto, R T Driessen and D W F Brilman of Institute for Sustainable Process Technology (ISPT), and J W Dijkstra, J A Z Pieterse and J Boon of Energy Research Centre of the Netherlands.

He presented the "alternative concept" for sour gas processing, in which an amine that is not dissolved in water, but rather "immobilized" on a solid support with a low heat capacity is utilised. In theory, as Peter explained, this would decrease the sensible heat requirement and also eliminate energy losses via the evaporation of water. Hence, the regeneration duty should be determined mostly by the reaction enthalpy. In principle this should achieve similar deep removal to solvent-based amines, and allow bulk removal, at a much lower energy consumption. Two cases studied were described: first a low pressure biogas feed was upgraded to pipeline specifications, using a combination of solid scavenger for H₂S removal, amine (solvent or sorbent) for CO₂ removal and TEG for dehydration; then a natural gas case was studied, focusing on the process design of adsorption and desorption using supported amine sorbents, and the results were compared with those of a conventional aqueous amine. In conclusion, Peter told us that immobilized amines have significant potential to make natural gas sweetening more compact and more energy efficient, the technical challenges to move from the lab to real world were already being investigated.



Peter Hauwert, Frames

GPA EUROPE ANNUAL CONFERENCE BUDAPEST, 13-15 SEPTEMBER 2017

TECHNICAL CONFERENCE – AFTERNOON SESSION 14 SEPTEMBER 2017

Improved EconamineSM Treatment of Sour Gas: A “One Stop Shop” For Sulphur Removal

The last paper in the acid gas removal session was entitled *Improved EconamineSM Treatment of Sour Gas: A “One Stop Shop” For Sulphur Removal*, presented by Robert Joyner who is a Senior Process Engineer at Fluor. The paper was co-authored by David Schulte, Steven Van Wagenveld, Curt Graham, Bryant Lynch and Nick Amott, all from Fluor Corporation.



Robert Joyner, Fluor

Robert walked us through a case study of performance improvements in acid gas removal from very sour well fluids, based on operating data from mega size Improved EconamineSM gas treatment units in the Middle East, where the robustness of Fluor's DGA3 based technology in acid gas and organic sulphur removal, especially for ultra-sour fields, has been demonstrated. In the example, it was shown that these units treat a feed gas with approximately 26 mol% H₂S, 10 mol% CO₂, COS, and mercaptans at roughly 65 barg and the treated gas is virtually free of H₂S, CO₂, and COS, and mercaptan levels are consistently below 10 ppm (mol).

In the presentation Robert described the limitations of conventional designs and presented an alternative design with superior temperature control, which results in a significant improvement in both absorber and overall Acid Gas Removal Unit (AGRU) performance. Ultra-sour gases often must be treated at low pressures due to the major hazards associated with H₂S and/or inherently low feed fluid pressure.

Fluor's design innovation showed that one can mitigate the posed HSE risks while still achieving 90%+ total mercaptan removal efficiency along with practically complete removal of H₂S, CO₂, and COS.

Practical Experience of Alarm Management from Various Sectors, the Lessons Learnt and the New Initiatives that Combine New Software and the Use of Algorithms

We then moved on from CO₂, H₂S and mercaptans to the safety arena....

The first presenter was Aatif Hashmi, a Senior Safety Consultant with ABB Consulting, specialising in Alarm Management and Functional Safety.

He told us about *Practical Experience of Alarm Management from Various Sectors, the Lessons Learnt and the New Initiatives that Combine New Software and the Use of Algorithms*.

We heard that Alarm Management is imperative to assessing, improving and optimising plant alarms thereby increasing the effectiveness of plant operators by only notifying them of a need for their intervention. Lack of alarm management not only increases inefficiencies within the process but also increases the likelihood of an incident to occur. We were reminded of the explosion at the Texaco refinery Milford Haven in July 1994, in which 275 alarms went off in the first 10 minutes of the incident and before the explosion. Aatif mentioned that there are many sites today that operate at an unmanageable alarm rate making it increasingly likely for an incident to occur.

This paper gave us a practical experience on alarm management from oil and gas and LNG on - and offshore projects in UK and internationally and covered lessons learnt from the rationalisation of thousands of alarms. Aatif talked about the challenges faced during the alarm management lifecycle, the importance of the Alarm Management Philosophy document and how to implement alarm change, the use of algorithms to increase the efficiency and also reduce the cost of a rationalisation review.



Aatif Hashmi, ABB

Experimental Tests and Qualification of a CFD Simulation Tool For Cryogenic Release Modelling through the JIP “FLNG Cryogenic Spillage Protection

The session's last paper was presented by Bruno Lequime and Mathieu Rivot, both from TechnipFMC. Co-authors were E de Carvalho, M G Molina-Borregales and N Noel, also of Technip, R Marcer, B Yerly and C Audiffren of PRINCIPIA, R Legent of Cybernetix, and V Tomsa of INSA.

