

NOVEMBER 2007 MEETING

Wednesday, November 14, 2007

TECHNICAL PROGRAM

Stabilization of Expansive Soils Using EcSS 3000TM Electrochemical

Speaker: [Russ Scharlin, P.E.](#), Vice President with [Environmental Soil Stabilization, LLC.](#), Arlington TX, Tel. No. 817-274-1500.

PRESENTATION SUMMARY

To a room of about 50, Mr. Scharlin, who has earned BSCE and MSCE degrees from the University of California at Davis and is a licensed professional engineer, gave a follow-up slide presentation to what he presented to the FPA in [September 2002](#), entitled, *Stabilization of Expansive Soils Using EcSS 3000TM Electrochemical*.

Mr. Scharlin's company has been in existence since 1993 with the sole purpose of treating expansive soils. The proprietary chemical solution his company sells is applied to expansive clays either through injection or mechanical mixing. Once applied, the solution, called "EcSS 3000TM" is undetectable and its effects on reducing the swell potential in clay is irreversible. On many of his projects, the swell potential (as tested by standard swell testing) is reduced from more than 5% to less than 1%.



When he gave his [September 2002](#) presentation, Mr. Scharlin said his solution was being tested at Texas A&M. Since that time he has moved its research and development to Penn State, who concluded in 2006:

When montmorillonite is treated with EcSS 3000TM soil stabilizer, the following is observed:

- The treatment processes are irreversible and do not cause preswelling of the clay.
- The interlayer spacing is reduced and the interlayer cations are exchanged. Si-O-Al bonds are broken resulting in the separation of amorphous silicon and soluble aluminum from the structure.
- The surface charge (zeta potential) is reduced.
- Water originally bound by the clay particles, and within the mineral interlayer is released.
- Particle size is reduced, and surface area is reduced due to flocculation.
- Cation exchange capacity (CEC) is reduced.
- Liquid limits (LL), Plasticity limit (PL) and Plasticity index are reduced indicating lower plasticity, swelling and compressibility characteristics.
- The extent of swelling is greatly reduced.
- Uniaxial compression test shows an increase in strength of montmorillonite as a result of the treatment with EcSS 3000TM soil stabilizer.

The Penn State researchers further described the solution they tested as follows:

"When EcSS 3000TM solution is added to clay or soil, it has an immediate effect on the properties of the soil as cation exchange begins to take place between interlayer cations and hydrogen ions in solution. This reduces the density of the electrical charge around the clay particles, which leads to them being attracted closer to each other to form flocs, the process is termed flocculation. It is this process which is primarily responsible for the modification of the engineering properties of the clay. So, montmorillonite loses its plasticity immediately. In the meantime, a catalyzed attack on the Si-O-Al bonds in the tetrahedral sheets takes place (organic sulfonate acts as catalyst) causing disintegration and separation of amorphous Si into the floc making them dense and impermeable. These two processes are responsible for the enhanced strength, reduced CEC and stopping expansion."

According to Mr. Scharlin, about half of the swell potential reduction comes from around the clay particles and the other half comes from within the clay particles as described by Penn State.

To download Mr. Scharlin's slide presentation, [click here](#).

To read a summary of Mr. Scharlin's September 2002 FPA presentation, [click here](#).