Society of Petroleum Engineers
Distinguished Lecturer 2015–2016 Lecture Season

Lecture Title
Well Design and Integrity:
Importance, Risk, and Scientific Certainty

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The term "Well Design and Integrity" has taken on added meaning as a result of intense media scrutiny and public interest regarding hydraulic fracturing and the tragic Macondo well blowout in the Gulf of Mexico. The complexities and costs of well design have increased significantly to meet the challenges of ultra-deep wells exceeding 30,000 ft., ultra-HPHT wells (500F and 30,000 psi), and ultra-deepwater drilling (exceeding 10,000 ft.). As a consequence, the risk to companies designing wells for these applications has increased. As we know from recent events, the consequences of failures can be enormous, and minimizing the risk of such catastrophic failures is imperative. It is not simply coincidental that the engineering tools for well design have become ever more complex. Tools such as nonlinear finite element analysis (FEA), computational fluid dynamics (CFD), and multi-physics software are now commonly used. What are these tools and the input data required for output of dependable and accurate results? This presentation will summarize applications of these tools, exhibiting their input requirements, and output interpretation and quality. I will present two applications of current keen interest in the industry: the time dependent deformation of salt and the compaction of soft rock. Both rocks exhibit complex behavior and both are responsible for costly failures. I will discuss computational modeling of the temperature dependent, viscoplastic response of salt and "soft" porous rocks, and compactive behavior of high-porosity formations. Calibration of material model parameters is vitally important, but for non-metals can require a significant number of samples, which are difficult and expensive to acquire and test. The correct selection of a validated material model can be the key to success or failure in minimizing risk.

Biography

Dr. L. Brun Hilbert, Jr. is a Principal Engineer in the Mechanical Engineering Practice at Exponent Failure Analysis Associates, Inc., and consults in mechanical and petroleum engineering. In his work, Dr. Hilbert analyzes the root cause of failures, and performs proactive consulting to assist clients in failure prevention, design improvement, and risk minimization. He has worked in the upstream petroleum industry for over 30 years and has been an SPE Member since 1982. He performed applied research in the Drilling & Completions Division of Exxon Production Research Company. He holds a Ph.D. degree in Rock Mechanics from the University of California, Berkeley, and an MS degree in Mechanical Engineering and BS degree in Mathematics from the University of New Orleans.