

Recommended Baseline Sampling for PermeOx[®] Ultra

PermeOx[®] Ultra is a calcium peroxide based product that is engineered to slowly release oxygen to stimulate aerobic bioremediation of many common environmental contaminants of concern. PermeOx Ultra is typically applied as an amendment to an excavation, through *in situ* soil mixing, or via direct push injection techniques.

PermeOx Ultra is a powdered product which has a low solubility and can be applied either as a dry powder or as a slurry, to assist in product distribution, to minimize dust, and to provide the hydration necessary to initiate the release of oxygen. PermeOx Ultra Granular is also available to provide ease of use for backfill applications.

This document provides guidelines for baseline sampling prior to the application of PermeOx Ultra or PermeOx Ultra Granular for enhanced aerobic bioremediation. The following analysis are recommended in the treatment area monitoring locations installed prior to the application.

Critical Parameters

- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (sVOCs)
- Total petroleum hydrocarbons (TPH)
- pH
- Dissolved oxygen (DO)
- Redox potential (Eh)
- Chemical oxygen demand (COD), in soil and groundwater
- Biological oxygen demand (BOD), in soil and groundwater

Non-Critical Parameters

- Total organic carbon (TOC) in soil or fraction organic carbon (*foc*)
- Reduced metals, such as dissolved iron and manganese
- Reduced inorganics, such as sulfide, nitrate, and chloride
- Alkalinity and hardness

Critical parameters are used to assess the applicability of an aerobic treatment approach and can establish a baseline for potential secondary plume contaminants (e.g. heavy metals). The non-critical parameters are optional, but can provide general information about the soil and water chemistry which may be useful when analyzing performance monitoring data.

General Soil and Groundwater Chemistry

At a minimum, pH, Eh, DO, and TPH are recommended to evaluate the conditions within the impacted area. These will help to establish the loading requirements and to select the appropriate PermeOx Ultra application rate. In addition, BOD and COD are recommended to provide a more refined estimation of the PermeOx Ultra dosage.

Oxygen Demand Estimate

The most comprehensive way to estimate oxygen demand for a site is by directly measuring either the COD or BOD in soil and groundwater. The COD and BOD include the oxygen demand from everything in the sample that could be either biologically or chemically oxidized, respectively, including the natural oxygen demand.

If these parameters are not available, the oxygen demand could be estimated from the TPH or individual VOCs in the soil and groundwater via stoichiometric calculations. If only groundwater data is available, the sorbed concentrations are estimated using soil organic carbon partition coefficients (K_{oc}) and f_{oc} values.

In addition, the natural oxygen demand in the soil and groundwater has to be considered, including naturally occurring degradable organic carbon, reduced metals (e.g. ferrous iron), and inorganics (e.g. nitrite and sulfide). DO levels and ORP will also indicate whether naturally occurring metals and inorganics could be expected to primarily exist in a reduced or oxidized state.

Please contact PeroxyChem for additional guidance.

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