Gas Processing Challenges in the Energy Market

The 20th Annual Technical Conference of the Gas Processors Association – GCC Chapter was successfully held on 9th May 2012 at The Address Dubai Mall Hotel in United Arab Emirates with the theme of “Gas Processing Challenges in the Energy Market”.

At the opening session of the conference, welcome remarks were delivered by the Chairman of the GCC Chapter Mr. Saad A. Turaiki, Vice President - Southern Area Oil Operations of Saudi Aramco. The keynote speech of the conference was delivered by Mr. Saeed Khoory, CEO of ENOC.

Dubai Natural Gas Company Limited (DUGAS) was the sponsor of the 20th Conference in Dubai.

Ten technical papers were presented by the Chapter’s member companies which include the major Oil & Gas companies within the Gulf Cooperation Countries. In addition there were presentations from Saudi Aramco and Qatar Petroleum International (QPI).

Other papers presented were from QP, DUGAS, Banagas, Emirates Gas, Emarat and G.I. Dynamics which covered a wide range of topics relevant to the gas processing industry highlighting the challenges, latest developments and best practice in this important industrial sector in the region.

Mercaptans Removal and Sulfur Recovery was the subject of the 7th Specialized Technical Seminar which was organized by the GPA-GCC Chapter.

More than 120 participants from the GCC and international delegates have attended the seminar which was held on 21st November 2012 at The Address Dubai Mall Hotel.

Consolidated Contractors Company (CCC), GCC Chapter’s member company, was the sponsor of this event.

Seven technical presentations were delivered covering a wide range of topics on the subject seminar highlighting the latest developments and experiences in this important industrial sector in the region.

The session has commenced with opening remarks by the Chapter Chairman Mr. Fahad T. Al-Subaiey, Executive Director, Gas & Power - QPI followed by a keynote speech by Mr. Sohel N. Ghorayeb –

Continued on 2

Mr. Saad A. Turaiki

Mr. Saeed Khoory

Mr. Sohel N. Ghorayeb & Fahad T. Al-Subaiey

Fahad T. Al-Subaiey
Chapter Chairman

Specialized Technical Seminar
21st November 2012 - The Address Dubai Mall Hotel, UAE

Mercaptans Removal & Sulfur Recovery
Business Development Executive, CCC and then followed by the technical papers as per the following:

Complex Gas Processing Made Simple
Mr. Matthijs de Oude, Mr. A.H.M. Abdul-Hassan, Shell Global Solutions International BV, The Netherlands

Buffer-Gas Technology
Dr. Robert Amin, World Gas Technology Company, Australia

Sulfur Plant Configurations for Weird Acid Gases
Mrs. Kelley F. LaRue, Mrs. Susan M. Grigson & Mr. Hank M. Hudson, Ortloff Engineers, Texas
& Mr. Naji Abou Chedid, UOP – Honeywell, Saudi Arabia

Comparison for Total Sulphur between Sulphur Analyzer Lead Acetate Based and Gas Chromatography PFPD Detector Based
Mr. Hamad A Hassan, Banagas, Bahrain

SuperClaus Sulfur Wash in Saudi Aramco UGP
Mr. Ghannam Al-Ghannam, Saudi Aramco, Saudi Arabia

An Integrated Approach to Sour Gas Field Development
Ms. Mona Bhagat, Petrofac Engineering, UK

Case Study: Mercaptans Sweetening of Iso-pentane at Yanbu NGL Fractionation Plant
Mr. Bejoy K. Bharatiya, Saudi Aramco, Saudi Arabia

The session chairman was Mr. Khalid Al Awadi, Emarat Technical Affairs Specialist of Emirates General Petroleum Corporation, (Emarat).

The papers touched on subjects of high interest to the audience which provoked good interaction between presenters and participants, sharing their knowledge and experience. The success of the seventh specialized seminar proved the importance of the selected subjects and the importance for focusing on such areas of high and common interest to the GPA-GCC Chapter member companies.

