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Technical Response to Flint FAST Start Program Memorandum: Analysis of Selected Service Line Pipe Materials

Literature Review and Materials Analysis

- The researchers based their conclusion on previous generations of HDPE piping systems (such as PE24xx, PE34xx) that are no longer being sold in in the US. Use of outdated information results in several misstatements such as the references to the Las Vegas performance issues. The current generation of HDPE, available since 2008, is PE4710 as recognized since ANSI/AWWA C901-2008.
- For example, the report claims "No PE pipe has been in use for more than 30 years". This is demonstrably false: the first HDPE pipe used for water dates back to 1961.
- Many of the concerns raised as a result of prior generation technology can be resolved by further review of the materials listed in the **Key Resources** sections below and by the standards and practices pipe manufacturers follow such as ASTM D3350, ASTM F2263, AWWA C901 and AWWA C904. These standards also meet the requirements of the Safe Drinking Water Act (SDWA).
- In the Home Innovation Research Lab report PEX Design Guide, it states: "Based on extensive testing and material performance over the span of more than 40 years, PEX piping has proven to be a durable material that does not suffer from some of the historical problems associated with metallic piping, such as reduced interior dimension (occlusion), corrosion, electrolysis, filming, mineral build-up, and water velocity wear."
- The standards also resolve concerns such as contamination. As the AWWA notes, "If a water... pipe must pass through a contaminated area or an area subject to contamination, consult the pipe manufacturers regarding permeation of pipe walls, jointing materials, and so on, before selecting materials for use in that area."
- The **Key Resources** discussion highlights several of the relevant standards and references.

Economic Analysis

- The attachment for the economic analysis was not provided with the report for public review and comment. The assumptions outlined in the memorandum suggest several flaws in the analysis.
- Estimates for the life of copper is based on projected useful life while plastics are limited to their warranty. Based on the operating conditions in Flint [CL 1.5ppm, pH 8.0, T 48°F (38°F - 57°F), 100psi (assumed)], the oxidative resistance of PE pipe (3/4" DR9 PE4710 CC2) is projected to exceed 100 years. The CDA Manufacturer's 50-Year Warranty* is limited to 50 years.[1] The analysis would be more representative of the materials if it used equal service lives or a standard 50 years for Copper, PE and PEX. *Note this CDA warranty *excludes* water service applications.
- For the LCA to be positive for copper the analysis must assume material appreciation instead of standard depreciation, high copper prices 75 and 100 years in the future, and/or negligible costs for end-of-life copper reclamation. These assumptions should be made clear in order to be validated.

Transparency

- The survey of utility experiences regarding 'movement from plastics back to copper' was not provided with the report for public review and comment.
- The report would benefit from a balanced discussion as to the failure mechanisms, corrosion risks, or EPA SDWA concerns with all pipe systems including copper. See for example A White Paper Review: History of Use and Performance of Copper Tube For Potable Water Service.[2]

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[1] https://www.copper.org/applications/plumbing/restools/wrnty/cu_50yr_warnty_main.html

[2] https://www.wsscwater.com/water-quality--stewardship/research/pinhole-leaks--corrosion-control/copper-pipe-white-paper.html

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Key Resources Addressing Drinking Water Safety / Health Effects of HDPE and PEX Piping

- **NSF Standards** are approved by the American National Standards Institute (ANSI). A key standard in water quality/safety is NSF/ANSI 61: Drinking Water System Components-Health Effects. NSF/ANSI 61 establishes evaluation criteria to ensure products such as piping/tubing, fittings, valves, meters, joining/sealing materials, paints, coatings, etc. contacting drinking water do not add contaminant concentrations to drinking water that could cause adverse human health effects. NSF/ANSI 61 was developed at the request of the US Environmental Protection Agency in 1984. The US EPA retains oversight of this standard with USEPA representatives serving on the NSF/ANSI 61 standards committee. In addition, a USEPA toxicologist is chairperson for the independent risk assessment committee (Health Advisory Board) that establishes limits for any chemicals that may migrate from water contact products into drinking water.
- **NSF International FAQ on Health Effects of PE Pipe and Fittings**[3]
- **NSF International PEX Fact Sheet**[4]
- **NSF International PEX FAQ on Health Effects of PEX Tubing**[5]
- **The American Water Works Association (AWWA)** Standards represent a consensus of the water industry and are developed by following procedures defined by committees under the AWWA Standards Council and accredited by the American National Standards Institute (ANSI).
- **ANSI/AWWA C904-16** Section 4.2.1 "Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for potable water….systems as applicable"
- **ANSI/AWWA C901-08: "**4.2.4 *Certification.* PE compounds shall be tested and certified as suitable for use with potable water by an accredited testing agency acceptable to the purchaser, in accordance with requirements that are no less restrictive than the applicable requirements in NSF/ANSI 61."
- **AWWA C901-17** (issued for public review on 9/9/16 by ANSI and AWWA; effective 8/1/17): "4.2.1 Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for potable water, wastewater, and reclaimed water systems as applicable." And "4.2.1.2 … PE Compound used in potable water service applications shall be classified as CC2 or CC3 per ASTM D3350, Sec. 10.1.11."
- **AWWA C901-77: "**2.1.6 *Certification.* PE compounds shall be tested and certified as suitable for potable water products by the NSF Testing Laboratory* or the CSA Testing Laboratory†, or any other similarly accredited testing agency acceptable to the purchaser. In any case, tests shall be made in accordance with requirements that are no less restrictive than the applicable requirements specified in Sec. 3 and 4 of the 1976 issue of NSF Standard No. 14."
- **Assessment and Calculation of BTEX Permeation Through HDPE Water Pipe**[6] report by IUPUI – A Purdue University School.
- **PPI Statement Y: Taste and Odor of Drinking Water from Plastic Piping Systems**[7] addresses taste and odor concerns about plastic pipes.