Bruno is a Technology Officer Safety, working in the HSE in Design Division and Mathieu is a Risk Quantification Lead Engineer. The joint presentation was entitled *Experimental Tests and Qualification of a CFD Simulation Tool For Cryogenic Release Modelling through the JIP FLNG Cryogenic Spillage Protection*.

Technip has been a pioneer in the design of FLNG (Shell, Petronas, Yamal). The risks from accidental releases of cryogenic fluid (i.e. steel brittle fracture and consecutive fire and explosion escalations) is a key challenge in these facilities. From 2013 to 2015 TechnipFMC led the Joint Industry Project (JIP) FLNG Cryogenic Spillage Protection. One of the objectives of the JIP was to set up a qualification program at the best possible FLNG topsides scale to improve the knowledge of cryogenic releases. The program provided access to software EOLE, which is capable of predicting the behaviour and impact of different types of cryogenic spillages. (Technip and project sponsors can access these).

We had a fantastic afternoon at the annual GPA conference afternoon papers and we were all ready for some more interesting networking and looking forward to the Gala dinner...

Myrian Schenk

2017 Companions' Tour

Ten ladies joined us this year on the last Companions' Tour I will organise. Sadly, we had to leave Loyola at the hotel as she had work to do, and neither Rob nor John joined us this time either but I will be in Rome in May 2018, so I hope they will be able to join us then.

Our day started on a small coach on a tour around the city of Budapest with places of interest being pointed out to us. Leaving Ana on the bus to get to know her new boyfriend, our driver, our guide took us to St. Stephen's Basilica, the largest church in Budapest. This Roman Catholic church is named in honour of St. Stephen, the first king of Hungary and whose right hand is supposedly housed in a shrine in the reliquary. Completed in 1905, its architectural style is neo-classical with a Greek Cross ground plan. It has a very large dome and the cupola is magnificent. The entrance façade is anchored by two large bell towers. The street leading up to the basilica was very busy as workmen were setting up Christmas Market wooden huts ready for the Chocfest that coming weekend.

We then continued the bus tour where the next stop was Hero's Square. The square was busy, not just with tourists, but with workmen preparing the square for an equestrian event at the weekend also.



Companions catching up again

The next stop was outside of Budapest at the Gödöllő Palace. After a rest for coffee, and cake of course, we entered the favourite palace of Queen Elisabeth of Hungary (1837-1889), known to history as Sissy. She was the wife of Austro-Hungaria's Emperor Franz Joseph I and mother to Franz Ferdinand whose



Ladies who lunch...

assassination in 1914 started World War 1. Building started in 1733 and several extensions have been added since. At its peak it consisted of eight wings, a church, a theatre, a riding hall, a hothouse, greenhouse flowers, and an orangery. After a varied history it fell into ruin after World War 2. The National Board of Monuments took over the building in 1981, when rehabilitation and preservation started. The parts of the palace we saw were renovated but were somewhat sparse of furniture in some areas.

The highlight of the tour, and the part I had been most looking forward to, was the last visit of the tour. In the heart of Domohvölgy we went to the Lazar Equestrian Park owned by the coach driving world champions, Vilmas and Zoltán Lázár. On arrival we were welcomed with fresh scones topped with crackling or cheese and seeds, fruit brandy and mineral water. We were taken on a short hay cart trip around the grounds – although

our driver was very quick and some of our party were not impressed!

The lunch provided was traditional Hungarian fare of goulash, roast meats, bacon and onion potatoes, fried jacket potatoes and rice with farmhouse pickles followed by custard pie with apricot jam,

all washed down with white wine! All the time we were in the dining room we were entertained by a gypsy band which was most enjoyable.

After lunch we visited the Hall of Champions where we saw the coaches used by the brothers for different disciplines and many of their trophies and medals won, but the last and highlight event was the unforgettable performances of Hungarian horsemanship, a tradition that goes back to the Magyar hordes who conquered Hungary in the 9th century. We were amazed by the Nomad cavalry fight, archery from

horseback, four-in hand driving of the herdsman and other wonderful riding performances, the highlight of which was one man riding ten horses while standing on the rears of two.

My first Companion's Tour was in 2003, and some of you have been at every one of those. I call you my friends even though we may meet only once a year. I will be in Rome in May where I hope Sandy will be able to join us on our day out.

After the day's events, there was just time to get ready for a fantastic evening's entertainment, with a very special private Metro train ride to take us to the majestic Conference Dinner venue at the Restaurant Gundel.

