THE WORLD OF TECHNOLOGY: EMERGING TECHNOLOGY AND IMPLICATIONS FOR THE GREATER CASPIAN REGION

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Technology

Technology has played a critical role in every facet of our businees and will play an increasingly important role in how our industry evolves. Technology has enabled the industry to significantly reduce costs and develop oil & gas fields which, at the time, seemed to possess insurmountable technical challenges. More recently, technology advancements with the Internet, alternative fuels, and renewable resources threaten to dramatically change our business in the future.

Exponential advances in information, Internet, and communications technologies offer our industry unlimited opportunities. Contrary to the popular perception of the oil and gas industry “old economy and low-tech”, we are posed to take full advantage of these advancements. The reality is that the oil and gas industry has always leveraged information technology extensively. In fact, geoscientists represent one of the most information technology intense communities.

Our challenge as an industry will be to rapidly adapt and apply technology advances to our business ventures around the world. Given its reserve potential and unique technical challenges, the Greater Caspian Region provides an excellent opportunity to demonstrate this capability. However, we must recognize that our legacy will be created not only by the application of technology, but also by our ability to transfer technology to the Caspian region.

To provide an example of technology application and transfer in the caspian region, a few technical challenges being addressed by TengizChevroil (TCO) to develop the Tengiz field will be reviewed. Specifically, the development and application of technology to reservoir characterization and sour gas injection are discussed. Tengiz produces high gravity, H2S-rich oil from a reservoir containing abundant solid bitumen. Geochemical and petrographic evidence suggest there were perhaps two stages of petroleum migration into the Tengiz reservoir, both generated off-structure from a marine source rock. The initial charge gave rise to solid bitumen, and the second, most likely from the same source at higher maturity, accompanied by a significant influx of H2S arising from thermochemical sulfate reduction (TSR) deep in the basin, filled Tengiz with its present-day oil.

Reservoir Characterization

Characterization of the massive Carboniferous-Devonian carbonate reservoir is difficult due to the limited availability of the well data. Reservoir architecture has evolved through the analysis and description of the original Russian core and log data, and the newly

acquired TCO cores and logs. A TCO-supported outcrop study of Carboniferous outcrops located in Asturians, northern Spain has aided in understanding the depositional facies in Tengiz. Both platforms have similar geometries of horizontal and planar platform beds bordering steep flanks, and comparable shoaling upward depositional cycles.

A 1050 km2 3D seismic survey run in 1998-99 is contributing to a greater understanding of the Tengiz field. Seismic horizon and fault interpretation provide the structural definition of the reservoir and the delimit regions with distinct reservoir properties. Attribute analysis employing ASTRAL serves to populate the model with porosity estimates. An appreciation of the fracture contribution to productivity in the rim and flank regions of the field is providing an additional role for the seismic data in fault detection and fracture characterization.

Formation evaluation technologies are also playing and important role in characterizing the Tengiz reservoir. Comprehensive logging programs are required for all new appraisal wells and deepening candidates to better understand the distribution of porosity, water saturation, and bitumen content in the Tengiz reservoir.
Application of Facies Assemblages to condition the geostatistical simulation of reservoir properties is playing an important role in reservoir characterization of the Tengiz field. The term facies assemblages represent contrasting sets of well log curve-derived features that allow us to delineate rock volumes, which better predict reservoir performance and support the geologic interpretations.

Sour Gas Injection

TCO is using full-field reservoir models to study two future development options: conventional sour-gas processing plants (primary depletion) and sour-gas injection (SGI). The reservoir model integrates seismic, well log, and core data into a detailed reservoir description, which includes three regions (platform, rim, and flank) and three vertical units. Although the regions have different production characterizations the current history matching process shows good horizontal and vertical continuities in the field.

SGI is being evaluated for reservoir pressure maintenance in th field with some displacement mechanisms. A 350,000-cell model is being used to simulate SGI. The SGI will be a first contact miscible flood with a required surface injection pressure of 7,000 to 9,000 psi. This operating pressure exceeds that of SGI facilities currently in operation around the world. Therefore, TCO is managing the development and integration of technology to meet this design requirement. The combination of high pressurs and sour-gas has required a detailed materials evaluation (design & testing) of compressor components, pipeline material, and elastomericseals. Of foremost importance in the evaluation is the need for high reliability and thus safety.