

Efficiency Improvements for Facilities Focus of Workshop

Innovations aimed at improving efficiencies in surface facilities were the focus of an SPE Applied Technology Workshop (ATW) titled "Surface Facilities: Improving Efficiencies in Production, Energy Conservation, CO₂ Reduction, and Waste Management" held in Dubai. More than 50 attendees from 25 companies and 16 countries reviewed the challenges of oil/water/gas separation, conservation, emission, and waste management in the backdrop of increasingly stringent regulatory requirements.

Abbas Ahmed Yousef, field manager for Adco's Bab field, opened the ATW with a keynote address focusing on the means to improve surface-facility efficiency, emphasizing the need for operators to adopt more enhanced oil recovery (EOR) techniques to improve production efficiencies. He also touched on the importance of energy conservation and emissions and waste management, particularly as producing fields mature.

Oil/Water/Gas Separation and Handling

In the ATW's first session, Ahmed Abdulmajeed of Saudi Aramco discussed process enhancements in gas/oil separation plants within his company. He reviewed how a new mixing valve for wash water going to desalters was able to reduce wash water consumption from 50 to 30 gallons per minute, resulting in more than 10 million gallons of water savings over one year. He also discussed how the implementation of a smokeless, high-pressure air-assisted flare system, which employs a new flare-tip design and additional flare-tip shield, provides for better gas combustion. Saudi Aramco is also testing an in-line water separator that promises to remove approximately 70–80% of water without the need to treat in a gas/oil separation plant and with quality in the range of 22–35 ppm of oil in water.

Alexander de Kruijf of Petroleum Development Oman (PDO) discussed the pitfalls of improper oil and gas sampling and made predictions on future process-equipment design. Inaccurate measurement of H₂S in one PDO application led to deteriorating sales gas quality, with H₂S concentrations reaching 5 ppm. The result was 4 months of deferment equivalent to approximately 100,000 BOPD. To prevent acid corrosion in equipment, de Kruijf stressed the importance of routinely measuring for organic acid, using corrosion-resistant alloys with increased corrosion allowances, and implementing organic pH neutralizers. In general, he advised that production chemistry programs should be an integral part of a project's process.

Oliver Garnier of Total reviewed a strategy to maintain production from his company's mature Abu Al-Bukhoosh field. The field has been producing since 1974, and present production is 15,000 BOPD with an average basic sediment and water (BS&W) of 86%. By implementing improvements, including increasing the impeller size in the gas recovery compressor, closing wells with too high a BS&W, optimizing well productivity by using multiphase flowmeters, and implementing de-emulsifier injection with gas lift, Total has managed to level the oil production potential to above 16,000 BOPD since 2007.

Applying Advanced Tools, Methodologies

Session Keynote Speaker Colin Fairweather of AMEC presented his company's experience with the fully integrated engineering system, which links an electronic version of a processing plant with its real-world counterpart. At every stage of a project, the system electronically adds data and deliverables to the project database. "Fully integrated engineering systems provide an environ-

ment that enables the collaboration of all parties and applications, even from multiple locations, in a safe, efficient, and effective manner," Fairweather said.

Saudi Aramco's Mishaal Alhetairshi discussed the latest trends in instrumentation design. Alhetairshi said that the financial performance of an existing production facility can be improved only by optimizing the performance of the plant's distributed control system, a system that typically may control up to 75% of a plant's equipment. He also stressed the dramatic growth of wireless instrumentation and control, and noted that while security and reliability concerns persist, wireless systems are lowering infrastructure costs and providing greater flexibility in integrating and managing both green- and brownfield projects.

Amjad Elabed of Adco reviewed his company's initiatives in well clustering and flowline and facility corridor projects. He stressed the benefits of coridor, including decongestion, enhanced safety, fewer drilling deviations, improved hydraulics, and overall better integrity management of the pipeline network. Placing flowlines in corridors also reportedly provides a concerted manner for combating sand movement. To overcome the corrosion because of sand movement in flowlines, Adco uses cathodic protection on wells, and isolates the wells from flowlines with shutdown valves located approximately 100 m from the wells. He mentioned the benefits of clustering of wells, including providing shorter distances for rig transport, an improved means of introducing new technology, and better preparation for future artificial lift operations.