Anne Dunlop



Restaurant Gundel

GPA EUROPE ANNUAL CONFERENCE BUDAPEST, 13-15 SEPTEMBER 2017

TECHNICAL CONFERENCE – MORNING SESSION 15 SEPTEMBER 2017

Moderated by Gauthier Perdu, PROSERNAT SA

After the wonderful dinner offered at the Restaurant Gundel on Thursday night, the Friday morning session had five papers. The main theme was around aspects of NGL recovery in gas conditioning.

The Future of Learning

First, the assembly was fortunate to start the morning with a paper presented by Malcolm Harrison from JM Campbell/Petroskills Limited. Malcolm has a wealth of experience in the energy industry, gathered in his technical and business positions in natural gas producers and energy distributors, before his current position in a training organization. As such he took stock of *The Future of Learning*. He gave a very original and exciting presentation on the game changers of his branch of the oil and gas industry, itself completely renewed by the revolution created by such issues as: lower production prices; the pending impact of Government Regulation to reduce hydrocarbon emissions; and the huge loss of experience after tens of thousands of employees have left the industry during four years (up to now) of downturn. We may be close to the appraisal of new projects and re-development of new capacities of energy production from fossil sources, after years of investments made predominantly in capitalistic concentration and in renewable sources of energy. But things will never be the same and the industry has to face:

- The lack of skills following personnel's exit from our industry. Their experience would have led them to occupy senior management positions today.
- Those who have survived have lesser skills, are younger, and yet they have to be the decision makers.

As a result, the oil and gas industry will have to deal in the short term with a big hole in succession when Oil and Gas projects are revived. This will lead to a large demand for skills and new perspectives for organisations providing training and education of staff. These training organisations will

have to make their own revolution to adapt to the demand that has evolved: e-learning; blended learning; MOOC; SPOC; social media etc.

In this context, Petroskills/JM Campbell has evolved new offers, schedules and programs. Malcolm provided an enlightened and a relevant summary of the situation, through his enthusiastic presentation.



Malcolm Harrison, Petroskills-JM Campbell



Fiona George, WorleyParsons

Propane Equivalent for Flexible Plant Design

Fiona George, from WorleyParsons, brought us back to the topic of the morning – NGL. She gave an instructive paper entitled *Propane Equivalent for Flexible plant Design* describing a modern approach to optimize a simple NGL separation plant when it is fed by a wide range of feed gases with various compositions. She introduced the propane equivalent concept to change the inlet composition into a single equation parameter, after she had demonstrated that none of the methods considered so far have produced a satisfactory method to analyse the effects of the feed composition and their consequences on the operation on a Turbo Expander / Joule Thomson NGL separation plant. She has derived the method used for years to test the inter-operability of natural gases from the existing fields of Northern UK North Sea with new ones, or new sources of gases arriving from elsewhere.

She concluded that for any given feed composition, the Propane Equivalent value can be calculated to assess the liquids which will be produced for any given feed rate at a range of LTS operating temperatures and pressures. This information is useful both for debottlenecking of existing plants and for design of new plants. For an existing plant, knowing the Propane Equivalent, the LTS operating temperature at a fixed operating pressure can be selected to ensure that the LTS liquids remain within the design capacity of the plant. Predictions can also be made to check how future gas compositions could be accommodated as it enables a quick pre-screening of potential feeds to a NLG gas plant, and identifies if there are likely issues in their processing.



Muneeb Nawaz, Costain

Gas Terminal Optimisation meets Montreal Protocol Directives

The third paper, entitled *Gas Terminal Optimisation meets Montreal Protocol Directives* was given by Muneeb Nawaz from Costain. The paper was co-authored by Michael Spencer, Stuart Campbell and Terry Tomlinson also of Costain. It focused on the modernization project of the Perenco UK (PUK) Dimlington gas terminal, to efficiently and economically meet the Ozone Depleting Substances Directives of the Montreal Protocol. This is one good example of the type of projects our industry has to conduct now, as the need to protect the environment is one of the drivers of the upgrade of existing installations. The project faced many challenges as it was necessary to avoid any major disruption of the UK North Sea Gas Terminal operation. The success of this project was recognised by a major IChemE award.

The Dimlington Terminal is a gas compression terminal with gas dewpointing trains using mainly Freon R-22 refrigeration units to meet UK gas specs. Freons are now banned from modern installations for their adverse role on the depletion of the ozone layer in the atmosphere. The Montreal protocol began in 2015 and has imposed a ban on refilling any system with Hydrochlorofluorocarbons (HCFCs). Costain was awarded the conceptual project, and further on, the project for the upgrade at the site. After the evaluation of many options, the selected process scheme was a combination of J-T expansion, refrigeration (using a refrigerant with low hazard rating and compliant with new legislations) and the use of methanol as hydrate inhibitor to meet gas export specifications. Muneeb highlighted how the project succeeded in the coordination of activities, well-organised logistics and delivery of equipment, and Costain completed the implementation of the engineering and construction activities within the short modernization schedule at Dimlington. The project also achieved high levels of safety, and the upmost respect for the environment, which all earned client satisfaction.

