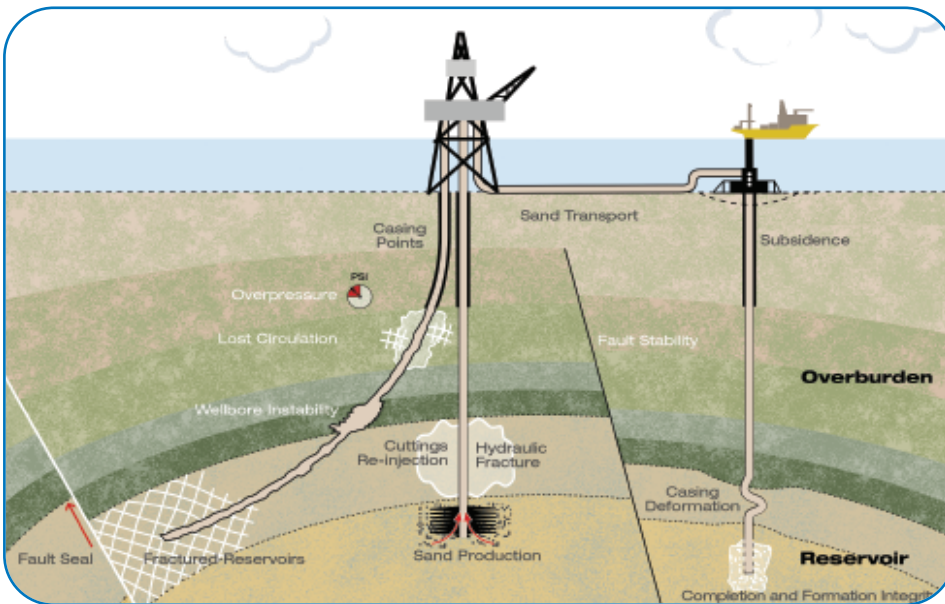


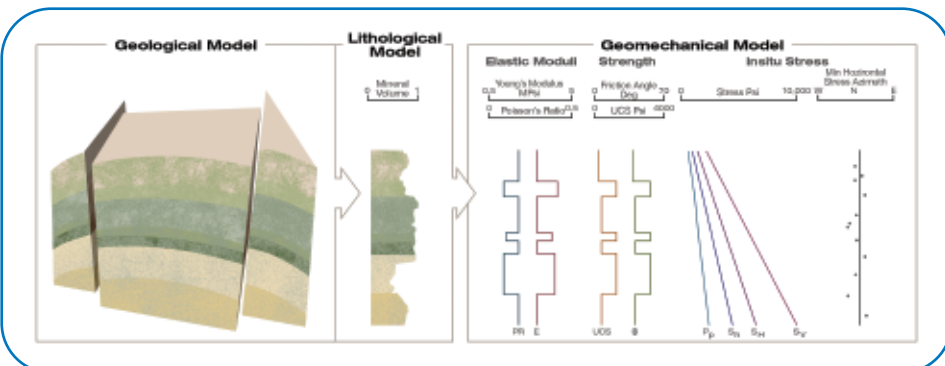
Introduction

Baker RDS combines technical expertise in all subsurface and well engineering disciplines to provide Geomechanics solutions to field scale and individual well problems.

The RDS Geomechanics team is led by industry specialists who work with other experts in structural geology, geophysical interpretation, formation evaluation, reservoir modelling, production technology and well engineering. A fundamental knowledge of Geomechanics is a key part of many RDS workflows as Geomechanics can often underpin optimised engineering and has been proven to realise significant project cost savings.



Well-to-field applications—from appraisal to abandonment



The RDS Geomechanical model

Our expertise includes:

- > Geomechanical modelling (1D, 2D and 3D)
- > Rock mechanics testing
- > Image log analysis
- > In-situ stress characterisation
- > Pore pressure prediction
- > Sand production prediction
- > Wellbore stability evaluation
- > Natural fracture permeability
- > Fracture stimulation modelling
- > Geomechanics training courses

We can optimise your:

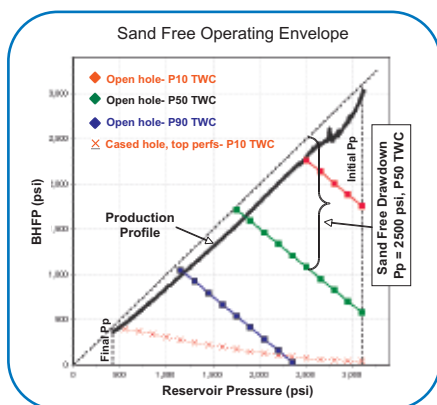
- > Drilling performance
- > Well trajectory strategy
- > Well placement strategy
- > Sand production mitigation
- > Production from stimulation
- > Production from naturally fractured reservoirs
- > Water / gas injection well design
- > Cuttings re-injection design
- > Fault seal and stability understanding
- > Reservoir compaction understanding
- > CO₂ disposal and gas storage

