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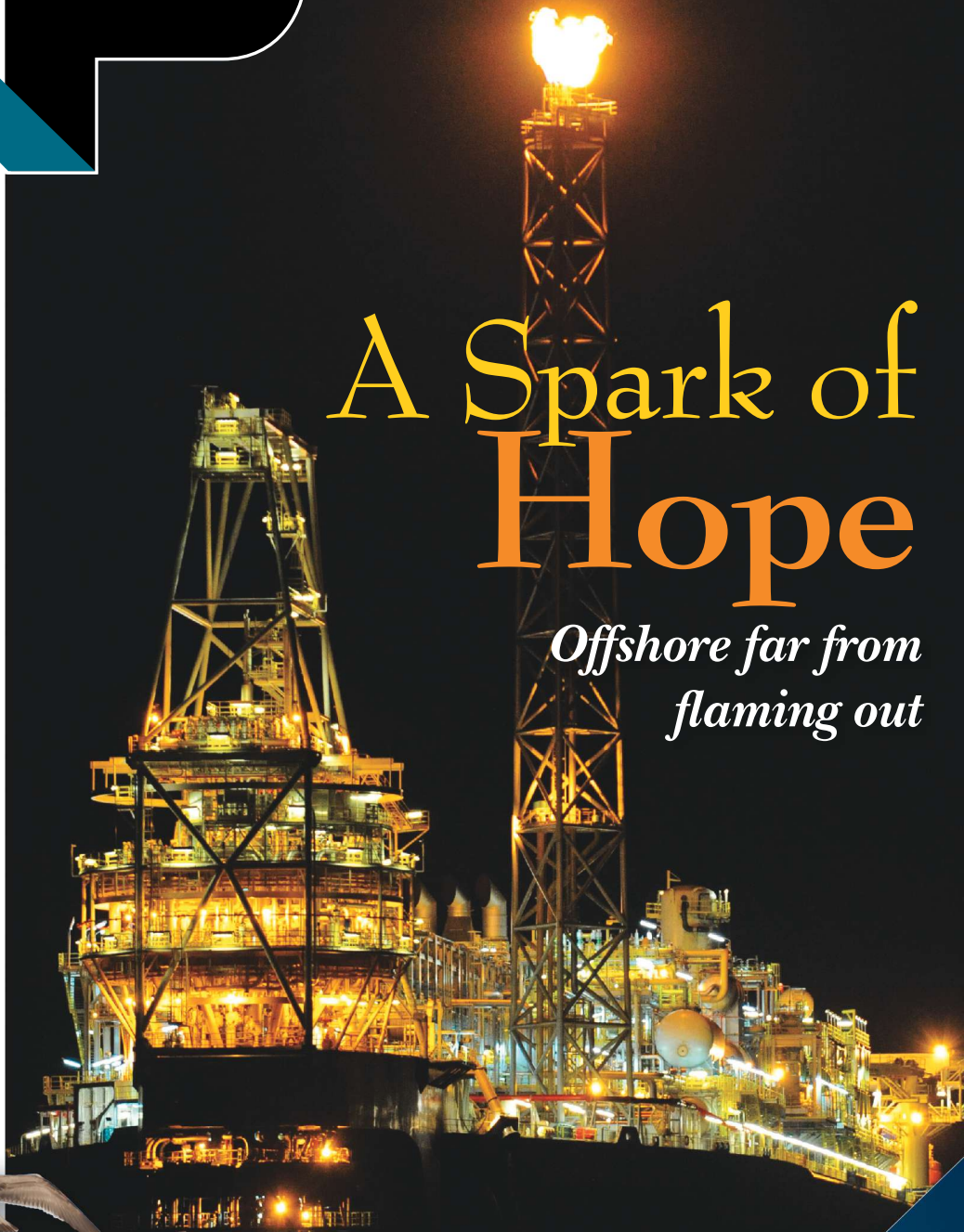
**Proppant-delivered Scale
Inhibition Enters Deep Water**

CARBO



A Spark of Hope

*Offshore far from
flaming out*



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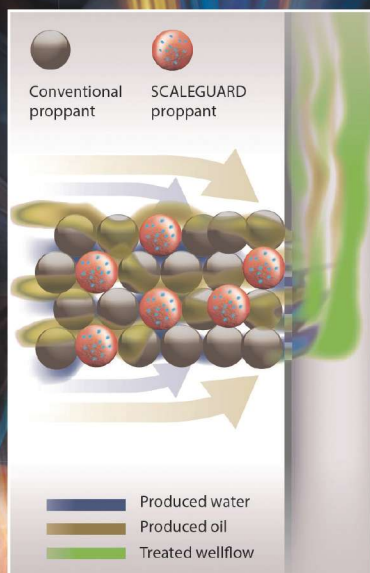


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CARBO Engineered Robust Combination to Sustain Deepwater Flow

A new single treatment approach prevents scaling, maintains production-enhancing conductivity in deepwater wells

Right: Scale-inhibiting chemicals infused within the proppant are released into the fracture only on contact with water to deliver highly efficient production assurance.