Revamp of a Propane Recovery plant to 90% Ethane Recovery from Design to start-up

After the break, the audience appreciated the paper *Revamp of a Propane Recovery plant to 90% Ethane Recovery from Design to start-up*, which was well communicated by the joint speakers John Mak and Brian Jung from Fluor Energy & Chemicals' offices in California. The paper was co-authored by Alejandro Ramirez and Curt Graham, also from Fluor Energy and Chemicals. It described the modernization of the 600 MMSCFD propane recovery cryogenic Pemex Criogénica 2 plant which has been in operation for more than 18 years. The plant has faced in recent years a new demand for ethane to supply the downstream cracker. Fluor presented the successful conversion from propane recovery to high ethane recovery using the Fluor patented Residue Gas Reflux process. The conversion was achieved with minimal capital investment and a quick turnaround, because the long lead equipment such as compressors, columns, and propane refrigeration system had adequate margins which could be reused at site. The project also succeeded in re-using the existing structures and foundations of demolished equipment for the new equipment to minimize pipe routing and construction time. Despite challenges, the new plant meets client expectations of 90% ethane recovery.



John Mak and Brian Jung, Fluor

The revamp of the Criogénica 2 plant of PEMEX by Fluor Energy demonstrates that many factors, such as changes in feed gas composition or market conditions, may require a propane recovery plant to be revamped for high ethane recovery, which means high and intensive new investments at site. It demonstrates that initial margins imposed on critical equipment, selected at the early stage of the grass root project, have been very useful and have helped the revamp project to control its costs and schedule.

Choosing the Right Nitrogen Rejection Scheme

We closed the morning session, and the 2018 Convention, with a paper given by Nicolas Chantant from Air Liquide Global E&C Solutions France. Nicolas' co-authors were Paul Terrien and Sylvain Gérard, also from Air Liquide. The paper *Choosing the Right Nitrogen Rejection Scheme* delivered a very exhaustive and precise summary of the various arrangements of nitrogen rejection units (NRU) used in the natural gas industry. Cryogenic Nitrogen Removal Unit is a simple, cost effective and efficient way to remove nitrogen from natural gas. However the number of parameters to take into account for the selection of the unit requires an extensive knowledge of all the possible issues. The discussion reviewed the various options and gave the advantages and the drawbacks of the most sophisticated schemes from one to double or three columns. As for the NGL recovery processes, the NRU uses a variety of refrigeration schemes ranging from simple JT expansion to external refrigeration cycles using nitrogen, methane, or mixtures of refrigerants. The paper clearly demonstrated the capabilities of Air Liquide in the field.

Gauthier Perdu

GPA EUROPE AGM AND TECHNICAL CONFERENCE LONDON, 23 NOVEMBER 2017

MORNING SESSION

Moderated by Christian Bladanet, Technip

After the introductory notes and some fresh warm coffee, everybody was eager to learn about and share key safety aspects of the gas industry, such as ISD, QRA, HAZOP, SIL and LOPA, which, as everybody knows means Inherently Safe Design, Qualitative Risk Assessment, Hazard and Operability study, Safety Integrity Levels and Layer of Protection Analysis.



Juliet Vuong, CB&I



Mahader Kassa, CB&I



Julie Venables, Fluor



Adrian Jones, Costain

How Can We Pursue Inherently Safer Designs in Projects?

Juliet Vuong and Mahader Kassa from CB&I opened the fire by answering the question *How can we pursue inherently safer design in projects?* The first answer, expressing the concept defined by Trevor Kletz, considered the father of ISD, is to remove the source of the danger. A strong concept indeed but with a risk of having most of us jobless if we apply it to the extreme of not building gas processing facilities. That was when Juliet and Mahader's presentation struck a chord by explaining how we can still continue to develop our business, while building safer plants. After some interference with the audio system of the room next door, which was a proof that risk cannot be fully eliminated, Mahader presented three examples of ISD applied in recent projects, to illustrate that although it could be regarded as common sense, ISD actually needs a systematic approach and good coordination, at the earliest stage of projects.

Effective Achievement of Inherently Safer Design

Then Julie Venables from Fluor presented various methods and approaches to implement ISD on a project, with her paper entitled *Effective Achievement of Inherently Safer Design*, co-authored by Nick Amott, also of Fluor. Although we all aim at eliminating all kind of risk in our installations, Julie raised the million dollar questions of what risk can be tolerated, and what an organisation is ready to invest to decrease risks to reach the ALARP status? To answer them, Julie detailed various methods and techniques that can be applied to assess or quantify risk, and ensure that we design projects which allow all of us (designers, operators, citizens) to sleep quietly, with the peace of mind of having done all that is realistically possible to reduce the likelihood and consequence of an accident.

