

# Buffers



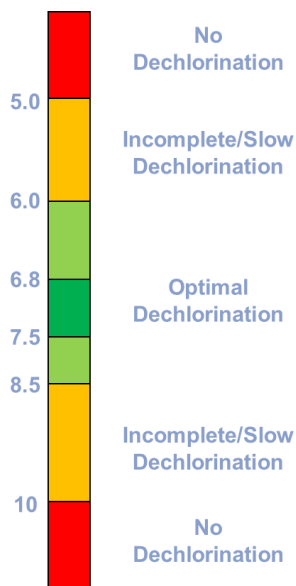
- Artificial pH modification to control enhanced bio and metals stabilization
- Soluble, colloidal and long-lasting buffers for subsurface environments
- Compatible with EDS-ER, Nutrimens, EDS-QR, ZVI and TASK products
- Tersus sources powders, solutions or colloidal suspensions of alkaline suspensions, carbonates, hydroxides or buffers.

## Principle

Most successful bioremediation applications have been performed in aquifers with circum-neutral pH. Bioremediation in low pH aquifers, however, is usually ineffective, presumably because organohalide respiring organisms do not dechlorinate well below pH ~ 6. In many cases low pH is a function of the natural site geochemistry, but low pH conditions also can occur from substrate fermentation and reductive dechlorination of target chlorinated VOCs.

Tersus sources pH buffering solutions and bases to address low pH issues. These include sodium bicarbonate, dipotassium phosphate, calcium carbonate and magnesium hydroxide, among others. Analyzing results from a titration test on site soils and groundwater can help quantify buffering requirements for *in situ* cases.

**pH Effect on Reductive Dechlorination**



**Packaging Options**

Product	Magnesium hydroxide	Sodium Bicarbonate	Dipotassium Phosphate	Sodium Carbonate
<i>Chemical Formula</i>	$Mg(OH)_2$	$NaHCO_3$	$K_2HPO_4$	$Na_2CO_3$
Alkalinity: lbs $CaCO_3$ Eq.	1.72	0.60	0.57	0.94
Characteristics:	9-10 max pH. 95% efficient, particularly on metals, long lasting, low cost, mixing required	Simple, aqueous phase addition of alkaline solution limited by groundwater residence time	Minimize pH changes, used as nutrient, risk of clogging	11.6 max pH. 100% efficient, high volume required, potential sodium toxicity

## Field Application Design

Tersus recommends performing a titration test on site water and soils to determine amount of product required to neutralize aquifers. pH adjustment and buffer products are shipped as mixable powders or as ready-to-use suspensions. Soluble Sodium Bicarbonate is used for low acidity and high injection volume requirements, while  $Mg(OH)_2$  can be mixed and direct pushed as a slurry with other amendments for remediation. Fine grained Calcium Carbonate (Limestone) and Potassium Bicarbonate ( $KHCO_3$ ) are alternative buffer chemistries that Tersus may recommend based on aquifer geochemical conditions, contaminant type, field application, and treatability study results.

## Magnesium Hydroxide

Tersus' magnesium hydroxide provides a lasting pH adjustment that buffers acidic aquifers or treats toxic dissolved metals. Using this product reduces the risk of overshooting the pH into dangerously basic conditions. A saturated solution of  $Mg(OH)_2$  will have a pH no higher than 10. This buffer can be used on its own or in combination with emulsified oil products.

### Advantages

- Long-term pH adjustment
- Minimized risk of overshooting pH
- Ships in small containers as a liquid or as a powder
- Easily diluted with water in the field

### Product Content

Chemical Name	CAS Number	Composition (% wt)
Magnesia	7439-95-4	98.5
Oxides of Si, Fe, Al, Ca & Inorganic salts, silicates and carbonate	Mixture	1.5

### Product Characteristics

Parameter	Specification
Specific Gravity	1.45
Hazards identification	Not classified
Appearance	White liquid

## Sodium Bicarbonate

Tersus' sodium bicarbonate is a commonly used, low cost, safe, soluble product that provides aquifers with a pH neutralization capacity.

### Advantages

- Typically, no significant heat or gas generation
- Low precipitate volume
- Maximum pH of 8
- Ships in 50-lb bags or as a concentrate in 275-gallon IBC totes.
- Soluble chemical will follow groundwater path

### Product Content

Chemical Name	CAS Number	Composition (% wt)
Carbonic and sodium salt	144-55-8	>98

### Product Characteristics

Parameter	Specification
Bulk Density	500 -1300 kg/m <sup>3</sup> (2.21-2.23 relative density)
Solubility in water	93 g/L (20 °C)
Appearance	Crystalline, white powder