ORC TECHNICAL BULLETIN #2.4.3.1

# Oxygen Release Compound, ORC®

## Compatibility with Underground Tanks and Pipes

The use of ORC in proximity to underground tanks and pipes should not be of concern. Underground tanks and pipes are installed to meet the relatively corrosive conditions of wet soil. Also, the advent of Fiberglass Reinforced Plastics (FRPs) has greatly diminished overall concerns in this area. Both metal and FRP installations are normally exposed to fairly wide ranges of pH, variable oxygen saturated water conditions and even corrosive mineral contents - usually under a variety of advective conditions. The biggest threat to system failure lies in poor installation and not in the presence of materials such as ORC that are safe enough to place in an aquifer.

In contaminated aquifers the native levels of oxygen are depleted; ORC simply restores those levels. The saturated oxygen content of the water can reach 20-30 ppm in the immediate vicinity of concentrated masses of ORC, however, due to the ongoing demand in the larger treatment zone the average oxygen level will generally be less than normal background conditions. A typical case might be a normal saturation of 8 ppm which drops to 0 ppm upon impact from a spill and then, upon the addition of ORC, maintains at 1-2 ppm in the presence of active remediation. Sometimes the contaminant removal rate is high enough such that background oxygen is still anoxic even though remediation is actively in progress. If ORC is mixed in soil, the pore water in the immediate vicinity of concentrated masses of ORC can reach elevated oxygen levels. Therefore, it is important to do a thorough job of mixing ORC in soil in order to convey the oxygen uniformly in the aquifer.

Metals such as cast iron and higher grades of steel are subject to oxidative corrosion over all ranges of water-oxygen content. Normal design factors consider this with the thickness and type of metal used as variables. Design lifetimes are typically 20-30 years, even when these materials are used in cooling towers subject to both high flows of oxygenated water and deliberately added chemical oxidants.

It is important to note that normal engineering specifications are compromised by improper installation of tanks and pipes. This is over and above the fact that an improper selection of materials may occur and design lifetimes may be exceeded. It must be made clear that the first and foremost obligation, independent of evaluating any impact from ORC, is to assure that proper installation occurs in order to avoid stress and premature failure. ORC will not cause problems with underground installations if they are designed and installed properly.

ORC may actually inhibit corrosion as a function of its pH. A pH of 7.4 or above is considered beneficial in reducing the corrosion potential of most metals. ORC can facilitate this as pH in the immediate vicinity of any concentrated deposit of the product is on the order of 9-10. Thus, ORC placed in the vicinity of metal materials should actually act to reduce metal corrosion if it is close enough to have an effect on local pH. The elevations in oxygen content are well within the design range of the metals; pH, groundwater composition and conductivity have a much greater influence on metal corrosion. For example, water high in chlorides and with lower pH is much more corrosive than lower ionic content alkaline water.

There are a wide range of plastics and pipes or Fiberglass Reinforced Plastics (FRPs) which may be used in underground service. Each type of plastic will have its own characteristic degradation profile. These tanks and pipes are replacing metals due to their greater chemical resistance to corrosion. In many cases plastics can withstand significant concentrations of either acidic or caustic chemicals. For example, epoxy resins are recommended for use with sulfuric acid up to 50% concentration and $200_{o}$ F. Polyester resins are recommended for use with 35% hydrogen peroxide up to $100_{o}$ F and polyethylene is recommended for use with any concentration of caustic up to $150_{o}$ F. Examples such as these can be derived from most tables of detailed corrosion data, such as those appearing in the Chemical Engineer's Handbook (edited by Perry and Chilton). Overall, FRPs withstand a variety of harsh outdoor conditions where they are subject to high temperatures, ozone and UV. These conditions are much more severe than would be caused by ORC being placed in contact with or near an underground tank. It is highly unlikely that either low levels of oxygen, or the slightly elevated pH in the vicinity of the tank or pipe, would have any measurable effect on the tank or pipe.

Occasionally, there is a question on the effect of ORC on cathodic protection mechanisms. While it is conceivable that ORC could hasten the corrosion of a zinc rod designed to protect underground metals from electrical currents, the same arguments apply as for the tanks and pipes relative to oxygen levels and pH. Should the rod need replacement earlier than necessary due to the action of ORC, and this is far from a certainty, this operation is fairly low cost and simple to perform.

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