Using Quantified Risk Assessment (QRA) in Feasibility Design

After a well-deserved break, Adrian Jones from Costain explained how one of the most important, but also complex, risk management tools, the QRA, can be simplified to become effective at the early stage of a project, and provide critical orientations and conclusions at a stage where a conventional QRA could not be performed realistically. Adrian illustrated this approach in his presentation entitled *Using Quantified Risk Assessment (QRA) in Feasibility Design* with the example of the installation of a new compression station, where a coarse QRA allowed the assessment of potential risk for the surrounding dwellers, and confirmed that the proposed location would not present an unacceptably high societal risk, then allowing land to be acquired and the project to move forward.



Ian Hitchen, Rowan House.

Quantifying Residual Risk as Part of the HAZOP Process

Another industry standard used in the frame of ISD is the HAZOP. Ian Hitchen from Rowan House Ltd took to the stage at the end of the morning session to detail how to quantify residual risk as part of the HAZOP Process, in his paper co-authored by Zaffer Khan, also of Rowan House Ltd. As said earlier, measuring risk is a highly subjective exercise, so a calibrated matrix considering the consequence of a hazard, the probability of the presence of people and the likelihood that the hazard will occur, is now used to help the designers and operators to assess, as objectively as possible if a risk is acceptable, or if an additional layer of protection is required. Again, even if nobody can realistically be 100% sure that a project is risk and accident free, this powerful tool provides a rigorous guidance towards collectively acceptable levels of risk.

After these four very intense presentations, all the delegates were on the verge of risking hypoglycemia, and it was collectively concluded that it would be inherently safe to add a layer of food in our stomach, and continue the debate around a full plate.

GPA EUROPE AGM AND TECHNICAL CONFERENCE LONDON, 23 NOVEMBER 2017

AFTERNOON SESSION

Moderated by Adrian Finn, Costain

Brownfield Gas Developments

Late Life Gas Production Enhancement

The first half of the afternoon's Technical Session saw two papers on Brownfield Gas Developments. The first by Charlotte Wright of Petrofac, co-authored by Reza Fallahi Alvani and George Kontarakis, considered *Late Life Gas Production Enhancement* and presented a structured approach to meeting phased increased production for an offshore gas production system through to onshore gas processing, which included gas sweetening, nitrogen removal and sales gas compression. The initial enhancement (Phase One) was achieved by noting that the required one hour of pipeline buffer could be maintained at reduced gas flow with a reduction in flowing head tubing pressure (FHTP) of 5 bar so pipeline pressure to shore could be lowered to increase gas flow at minimal cost. Production compressor options were examined to increase gas flow further (Phase Two) by initial screening with more promising candidates proceeding to cost benefit analysis based on net present value (NPV). The limitations imposed by existing dehydration and acid gas removal equipment were clearly explained.

With the production compressor operating in recycle to prevent surge at the low gas flow, the recycle valve could be replaced by an educator to reduce gas pressure from 74 bar whilst drawing in gas at 17 bar and boosting it to 21 bar. Educator installation could be achieved in limited time and avoided both production compressor changes and any changes to existing onshore gas processing systems. This low cost, reliable and relatively simple modification gave the highest NPV and the optimal approach for Phase 2 production enhancement.



Great to see young professionals in London

Strategy for a Successful Revamp

Céline Volpi of TechnipFMC presented *Strategy for a Successful Revamp*. Plant revamp may be due to the need to increase production, to meet a new feedstock requirement or for revised product specifications, with the challenge of minimising plant modifications and limiting CAPEX with plant changes needing to be made in a short shutdown to minimise production losses.

Celine presented TechnipFMC's structured approach to defining overall project objectives and the constraints imposed by existing equipment and utilities, evaluating the actual plant performance to provide a benchmark for assessing improvements and then exploring feasible modifications. The structured approach ensures the most cost-effective modifications are prioritised with key CAPEX and plant performance issues addressed in a logical and prioritised order. The potential limitations and modifications were clearly explained in terms of equipment, pipework and instruments, with the critical (and often missed) issue of thermowell vibration highlighted. The importance of addressing constructability issues and site safety in conceptual design assessments was stressed to provide the best debottlenecking approach. Two examples of the methodology in practice were presented for a gas plant capacity enhancement and for an upgrade to meet more stringent sulphur limits.



