

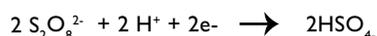


## INFORMATION

Recent applications of *in situ* chemical oxidation (ISCO) have shown that ISCO can be a cost-effective remedial strategy for organic contaminants in groundwater and soil. The application of ISCO to contaminated source areas usually results in an immediate benefit to groundwater in the area. In addition, contaminant flux can be reduced or eliminated mitigating further contaminant plume issues. Redox Tech, LLC has recently formulated a mixture of sodium persulfate and calcium peroxide that can be employed for ISCO applications.

The mixture in Oxygen BioChem (OBC™) supports a two-fold mechanism for treating contaminants of concern. OBC delivers one of the strongest chemical oxidants for short-term ISCO, and also provides electron acceptors (oxygen and sulfate) for longer-term biological oxidation.

Sodium persulfate has emerged recently as an important oxidant for *in situ* remediation of volatile and semi-volatile organic compounds. Persulfate is the strongest oxidant within the peroxygen family, with an oxidation potential of 2.12 volts. As illustrated below, the direct oxidation half-cell reaction for persulfate involves a two-electron transfer:

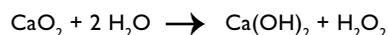


However in most cases, rapid destruction of the contaminant of concern requires that the persulfate be activated in order to generate sulfate radicals. Sulfate radicals are powerful oxidizing agents, with an oxidation potential of 2.6 volts. Activated persulfate is catalyzed with the peroxide and base provide by the calcium peroxide:



Activated persulfate can remain available in the subsurface for months providing a combination of power and stability.

The calcium peroxide provides several benefits. First, it imparts the alkalinity and peroxide needed to activate the persulfate using activation chemistry. Second, when mixed with water it provides a long-term, slow release source of hydrogen peroxide and calcium hydroxide.



The hydrogen peroxide that is slowly formed decomposes to oxygen and water, providing an extended oxygen source for subsequent bioremediation of petroleum hydrocarbons.



The resultant calcium hydroxide (hydrated lime) that is produced serves several purposes. First of all, it increases the total dissolved ion concentration, which makes the solution less likely to leach metals from the soil into the groundwater. Secondly, the calcium from the hydrated lime will precipitate the sulfate that is produced during the consumption of the persulfate. The calcium sulfate (gypsum) precipitation helps to reduce sulfate groundwater concentrations, which may impact the secondary drinking water standard of 250 ppm.

The mixture in Oxygen BioChem (OBC™) provides chemical oxidation as well as electron acceptors (oxygen and sulfate) for longer-term biological oxidation. The predominant short-term reaction is chemical oxidation, while the longer-term remediation process is biological oxidation. Table I lists commonly treated contaminants by OBC.

Below is a list of advantages and strengths of OBC:

- Works on a wide range of contaminants
- Oxygen content about 46% by weight
- Facilitates both chemical oxidant and bioremediation
- Typically 40% by weight solubility for the persulfate

Table I. Contaminants Commonly Treated by OBC

CONTAMINANTS COMMONLY TREATED	
BTEX	1,4-dioxane
MTBE	PCBs
PAHs	Pentachlorophenol
Chlorinated Alkenes	Chlorinated Alkanes