

Provectus® Oxygen Release Substrate™ *Well and Bulk Deployment of Dissolved Oxygen and Nutrients*

ORS TECHNOLOGY DESCRIPTION

Provectus® Oxygen Release Substrate (ORS)™ technology is a proprietary, field-proven source of dissolved oxygen plus inorganic nutrients (e.g., phosphorous, nitrogen) and buffer to enhance the aerobic biodegradation of groundwater contaminants such as petroleum hydrocarbons (e.g., BTEX, jet fuel, semivolatiles organics). In the subsurface, the ORS materials will react with water to release oxygen slowly for a period of 3 to 6 months:



Our ORS is specifically designed to accelerate the aerobic biodegradation of organic compounds using naturally occurring microbes and enhance subsequent natural attenuation processes. In most cases, microbial inoculants are not required since the naturally occurring microorganisms are already present and well adapted to the site-specific conditions. Typical ORS applications include soil mixing and addition to backfill materials (ORS), placement in wells (ORS Sleeves), and subsurface injection via direct push (I-ORS). Additional information regarding the different ORS lines can be found on our website.

BENEFITS OF PROVECTUS® ORS™

- ◆ Three different ORS options depending on site-specific conditions, remedial application and budget.
- ◆ Significant cost savings realized due to high oxygen release rate and lower price compared to alternatives.
- ◆ Contains nutrients and is pH-buffered to reduce self-encapsulation.
- ◆ Estimated longevity of 3 to 6 months.
- ◆ Substantial time savings in the field because the reusable ORS Sleeves (PVC or stainless steel) are easy to insert and retrieve from the well (see picture).
- ◆ Ease of determining the exact depth at which the ORS Sleeve is deployed.
- ◆ Sleeves available for 2" and 4" wells.
- ◆ Up to three ORS Sleeves may be suspended in a well to increase vertical zone of influence.



PROVECTUS® ORS FAQs

- ◆ **What are the main differences between the Provect-ORS technology and market alternatives?** Our ORS contains a well-buffered source of controlled release oxygen plus inorganic nutrients designed to accelerate the aerobic biodegradation of various organic compounds and enhance natural attenuation processes. Provectus can manufacture site-specific blends based on contaminants of concern, geochemistry and remedial goals.
- ◆ **Do I need microbial inoculants?** In most cases, the naturally occurring (indigenous) microorganisms that are already present within the aquifer are well adapted to the contaminants and site-specific conditions. Therefore, inoculants are not required.
- ◆ **What contaminants are amenable to aerobic biodegradation with ORS?** Petroleum-based aromatics (e.g., BTEX, phenol) and aliphatic hydrocarbon mixtures (e.g., heating oil, diesel fuel, jet fuel, kerosene) are primary targets; MTBE, dioxane, pentachlorophenol, and other compounds are also potentially amenable to aerobic biodegradation.
- ◆ **How much does ORS cost?** Provectus ORS typically costs 25% less than market alternatives.
- ◆ **How often should I replace my ORS Sleeves?** The ORS Sleeves are typically replaced every 3 to 6 months. However, various site-specific factors will influence the effective lifetime of the Sleeve.
- ◆ **Do I need to install new wells?** No. The ORS Sleeves are designed to fit standard 2-inch and 4-inch diameter groundwater wells.