Charlotte Wright, Petrofac



Time for a break



Celine Volpi, TechnipFMC

AFTERNOON SESSION

Moderated by Adrian Finn, Costain

Pressure Relief and Blowdown

"Magic" Pressure Rise

The second half of the afternoon's Technical Session, on *Pressure Relief and Blowdown*, commenced with "Magic" Pressure Rise by Adam Wills of ABB Consulting, co-authored by Chris Flower. The "Magic" pressure rise of the title was described by Adam as being due to thermodynamic and physical properties being easily sourced from process simulation software and being used for elevated pressure for relief assessments but without proper consideration as the source of increased pressure or proper plant modelling. Hence this "Magic" pressure rise is not supported by an energy and material balance and therefore erroneous.

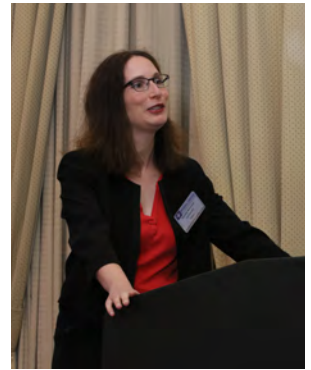


Adam Wills ABB

Adam highlighted errors in plant and system modelling, that lead to errors in further calculations, and the need for more rigorous modelling for relief, flare and blowdown. He provided some case studies showing the magnitude of likely errors due to poor selection of fluid properties prediction method, especially for polar and/or ionic liquids, and the effect of non-equilibrium conditions in transient situations. He exhibited how using actual equipment data such as compressor curves improves model fidelity and avoids or at least reduces "Magic" pressure rises. The useful "Modelling Checklist" presented serves to question and check each aspect of the process model to ensure it is as close to the real system as possible, engineering calculations are more rigorous and design more accurate.

Blowdown: how a safety system impacts design?

The final presentation by Michèle Normand of TechnipFMC discussed *Blowdown: how a safety system impacts design?* Michèle examined the importance of equipment depressurisation to lower the inventory of flammable material and to reduce the potential source of fire. The importance of an agreed depressurisation philosophy between plant operator and designer was noted.



Michèle Normand, TechnipFMC

The requirements for blowdown system design have increased over time with improved system modelling being available including dynamic simulation. Codes such as API 521 have evolved from a prescriptive approach to a performance based design. These have increased plant safety whilst requiring more engineering and potentially having significant effects on plant design, both for process and relief systems. For instance, API 521 5th and 6th editions are not prescriptive in the time to depressure but require the consequence of fire to be assessed in evaluating the depressurisation time to avoid equipment rupture.

The types of fire scenarios requiring consideration for design are more extensive than the pool fire scenarios on which earlier versions of API 521 were based. Depressurisation for jet fires is more stringent. Design tools for modelling of fires are more readily available to help assessments.

Michèle provided an excellent assessment of how fire and depressurisation assessments have developed and become more sophisticated in the interests of fire protection, how blowdown system design affects oil and gas processing facilities and the interactions between process and safety systems. The Technical meeting was brought to a close, before delegates headed to the drinks reception to relax and wind down!



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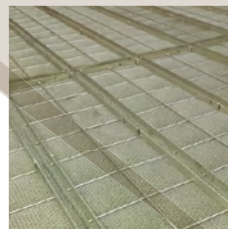
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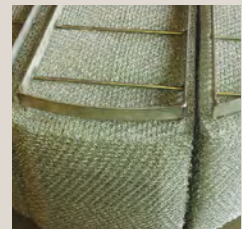
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KVP
Vane Packs for
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KWM
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fine mist removal



KDM
Dual Media
Mesh for ultimate
performance

GPA Europe Chairman's Annual Report - 2017



Tony Wimpenny receives Best Paper Award 2017

Ladies and Gentlemen, friends and colleagues, thank you for taking the time to join us today for our Annual General Meeting.

It is great to see so many of you here and we really appreciate your efforts, not only for being here today but throughout the year, which has ensured the success of our excellent conferences at some of the best locations in Europe.

We continue to be affected by the global impact on our industry and although we are just beginning to see some light at the end of a very long tunnel we are all aware of the fragile economic climate that we must operate in and the fiscal constraints that we all have to adhere to. Nevertheless, it is incumbent on us all to convince the purse holders that the benefits provided by GPA Europe are well worth the cost and without you we will not be able to continue to provide the high level of conferences and papers, so your continuing support is greatly appreciated.

So let me summarise what we did achieve this year:

We began, in February with our Young Professional's Training day, in Rueil-Malmaison, Paris, which was hosted by IFP Energies Nouvelles and the IFP School. We had a total of 75 delegates attending with the majority of these being Young Professionals, but sadly there were far less university students than we had hoped. This is something that we are working on to address next year when we revisit Paris in March. The themes for this conference were developed and agreed by our young professional committee and we are extremely pleased with their involvement and support on the management committee.

