

TerraGuard-1 (Novel Clay Control)

SUMMARY:

Conventional rock contains swelling clays such as smectite and migrating clays like illite/montmorillonite and kaolinite. TerraGuard-1 is a liquid clay control product designed to reduce this clay swelling as well as fines migration. It offers protection in both gel and slick water frac fluids and is also compatible with drilling flush systems. Since TerraGuard -1 is non- surface active, it does not adversely affect formation wettability. Furthermore, this product can be used in fresh, brine, or acid systems and will not hinder the performance of acid corrosion inhibitors.

ADVANTAGES:

- ◆ Mild ionic charge renders TerraGuard -1 non-reactive with common fracturing additives.
- ◆ Low toxicity and user friendly.
- ◆ Effective on all types of swelling and migrating clays and shales.
- ◆ Can act as a permanent clay stabilizer in addition to preventing clay swelling.
- ◆ Cost-effective alternative to KCl.
- ◆ Can be run continuously throughout the treatment rather than batch mixed if desired.
- ◆ No effect on formation wettability.

MIXING & BLENDING INSTRUCTIONS:

- ◆ Batch mixed into the fluid or continuously mixed "on-the-fly".
- ◆ Inject on suction side or discharge side of the blender/hydration unit.
- ◆ Typically run at 1-5 GPT.
- ◆ Common loading is 2 GPT.

TECHNICAL LAB RESULTS:

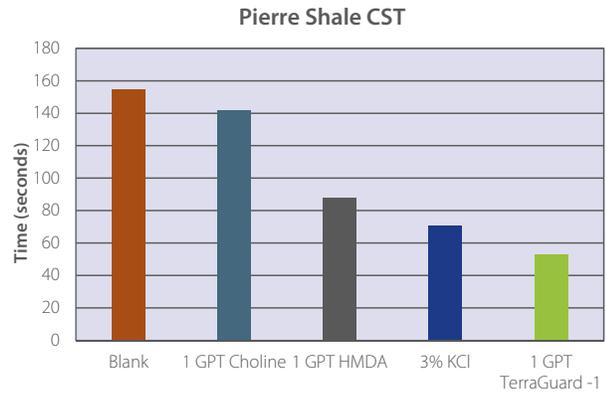
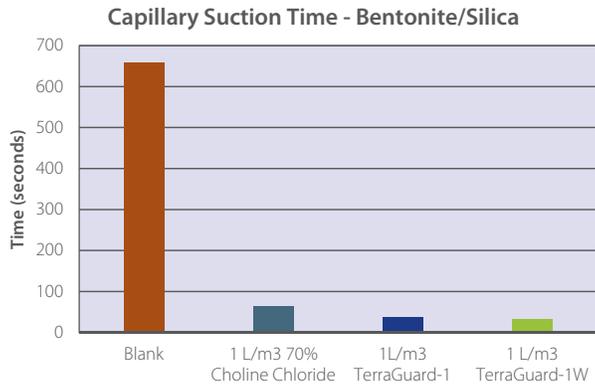
TerraGuard is a "new to industry" molecule that offers multiple functionality while outperforming most other clay controls at a competitive price. In unconventional rock (shales), matrix damage from clay swelling and fines migration is not as common but physical changes to the formation that occur during hydraulic fracturing and drilling processes can lead to embedment and nano-indentation which can be as damaging as clay swell/migration. The results of lab testing described below demonstrate the benefits of using TerraGuard-1.

Capillary Suction Time (CST) Test:

Capillary suction time test measures clay swelling as a function of flow capacity of a fluid. The graphs which follow clearly show that TerraGuard-1 out performs standard clay control Choline chloride by 42.7% in the standard bentonite test. When compared to an unconventional shale (Pierre), we see a performance increase of 62%.



Capillary Suction Time (CST) Test (cont'd):



Roller Oven Stability

Roller Oven stability tests simulate fluid around rock particles (usually drill cuttings) and how entrainment and fines migration occur in the presence of a frac/drill fluid. When the erosion/dilution of the rock cutting was measured in test samples, TerraGuard-1 shows a 29% increase in performance when compared to Chlorine Chloride after the first exposure and a 69% increase in performance in fresh water environments.

