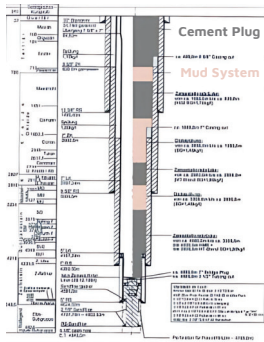


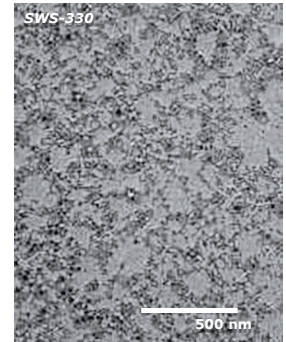
ENHANCING PLUG & ABANDONMENT APPLICATIONS

SWS-330: Reactive Fluid



During P&A-applications, cement slurries are often pumped on top of mud systems. Here, the carrying capacity of these fluids is crucial for proper cement plug placement.

SWS-330 is a colloidal suspension of nano-scaled particles. In the presence of divalent cations (e.g., Ca^{2+} from cement hydration), the viscosity of this WGK-1 product suddenly peaks creating an excellent base for optimized P&A applications.

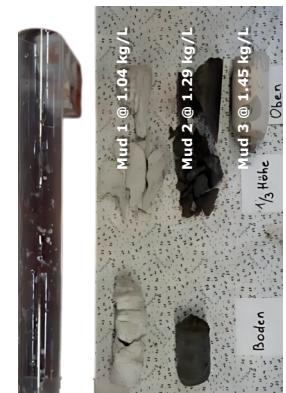


Lab Experiments

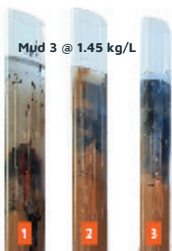


First, a customized lab instrument and method for cement slurry placement was established. Next, the carrying capacity of three water-based mud systems was determined. Here, the lower the difference between fluid densities, the better the separation between cement plugs and mud systems.

Fluid	Soda, kg/m ³	Bentonite, kg/m ³	CMC LV, kg/m ³	NaCl, kg/m ³	Barite, kg/m ³	Density, kg/L
Mud 1	1	80	0	0	0	1.04
Mud 2	1	80	5	302	0	1.29
Mud 3	1	70	5	302	275	1.45
4	API Class G					1.90

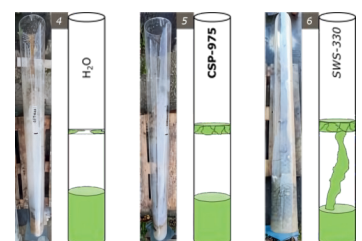
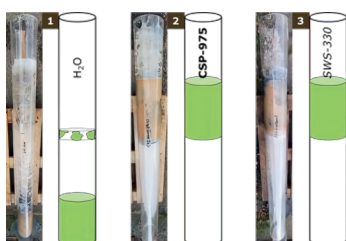
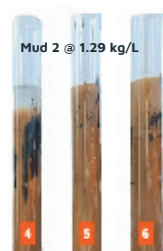


Yard Testing



Employing standard pumping equipment and a diverter, an API Class G cement slurry was placed on top of two different mud systems.

The reactive fluid SWS-330 greatly improves the carrying capacity of the mud / cement system resulting in an optimized fluid separation. This facilitates proper cement plug placement, even at lower mud densities.



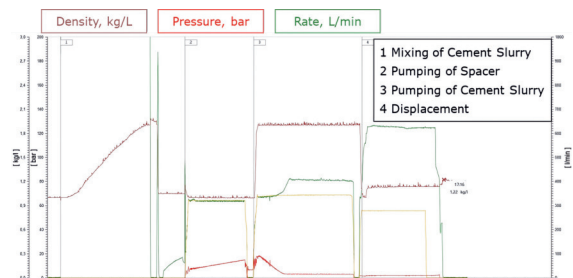
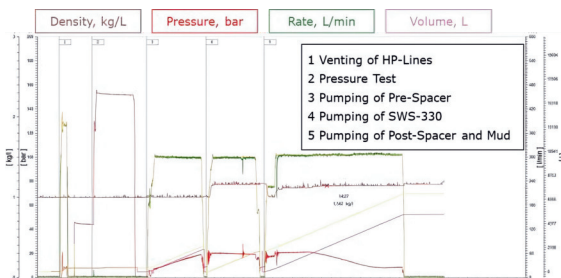
Standard Equipment on Site



Pumping Schedule

Fluid	Name	Composition	Volume, m ³	Density, kg/L	Rate, L/min
1	Pre-Spacer	Fresh-Water + 6 kg/m ³ Xanthan Gum	2	1,00	300
2	SWS-330	1:1 Mixture with Spacer System	2	1,18	300
3	Post-Spacer	Fresh-Water + 6 kg/m ³ Xanthan Gum	1	1,00	300
4	Mud	As received by client	4	1,15	300

Fluid	Name	Composition	Volume, m ³	Density, kg/L	Rate, L/min
1	Spacer	Fresh-Water	2	1,00	300
2	Cement Slurry	API Class G + 2kg CRE-120	4	1,90	300
3	Mud	As received by client	5	1,15	600



Benefits

- ✓ FES: Reliable partner for innovative solutions and long- term projects
- ✓ Excellent collaboration between experienced operational team with FES-lab personnel
- ✓ Improved carrying capacity of mud / cement systems employing a WGK-1 product
- ✓ Enhanced fluid separation, even at low mud densities resulting in material and cost saving potential

READY FOR SERVICE

Dr. Nils Recalde Lummer
 Senior Chemist

☎ +49 4471 980 08 25

☎ +49 151 41 42 58 82

✉ nlummer@fangmanngroup.com

🌐 fangmannenergyservices.com