These successful achievements demonstrated the valuable and effective efforts of the GPA-GCC Chapter in expanding its activities to better serve the oil and gas companies of the region by providing a unique platform for the professionals to share the knowledge, experience and industry best practice.
The reliable and proper performance of the safety relief system associated with any operating unit is a mandatory requirement in order to ensure that the unit would be adequately protected in the event of any overpressure scenario encountered. Hence, safety relief systems need to be carefully assessed to confirm compliance with guidelines recommended by good engineering practices and recognized industry standards. This paper presented Banagas experience based on a pilot study conducted to evaluate the adequacy of the safety relief system at Compressor Station-1.

The main purpose of the study was to identify any deviation in the pressure relief and flare system at Compressor Station-1 from industry recognized standards and propose solutions to resolve any determined concern. The first phase of the study included pressure relief analysis and flare system analysis.

The pressure relief analysis included the identification of all potential sources of overpressure for each piece of equipment, the quantification of the required relief rates, and the sizing of relief devices. Also, inlet and outlet pressure drop calculations were performed and results were evaluated against recommended limitations as per API code.

The flare system analysis aimed to identify any concern in the flare system associated with global relief scenarios. A total of 20 deviations from recommended industry standards were identified and in the second phase of the study, these concerns were further analyzed and whenever required, appropriate mitigation options were proposed to resolve the identified deviations.

Following the study, Banagas successfully implemented all of the study recommendations with major changes including installation of new safety relief valves and piping modifications being carried out during Compressor Station-1 shutdown (S/D) in October 2010. As a future objective, Banagas is planning to carry out the same study at it’s other processing facilities.
Emirates Gas LLC is wholly owned by Government of Dubai and a subsidiary of ENOC (Emirates National Oil Company) has embarked upon the CNG (Compressed Natural Gas) initiative in the Emirate of Dubai.

This initiative which is in its 1st Phase, envisages the establishment of two CNG Mother Stations to be constructed on existing Natural Gas Pipelines which will feed 5-7 CNG Dedicated Daughter Stations at fleet owner premises. These “dedicated” CNG Daughter Stations will be supplied CNG (Compressed Natural Gas) through purpose built road trailers from the CNG Mother Stations.

This Emirates Gas Initiative caters to dedicated fleets using CNG as an alternative automotive fuel, so that the dedicated CNG Daughter Stations are set up at the fleet owners premises.

This is in line with the Dubai Strategic Plan (2011-13) with the aim of providing gas stainable development by setting laws and regulations to reduce air, water and land pollution and using more environmentally friendly transportation fuels to reduce carbon footprint.

Procedural Based Control (PBC) Application for Gas Treating Processes

At Saudi Aramco process plants, startup, shutdown, and transitions are performed manually based on predefined procedures prepared and updated by the Operation Divisions. These procedures consist of set of tasks that should be carefully executed to ensure the avoidance of any operational errors. However, human beings are vulnerable to uncertainties and disturbances that probably make an operator to take wrong actions leading to undesired events.
Consequently, Process & Control Systems Department (P&CSD) of Saudi Aramco has been seriously considering the automation of the operation procedures to minimize the operator’s interventions to ensure safe and reliable modes of operation. To approve the procedural automation concept, P&CSD has piloted a Procedural Automation Application at one gas treating unit a Saudi Aramco gas plant.

In conclusion, the PBC solution standardizes operational procedures and captures the knowledge of experienced operators and engineers prior to retirement as well as provides a training tool for new operators and engineers to develop GT operations skills. It structures and automates the manual operation procedures to improve the operating procedures in terms of process safety and process operability.

