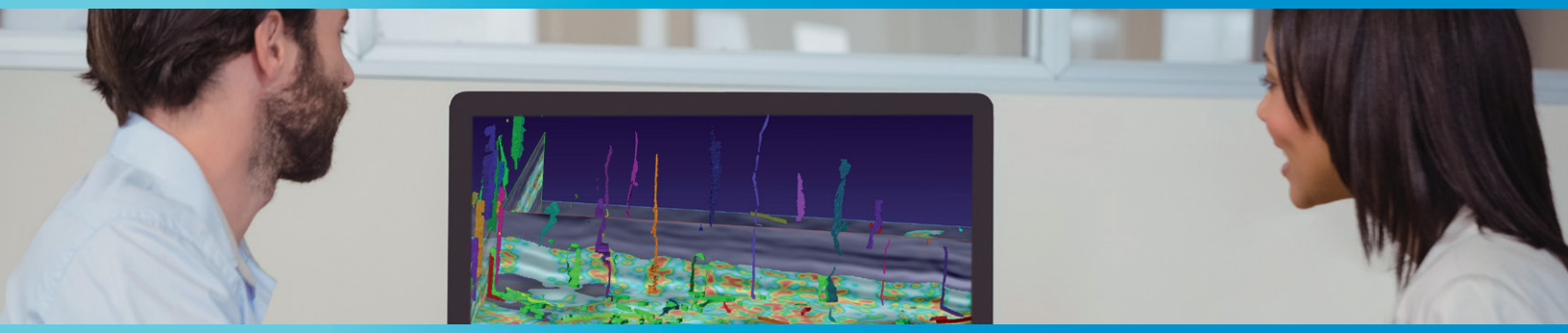
ResPack H_2O

Subsurface evaluation to minimize water production and reduce environmental impact



INDUSTRY CHALLENGES

Environment

Transportation, handling, and disposal of produced water and H_2S increases operators' environmental footprint.

Disposal

Proper of produced water, ensuring containment and avoiding leakage into production wells, is an important requirement of drilling programs.

Economics

Minimizing costs associated with produced water and H_2S can have a positive impact on return on investment.

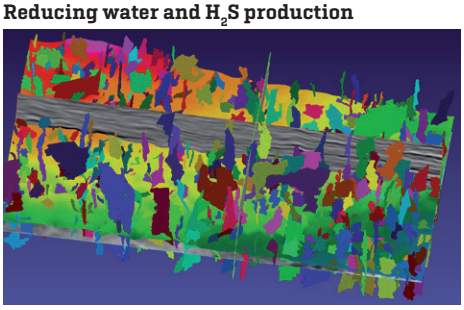
GEOSCIENCE SOLUTIONS

RESPACK H_2O ADVANTAGES

- Avoid high water or sour gas production by identifying basin faults and associated fractures linked to high water cuts and H_2S using CGG's **FaultFractureSpark** technology and 3D seismic
- Pinpoint water-bearing formations with petrophysical analysis throughout the target intervals
- Reduce water disposal risk by generating fault-leak-risk maps from the interpretation of fault, fracture, and karst relationships
- Recognize the potential sources of H_2S through geochemical analysis

PERMIAN BASIN EXAMPLES

Reducing water and H_2S production

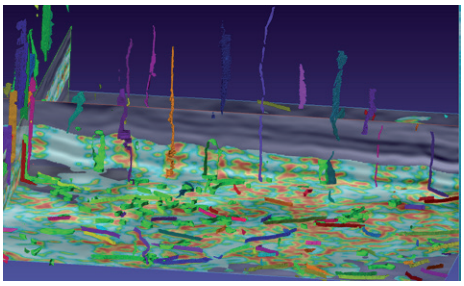


Identification of high-leak-risk faults contributing to high water and H_2S production.

Subsurface characteristics to avoid:

- Karsts with large vertical extent above the Canyon Formation (Midland Basin)
- Connections to high fracture density areas with large vertical extent above the Wolfcamp, drawing formation water and H_2S

Produced water disposal



Identification of karst development and fault relationship for produced water disposal.

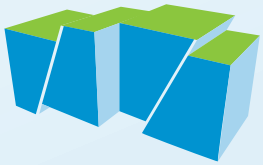
Characteristics of the best injection sites:

- Karsts that are vertically contained and do not extend above the Canyon Formation
- Karsts with faults below the Canyon Formation that connect to other karsts or zones of high fracture density

RESPACK H_2O DELIVERABLES

Fault and fracture volumes

- 3D-fault and discrete-fracture-network (DFN) volumes throughout the interval of interest
- Karst volumes within water disposal targets



Formation and hydrocarbon characterization

- Petrophysical analysis to identify water-bearing formations
- Geochemical evaluation and interpretation of potential source(s) of H_2S generation

Risk mapping

- Integration of the 3D fault/fracture volume, petrophysical analysis, and geochemical interpretations to generate production and produced water disposal risk maps
- On-demand well planning to identify and de-risk drilling locations based on petrophysical and fault analysis

RESPACK HYDROCARBONS ADD-ONS

ResPack Cuttings	**RoqScan**™ automated mineralogy analysis to provide geological ground-truth calibration for petrophysical analysis, rock physics, and reservoir characterization.
ResPack Hydrocarbons	Petroleum systems modeling to evaluate hydrocarbon generation, migration, and accumulation within the subsurface.
ResPack HD	Geostatistical inversions of rock-constrained petrophysical lithofacies to transform fine-bed equiprobable rock property solutions into seismic volumes.
ResPack Fast	Deterministic inversion using well logs, 3D seismic data, and machine learning to deliver rock properties fast.

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