Resistance of Solid Wall Polyethylene Pipe to a Sanitary Sewage Environment

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Foreword

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The purpose of this technical note is to provide general information on resistance of solid wall polyethylene pipe to a sanitary sewage environment.

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RESISTANCE OF SOLID WALL POLYETHYLENE PIPE TO A SANITARY SEWAGE ENVIRONMENT (PPI TN-15/2009)

All HDPE pipes produced under ASTM D3035, F714, D2447, D2239 and D2737 specifications are suitable for the transport of liquids, including water, fluid chemicals, effluents, municipal sewage, etc. The user should consult with the HDPE pipe manufacturer to determine whether the composition of the liquid material being transported is compatible with polyethylene pipe so as not to affect the service life below limits acceptable to the user.

The first application that used polyethylene (PE) as sewer pipe occurred in the Scandinavian countries and Germany in the mid-sixties. These pipes were used in direct burial. Prior to that time, PE had been used as a liner for ductile iron sewer pipe. An independent testing agency reported that no significant changes in the PE liner's chemical or physical properties were noted after more than 25 years in sewer service.

Sanitary sewage is not itself highly corrosive but, under anaerobic conditions, bacteria may decompose sanitary sewage and form hydrogen sulfide (H_2S) gas. The gas combines with moist air above the fluid stream and forms sulfuric acid (H_2SO_4) which then severely attacks metallic or concrete pipe while having no effect on PE pipe. In addition to the sulfuric acid, small concentrations of household and industrial chemicals may be present. Even though environmental regulations do not permit the discharge of certain chemicals into the waste stream, some of these chemicals may also be present due to accidental discharges.

PE is highly resistant to the wet, hydrogen sulfide gas and the low concentrations of sulfuric acid found in a sanitary sewer. PPI TR-19 "Thermoplastic Piping for the Transport of Chemicals", contains information on PE's resistance to various concentrations of sulfuric acid and other chemicals. For instance, in gravity flow applications, PE is resistant to 90 percent sulfuric acid solution at service temperatures up to 120°F. Furthermore, as stated in PPI TR-11, "Resistance of Thermoplastics Piping to Micro and Macro Biological Attack", PE is also resistant to microbial attack by the bacteria in sewage. In one study, rings of 24 inch diameter profile wall PE pipe were deflected 10 percent to place them under stress, immersed in a sewer for nine months, and them removed and tested for ring stiffness. There was no difference when the stiffness of the immersed samples was compared with that of the control samples.

In the event of an inadvertent chemical discharge, PE has excellent resistance to most corrosive chemicals and has a much higher resistance than metal or concrete pipe materials. The list of chemicals which can cause damage is short and consists primarily of strong oxidizers such as aqua regia, bromine, nitric acid (50 percent solution or greater), and organic peroxides. Concentrations of these chemicals, which could result in some oxidation of the PE, will cause severe damage to other piping materials; however, these concentrations are rarely, if ever, found in sewers.

Another mechanism of chemical attack could be absorption of certain hydrocarbon solvents into the PE causing swelling and some loss of stiffness and strength. Normally, when the chemical agent is

removed, the PE returns to its original condition. PE is not soluble at ambient temperature by any known chemical and only demonstrates limited swelling in many solvents. PE pipe is acceptable within certain temperature limitations for exposure to undiluted gasoline and jet fuel, but its exposure should be limited to relatively short periods of time, such as would be the case during an accidental spill into a sewer. The dilution of gasoline, jet fuels, etc by sewage will greatly reduce this effect.

When PE piping is being considered for use in industrial sewers that may contain large quantities of chemicals, TR-19 should be consulted to determine the suitability of PE for a particular application. In addition, due to the possible interaction of various chemicals, a testing program involving exposure of PE samples to the expected chemical effluent is highly recommended for these types of applications.

More than 40 years of utilizing PE piping in sewage applications has demonstrated that it has the necessary resistance to provide reliable long-term performance.