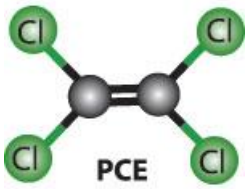
What Is PCE and Why Do We Care?

What is PCE?

Tetrachloroethene (pronounced tet'ra klor'o eth-een), or PCE, is a manufactured chlorinated organic compound that is used as an intermediate product in chemical manufacturing and as a solvent by automotive repair shops, paint shops, machine shops, service stations and dry cleaning establishments.

PCE is also commonly referred to as tetrachloroethylene, perchloroethylene and PERC.



At room temperature, PCE is a nonflammable liquid, and its extensive use from the 1940s through the 1980s was because it was much safer than the flammable solvents used previously. PCE use has decreased since the 1980s because of increased efficiencies in the industrial processes where PCE is used, concerns over environmental impacts, and availability of alternative solvents.

What are the physical characteristics of PCE?

Liquid PCE is denser than water, and has a limited tendency to mix with or dissolve in water. In fact, only about 1.5 fluid ounces of PCE will dissolve in 100 gallons of water. Any additional PCE added to 100 gallons of water would exist as a separate liquid phase, much like what happens when water and oil are mixed. As a result of its low solubility and high density, liquid PCE tends to "***sink***" through water and can exist in the groundwater environment as a separate dense non-aqueous phase liquid (or DNAPL) that will collect or pool at or along low points.

PCE has a high vapor pressure allowing it to easily evaporate into the air. This characteristic of PCE contributes to our being able to remove PCE from groundwater during remediation by air stripping.

PCE has a sharp, sweet odor. Most people can smell PCE when it is present in the air at a level of 1,000 parts PCE per billion parts of air (1,000 ppb); however, some people have a more sensitive sense of smell and can detect it at even lower levels.

What happens to PCE in the environment?

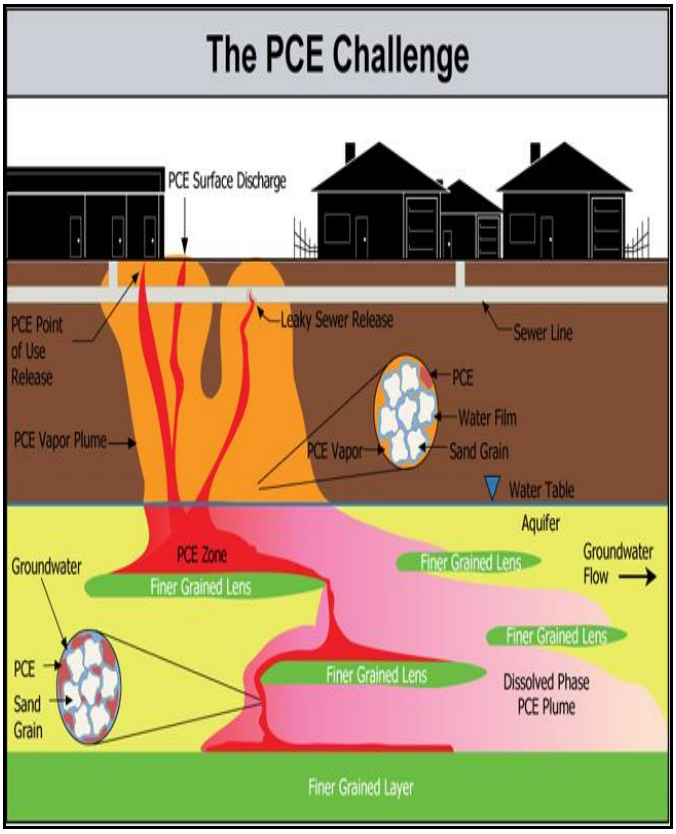
Because of the high vapor pressure of PCE, much of it that enters into the environment evaporates into the air, where it can then be broken down by sunlight or brought back to the land surface by rain.

Small amounts of PCE (roughly 0.012 % by volume) can dissolve in surface water or groundwater. This PCE will move as a dissolved phase along with the water. However, larger amounts of PCE can exist as a separate DNAPL. This DNAPL will tend to move vertically downward and collect in low spots or along impermeable barriers. DNAPL is difficult to detect in the environment and can act as a source for dissolved PCE in groundwater over time.

Under certain conditions in soil and/or groundwater, naturally occurring microorganisms can break PCE down through a process known as reductive dechlorination. Under oxygenated conditions in soil and/or groundwater, PCE tends to be environmentally persistent.

What Is PCE and Why Do We Care?

The Underground Movement of PCE



PCE originating from product spills or contaminated sites can be exposed in excavations. People working in these excavations can be exposed to PCE present as a liquid through skin contact or vapor through inhalation. PCE originating from product spills or contaminated sites can also infiltrate nearby buildings as a vapor. People living or working in these buildings can potentially be exposed to PCE through inhalation.

Finally, PCE could be ingested as a result of drinking water containing PCE. The EPA has defined the maximum contaminant level (MCL) for PCE as 5 micrograms per liter (µg/L). The EPA indicates that potential effects to long-term exposure above this level could include liver problems and an increased risk of getting cancer. It only takes a small amount of PCE to contaminate water to concentrations above the MCL. Approximately 1 teaspoon of PCE would contaminate 450,000 gallons of water to a dissolved PCE concentration exceeding the MCL.

Additionally, exposure to high concentrations of PCE vapors (as might occur in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and (in extreme cases) death.

How did PCE become such a problem?

PCE was used extensively from the 1940s into the 1980s. During this timeframe, regulations governing PCE use and disposal were initially non-existent and early regulations (enacted in the late 70s) were less strict than they are today. As a result, unregulated or poorly regulated PCE use and disposal practices resulted in releases to the environment, and ultimately to contamination of aquifer systems. Potential sources include businesses such as dry cleaners, semiconductor plants, automobile repair and paint shops, and gasoline service stations. Military bases were also potential sources. Due to the large number of potential sources, correlating the PCE in groundwater to a specific source is often challenging.

130 Hickman Road, Suite 1 Claymont, DE 19703 Telephone (302) 798-9553 www.terrasystems.net