**Feed Gas Streams Integration Added Values**

*Natural Gas processing is one of the most important mechanism in gas value chain and play an integral part in controlling the cost of value chain components to achieve lower operational costs, the overall concept of reaching lowest cost was further extended and developed within the boundary of Qatar by continuously exploring opportunities to add value, to existing facilities and concurrently outside Qatar by developing Qatar Petroleum International as investment arm to Qatar Petroleum to the world, an organization concept inherited with skilled and experienced industry professionals, to establish appropriate technologies, and apply QP core experience and corporate governance, advancing the interests of Qatar in the international arena with prudent investment approach, whether it is development or acquisitions, the winning formula is adopted from the parent company and has definitely proven itself time and time again.]*

The gas processing journey started since late sixties with the processing of associated gas that exists in a form of solution with crude oil in underground reservoirs, in eighties the non-associated gas from the north field transport for processing, the two type of source gas the associated gas and the non-associated gas, were at the begin processed separately as two feed streams utilizing a combine products treating, transporting and storage facilities.

With the continuously effort of exploring opportunities to add value to existing facilities a challenges to integrate the two sources gas stream, as combine feed to the extraction and separations units is undertaken, while applying the skills of solving the operation, environments, and customers constraints issues. The decade knowledge gained and longtime experience helped in understanding the hydrocarbons & non-hydrocarbon component behaviors, their physical & chemical existence and their market demand profiles. Other unique issues were also taken in consideration such as the realization of the fact of the generic depleting natural of the non-associated gas with time; this has made the task very challenging, hard-hitting and exceptional to Qatar Petroleum.

The breakthrough achieved first when an associated gas source was injected in to the non-associated gas pipeline at a distance of more than 200 KM away from the gas processing facilities allowing both gas source to flow together at a ratio of 10% to 90% volume base and up to 20% to 80% after the success of the first trail, the initiative motive was to reduce flaring at a remote offshore location, the design made robust to guarantee success, the implementation was done progressively as experiment to achieve the progressive learning and record the results, the first modification made at the off take point to upturn the pressure of the gas for injection and the second modification was done at the processing facilities to debottleneck the liquid handling equipment to cope with the liquid volume increase, available margin in the existing treatment and storage facilities was utilized to handle the new product flow.

With the success of this initiative, associated and non-associated gas streams, by maximizing the utilization of existing equipment to achieve efficient operation at lower cost. This effort has documented
the excellent management of the gas processing value chain with benefits passed to the oil production flaring mitigations. Further benefits have been achieved from the integration and will be utilized in the enhance oil recovery regime (EOR) as one of the options in EOR proposal, recognizing that the EOR is one of the destiny to come in any oil and gas production life cycle.

The most impressive achievement to be noted is that in short time the international investment arm of Qatar Petroleum, Qatar Petroleum International managed to hold on its portfolio operating facilities outside the state of Qatar, running internationally at full compliance to local and worldwide safety, environments and regulatory mandates.

UAE Gas Supplies Shortages Solutions, a Model to any GCC Country to Adapt

Almost all GCC countries are facing gas supplies shortages now due to increase of gas demand related to electricity, water and industries demand, having the sources (supplies) at fixed level that will do not meet current summer demand and may lead to increase of oil burning, thus losses of GCC oil sales revenues from the international markets.

The paper presented 10 solutions to the current gas supplies shortages in ways that it uses data base of UAE figures as a sample to preset the solutions in a format that can be used for any country.
Optimizing Gas and NGL Short Range Operating Plan (SROP)

The objective of this paper was to share the concept of utilizing the state of the art optimization and simulation technology to generate optimum monthly Short Range Operating Plans (SROP) for gas and NGL in Oil Supply Planning and Scheduling (OSPAS) Department.

The model which has been commissioned is capable of optimizing all modes of operation starting from the gas oil separation plant (GOSPs) down to the terminals and passing through all important operations in the gas and NGL plants with an objective of maximizing the net revenue and meet the NGL and gas demand while considering all operational constraints such as capacities. As part of the monthly SROP cycle, the paper also covered the challenges of managing export NGL inventories and recommendations to mitigate that including the idea of utilizing an optimization model to help managing and optimizing the export NGL inventories.

