



Fact Sheet on the Safety of PEX Plumbing Products December 16, 2016

Crosslinked polyethylene (PEX) tubing has been one of the most commonly used materials for residential housing in the USA and Canada for over 20 years, and the use of PEX is increasing in residential and commercial construction across North America for plumbing, hydronic heating and other applications.

Claims have been made in the past that PEX tubing adds chemicals, which may be harmful to human health, to drinking water. However, those claims have ignored the fact that it is mandatory for PEX tubing to be tested and certified to NSF/ANSI 61, which is a standard that helps to ensure that the product will not contribute harmful levels of contaminants to drinking water.

NSF/ANSI 61 contains a test procedure for evaluating the concentration of any chemical contaminant that a material may contribute to drinking water. It also requires a toxicological assessment of the daily dose of that contaminant which a person may safely consume where no adverse health effects would occur. Only products that meet this stringent standard are allowed to bear the “NSF-61” or “NSF pw” mark for potable water safety.

For example, a test that NSF conducted showed that some newly installed PEX tubing may sometimes contribute 1 part per billion (1 ppb) of xylene to drinking water. A part per billion is equivalent to one drop of water in an Olympic-size swimming pool. However, NSF/ANSI 61 defines the safe threshold for the total allowable concentration (TAC) of xylene in drinking water as 10 parts per million (ppm). That is 10,000 times higher than the 1 ppb occurrence level for xylene added by PEX tubing.

So while claims that “PEX adds xylene to drinking water” may alarm some consumers, the scientific data shows that the levels of xylene added are 10,000 times below the safety threshold.

NSF/ANSI 61

NSF/ANSI 61: *Drinking Water System Components - Health Effects* is the American National Standard for health effects of drinking water system components. It establishes the health effects requirements for the chemical contaminants and impurities that are indirectly imparted to drinking water from products, components and materials used in drinking water systems.

Plumbing codes and state and provincial drinking water agencies across the U.S. and Canada require products such as plastic pipes and fittings that contact drinking water to be certified to NSF/ANSI 61 by an accredited certification organization.

The standard is maintained by a joint committee with equal representation from regulators (such as the U.S. EPA, Health Canada and state drinking water officials), users (such as water purveyors, utilities and engineers) and product manufacturers. NSF/ANSI 61 is accredited by the American National Standards Institute (ANSI), which ensures the standard is developed and maintained using an open, consensus process and has representation by all stakeholders. The committee meets annually and any



member of the public is allowed to attend the meeting or submit suggestions for improving the standard.

Product Testing

The product testing process for PEX under NSF/ANSI 61 is quite rigorous. First, a formulation review is performed on the raw material, ingredients and the manufacturing process to determine what possible contaminants could leach out into drinking water. This review determines what type of chemical extraction testing is necessary for the specific product.

PEX tubing is tested by exposing the tubing to formulated exposure waters, and then analyzing the exposure waters for contaminants. In other words, testing is designed to measure if contaminants leach from the tubing into special water that is formulated for this purpose. Three separate formulated waters are used during the product exposure. Both pH 5 and pH 10 test waters are separately used for exposures, as these are aggressive toward extraction of metallic contaminants. A pH 8 test water is used during the exposure for organic based contaminants. In addition to 73°F (23°C) testing, products intended for hot water use are exposed in water at 140°F (60°C) for domestic hot water systems or 180°F (82°C) for commercial hot water systems.

Tubing specimens are conditioned by exposure to the formulated waters for 17 days, with the water being changed on 12 of those days. The water collected from the final day, which encompasses a 16-hour exposure period, is then analyzed for contaminants. Any contaminants found must be below the total allowable concentration (TAC) established for the contaminants, or the product fails the test. For contaminants regulated by the USEPA or Health Canada, the TAC is equal to the regulated level. For non-regulated contaminants, NSF/ANSI 61 sets health-based pass/fail levels based on review of available toxicity data using the risk assessment procedures in Annex A of the standard. Contaminants with no toxicity data, or those that lack the minimum data to determine chemical specific concentrations in accordance with the requirements of Annex A, are evaluated under the threshold of evaluation (TOE) of 3 parts per billion (ppb) for the TAC.

Water exposed to PEX tubing and associated fitting systems is tested for the following contaminants as required by NSF/ANSI 61:

- VOCs (volatile organic compounds)
- Semi-volatile compounds (base neutral acid scan by gas chromatography/mass spectroscopy)
- Phenolics
- Metals including antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, selenium and thallium
- Methanol
- Tertiary butyl alcohol
- MTBE (methyl tertiary butyl ether)
- ETBE (ethyl tertiary butyl ether)
- Any other potential contaminant identified during the review of the tubing manufacturer's formula



These test methods are capable of detecting contaminants in water below 1 part per billion (1 ppb), and even lower for some contaminants.

Determination of Total Allowable Concentrations

The TAC values in NSF/ANSI 61 are based on risk assessments for contaminants, and they go through external peer review by the NSF Health Advisory Board (HAB). This panel consists of toxicologists from the U.S. EPA, U.S. state regulatory agencies, Health Canada, academia, consultants and chemical manufacturers. Following the external review by the HAB, the document then is submitted to the NSF Drinking Water Additives Joint Committee (consisting of equal representation by regulators, manufacturers and end users) for approval. The joint committee's recommendation then is reviewed and approved by the NSF Council of Public Health Consultants (public health officials from the U.S. and Canadian federal governments, states and provinces). The risk assessment values then are published in NSF/ANSI 61.

Finding Products That Meet the Requirements

PEX tubing that meets the health effects requirements of NSF/ANSI 61 will bear either the "NSF-61" mark or the "NSF pw" (potable water) mark on the print string, and will be listed on <http://www.nsf.org>. The "NSF pw" mark indicates the product meets the health requirements of NSF/ANSI 61 as well as performance, long-term strength and quality control requirements as required by NSF/ANSI 14: *Plastic Piping Components and Related Materials*. This provides assurance that drinking water coming from PEX tubing that is certified to NSF/ANSI 61 is safe for human consumption.

If a product has only the "NSF rfh" mark, this indicates the product has only been evaluated for radiant floor heating applications and is not intended for transport of potable water.

Currently, 140 PEX tubing products (made by 27 companies) are certified for potable water applications in NSF's certified product listings: <http://www.nsf.org/certified-products-systems>.

Continuous Verification of Product Safety

For PEX tubing listed for potable water applications, NSF performs at least three unannounced audits of each production facility annually. During these inspections, NSF verifies there are no modifications to the product formulation or processing. In addition, NSF verifies quality control tests are being done by the manufacturer. NSF also collects samples for laboratory retesting of each product family on an annual basis.



Further Information

If you have questions about the testing and certification of any NSF certified product, please contact our Consumer and Regulatory Affairs Hotline at 1-800-673-8010 or info@nsf.org.

About NSF International

NSF International is a global independent organization that writes standards, and tests and certifies products for the water, food, health sciences and consumer goods industries to minimize adverse health effects and protect the environment (nsf.org). Founded in 1944, NSF is committed to protecting human health and safety worldwide. Operating in more than 165 countries, NSF International is a Pan American Health Organization/World Health Organization (WHO) Collaborating Center on Food Safety, