

PPI STATEMENT A

Relative Oxidative Aggressiveness of Chloramines and Free Chlorine Disinfectants on Crosslinked Polyethylene (PEX) Pipes used in Treated Potable Water

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In a research project conducted throughout 2005 and 2006 at the request of the Building and Construction Division (BCD) of the Plastics Pipe Institute (PPI), Jana Laboratories, an accredited laboratory, examined the relative oxidative aggressiveness of two of the most common potable water disinfectants, free chlorine and chloramines, on crosslinked polyethylene (PEX) pipes.

For this research, samples of a commercially available PEX pipe were tested in general accordance with ASTM Standard Test Method F2023 *Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water*. PEX pipe samples were tested to failure in a continuous-flow test setup designed to accelerate failure by using elevated temperatures and the highest levels of disinfectants allowed by the US EPA for potable drinking water.

This project's test procedure deviated from typical ASTM F2023¹ testing by using

- i) a test fluid containing chloramines, and
- ii) a test fluid containing free chlorine.

Both fluids had the same 4.0 parts per million (ppm) concentration throughout the test.

For this research project, the test fluids were controlled to a pH of 6.8. Testing was conducted at elevated temperatures of 105°C (221°F) and 115°C (239°F) at 60 psig constant pressure. Testing at four (4) conditions was initiated, for a total of twenty (20) specimens of the same pipe sample.

¹ ASTM F2023 utilizes free chlorine, with water aggressiveness controlled by the minimum oxidative reduction potential (ORP) of the test water. The EPA maximum limit for treated potable water for each of these disinfectants is 4.0 ppm.

RESULTS

After the testing was completed, failure times of the PEX pipe specimens tested with the free chlorine test fluid were compared to failure times of the PEX pipe specimens tested with the chloramines test fluid. The results showed pipe failure times approximately 40% longer when tested with chloramines, compared to testing with free chlorine, in otherwise identical test conditions.

CONCLUSION

Based on these results, it is the position of PPI BCD that chloramines are less aggressive than free chlorine to PEX pipes. Testing of oxidative resistance using free chlorine, in accordance with ASTM F2023, will provide a conservative estimate of the time-to-failure for PEX pipes when used with the disinfectant chloramines.

Jana Test Report Project 04-2256 Rev. 1 is available from PPI upon request.