Block diagram summarizes the SROP process:

The paper in conclusion made a number of recommendations:

- Improve OP & SROP WP for Better Optimization
  - Include 4 months sale
  - Generate 4 months inventory projection
  - SROP to consider latest NGL prices
  - Quantity loss of containing additional NGL to be evaluated by Sales

- Enhance Projection Report
  - This shall have a positive impact in showing a clear plan in the daily report. This covers many suggestions such as:
    - Last 24 hours changes (+/-)
    - Creep alarm for the incremented receipt
    - OP commitment balance (YTD)
    - Flexibility to change the alarm limit
    - Add inventory % column
    - Reflect 4 months projection
    - Add data retrieval capability

- Develop NGL Projection Simulator
  - This shall help simulating all possible what-if scenarios and justify project in case of expansions.

- Enhance Customer Intake
  - This shall be done through the Domestic Sales Department by emphasizing the planned versus actual.

OSPAS continuously work to develop state of the art models to optimize the hydrocarbon plans and exert efforts to integrate these models starting from the upstream modes of operation to the downstream inventories in order to ensure maximum net revenue to the Company.

The GPA GCC Chapter wish to extend their sincere thanks and appreciation to Dubai Natural Gas Company Limited (DUGAS) for sponsoring and supporting the 20th Technical Conference in Dubai.

Thank You!
Natural Gas and other Feedstock Options into Petrochemicals, Integrated Approach and Future Trends

The feedstock is fundamental to any product development. The right properties, volumes and prices of the feedstock are the key elements to dictate the plant configuration. The feedstock for petrochemical plants is available in two forms; natural gas (primarily ethane) and liquids (mainly Naphtha or LPGs such as propane and butane).

The expansion and development of new petrochemical plants require diversification of the feedstock mix. The mix feedstock can be used to produce diversified products including aromatics, intermediates and advanced chemical products. The integrated petrochemical complex offers better utilization of feed stocks and chemical value streams increasing returns on investments. The integration of refineries, petrochemical and polymer operations deliver significant synergies.

Since few years, Qatar Petroleum International (QPI) is diligently watching the petrochemical market and evaluating the dynamic of the marketing indicators. The GCC players and other international oil companies are looking forward to invest worldwide by supplying the feedstock to capture a greater share of the hydrocarbon value chain in Asian, European and American market. However, the viability of these investments is controlled by demand and supply of feedstock and products market. The discovery of unconventional shale gas reserves and biological hydrocarbons has changed the petrochemical industry. The unconventional shale gas, biological hydrocarbons and coal have gained significant attention as potential feedstock sources.

This paper intended to reveal the utilization of natural gas into the development of petrochemicals. It discussed the other feedstock options and the ways how the integrated approach can be realized. The paper also questioned about the forthcoming trends.

The paper concluded:
1. Due to shortage of natural gas feedstock (methane and ethane) in the Gulf countries, the trend is towards the utilization of mixed liquid feed stocks for petrochemical production, which don’t offer the same cost advantages as natural gas.
2. However, with the utilization of liquid feedstocks, petrochemical companies will enjoy the benefit of diversified products slate including aromatics, intermediates and advanced chemical products.
3. By employing ‘integrated approach’, the integrated refinery and petrochemical complex offers better utilization of feedstocks, chemical value streams and improved returns on the investment.
4. QPI and international oil companies are looking forward to invest worldwide by supplying the feedstock to capture a greater share of the hydrocarbon value chain.
5. The future trend in the US petrochemical industry is shifting towards the light feeds for new ethylene crackers because of the advancement of unconventional shale gas as potential feedstock source at low prices.

Treat Gas Plant and MTBE Plant Waste Water using a Membrane Biological Reactor and Reverse Osmosis Unit

The DUGAS Hydrocarbon Complex located in Dubai comprises 2 Gas Plants, a Sulphur Plant and a MTBE (gasoline additive) Plant. Waste water from these plants was a source of contamination to the environment. Committed to best environmental practice, DUGAS operates a comprehensive environmental management system to ISO14001. DUGAS Waste Water Treatment Plant (WWTP) was built to clean up the waste water so that the requirements of the DUBAI Municipality could be met.

