Please fill in the name of the event you are preparing this abstract for.	International Petroleum Technology Conference
Please fill in your 5-digit IPTC manuscript number and IPTC Control number.	IPTC-19222-MS 19IPTC-P-1897-IPTC
Please fill in your abstract title.	A Novel Workflow for Far-Field Stress Characterization Using Stress-Sensitivity of Anisotropic Formations to Acoustic Waves

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Abstract

Objective/Scope

Advancements in drilling practices currently allow drilling of complex trajectories. However, drilling and completions of such wells is quite challenging. A robust Geomechanical model helps in designing hydraulic fracturing, cap rock integrity, wellbore stability and implementing EOR techniques. Correct estimation of horizontal stress magnitudes, regime and direction play a critical role in such models. However, correlations established so far had a lot of uncertainty associated with estimating these stress magnitudes.

Method/Procedure/Process

An integrated stress analysis (ISA) approach incorporating the advanced acoustics measurements, image and caliper data is adopted for quantifying the rock mechanical properties and anisotropic stresses, to determine the magnitude, regime and direction of horizontal stresses with minimal uncertainties. In the stress-induced anisotropic sands, shear anisotropic processing results coupled with the radial profiling, pore-pressure and rock-mechanical properties helps in estimating the horizontal stress magnitudes.

The derived anisotropic horizontal stress magnitudes are validated with variation of shear slowness with distance from borehole plots; and further calibrated with the direct in-situ stress measurements like micro frac and DFIT.

Results/Observation/Conclusion

Current day borehole sonic measurements are proficient in recording axial, radial and azimuthal waveforms, thereby characterizing formations near well bore as well as the far field. Stress concentrations around the borehole leads to radial shear slowness variation. Modeling of stress-sensitivity to acoustic waves in the anisotropic sand bodies in a non-linear elastic well-bore stress model makes estimation of stress magnitudes possible.

This study has showcased the successful characterization of stress regime, magnitudes and direction, using an innovative approach, hereby described as Integrated Stress Analysis, utilizing the acoustics, image and caliper data and later validated using the stress-test data. Stress magnitudes derived from ISA approach can be used to establish far-field tectonic strain, and in turn poro-elastic stress modelling in the field and act as an input in building a robust 3-D Geomechanical model, which eventually will help in mitigating well-bore stability issues, cap-rock integrity study, completion and sand production prediction etc.

Novel/Additive Information:

A unique amalgamation of advanced acoustic, image and formation testing workflows has been demonstrated, opening new ways of collaboration between several forms of formation logs and data for accurate and detailed horizontal stress characterization. This paves way to estimate the maximum horizontal stress magnitudes which otherwise remains a challenge in the industry.