



# BIOREMEDIATION BULLETIN 1.2

## PermeOx<sup>®</sup> Plus in Remediation Treatments

Throughout the industry, the use of oxygen amendments to enhance bioremediation is increasing. One common practice is to enhance aerobic microbial activity to degrade hydrocarbons. Several years ago, FMC introduced a solid, oxygen-releasing calcium peroxide product under the name PermeOx<sup>®</sup> for environmental and agricultural applications. This formulation has been refined to offer added benefits over all commercially available oxygen release compounds into its present form, **PermeOx<sup>®</sup> Plus**. The formulation of **PermeOx<sup>®</sup> Plus** provides a slow release of oxygen. As a solid, it is ideal for use in bioremediation technologies such as land farming, biotreatment cells and multiple lift soil systems. As a slurry, **PermeOx<sup>®</sup> Plus** can be added to groundwater to speed up the natural biodegradation of petroleum and other compounds. Laboratory research and field experience have shown that **PermeOx<sup>®</sup> Plus** can speed up the bioremediation process and offers a very cost-effective remedial alternative compared to other remediation methods. Enhanced bioremediation using **PermeOx<sup>®</sup> Plus** is also a very effective polishing step, which can achieve lower compliance point concentrations or clean-up standards after a more aggressive source-removal technology such as oxidation or product removal, etc. has been completed.

### Chemistry

Soil moisture and or placement into a hydrogeologic system trigger a gradual release of oxygen after adding **PermeOx<sup>®</sup> Plus**. This oxygen release proceeds stepwise, starting with formation of hydrogen peroxide and calcium hydroxide. The hydrogen peroxide then decomposes to form oxygen and water thus increasing the dissolved oxygen content of groundwater and soil moisture within the vadose zone. **PermeOx<sup>®</sup> Plus** is an off-white, dry, flowable powder containing a minimum 75 percent calcium peroxide and has active oxygen content of 18 percent (by weight), versus 10 percent oxygen in commercially available magnesium peroxide.

### Field Experience

Field experience has shown that **PermeOx<sup>®</sup> Plus** offers substantial benefits in the following situations:

- In groundwater remediation where enhanced biodegradation can achieve clean-up goals.
- When limited space or access demands in-situ treatment.
- In land farming where operators wish to reduce the frequency of tilling and control costs of remediation.
- In clayey soils to provide a source of oxygen and permit more efficient movement of nutrients and oxygen through the soil.
- In remote locations where daily or weekly site maintenance and monitoring is not practical, or other means of oxygen supply are not readily available.

In pilot tests at an EPA Superfund site, **PermeOx<sup>®</sup> Plus** treated soils showed increased total microbial populations and species diversity when compared to control and tilled plots. Increasing species diversity suggests the ability to degrade a wider range of chemical contaminants.