The design philosophy required that waste water shall be upgraded...
for use as irrigation water, thus replacing procured irrigation water. It was decided to position the plant at a location that would enable delivery/filter cake removal lorries not to enter hazardous plant areas, and to minimize plant foot print. It was decided to use a fully automated Membrane Bioreactor (MBR) for removal of chemical pollutants because of its characteristically small foot print.

Design had to take into account wide fluctuations in contaminant loads, periodic occurrence of a liquid slug from the offshore pipelines with the concomitant flow of waste water as well as a boiler purge from time to time. DUGAS was also concerned about the biodegradability of the waste water and the presence of substances that would be toxic to a biological process. The flow sheet development was based on waste water analyses and flow rates. Since DUGAS had a state of the art laboratory, most analyses and laboratory testing could be undertaken in house.

In summary, the plant has been operated for 9 months and has successfully produced water that can meet the requirements of the Dubai Municipality for irrigation. The plant has proved that it can accept and treat successfully waste water that has high variations in contaminant loads. The waste waters were found to be completely biodegradable and show no signs of toxicity.

The UF and RO membranes need to undergo chemical cleaning when the flux through the respective membranes falls below a minimum value. The intervals between membrane chemical cleaning are significantly longer than expected, indicating the cleanup performance of the activated sludge (biology) surpasses expectation.

The RO Concentrate stream is successfully disposed of by solar evaporation. DUGAS’ waste water is now treated to a standard whereby it can be used for irrigation.

Exercising the Option of CO₂ Slippage to Mitigate Acid Gas Flaring during SRU Expansion Bellow Failure

In the Claus process Sulphur Recovery Units, metallic bellow expansion joints in the tail gas line to incinerator, seldom fail by developing crack on the bellow element due to various mechanical and metallurgical reasons.

Any such bellow failures are irreparable and it demands replacement of the entire expansion bellow assembly which is a long lead item. Though the incinerator operates at a negative pressure, tail gas inlet line used to have a slight positive pressure proportionate to the volumetric flow rate of tail gas that will cause the harmful toxic tail gas to leak through the cracked bellow creating an HSE hazard. To prevent the above leakage, SRU unit will be forced to operate at reduced throughput rates by flaring Acid gas from the upstream Acid gas removal units until replacement of the bellow joint which will cause a serious impact on the environment and result in loss of sulphur production.

Exploiting the selective absorption characteristic of absorbent (Methyl-Di-Ethanolamine) used in acid gas removal units has been successfully undertaken in Qatar Petroleum’s NGL-3 Plant in order to eliminate the prolonged, anti-environmental acid gas flaring and to curtail the loss of sulphur recovery forced by the above situation.

Detailed description of the attempts and actions taken towards the above task execution to minimize Acid Gas flaring without violating the AGRU product specs and without further deteriorating the leaking expansion bellow were covered in the paper with the details of benefits realized.

The paper concluded as increasing the CO₂ slippage in the Amine absorbers has reduced the CO₂ content of Acid Gas considerably and...
stopped the anti-environmental Acid Gas flaring from AGRU. This achievement has saved and protected the environment from the impact of flaring around 300 mmscf of Acid Gas and therefore a loss of around 2610 tons of liquid sulphur product estimated to be 1.72 MM QR has been avoided.

Increasing CO₂ slippage in absorber columns has a very minor contribution in change of lean gas composition, Only the CO₂ content has increased from an average of 0.99% to around 1.4%. H₂S content reached a maximum level of 2.0 ppm against 1.0 ppm at normal condition.

### Nitech™ NRU: New Global Standard Cryogenic Nitrogen Rejection

The Nitech™ nitrogen rejection (NRU) technology, developed and patented by BCCK, economically removes nitrogen from natural gas streams without the complexity and inflexibility typically associated with cryogenic nitrogen rejection. BCCK’s Nitech™ NRU technology is typically less expensive on both OPEX and CAPEX in comparison to the other cryogenic technologies, as it was specifically designed for separation of methane and nitrogen and is not derived from air separation.

