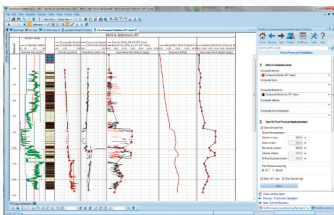


## SERVICES

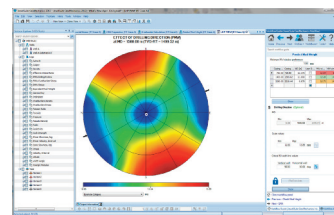
### DIRECTIONAL AND HORIZONTAL DRILLING

Many of the same principles used to drill a successful ERD well are used in directional and horizontal drilling operations. Torque and drag, hydraulics and swab/surge analysis, in addition to rigsite-based monitoring, can make the difference between successful liner and casing runs and stuck pipe. Gas wells, typically drilled in an S-well configuration, can be especially problematic, both from a torque and drag standpoint as well as from a pore pressure and tripping (swab) well control perspective.

Additionally, having a solid picture of the rock being drilled through, from pore pressure analysis to rock strength and wellbore stability studies in both 1-D and 3-D, can greatly optimize ROP, increase safety and minimize downtime, as well as aid in frac design. We've been on a lot of wells that have had issues, from curves that were collapsing prior to landing due to low MW and incompatible chemistry, to self-induced kicks because there was no one on-site to accurately model and produce a tripping schedule that stays above pore pressure. None of the issues were insurmountable, but they required a dedicated team in the field to solve them, and an accurate Well Design Study, done predrill, to ensure that the well plan and tubulars best matched the formations being drilled.



*Pore pressure prediction from gamma ray zonation model, and trend lines for composite density and resistivity*



*Effect of drilling direction on collapse pressure for predict mud weight*

HXR's rig-based Drilling Specialists have experience in:

- Bakken/Three Forks
- Eagle Ford
- Haynesville
- Fayetteville
- Barnett
- Mission Canyon
- Red River
- Almond
- Mesa Verde
- Niobrara
- Cotton Valley
- Smackover
- Woodford

HXR has significant experience in horizontal drilling, not only from a design standpoint, but also from a DSM capacity. In fact, many of our Drilling Specialists have backgrounds in drilling fluids and directional drilling as well as time spent as Drilling Supervisors. Using ERDPro<sup>®</sup>, one of the most advanced modular drilling engineering software suites on the market today, and developed specifically to address the needs of our clients who demand expert rig-site analysis of real-time drilling parameters as well as highly accurate engineering models, HXR can help you plan even your most difficult drilling and completions projects.

- Torque and drag analysis
- Well trajectory design
- Hydraulics and swab/surge analysis
- Casing design (conventional, floating/rotating)
- DP/BHA design
- Wellbore stability and hole cleaning analysis
- Drilling fluids design and oversight
- MPD design and analysis
- MSE/DSE calculation and tracking