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## Permeation in Plastic Pipe Used for Potable Water

Originally Adopted July, 1984\*  
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### INTRODUCTION

Plastic pipe has been used for potable water systems for over 30 years and has been demonstrated to be safe and economical in this application. Over these many years of satisfactory use, the occurrence of permeation has been extremely rare and has been observed only in situations where there was unusual and severe environmental contamination. In these instances, the question of permeation of potable water piping systems—which can affect all types of piping systems—needs to be addressed. Permeation refers to the phenomenon by which chemical substances in surrounding soils can travel through the walls of buried pipe or of piping components such as gaskets.

### PROVEN ADVANTAGES

Plastic pipe has been shown to be an environmentally safe way to transport drinking water because plastics used in potable water pipe are inert in the normal environment. Bacteria or fungi do not affect them, and they do not react with acidic or basic soils. Plastic pipe does not rust or corrode. It is resilient, resisting cracking or breaking, even in unstable soil conditions.

In short, plastic pipe often works better, lasts longer and is more cost effective than the materials it replaces. The documented performance of plastic pipe has made it a preferred material.



## **CONCERNS**

In potable water systems, one of the primary concerns is the maintenance of water quality—the piping materials must protect the water from any possible external contaminants while also being neutral to water quality. All piping systems appear to have some slight potential for contamination from external reagents though permeation of gaskets, permeation of pipe wall, and liquid exchange through all types of leaks. For example, metal and concrete piping are vulnerable to corrosion by inorganic acid and alkaline contaminants that could make the piping vulnerable to infiltration. Plastic piping is immune to this type of attack. On the other hand, some organic solvents, if present in sufficient quantity, could be absorbed by the pipe material and permeate into the water. Fortunately, serious environmental contamination of soils are rare occurrences and readily identifiable.

In soils heavily contaminated with hydrocarbon solvents, permeation also can occur through the elastomeric gasket joints, which are used extensively with a variety of different types of piping materials. Tests conducted by the Battelle Research Institute,<sup>1</sup> where piping systems were tested under exaggerated conditions in soil heavily saturated with contaminants that could permeate plastics, have indicated that permeation will occur rather quickly through gasketed joints in a variety of different types of potable water piping. In a real-life situation, of course, the degree of permeation, if any would depend upon the severity of soil contamination, the type of contaminant, the composition of the soil itself, and the flow rate (and dilution) past the permeated materials.

## **RECOMMENDATIONS**

In any situation where heavy soil contamination occurs, no pipe system can be considered resistant to permeation. For these reasons, the contaminating source must be controlled or the pipe route avoided altogether, regardless of the pipe material being used. In areas of known or suspected contamination, the design of the distribution system should be based on a careful analysis of the situation. Situations calling for scrutiny on a case-by-case basis would include (but not be limited to):

Tank farms or industrial sites containing chemical or petroleum storage tanks and pipelines where a malfunction or leak would contaminate the surrounding soil.

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<sup>1</sup> “Phase One Report on Evaluation of the Permeation of Organic Solvents through Gasketed Jointed and unjointed Polyvinyl Chloride, Asbestos/Cement and Ductile Iron Water Pipes,” Cassady, Cole, Bishop, and Pfau, Battelle Laboratories, October, 1983.



Storage ponds or land disposal sites for industrial process water or wastewater containing toxic chemicals

Solid waste disposal sites

An area that has been known to be contaminated by the long-term presence of toxic chemical substances.

Appropriate technical data and individual manufacturers' recommendations should be consulted on the overall design of a pipe system for these situations.

## **OUTLOOK**

As long as proper consideration is given to these potentially serious contamination sources in planning and installing potable water piping systems, the likelihood of a permeation problem causing a public health hazard is remote. In situations of serious contamination, everything in contact with the soil is affected—including potable water pipes. Clean up of these types of environmental hazards, of course, must be the first priority. Fortunately, these conditions occur infrequently. Therefore, in the vast majority of circumstances, plastic piping systems can be used with the confidence that they are economical yet very safe way to convey drinking water.

