RegenOx™

Advanced Chemical Oxidation

Compatibility with Underground Storage Structures and Pipes

The use of RegenOx™ in proximity to underground tanks and pipes is not a 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 the overall concerns in this area. Both metal and FRP installations are normally exposed to fairly wide ranges of pH, oxygen saturated water and even corrosive mineral contents. The biggest threat to system failure lies in poor installation and not in the presence of materials such as RegenOx.

Interactions with metals and plastics are an extremely complicated phenomenon that is dependent on time, temperature and concentrations. Given enough time, oxidizers and caustic solutions will slowly react with certain metals and plastics. RegenOx has a high oxidizing potential and a high pH; however, RegenOx is relatively short-lived in the subsurface (2-4 weeks). Because the high pH and oxidizing conditions are very localized and temporary, RegenOx will not affect most subsurface structures near the treatment zone. A detailed discussion of materials compatibility follows.

Metals

After RegenOx application, a pH increase is often observed in the treatment area. The actual pH values can range anywhere from 7-12, with pH values of 9-10 most common. Generally, pH values return to neutral or ambient levels within 4 weeks following the injection event. Iron corrosion rates drop at high pH (10-12), so a high pH may actually inhibit iron corrosion. However, as pH increases, corrosion rates increase for aluminum and zinc. If the pH remains high for an extended period of time, this may have implications for buried electrical conduit which are frequently zinc coated iron or aluminum.

In order to summarize all the factors that may lead to metal corrosion, it is customary to use a grading system as an overall guide. In a corrosion index (Table 28-2) in the Chemical Engineer's Handbook (edited by Perry and Green), two categories apply to RegenOx: oxidizing media and alkaline solutions. This index is graded from 0-6 with a rating of 4-6 being good to excellent in terms of compatibility. A summary of the relevant information from this table is shown in Table 1 below. Materials rated a 4 or higher with oxidizing media and alkaline solutions include cast iron, ductile iron, mild steel, stainless steel, Incoloy 825 nickel-iron-chromium alloy, hastelloy alloy C-276 and Inconel 600. Materials receiving low ratings (unsuitable, poor or fair) with oxidizing media include aluminum brass, nickel-aluminum bronze, lead and silver. Caustic conditions may cause problems with silicon iron, aluminum, aluminum brass, nickel-aluminum bronze, lead, titanium and zirconium.

Table 1. General Corrosion Properties of Some Metals and Alloys *(from Perry's Chemical Engineers Handbook, Table 28-2)*

Materials	*Alkaline Solutions* *Caustic and mild alkalies*	*Oxidizing Media* *Neutral or alkaline solutions*
Cast iron	4	4
Ductile iron	4	4
Mild Steel	4	4
Ni-Resist corrosion cast iron	5	5
Stainless steel	4 – 5	6
14% Silicon iron	2	6
Incoloy 825 nickel-iron-chromium alloy	5	6
Hastelloy alloy C-276	5	6
Hastelloy alloy B-2	4	3
Inconel 600	6	6
Copper-nickel alloys up to 30% nickel	5	4
Monel 400 nickel-copper alloy	6	5
Nickel	6	5
Copper and silicon bronze	4	4
Aluminum brass	2	3
Nickel-aluminum bronze	2	3
Bronze	4	4
Aluminum and its alloys	0	0-4
Lead	2	2
Silver	6	2
Titanium	2	6
Zirconium	2	6

Plastics

A wide range of plastics and pipes or Fiberglass Reinforced Plastics (FRPs) may be used in underground service. Each type of plastic will have its own characteristic definition 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 caustic chemicals. Overall, FRPs withstand a variety of harsh outdoor conditions where they are subjected to high temperatures, ozone and UV over long periods of time.

Reference

Perry's Chemical Engineer's Handbook, Seventh Edition. 1997. Editors: Perry, R. H.; D.W. Green, J.O. Maloney. McGraw-Hill Publishing.