Although not part of our program a few of our more adventurous souls travelled to San Antonio in the USA for the GPA Midstream Convention. It was during this that two of our colleagues were honoured for their services with firstly; Adrian Finn being presented with an individual plaque recognising his hard work as a member of the Editorial Board for the GPSA Engineering Databook (copies of which are available on request) and secondly to Sandy Dunlop who received a Citation of Service in

honour of more than 20 years' service to the gas industry. I believe a well-deserved round of applause is in order.

We then moved to Milan in May for our Spring Conference. It was here that we trialed something different and that was a panel session. Even though this was not quite as successful as we had hoped, we do believe it can be significantly improved and provide a real opportunity for the transfer of knowledge in a less formal environment. We realise however, that we need to select a "Presenter" with the flair and tenacity to bring out the best in the audience and for that I humbly apologise (I was the presenter) for my shortcomings. We continued with a short knowledge session which, although much shorter than normal, packed in a great amount of detail and then a full technical meeting following our tried and tested program and I am pleased to report was a great success.

For this year's annual conference we visited the beautiful and historic city of Budapest in Hungary. We opened the conference with a knowledge session entitled "Getting the full use out of the GPSA Engineering Data Book" (copies of which are available on request).



Sandy and Anne retire

◀ This proved to be a very useful and helpful session and our thanks go to Simon Crawley-Boevey for providing the guidance and necessary patience.

We followed this with a full program of technical papers that were highly informative and greatly appreciated. As has become the "norm" with our annual conferences especially with Sandy and Anne at the helm we were all in for a surprise. This took the shape of a train. Now I know there's nothing too surprising about a train, however this was not an ordinary train, this was our own private underground train, just for GPA Europe, which took us to the historic and famous Restaurant Gundel where we sampled the local cuisine. It was also great to see a good number of companions making the tour and many thanks to Anne for keeping them all entertained.

This brings me up to date with today's Knowledge Session, AGM and Technical Meeting here in London which is our final event for this year.

2017 has been a difficult year for GPA Europe and we, like most, have suffered with trying to run an organisation within the budget constraints that have so affected our industry. We face many challenges going forward and the committee realises that we cannot just keep doing what we have always done in the past and hope that it gets us through. We need to analyse what we do, we need to not only just talk, but to listen to what you, our members want and need from this organisation. I'm sure that together we can meet those challenges and not only succeed but further enhance what we do and ensure that the future conferences and events provide value for money, knowledge transfer and an environment that we all feel comfortable

and happy to be part of.

I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel. I do hope that we make you feel valued, as members of GPA Europe and I look forward to seeing you all at as many future events as your time and resources will allow.

Before I close, I would like to express my sincere thanks to the Directors, Management Committee and Programme Committee who give their time generously to GPA Europe.

Then of course there is our Executive Administrator, Sandy Dunlop, ably supported by his wife Anne, who have helped steer this ship and ensured that whatever we have thrown at them, has been dealt with efficiently and professionally. They have worked tirelessly since taking over the reins at the end of 2010 and have, I'm sure you will all agree, provided us with many wonderful events, first class accommodation, interesting venues to sample excellent food and wine and the odd surprise thrown in for good measure along the way. How can we ever forget Sandy's knees during our wonderful 30th anniversary dinner in Edinburgh?

It is therefore with much regret that they have decided to retire and that this is the last event that they will be fully involved with from the organisational side, but they leave us in very good shape with all of next year's events already booked, a position that I'm sure our new executive administrator (more on this later) is very pleased about. I hope that we continue to see one or both of them at some of our future events.

To all members of GPA Europe, thank you for your support in 2017 and all the best for 2018.

Sandy Dunlop retires

as GPA Administrator

After seven years at the helm of GPA Europe in the role of administrator, assisted greatly by Anne, Sandy Dunlop took the decision to retire, and to hand over the reins to the new team of Malcolm Harrison and Helen Cozens. The AGM and Technical Conference was Sandy and Anne's last event, and Sandy couldn't resist taking to the stage to bid the audience farewell with a very entertaining speech:

I had thought of calling this part of the agenda – the Sexit, but with all the current concerns about inappropriate behaviour, perhaps not. Having said that getting to today has been almost as fraught as the Brexit discussions between Messrs Barnier, Tusk and Junkers and our bunch of jokers!

Seven years ago (it seems like only yesterday!), I took over this job from Don Cooney who had extended the original pro-tem Executive Administrator role from Forcom, and set up the system we all now enjoy – and so I think I should open by thanking Don for not telling me about all the things I would have to do!!!! I might not have taken on the job!

