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Italian Section

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SALA BARBARA
5° Palazzo Uffici - Eni E&P division
Via Emilia 1
SAN DONATO MILANESE

11:00

2007-2008 SPE Distinguished Lectures Series

THE PHYSICS OF STEAM INJECTION IN FRACTURED CARBONATE RESERVOIRS: ENGINEERING DEVELOPMENT OPTIONS THAT MINIMIZE RISK

By Gordon T Shahin Jr. – Shell Int. E&P

➢ ABSTRACT

Naturally fractured carbonate reservoirs hold over 20 billion barrels of heavy oil worldwide. Thermally Assisted Gas-Oil-Gravity-Drainage is a novel thermal EOR technique which has applicability in selected reservoirs. In conventional GOGD, vertical fractures cause the gas-oil contact in the fracture system to advance ahead of the gas-oil contact within the matrix blocks causing the oil in these blocks to become mobile. The addition of heat in the fractures generates additional hydrocarbon gas cap, lowers the viscosity of the oil, and accelerates GOGD, as seen in the 220 cp heavy-oil Qarn Alam field in Oman. Pilot results in the Qarn Alam field support the commerciality of this process, and a first-of-it 's-kind steam injection project is being implemented. The economic success of the project depends on the ability to credibly predict steam requirements and oil production for various fracture realization scenarios. To this end, it is important to quantify the areal density of the fracture system, and to use this information to accurately model new steam process mechanisms. Two key mechanisms are heat transport through the fractures and into the matrix, and subsequent gas cap generation due to thermal volatilization of the oil. To understand these factors, deterministic fracture studies were undertaken. From these studies, fracture permeability and spacing map realizations were created for direct input into reservoir simulations. The process mechanisms involved in TA-GOGD were validated by history matching laboratory experiments, while the field forecast model results were validated by history matching pilot performance data. A new fully integrated workflow of fracture characterization, integrated reservoir physics, and static and dynamic modeling has enabled uncertainties and risks to be managed in a scenario based development approach.

➢ BIOGRAPHY

Gordon Thomas Shahin Jr. is a Senior Staff Reservoir Engineer at Shell's International E&P Technology Organization in Houston, Texas. He holds BS (Honors), MS and PhD degrees in Chemical and Bio Chemical Engineering. Dr. Shahin joined Shell's Bellaire Research Center and worked in the Chemical Flooding Group for 6 years. Field assignments took him to New Orleans, as the technical lead for implementation of two successful pilots involving polymer and Enhanced Alkaline Flooding (ASP) technologies. During the early 90's, he implemented conventional and light oil steam injection projects in California, while part of the Advanced Thermal Technology Group. As Technical Operations Supervisor, he oversaw the operations and analysis of results from two of Shell's Thermal Conduction Oil Shale Pilots. He is currently a Senior Technical Leader in Shell's Integrated Field Study Group, focusing on global application of EOR techniques. Dr. Shahin holds over 60 patents in thermal recovery and related technologies, and has authored numerous papers in his 20-year career with Shell.