Nobuo Morita, J Pet Environ Biotechnol 2016, 7:3 (Suppl)
http://dx.doi.org/10.4172/2157-7463.C1.015

World Congress on

Petroleum and Refinery

July 21-22, 2016 Brisbane, Australia

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New casing design criterion for reservoirs with high porosity

The standard casing design is based on collapse, burst and tensile failures under simplified loading. However, if a casing or screen is cemented to a high porosity formation, complex stress state may appear in casing or screen. Multi-finger caliper logs obtained from the wells in the Gulf of Mexico and in the North Sea showed significant casing deformations, while they were still usable without losing integrity. The reason was that most of these casings were uniformly deformed without rupture or without kinks. The magnitude of elongation and compression of these casings were 3 to 5% while the strains at the yield strength were 0.3-0.5%. These observations indicate that casing design for high porosity reservoirs should include the steel properties beyond the yield strength while the API casing design criterion is strictly based on the steel properties up to the yield strength. Extension, compression and line load casing tests were conducted from H-40 to V-150 casings up to failure by using a 5000 kN loading machine. The tests showed the casings were uniformly deformed until the maximum load so that they were usable up to the maximum strength without significant distortion. In the past, casing failures were tried to be mitigated by increasing the casing grade, however, increasing the grade sometimes deteriorated the casing problems since a higher grade casing could not tolerate the significant stretch or compression once they exceeded the yield stress. Selecting a proper grade and thickness of casings is the key for mitigating casing failure.

Biography

Nobuo Morita is a new Professor of Harold Vance Department of Petroleum Engineering, Texas A&M University, Texas. He was a Professor of Resources and Environmental Engineering department, Waseda University, Japan, for 20 years, with a rock mechanics and completion engineering lab. He was a research fellow, ConocoPhillips, for 13 years. He has formed Geomechanics Joint Industry Project and is monitoring various geomechanics projects such as sand control, well stability, causing problems and conventional and unconventional fracuring with laboratory experiments and numerical models.

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