Reducing CO₂, Other Emissions

The ATW's third session focused on improved energy conservation efforts to

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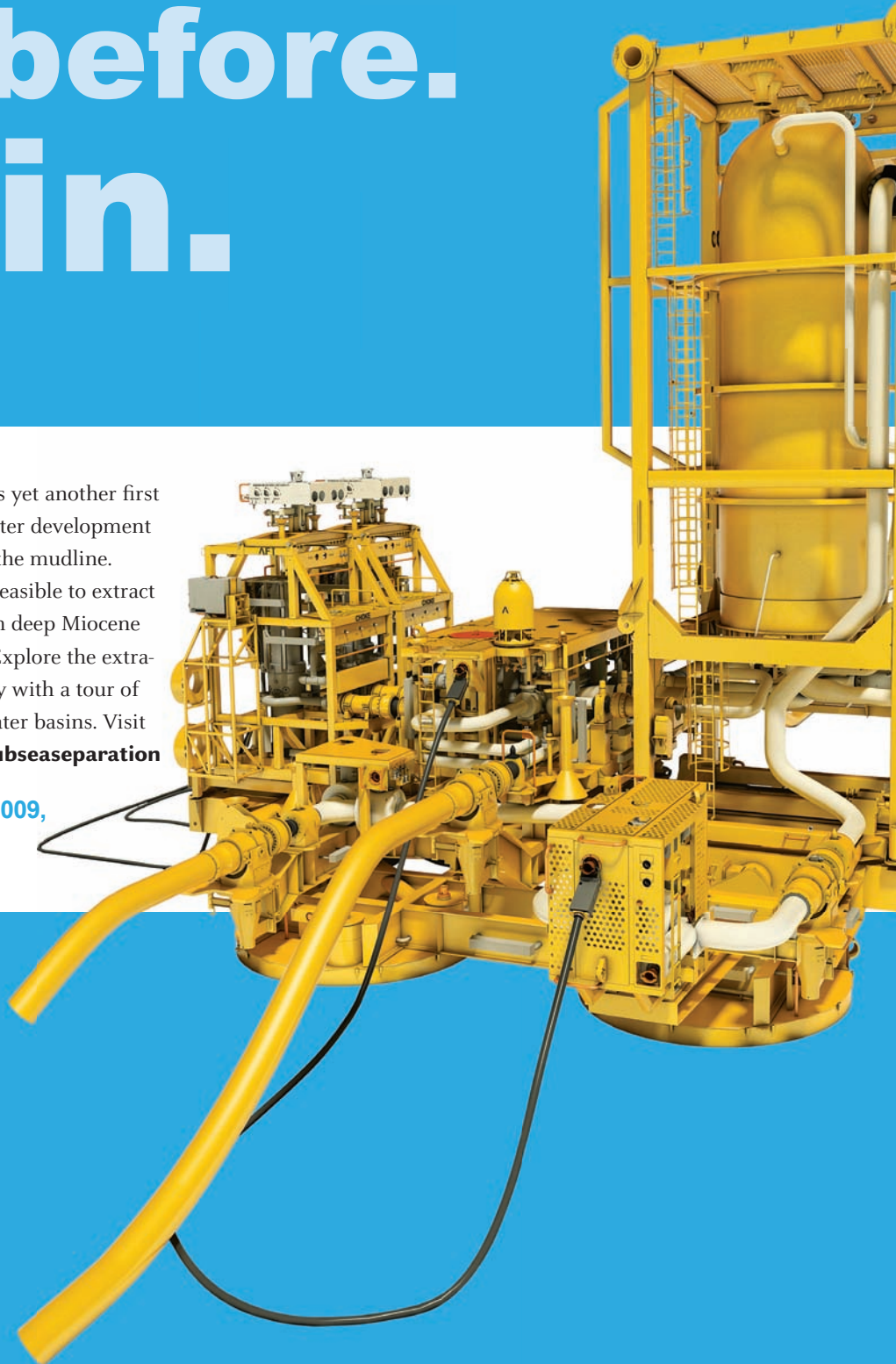
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standoff, well strength and geometry, zonal isolation required, and the degree of centralizer flexibility needed to traverse known formations, as well as an evaluation of start and running forces.

Under-reamed wells present particular problems. Most bow-spring centralizers will break if they have to locate in a hole of larger diameter than the casing they have just passed through. Modern wells are highly complex and run to increasing lengths. The preload of an oversize bow-spring centralizer results in an accumulative resistance that can prevent passage of the tubular to final depth.

A case study from a Brazilian field illustrates some of these points. The Bonito field in Brazil's Campos Basin is a carbonate reservoir located in 145 m of water. It has been producing oil for more than 25 years but recent oil recovery was low. In an attempt to improve oil recovery, a horizontal drilling project with selective stimulation was designed. Effective zonal isolation was essential to the stimulation treatments. Simulation showed that if 7 in. casing was run in a hole less than 9½ in., that ECD could become a problem. The 9½-in. hole was drilled, and cement was successfully circulated. The results showed that with proper planning, horizontal legs in excess of 2000 m, can be effectively isolated and then stimulated, allowing operating companies a better return on investment.