Geomechanical Modelling

Using drilling information, well logs and core data, we build full Geomechanical models which include magnitude and orientation of principal Earth stresses, pore pressure and rock mechanical properties. RDS designs, manages and QA/QC rock mechanics core tests by subcontracting specialised labs. We utilise a wide range of data and techniques including drilling data, well logs, seismic, basin modelling and 3D numerical methods to derive accurate pore pressure models. 3D basin-scale, field-specific and 1D well-based geomechanical models are quality controlled by expert geoscientists, petrophysicists and well engineers, and are cross checked with RDS regional stress and rock strength databases.

Sand Production

We predict sand production in injection and production wells under drawdown, depletion or following water breakthrough. This is achieved using in-house empirical, analytical and numerical techniques where appropriate. This service can be provided on a real time basis to facilitate oriented and selective perforation strategy decisions. All 3-dimensional well and perforation geometries can be analysed to optimise sand free production. When sanding is predicted, as part of RDS integrated sand management services, geomechanics specialists work closely with production technologists and completion engineers to find and implement an optimum sand control and management strategy.



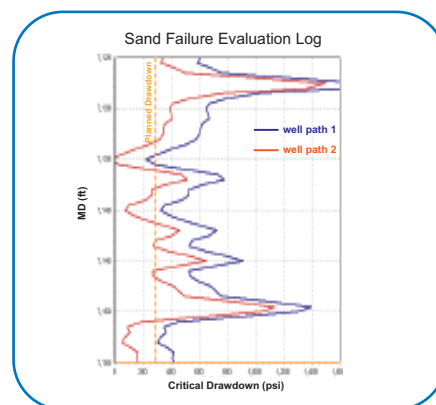
Sand free operating envelope

Wellbore Stability

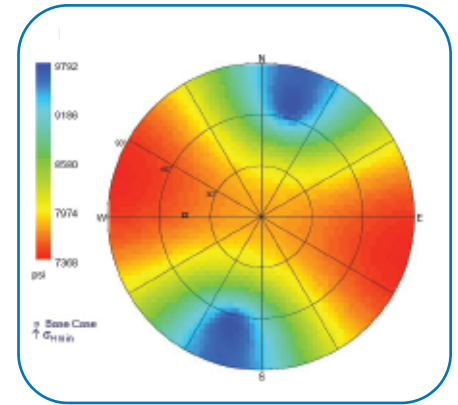
RDS can provide wellbore stability analysis for generic and optimum well trajectories using calibrated geomechanical models. Optimum safe mud weight windows are provided using pore pressure, shear failure, tensile fracturing and permeable fracture limits, along the complete well path for all well trajectories. Special cases such as shallow gas hazards, chemically reactive rocks, weak bedding planes, natural fractures and faults, salt domes and underbalanced or managed pressure drilling can also be addressed. Optimum and less damaging drilling muds can also be designed using in-house drilling and completion expertise. RDS wellbore stability analyses are always cross checked with well engineering requirements and can be provided on a real time basis during drilling if required.

Fracture Stimulation

Hydraulic fracture treatments can be optimised to maximize net present value (NPV) while mitigating complex issues such as undesirable fracture growth, multiple fracturing, fracture tortuosity, premature screenouts and inadequate proppant coverage. Fracturing can also be optimised for unconventional applications such as geothermal reservoirs, coal bed methane gas reservoirs, naturally fractured reservoirs, CO₂ injection, produce water injection and drill cuttings injection. While productivity optimisation is an integral part of fracture treatment design, this can also be integrated with an overall field optimisation process.



Sand failure evaluation log



Effect of well trajectory on formation breakdown pressure

Water & Cuttings Injection

We model water injection fractures considering both mechanical and thermal effects. This can be developed into a full water flood analysis using a reservoir simulator if required. Cuttings re-injection wells can also be designed using similar methods.

Fault Sealing & Activation

Fault reactivation caused by production-induced changes in Earth stresses and reservoir pressures can be modelled by knowing fault and fracture properties and in situ stress and pore pressure conditions. Fault activation can provide conductive paths for drainage but can also cause well failure if strains are excessive. Geomechanical assessment of fault sealing and stability is also essential for underground gas storage and CO₂ sequestration projects. RDS geomechanics fault sealing and activation analysis is complemented by in-house geological modelling and 3D visualisation capabilities.

Subsidence & Compaction

The Geomechanics team can assess reservoir compaction and the associated effects that can cause well damage lost production: permeability reduction, surface subsidence, fault and bedding plane movement. Compaction can be modelled using 3D numerical techniques or a simpler analytical method depending on the complexity of the field geology.

RDS

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