PERMEATION OF PVC AND HDPE PIPE – ADVANTAGE PVC

In the pipe world, "permeation" is the movement of chemicals through a pipe wall or gasket. Chemical permeation is a design consideration for potable water pipe, since there may be adverse effects on the fluid inside the pipe.

RESEARCH – GENERAL

Permeation became a concern in the 1970s. Since then, the topic has been thoroughly studied and many papers have been published by independent researchers such as Berens, Park, Pfau, and Vonk. Some of their findings are:

- Water quality can be affected if organic soil contaminants permeate through water pipe walls or gasket materials.
- Most pipe permeation incidents involve soil contamination from automobile-related petroleum products.
- PVC pipe is an effective barrier against permeation of most environmental pollutants, except for situations involving gross spills or leaks of a strong swelling solvent in the immediate vicinity.
- PVC pipe is virtually impermeable at low organic chemical activities.
- Polyethylene and polybutylene pipes account for the vast majority (82%) of permeation incidents.

GASOLINE-CONTAMINATED SOILS – NO PROBLEM FOR PVC, MAJOR ISSUE FOR PE

In 2007 the American Water Works Association Research Foundation (AWWARF) published a detailed research project titled, "Impact of Hydrocarbons on PVC/PE Pipes and Pipe Gaskets" (Ong, et al). Click here for the report.

The report found: "PVC pipes were impervious to premium gasoline and gasoline saturated water for over two years of exposure and, therefore, can be used in soils contaminated with gasoline, regardless of the level of contamination."

For polyethylene pipe, the study concluded:

- "Gasoline permeates rapidly through PE pipes at all saturation concentrations and contaminated soil conditions."
- "For practical purposes, there is no level of contamination at which PE pipe is resistant to gasoline or chlorinated solvents."
- "It is important to note that permeation occurs regardless of external concentration."

PVC PIPE GASKETS

While it is true that gaskets are more permeable than PVC pipe, the AWWARF study (Ong, et al) indicated that gasketed joints were less susceptible to permeation than PE pipes. For PVC pipe joints with SBR or NBR gasket materials:

- Gasoline-contaminated groundwater – no level of contamination will cause the MCL for benzene to be exceeded.
- Gasoline at full concentration – the MCL for benzene will not be exceeded as long as there is minimal flow in the pipe.

PERMEATION – A CONCERN FOR PE PIPE

Permeation occurs through PE pipe in the presence of small concentrations of gasoline contamination. This makes the use of PE pipe problematic for many projects where contamination currently exists or may exist in the future.

References: "Prediction of Organic Chemical Permeation Through PVC Pipe," Berens, A.; "Impact of Hydrocarbons on PE/PVC Pipes and Pipe Gaskets," Ong, S. et al; *Permeation of Plastic Pipes by Organic Chemicals,* Park, J. et al; "Phase III Report on Evaluation of Permeation of Organic Solvents Through Polyvinyl Chloride, Asbestos Cement and Ductile Iron Water Pipes," Pfau et al; "Permeation of Organic Soil Contaminants Through Polyethylene, Polyvinyl Chloride, Asbestos Cement and Concrete Water Pipes," Vonk, M.; *Handbook of PVC Pipe*, Uni-Bell

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