I guess that there have been one or two highlights, (apart from the conference surprises, which I hope you all enjoyed!) including the Incorporation of GPA Europe Ltd., the challenges of changing In Brief to now a virtually self-financing operation, moving from heavy paper packs at conference to USB sticks, establishing a common set of processes which I hope will ease Malcolm and Helen's takeover and then of course there were the challenges of two GasTech's and DMG!!!!



These things have added to the excitement of what has been a most enjoyable period and I would like to single out a few people for special mention.

One of the advantages of having control of the archive going back to 1985, is that I could find some old photographs!

- Colin Woodward – the sage of Durham who has an uncanny knack of finding typographical errors after I have spent at least a day trying to get rid of them!
- John Sheffield and Adrian Finn, who always seem to be around when support is needed – need a session chair or an overview presentation, they have always come up trumps. And John also - special thanks for all that fun we had trying to set up a deal with DMG!
- Christian Bladanet (who somehow managed to avoid having his photograph taken!!), especially for support in setting up the YP meetings in Rueil Malmaison. He did compliment me on my French emails until I disabused him by reminding him that Microsoft Translator was very good! Christian has also always been able to rustle up a paper (or two) from Technip FMC when required.
- Lorraine Fitzwater for putting up with me moivering her about the need for additional papers to make up a conference package or finalising a programme or the annual Best Paper calculations. Malcolm, you are going to miss Lorraine as Programme Chair, but I am sure Myrian will more than make up the role.
- To all the members of the ManComm and ProgComm who have supported what I have been doing to make it a success, and

particularly to

- Jon Lewis for getting me the Minutes of Meetings, eventually (wink),
- Martin Mayer for putting up with my long-winded monthly reports and of course
- The Chairmen with whom I have worked, David Weeks, Keith Thomas, Paul Openshaw and Steve O'Donnell. Particularly thanks for all your support though the period of incorporation which was a necessary means of making the GPA Europe up-to-date and much more business-like for the future.

You can see what has happened to people who work for me for seven years, but seriously, all these guys put their time in for free in the middle of a very pressing day-job to keep the GPA Europe going so can I ask you all to give them a special round of applause.

I would also like to thank all you guys for your support, for getting payments through your accounts departments (!!), for coming along to meetings and responding to Calls for Papers, and attending conferences. Without your support my job would have been infinitely more difficult.

And then last, but very certainly, not least there is my wife Anne who has (and it has to be said, in some cases grudgingly!) put up with me having to work at the weekends, helped with stuffing In Briefs before we went electronic, and invoices into envelopes and names into badges, manning exhibition stands at GasTech and Reception desks at Conference, reminding you all to give your badges back and leading the Companions' Tours - words are not enough to express my sincere thanks.

I will now, over the next month, hand over to Malcolm and Helen, to whom I give my thanks for stepping into the breach and I know you will all support them as you have supported me as they take on this role. Please cut them some slack – there is an awful lot to do and there will be delays in the early days (I had those problems!) but I hope I have set up the systems for their and your benefit and I am sure they will quickly settle in, and I wish them every success in the role.

I originally decided to take this role to wind down to my retirement date and get out of the rat race of having to write reports and strategies and plans for people who had little idea of what was happening in the real world out there, and I have to say that I have thoroughly enjoyed the time. It has been a real learning curve structuring the systems to handle the maze of stuff to be done and working on my own has been an interesting challenge, but, and I mean this - truly great fun.

I have now decided that it is time to hand-over, and spend more time with my four (soon to be five) wonderful grandchildren, doing a bit of relaxing travel with Anne, and spending more time working on my handicap – and I am going to decide what I want to do for a change! Anne said I could say that! I am sure she has a list as long as my arm and everyone keeps telling me I will wonder where I found the time to do any work!

Thank you all and while this is good bye, it is not Sexit!, as I will attend ManComm meetings and conferences in future – so I will see you then and thank you once again for a great time.

Thank you.

FORTHCOMING EVENTS

2018 ANNUAL CONFERENCE

16-18 May, 2018

NH Vittorio Veneto Hotel, Rome, Italy

- Technical Papers
- Conference Dinner
- Companions Tour

2018 AUTUMN TECHNICAL MEETING

19-21 September 2018

Crowne Plaza Barcelona Fira Center, Barcelona

- Panel Discussion
- Knowledge Session
- Topics on Improving efficiency and availability in the energy industries

AGM & TECHNICAL MEETING

22 November 2018

Hilton London Paddington Hotel

BREAKING NEWS

Keep your eyes wide for 2019 events. We have agreed with Shell, the world's largest independent gas producer, that they will host a GPA Europe conference in the spring next year.

It promises to be VERY special. Be you speaker, supplier, sponsor, operator or exhibitor there will be something for everyone.

Block your diary.

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This listing of current Corporate Members represents the status as at 28 March 2018.

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