Water Based Drilling Fluid Contaminant Determination and Treatment

Contaminant		WT	FV	PV	YP	Gels	FL	pH	P_m	P_f	M_f	Cl^-	Ca^{2+}	Solids	Treatment
Cement		—	↑	—	↑	↑	↑	↑	↑	↑	↑	—	↑pH↓ 11.5	—	Bicarb, or SAPP, or thinner, bicarb and citric acid
Gypsum or anhydrite		—	↑	—	↑	↑	↑	↓	↓	↓	↓	—	↑	—	Caustic, dilution water and thinner, or soda ash (plus fluid-loss polymer)
Salt		—	↑	—	↑	↑	↑	↓	↓	↓	↓	↑	↑↗	—	Caustic, dilution water, thinner and fluid-loss polymer
Carbonate or bicarbonate		—	↑	—	↑	↑	↗	↓	↓	↗→	↑	—	↓	—	pH <10.3: lime pH 10.3 to 11.3: lime and gyp pH >11.3: gyp
H_2S		—	↑	—	↑	↑	↑	↓	↓	↓	↓	—	↗	—	Caustic, lime and zinc source (zinc oxide)
Solids	Old	↗	↗	↗	—	↗	—	—	—	—	—	—	—	↑	Dilution water and solids-removal equipment
	New	↗	↗	↗	↗	↗	↗	↘	↘	↘	↘	↗	↗	↑	Dilution water, solids-removal equipment and thinner

↑ *Increase* ↓ *Decrease* — *No change* ↗*Slight increase* ↘*Slight decrease*

Water Based Drilling Fluid Contaminant and Treatment

Contaminant	Contaminating Ion	Treatment	Treating Concentration (lb/bbl)
Carbon dioxide	Carbonate Bicarbonate	Gyp to reduce pH Lime to raise pH Lime to raise pH	mg/l x F_w x 0.00100 mg/l x F_w x 0.000432 mg/l x F_w x 0.00424
Gypsum and anhydrite	Calcium	Soda ash SAPP Sodium bicarbonate	mg/l x F_w x 0.000928 mg/l x F_w x 0.000971 mg/l x F_w x 0.00735
Lime or cement	Calcium and hydroxyl	Sodium bicarbonate SAPP Citric acid	lb/bbl excess lime x 1.135 lb/bbl excess lime x 1.150 lb/bbl excess lime x 1.893
Hard or seawater	Calcium and magnesium	Caustic soda	mg/l x F_w x 0.00116
Hydrogen sulfide	Sulfide (H_2S, HS^-, S^{2-})	Zinc oxide* plus sufficient caustic soda to maintain the pH above 10.5	mg/l x F_w x 0.00091

*Other zinc compounds such as chelated zinc or zinc carbonate may also be used. An excess should always be maintained in the system.

NOTES:

1. F_w is the fractional % of water from retort.
2. Excess lime = 0.26 (P_M – (P_f x F_w)).

Non-Aqueous Drilling Fluid (OBM/SBM) Property Effect From Contaminant and Treatment

Insufficient Viscosity

Cause	Treatment
Undertreatment of viscosifier	Add organophilic clay
Lack of proper particle size distribution	Add rheology modifiers
Low Water Content	Add water (brine)
New mud, lack of shear	Shear through bit or shear unit
Gas stripping	Increase mud weight
	Add wetting agent
	Add primary emulsifier and lime

Excessive Viscosity

Cause	Treatment
High water content (saltwater flow)	Dilute with base fluid
	Add primary emulsifier and lime
	Add wetting agent
	Add OBM thinner/dispersant
Incorporated drill solids	
1. High solids (% volume)	Centrifuge/solids control
	Use dilution
	Add wetting agent
	Add OBM thinner/dispersant
2. Fines solids problem	Centrifuge/solids control
	Use dilution
	Add wetting agent
	Add OBM thinner/dispersant
3. Water-wet solids	Add wetting agent and primary emulsifier
	Decrease water content
	Reduce solids content
High-temperature instabililty	Add wetting agent and primary emulsifier
	Decrease water content
	Reduce solids content
Acid gases	Add lime (conventional system)
	Add primary emulsifier and wetting agent
	Increase mud weight
	If H2S, add H2S scavenger
Overtreatment	Dilute with base fluid

Water-Wet Solids

Cause	Treatment
Super-saturation	Add emulsifier and wetting agent
	Add OBM thinner/dispersant
	Add water sparingly
Excessive solids	Use soids control and dilution with base fluid
	Adding wetting agent
	Add OBM thinner/dispersant
Undertreatment	Add primary emulsifier and wetting agent
	Add OBM thinner/dispersant

Increase in HTHP Fluid Loss

Cause	Treatment
Weak emulsion	Add primary emulsifier
	Add lime (conventional system)
Lack of proper particle size distribution	Add fluid loss additive
	Add organophilic Clay
	Add weight material or bridging agent
High-temperature instability	Add primary emulsifier and wetting agent
	Add lime (conventional system)
	Add fluid loss additive

Water in HTHP Filtrate

Cause	Treatment
Weak emulsion	Add primary emulsifier and wetting agent
	Add lime (conventional system)
High-temperature instability	Add primary emulsifier
	Add lime (conventional system)
	Add fluid loss additive

Carbon Dioxide Contamination

Indicator	Treatment
P_{OM} decrease	Increase mud weight
	Add lime
Rheology increase	Add primary emulsifier and wetting agent
	Add base fluid for dilution
	Increase mud weight
	Add lime

Hydrogen Sulfide Contamination

Indicator	Treatment
P_{OM} decrease	Increase mud weight
or Foul odor	Add lime
or Mud turns black	Add primary emulsifier and wetting agent
or Drill pipe turns black	Add H_2S scavenger

Shaker Screen Blinding

Cause	Treatment
Water-wet solids	Add wetting agent
	Add primary emulsifier
	Add OBM thinner/dispersant

Water Flow

Cause	Treatment
Decrease in OWR (water intrusion)	Increase mud weight
Decrease in mud weight	Increase mud weight
	Add primary emulsifier and wetting agent
	Add lime (conventional system)
	Add base fluid to adust OWR
	Add salt to adjust brine salinity