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[3] http://plasticpipe.org/pdf/faq-on-health-effects-pe-pipe-fittings.pdf
[4] http://www.nsf.org/newsroom_pdf/water_PEX_fact_sheet.pdf
[5] http://www.nsf.org/newsroom_pdf/water_PEX_plumbing_products__faq.pdf
[6] http://plasticpipe.org/pdf/permeation-report.pdf
[7] http://plasticpipe.org/pdf/statement-y_taste_oder.pdf

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Key Resources Addressing Durability and Long-term Material Life: HDPE/PEX

- **Life cycle cost analysis**[8] by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the federal government agency for scientific research in Australia
- **Fatigue of Plastic Water Pipe**[9]: A Technical Review with Recommendations for PE4710 Pipe
- **PEX Design Guide**[10] by Home Innovations Research Labs, ICC PPI, PPFA
- **Long-Term Performance Prediction of PE Pipe**[11] by the Water Research Foundation

HDPE/PEX Case Studies

- **Livonia, MI**[12]: How to be Environmentally Progressive, save Infrastructure in Tough Economic Times
- **Lansing, MI**[13]: Pipe bursting didn't burst their budget; Trenchless water main replacement — a first in the capital of Michigan
- **Lyon Township, MI**[14]: HDPE Potable Water Line Extension provides Solution
- **Spokane, WA**[15]: HDPE makes it a bit less expensive to build a new home
- **Duchesen County, UT**[16]: Durable Water Delivery System to Farming Community with Extreme Environmental Conditions
- **Maize, KS**[17]: Kansas Town Gets State-of-the Art Water [HDPE] System
- **Cascade, ID**[18]: City of Cascade Idaho Employs HDPE for Entire Water and Wastewater System
- **Blount County, TN**[19]**:** South Blount Utility District Puts REHAU MUNICIPEX to the Test
- **Fauquier County, VA**[20]**:** MUNICIPEX Keeps Virginia Residents' Water Running During Replacement of Water Main

Key Resources Addressing HDPE and Disinfectants/Chlorine

- **Impact of Potable Water Disinfectants on PE Pipe**[21] technical report by Jana
- **Polyethylene (PE) Pipe Performance in Potable Water Distribution Systems Past, Present and Future**[22] technical report by Jana

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[8] http://plasticpipe.org/pdf/life-cycle-cost-study.pdf
[9] http://plasticpipe.org/pdf/mid-fatigue-plastic-water-pipe-01-12-12.pdf
[10] http:/plasticpipe.org/pdf/pex_designguide_residential_water_supply.pdf?pdf=PEXHandbook
[11] http://www.waterrf.org/Pages/Projects.aspx?PID=2975
[12] http://plasticpipe.org/pdf/livonia-mi-pe-pipe-replacement.pdf
[13] http://plasticpipe.org/pdf/lansing.pdf
[14] http://plasticpipe.org/pdf/mid-case-study-lyon-mi.pdf
[15] http://www.spokesman.com/blogs/officehours/2014/aug/19/two-spokane-council-changes-make-it-bit-less-expensive-build-new-home/
[16] http://plasticpipe.org/pdf/mid-case-study-duchesen-ut.pdf
[17] http://plasticpipe.org/pdf/kansas-town-gets-state-of-the-at-water-system.pdf
[18] http://plasticpipe.org/pdf/cascade.pdf
[19] https://www.rehau.com/us-en/mechanical-and-plumbing/municipal-piping/project-profiles/south-blount
[20] https://www.rehau.com/us-en/mechanical-and-plumbing/municipal-piping/project-profiles/fauquier-county-wsa
[21] http://plasticpipe.org/pdf/impact-of-potable-water-disinfectants-on-pe-pipe.pdf
[22] http://plasticpipe.org/pdf/pe-pipe-performance-in-potable-water-distribution-systems.pdf

- **PE Compound Categorization for Potable Water Applications**[23]: Plastics Pipe Institute Technical Note, TN-43
- **Long Term Resistance of AWWA C906 Polyethylene (PE) Pipe to Potable Water Disinfectants**[24]: Plastics Pipe Institute Technical Note, TN-44

Other Publications on HDPE and PEX Water Service Line

- **Polyethylene Piping Systems Field Manual for Municipal Water Applications**[25]
- **PEX Water Service Line Installation Guide**[26]

[23] http://plasticpipe.org/pdf/tn-43-pe-compound-categorization-for-potable-water-applications.pdf
[24] http://plasticpipe.org/pdf/tn44.pdf
[25] http://plasticpipe.org/pdf/mid-pe-field-manual-municipal-water-applications.pdf
[26] https://www.rehau.com/download/871310/municipex-installation-guide.pdf