ChemiSol Energy Solutions

# CSES-1000 SERIES

## TECHNICAL DATA SHEET

### PRODUCT DESCRIPTION: Multi-Functional Silicate Blend

*CSES-1000* is an inorganic blend of sodium silicate and meta-silicate chemistries specifically designed for Enhanced Oil Recovery (EOR). The proprietary formulatory process results in unique types and ratios of functional silicates within the final product, with the end product containing an industry-leading silicon to sodium ratios in excess of 4:1. As such, the resulting chemical compound has numerous field applications and uses. Finally, CSES-1000 is a product that is stable, non-hazardous and environmentally benign.

### APPLICATIONS

- Enhanced Oil Recovery "Wetting" Agent
- Swelling Control for Formation Clays
- Stabilizing Agent for Hydrogen Peroxide – Delayed Heat Treatments
- Drill Cuttings Treatment/Clean-Up
- Non-Toxic Heavy Metal Precipitating Agent for Waste Water
- General Purpose Waste Water Flocculent

Consult your technical representative for specific, application recommendations.

### FEATURES & BENEFITS

- Effective wetting agent suitable for many applications
- Environmentally benign and readily biodegradable
- Significantly reduces interfacial tensions
- Product is Stable, Safe to Handle and Non-Toxic
- Stabilizes Hydrogen Peroxide allowing placement in well/formation
- Low dosage rates, typically 1 to 2 percent

### HOW IT WORKS

CSES-1000 works in three ways:

1. *Improving surfactant efficiency through the removal of hardness ions from reservoir brines, thus reducing adsorption of surfactants on rock surfaces.* By binding or precipitating hardness ions, it causes a more favorable oil release from the reservoir by preventing oils from binding to metals or clay and prevents surfactants from adsorbing to the formation. While silicate based, CSES-1000 does not introduce any significant amounts of silicate to cause scaling problems. Instead the high silicate ratio of CSES-1000 compared to commercial silicates allows the precipitating of hardness ions to be more complete.
2. *Buffering the system to maintain an optimal pH over a wide range of concentrations.* A very significant factor that determines whether a scale forms is the pH value of the system. Factors such as temperature, pressure, ionic

make-up and other less variables also play some roles but it is the pH that determines which solids phases form scale or precipitate to alter productivity. A buffered system helps minimize the interfacial tension within the formation thereby allowing better oil flow and recovery. It also helps to in controlling hardness ions in the formation, lessens formation damage, and results in less scale formation. Because high alkaline materials typically used react with the rock minerals and formation water, they dissolve native rock causing formation damage and increasing the concentration of scaling ions ($Ca^{+2}$, $CO_3^{-2}$, $SiO_4^{-4}$ which when they precipitate cause problems. (Note: most silicate in scale comes from the formation that was dissolved by the high alkaline conditions in traditional alkaline flooding fluids. Others have shown that the silicate precipitation is probably nucleated by calcium carbonate formation). All these equilibrium reactions show very high sensitivity to pH and tend to be accelerated by the presence of hydroxide forming metals e.g., $Fe^{2+}$, $Mg^{2+}$or $Al^{3+}$. Maintaining a stable pH is very beneficial for better controlling the enhanced oil recovery process.

3. *Converts carboxylic acids and phenolic acids into powerful surfactants to lower interfacial tension.* Crude petroleum is known to contain varying amounts for organic acid materials (e.g. carboxylic acids and phenolic acids) that can react with alkaline materials to form soaps. These soaps reduce the interfacial tension between the crude petroleum and water. This reduction in interfacial tension enables solutions to more easily displace residual oil from the pore of a reservoir. CSES-1000 is capable of converting the various these carboxylic acids and phenolic acids into surfactants to benefit oil recovery.

## HOW IS CSES-1000 DIFFERENT?

If CSES-1000 is silicate based, why not use a commercial sodium silicate solution from other vendors? While there are many differences, one of the most important difference is the manufacturing process. Traditionally, silicates formation converts sand at high temperature. Solid sodium silicate glass contains regularly small amounts of impurities, such as iron, aluminum, calcium and magnesium compounds, probably in the form of silicates which originate partly in the quartz, sand, and other raw materials used or which are obtained from the furnace walls by the action of the strongly alkaline silicate melt. Part of these impurities will dissolve together with the sodium silicate when a very concentrated solution is prepared, but some of these remain insoluble and form a suspension of more or less colloidal particles which either pass through filter cloth or form a slimy precipitate. This reduces the effectiveness of those materials for enhanced oil recovery.

Also, our proprietary process allows for higher more stable ratios of $SiO_2$:$Na_2O$ which cannot be obtained through the most common commercial methods. It is made from a purer silicon source. It is never converted into a solid form and re-dissolved into solution. This allows for the higher silicon ratios. This delivers more buffering and reactive silicate ions instead of hydroxide ions. Our process also supports larger silicate molecules which are more reactive to hardness ions. The higher ratio also allows the buffered pH of the solution to help reduce the harsh alkaline conditions of sodium hydroxide which makes it safer to handle.

## TYPICAL PHYSICAL PROPERTIES

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| Appearance | Liquid |
| Color | Slightly yellow to clear |
| Odor | Discernable Odor |
| Solubility | 100% |
| pH Neat | 11.3 – 11.7 |
| Density | 10.4 – 10.6 lbs/gallon |
| Boiling Point | 100°C / 212°F |
| Freezing Point | 32°F |