CARBO recently engineered a groundbreaking solution for a super major – completing a series of ultra-deepwater wells in the Gulf of Mexico’s Lower Tertiary where the economic exploitation of deep, low-permeability reservoirs requires hydraulic fracturing. The downhole environment was ripe for deposition of production-restricting scale, but using generally effective solid inhibitors would sacrifice proppant conductivity. Due to the very high closure stress (up to 20,000 psi), maintaining this conductivity was essential.

High-pressures and fluctuating temperatures in deepwater environments provide an ideal incubator for generating inorganic scale, long recognized as one of the industry’s costliest and most formidable flow assurance issues. Pumping solid inhibitors can be effective in preventing scale but sacrifices high proppant conductivity required to sustain maximum production beyond 30,000-ft and with closure stresses up to 20,000 psi.

Can lessons learned in onshore proppant-delivered scale inhibition transfer to deepwater?

To simultaneously prevent scale formation while maintaining high conductivity, CARBO planned and executed its uniquely engineered field application by combining its proppant-delivered scale-inhibiting technology, SCALEGUARD®, with its ultra-conductive KRYPTOSPHERE® high-density ceramic proppant. These technologies can be mixed with sand or ceramic proppant in completed wells. The groundbreaking deepwater infusion of water-activated chemical inhibitors within an ultra-high density porous proppant prevents scale development at its source while maintaining propped fracture integrity and maximum flow – all from a single treatment.

Prevention is more effective and economical... that’s where multi-functional proppant makes an impact.

SCALEGUARD: Proppant-delivered scale inhibition

Proppant-delivered scale inhibition in deepwater wells through CARBO’s unique technologies shows promising implications over the typical reactive, curative methods. Traditional interventions or workovers to remediate scale deposits include mechanical



CARBO provides wellsite services to ensure that each GUARD treatment is executed as designed.

techniques and/or dissolving scale through chemical squeezes. These conventional remediation measures are temporary, requiring repeat costly treatments.

Prevention is more effective and economical ... that's where multi-functional proppant makes an impact.

In addition to maintaining propped fracture integrity, proppant functionality has evolved to include its use as a chemical delivery mechanism to prevent scales in unconventional onshore wells.

In one of the first of more than 200 successful applications, SCALEGUARD technology was pumped during the hydraulic fracturing of five tight oil wells in the Greater Monument Butte Unit (GMBU) in the Uinta Basin. Rapid build-up of both carbonate and sulfate scales in the reservoirs had severely restricted production, requiring repeated corrective measures. Incorporating SCALEGUARD technology in the proppant pack effectively prevented scale from forming and restored production without remedial intervention.

The advent of hydraulic fracturing to tight deepwater reservoirs opened the door to transfer SCALEGUARD technology.

KRYPTOSPHERE: Ultra-conductive ceramic proppant technology

The use of KRYPTOSPHERE HD proppant was the key to this transference. To meet distinctive shale prevention and compressive strength requirements of these deep Lower Tertiary wells in ultra-deepwater GOM, CARBO went beyond the conductivity capabilities of conventional high density proppant, preparing for closure stresses of up to 20,000 psi.

KRYPTOSPHERE ultra-conductive high-density ceramic proppant technology is uniquely designed and manufactured to produce 2x baseline conductivity versus even high-strength bauxite proppant. Differentiators include raw material selection, proppant roundness and sphericity, size uniformity and strength derived from pellet microstructure, along with high alumina content. The increase in conductivity primarily results from an innovative manufacturing process which creates extremely round, mono-sized and fully-densified particles. ISO 135303-5 conductivity testing showed KRYPTOSPHERE HD proppant with dramatically increased compressive strength and twice the conductivity of high-quality HDC proppant.

A wealth of opportunities is available to reduce operating costs through the use of chemically infused, ultra-high-density, porous proppant technology. Additional testing and field applications of this emerging technology are planned in Lower Tertiary wells and similarly demanding environments.

Successful use of these robust technologies addressing deepwater flow is beneficial for completion, production and facility engineers both in onshore and offshore operations.

Visit www.EPmag.com/WhitePapers to download the complete white paper. **ESP**

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