**Major Advantages of the Nitech™ process are:**

1. Typically only three major components;
2. No cryogenic rotating equipment required;
3. Single distillation column with an integrated internal reflux condenser;
4. A less complex, more reliable and lower cost design.

**Additional Design Advantages**

- Small footprint (about 6x18 meters for a 200-500 million cubic meter annual plant).
- Minimum operator attention required with average runtimes in excess of 99%.
- Recompression horsepower requirements which compare favorably with even the most efficient conventional cryogenic process designs.
- Much lower power and compression requirements than non-cryogenic technologies.
- Significant nitrogen reduction - inlet nitrogen contents ranging from 5% to 70% can be reduced to 1%, depending on pipeline requirements.
- Possibility for integrated NGL extraction including ethane recovery in excess of 90%.
- Possibility for integrated helium recovery with helium recovery as high as 99%.
- CO₂ tolerant with no treating required beyond the capability of readily available amines.
- Quick restarts with cold restart from short shutdowns and online and on spec – just restart associated compression.
- Integrated LNG production (one step nitrogen rejection to LNG).
- Available for flow rates of 30 to 2500+ million cubic meters per year.
Gas Sweetening Workshops held in 2012

Gas sweetening workshop was conducted successfully twice during the year 2012, the 5th workshop on 7-8 May 2012 & the 6th workshop on 19-20 November 2012 in Dubai as part of the GPA-GCC Chapter technical program.

The instructor of the workshop is Mr. Kefah A. Al-Faddagh, Saudi Aramco, the Chairman of the Technical Committee.

Total of 51 participants mainly from the Chapter’s member companies attended these two sessions. It will be conducted again for the seventh time in Doha in May 5-6, 2013 at the Sharq Village & Spa. The prime objective of this workshop was to provide the participant with a good understanding of Gas Sweetening in general and common practice. This workshop presented a complete and up-to-date overview of the Gas Sweetening processes with emphasis on gas plant process operations.

Instructor
Kefah A. Al-Faddagh, Saudi Aramco

Best Paper Award 2012

The GPA – GCC Chapter “Best Paper Award” is granted to recognize outstanding technical papers which are delivered during the Annual Technical Conferences.

The best paper of the 20th Technical Conference held in May 9th, 2012 at The Address Dubai Mall Hotel - UAE, as ranked by the audience is:

“EMGAS Compressed Natural Gas (CNG) as a Green Fuel for Transportation”
Mr. Fazal Ali Khan, Emirates Gas (UAE, Dubai)

The Best Paper Speaker will be awarded by the Chapter Chairman and other Executive Committee members at the forthcoming Annual Technical Conference to be held on 7-8 May 2013 in Doha.

Awarded best speaker for the 19th Technical Conference - 2011 Best Paper

“Erosion and Corrosion in Acid Gas Removal Units”
Mr. Justin Hearn, BASF SE (Germany)

“Successful Amine Cleaning Technology Application in Saudi Aramco”
Mr. Saud H. Al-Mudaibegh, Saudi Aramco (Saudi Arabia)
About the GPA - GCC Chapter

OUR MISSION
To serve as a forum for the exchange of ideas, technology and information that will benefit both the upstream and downstream Gas Processing industries, and their Suppliers, with a view toward improving Plant Operations, Health, Safety and Environmental performance in the GCC countries.

OUR VISION
To be the focal point and the main source of information on the Gas Processing industry in the Gulf Cooperation Council countries.

MEMBERSHIP
Membership in this organization is open to GCC Representatives of:

• Companies owning and/or processing gas. These are classified as “Members”.

• GCC-based organizations involved in the supply and/or service to the gas industry. These are classified as “Associate Members” and are entitled to vote on all matters in the Organization’s Annual meeting except for the Executive Committee elections.

All membership applications are considered and approved by the Executive Committee.

EXECUTIVE Committee

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TECHNICAL Committee

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