Two wells were cemented according to plan and full circulation was maintained, and an effective annular seal was achieved. The effectiveness of the annular seal was further proved when the wells were stimulated. The 10 selective stimulation treatments were pumped according to plan, indicating that effective zonal isolation had been achieved.

While some operators are concerned about running casing with centralizers attached, centralizers can actually help get the pipe to bottom when properly matched to wellbore conditions. In these two Bonito wells 126 and 127, centralizers were run in the openhole section. The ability to rotate a pipe can also greatly assist the mud-removal process. The pipe movement does not need to be fast to be effective, and in this case 6 to 10 RPM was helpful. **JPT**

reduce the generation of CO₂ and other emissions. Keynote Speaker Mohammed Al-Fodari of Kuwait Oil Company (KOC) discussed initiatives his company has implemented to reduce emissions in facilities, and highlighted that it has achieved a reduction in the amount of produced gas flared from just under 14% to 4.35% during 2002–2009.

KOC's Fatima Abdali then discussed the company's strategy for carbon management, saying that a pilot study is planned to investigate using CO₂ for EOR operations. She said that the first stage will focus on acquiring a source of CO₂ for the EOR trials, and that CO₂ capturing technologies for KOC's own processes has yet to be explored.

Optimization of energy consumption in plants was the topic of the next two presentations. Anne Rocher of Total said that plans for improving energy efficiency should commence during a project's conceptual stage with the inclusion of energy-efficiency indicators and multidisciplinary energy reviews that incorporate best practices recommendations. Energy efficiency plans for existing plants should include detailed benefits of the new plan, a thorough implementation plan, and an impact analysis for each site. Montaser ZamZam of Adco reiterated these points, adding that typical areas of energy waste for all plants should be clearly identified up front and that successful optimization of energy usage will only come with commitment from all players.

Waste Management

In addressing new developments in water treatment and oil recovery, Keith Robinson of Oil Plus reminded attendees of the driving forces for new water treatments, namely increasing water cuts, challenging new fields, tighter supplies of water, and more stringent environmental requirements. He highlighted the importance of advances in filtration system technology, particularly related to seawater nanofiltration for sulfate removal, seawater deoxygenation, and seabed treatment of injection water.

Ahmed Nabi Hasan of KOC reviewed his company's experience with bulk handling of treatment chemicals and outlined several benefits over handling of chemicals in drums. KOC has experienced a reduction in chemical exposure to individuals when moving chemicals in bulk, as well as less spillage, reduced

operating and disposal costs, and more streamlined chemical delivery logistics.

Dalal Al-Whaib of KOC discussed the latest health, safety, and environment (HSE) practices in the engineering and design phases of a project. She stressed that HSE issues must be captured at a project's earliest stages to avoid costly and time-consuming variation orders. Key issues to consider can include an environmental impact assessment; a risk management plan; a project behavioral safety plan; and studies on fire/explosion risks, noise effects, and smoke/ventilation factors. The major challenges to effectively managing these HSE practices at a project's initial stages include obtaining strict compliance from contractors, said Al-Whaib.

Ahmed Al Quraan of the Bahrain Petroleum Company presented his company's centralized sludge treatment facility as a cost-effective means to ensure compliance with stringent environmental regulations. The facility takes sludge from various oilfield sources and processes it to yield solids that are suitable for disposal in a municipal facility or landfill.

Plant Monitoring, Maintenance Strategies

Corrosion monitoring and mitigation in KOC was the topic of Hasan Sabri's presentation, in which he stressed the importance of both internal and external corrosion monitoring and corrosion mitigation measures that encompass material selection, chemical injection, coatings, and cathodic protection. Ghassab Fahad Al-Ajmi of KOC then reviewed the company's experience with risk-based inspection in process plants, stating that 20% of the plant equipment commonly carries 90% of the total risk.

The final presentation was a case study of Abu Dhabi Marine Operating Company's in-situ chemical cleaning technique for a heat exchanger at its Zakum West facility. Ramesh Nagarajan of the company said that significant fouling in the heat exchanger due to using seawater as the cooling media necessitated the cleaning job. An in-situ technique using carboxylic acid was chosen, which required fewer resources, provided less HSE risks, and was more cost-effective compared with conventional hydro-jet cleaning. To avoid the problem of fouling in new plants, the company will use air coolers. **JPT**