

pH Levels

Moderate pH levels are maintained when ORC is used in bioremediation. Due to the insoluble nature of ORC, the pH increase remains highly localized. This elevated pH level helps control biofouling around ORC wells and has been shown to minimally, if at all, affect pH downstream. The following field data from a North Carolina site suggests that such migration is minimal or very slow.

North Carolina Site Oxygen Barrier pH Measurements

Day	50' UG	ORC	10' DG	25' DG	50' DG	85' DG
7	6.0	11.3	5.9	6.1	6.0	6.2
21	5.9	10.5	6.1	6.5	6.1	6.2
49	6.0	10.1	6.1	6.0	6.0	6.3
70	5.9	8.8	5.7	5.9	–	6.0
137	5.9	11.1	6.1	5.9	–	6.0

Note: The pH of ORC is approximately 9.0 and the hydroxide reaction products approach pH 10. In this experiment, the ORC was delivered in a concrete matrix which provides a higher pH, as observed in the ORC well - even at these elevated pH levels, there was virtually no migration. **UG = Upgradient; DG = Downgradient**

ORC (as MgO_2) and CaO_2 are both feasible as chemical oxygen sources, however, the pH increase caused by ORC stays more highly-localized at the source. Both oxides are converted to the respective hydroxides over time (as oxygen is released) as products are formed, the pH difference between starting with ORC and CaO_2 are even more pronounced. The pH of CaO_2 reaction products can approach 13 while those of ORC stay below 10. Furthermore, since the solubility of the products created from CaO_2 conversion is much higher ($K_{sp} = 5.5 \times 10^{-6}$) than MgO_2 as ORC ($K_{sp} = 1.8 \times 10^{-11}$), the pH will not remain as localized when CaO_2 is the starting source.

These differences would be even more pronounced in systems more-highly buffered than aquifer water. In buffered soil systems, the pH remains quite benign, below 8, even at ORC concentrations of more than 1% wt/wt. CaO_2 however, is difficult to use above 0.25% wt/wt. and causes a pH increase to nearly 11 by the time it is present at 1% wt/wt.