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Wed(NSI)day Live

Richter Predictor: Identify Pre-cursors to Induced Seismicity and Casing Deformation
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What is the typical magnitude of the variations in fracture propagation pressures? Also, what are the units for energy density?

Typical variations in fracture propagation pressure can range from a few hundred to over a thousand psi, depending on formation heterogeneity and local stress state. Energy density is reported in PSI/Hz or can be normalized per unit time for comparison, depending on the signal processing methodology used.

Please tell us something about the formation on slide 18? Is it a strike-slip regime or passive basin?

The example shown in Slide 18 is from the Western Canada Sedimentary Basin and is strike-slip stress regime.

How do you take into account frac isolation? Can these methods discern isolation loss vs. formation response?

Yes. Changes in the resonance signature can help differentiate between isolation loss (often abrupt, localized signal drop or spike) versus formation responses (more progressive and patterned). Combined with FDI data or FracBRAIN® fracture diagnostics, we can further improve confidence in the analysis.

Please define 'derivative energy.'

Derivative energy refers to the time-rate change in energy density across the pressure signal spectrum. It's normalized to stage duration, providing a stage-over-stage comparison of how much resonant energy is being introduced or mitigated.

I see pressure tracking, but doesn't injection rate impact total energy?

It does. However, what we're analyzing is the resonant energy pattern, not just absolute input energy. Resonance amplitude reflects how energy interacts with the subsurface—not just how much energy is pumped. Depending on the particular risk factors, we do take into account the hydraulic horsepower as a variable in understanding the relative energy response and energy balance of the system.

What qualities are required for the gauge? DFIT? Acquisition rate and resolution?

For ShearFRAC® analysis, we require discrete, high-fidelity pressure data at one hertz, with minimal repeated values and zero filtering. DFIT gauges, typically quartz-based, have historically shown some filtering, we prefer to have that filtering removed to align with our raw data quality standards. This ensures the most accurate and reliable real-time analysis possible.

Don't fluid changes like proppant concentration or viscosity impact wave arrival time?

Yes, but in most cases, the time shift is minor compared to the resonant frequency we're analyzing. These are accounted for in baseline calibration and are generally second-order effects, and have a minor impact on the resonant amplitudes detected. As the analysis focuses on the detection of large magnitude changes, the minor differences in arrival time are inconsequential.

You said a warning was sent before the M3 event. How do you estimate magnitude?

We infer magnitude risk by tracking the resonance amplitude and pattern changes across multiple stages. If the acceleration pattern matches previously observed precursors to M3+ events, we trigger an alert. We don't calculate magnitude directly but detect precursors reliably.

Is there correlation between 'energy release' and Microseismic?

Yes. Across multiple case studies, there has been strong alignment between high resonance phases and increased Microseismic activity. Richter Predictor™ detects energy transitions even in aseismic deformation where Microseismic and seismic is unable to pick up this part of the signal. This is the primary reason that the Richter Predictor™ can be used as an early warning tool.

Similar aseismic energy release has been documented in both INSAR and True Triaxial laboratory testing equipped with acoustic emissions and LVDT sensors, which was performed with insitu principal stress conditions

What is the magnitude/frequency of micro pressure fluctuations? Special gauge needed?

We're detecting fluctuations in the range of a few hundred to a thousand PSI, depending on basin characteristics and structural features. Frequencies are highly dependent on the structures activated. Standard surface gauges with discrete, high-fidelity pressure data at one hertz, with minimal repeated values and zero filtering and stable baselines are sufficient.

Are you installing this tech on injection wells or just new stimulations?

The Richter Predictor™ is currently deployed primarily on new stimulations. This technique can also be adapted to monitor injection wells for long-term deformation or induced seismicity. We are also exploring CO2 injection wells as this analysis should theoretically work in this application.

We welcome the opportunity to further discuss any of the above questions or any other questions you may have about the work we are doing at ShearFRAC®. info@shearfrac.com

Or visit our website: www.shearfrac.com