

## PE Piping Standards – Outdoor Storage

**Description:** Updating ASTM D2513 as a comprehensive material performance-based standard exclusively for polyethylene pipe

**Status:** Revision status of ASTM D2513 is now incorporated in version 2009a. Acceptance by federal/state regulators is under consideration. Creation of new ASTM standards is progressing for testing pipe suitability when the manufactured print line date has expired.

### BENEFITS

The benefits of this project are to update the dominant gas utility national standard ASTM D2513 to provide for clearer instructions, a reduced potential for the need to discard “aged” polyethylene (PE) pipe and provide a performance-based test to determine suitability of “aged” pipe.

### BACKGROUND

Modern PE pipe materials are highly engineered products but are not being used to their full capability in part because of a need to revise outdated industry standards and have those revised standards accepted by state and federal regulators. Under regulation, the currently recognized ASTM D2513-1999 edition addresses many forms of plastic pipe. However, experts in the gas industry desire to have a standalone PE pipe standard, removing all other plastic pipe references to separate standards. This would provide a clearer and more dedicated focus to material specification requirements translating between the PE pipe manufacturers and user, as intended, and not strictly a code of practice.

Also, ASTM D 2513-1999 that is recognized by federal regulation 10 CFR Part 192, states that any PE pipe, regardless of being MDPE or HDPE, must be discarded or proven to possess the original manufacturer’s specification for suitability beyond two (2) years of the pipe print line when being stored outdoors. Figure 1

illustrates common outdoor pipe yard storage. The concerns regarding the weatherability of PE pipe to be stored outdoors would appear to be conservative and not in agreement with manufacturers’ technical statements or research.



Figure 1: Direct UV Exposure on PE Pipe Stored Outdoors

### TECHNICAL APPROACH

Updating ASTM D2513 to become dedicated strictly to PE pipe involved working with the ASTM sub-committee and organizing additional plastic standards. A team consisting of PE pipe users, PE resin manufacturers, PE pipe extruders, and industry technical advisors, Plastic Pipe Institute (PPI) was created. This team developed the technical documentation and agreements for the updated ASTM.

Test methods commonly used during the manufacturing process of PE pipe and fittings

will be used for testing suitability of aged pipe to determine how detrimental the direct effects of the sun's ultraviolet (UV) exposure really are on PE pipe.

PE pipe specimens all aged beyond the manufacturer's print line date and stored outdoors were collected from different part of the USA for testing, some aged to eight years. Controlled laboratory tests were conducted to reveal the extent of UV damage. These tests included differential scanning calorimetry, confirming melt flow index, infrared spectroscopy and a fusion impact test. Each test served as an indicator of how the UV effects affected the properties of the PE pipe material. Microtome samples, which are small thin layers of pipe sequentially cut from the outside diameter to the inside diameter, were examined to determine the amount of degradation within the depth of the PE pipe wall.



Figure 2: Impact Testing to see Effects of UV Exposure on PE Pipe Stored Outdoors

Standard impact testing per ASTM F905 determined the strength of the fusion between a tee and an aged PE pipe. Figure 2 illustrates the test fixture with post failure results.

The results indicate that although all pipe stored outdoors will deteriorate or "oxidize" from UV

exposure, it appears that it only affects the surface and minor subsurface of the PE pipe. Typical PE pipe construction practices would remove this surface deterioration in preparation for various fusions.

These UV exposure results emphasize the need for a new ASTM standard for testing the quality of PE pipe stored outdoors, regardless of the length of time exposure.

### PROGRAM STATUS

As of 2009, ASTM D2513 has been revised from its 1991 edition to its current 2009a edition. It includes outdoor storage capabilities of 3 years for MDPE and 10 years for HDPE, coincident with typical manufacturer's specification agreements. State and federal regulatory bodies are considering its adoption into their mandates.

Currently, efforts are underway to create a new ASTM for testing suitability of pipe that has aged beyond a two-year limit.

### Highlights

#### Project goals

- Revise ASTM standards to reflect modern PE material
- Approach Federal / State regulators to recognize revised ASTM standards
- Conduct performance based test for aged PE pipe suitability
- Avoid discarding aged PE pipe still suitable for service

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