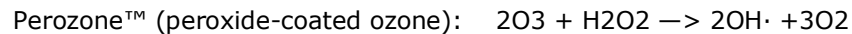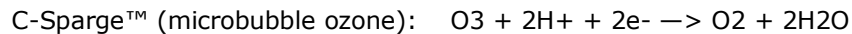# Soil Reclamation through Chemical Oxidation

In the past, contaminated soil was dug and removed to a disposal location. Present-day engineering relies increasingly on smart in-situ technologies with minimal site disturbance. Chemical oxidation is at the forefront of those technologies.

What is chemical oxidation? Oxidation is a common, everyday chemical reaction. Iron rusts. Apples turn brown. Sugar is burned during physical exercise. These reactions occur upon exposure to oxygen. There are other substances that cause oxidation, such as ozone and peroxide. They decompose organic compounds to carbon dioxide and water. The results of oxidation of chlorinated organics are carbon dioxide, water, and chlorides. This is chemical oxidation.

When do we use it? In principle, all pollutants that are sensitive to oxidation are candidates for this method of clean-up. Dissolved solvents and polycyclic aromatic hydrocarbons are especially receptive to oxidation. Therefore ozone and peroxide oxidation technology is particularly useful for clean-up of drycleaners, gas stations, and gas manufacturing plant sites. Using chemical oxidation, one can clean a site quickly and effectively.

How do the processes work? The ozone sparging process employs nano- to micro-sized bubbles of air-encapsulated ozone, created by forcing an air/ozone mixture through Spargepoints® into soil or groundwater. The ozone oxidation process may be further enhanced by coating the air/ozone bubbles with a liquid oxidant (Perozone ™). The microbubbles are pulsed through the soil and groundwater, yielding rapid clean-up. After reacting, ozone and Perozone™ both decompose to beneficial oxygen.

$$C\text{-Sparge™ (microbubble ozone):} \quad O_3 + 2H^+ + 2e^- \longrightarrow O_2 + 2H_2O$$

$$\text{Perozone™ (peroxide-coated ozone):} \quad 2O_3 + H_2O_2 \longrightarrow 2OH\cdot + 3O_2$$

The following compounds have been effectively treated with C-Sparge™ and Perozone™ technology:

Chlorinated Solvents	Petroleum Products	PAHs
PCE	MTBE	Naphthalenes
TCE	TAME	Acenaphthalenes
DCE	TBA	Benzoanthracenes
Vinyl Chloride	Benzene	Benzofluoranthenes
DCA	Toluene	Indopyrenes
TCA	Ethyl Benzene	Phenanthracenes
Chloroform	Methyl Benzenes	Pyrene
Methylene	Chloride	Xylenes