

STATEMENT U

Plastics Pipe Institute Position Statement on the use of Post-Consumer Recycled (PCR) Materials in Polyethylene Pipe & Conduit

Issued January 2003

Revised March 2009

Revised November 2020

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Polyethylene piping is extensively used for a wide variety of pressure and non-pressure applications from gas distribution through drainage. Equally diverse are the performance requirements for these varied applications. PE materials for all applications are required to meet recognized industry standards (e.g., ASTM, CSA, BNQ, AASHTO, and ISO).

Building standards and design procedures are evolving to incorporate sustainable design elements. This is a direct result of the current social and governmental atmosphere that demands responsibility with the use of our limited non-renewable resources. The U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program has previously recognized the use of recycled materials in building products. The ENVISION program managed by the Institute for Sustainable Infrastructure encourages the planning, design and delivery of sustainable and resilient infrastructure through education, training, and third-party project verification.

Several years ago, attention was focused on incorporating post-consumer recycled (PCR) polyethylene materials in polyethylene piping as a means to further plastics recycling efforts. The Plastics Pipe Institute (PPI) supported that initiative through an American Plastics Council ad-hoc committee of polyethylene pipe manufacturers, resin suppliers, researchers, and trade association representatives to develop means for the responsible use of post-consumer recycled polyethylene materials in polyethylene pipe.

The PCR Ad-Hoc Committee chose as its mission and objective to consider the responsible use of PCR in PE piping through consensus standards writing bodies that would define the performance requirements, material properties, proper applications and test criteria for the proper use of PCR PE materials for piping applications. PCR materials may be used in polyethylene non-pressure pipe when standards bodies for the particular piping application have established these requirements and criteria.



ASTM D3350 allows for the use of reprocessible and recyclable PE materials, provided that all specific requirements of D3350 are met. Some ASTM and Canadian product standards allow the use of recycled materials in non-pressure PE pipe applications. It is best to confirm the applicable application standards allow for the use of reprocessible and recyclable PE materials as some only allow the use of rework from a manufacturer's own production, e.g. ASTM F714.

As a trade association, PPI's position is that PCR materials may be used in certain non-pressure piping applications as long as they are used with the buyer's knowledge and as long as the governing standard has established performance criteria to assure satisfactory long-term performance for the intended application. Thus, the use of PCR PE materials in PE piping must be carefully evaluated so that long-term durability of polyethylene piping is assured.

NON-PRESSURE PIPES & CONDUIT

PPI supports continued work toward defining performance requirements, material properties, and test criteria that will result in the proper use of PCR materials in polyethylene pipe and conduit used for non-pressure applications. Although no current standards permit use of PCR in conduit, the industry is examining the viability of incorporating PCR. Standards that permit the use of recycled materials in corrugated plastic pipe applications have been developed by standards organizations, including AASHTO, ASTM, BNQ and CSA. The National Cooperative Highway Research Program (NCHRP) sponsored an extensive research program to investigate the use of PCR in corrugated HDPE pipe, and PPI supported this effort. Programs such as these have demonstrated that non-pressure corrugated HDPE piping that uses PCR PE materials can achieve equivalent performance to non-pressure corrugated HDPE pipe made from virgin HDPE compound when PCR materials are used properly. This research took nearly 8-years to complete and is well documented in the papers and reports below. In 2018, PCR was included in AASHTO M294 and ASTM F2306 standards, as long as equivalent performance requirements were met.

Related Research

- NCHRP-696 (2011). *Performance of Corrugated Pipe Manufactured with Recycled Content*. NCHRP Project 4-32. ISBN 978-0-309-46731-5 | DOI 10.17226/24934. National Academies of Sciences.
- Pluimer, M. (2016). *Evaluation of Corrugated HDPE Pipes Manufactured with Recycled Content in Commuter Rail Applications*. PhD diss. Villanova, Pennsylvania; Villanova University, College of Engineering.
- Pluimer, M., Thomas, R., (2016). *Predicting Service Life for Recycled PE Materials via the Unnotched Constant Ligament Stress (UCLS) Test*. Proceedings PPXVIII Plastics Pipe Conference, Berlin Germany.



- Pluimer, M., McCarthy, L., Welker, A., Musselman, E., (2016). *Long-term Performance of Corrugated HDPE Pipes Manufactured with Recycled Materials for Commuter Railroad Applications*. Proceedings PPXVIII Plastics Pipe Conference, Berlin Germany.
- NCHRP-870 (2017). *Performance of Corrugated Pipe Manufactured with Recycled Polyethylene Content*. NCHRP Project 4-39. Transportation Research Board of the National Academies. Thomas, R., Cuttino, D., TRI/Environmental, Inc. Austin, Texas.
- Kurdziel, J., Pluimer, M., (2018). *Engineering and Testing Requirements for Infrastructure Pipeline Applications Utilizing HDPE Recycled Materials*. Proceedings PPXIX Plastics Pipe Conference, Las Vegas, Nevada USA.

PRESSURE PIPES

Pressure pipe compounds require demonstration of the long-term hydrostatic strength. The use of PCR materials in pressure pipe compounds may introduce inhomogeneities that can cause localized stresses; these stresses may significantly accelerate cracking mechanisms negatively affecting long term performance¹. Therefore, PCR is not used in pressure pipe compounds². Pressure pipe compounds with a demonstrated long-term hydrostatic strength are listed in PPI TR-4.

SUMMARY

The Plastics Pipe Institute, its member companies, support ongoing work to continue development of standards that incorporate PCR.

ABBREVIATIONS

- AASHTO – American Association of State Highway and Transportation Officials
- ASTM – ASTM International
- BNQ – Bureau de Normalisation du Quebec
- CSA – Canadian Standards Association
- HDPE – high density polyethylene
- ISO – International Standards Organization
- PCR – post-consumer recycled
- PE – polyethylene

¹ Frank, A., Berger, I.J., Messiha, M., Ek, C.G., Schuler, N., Storheil, J.M., et al. (2018). *Slow Crack Growth Resistance of Non-Virgin Polymers*. Proceedings PPXIX Plastics Pipe Conference, Las Vegas, NV.

² The use of clean rework materials from a manufacturer's own pipe production is permitted in most applications as it is a controlled source of material with known long-term properties.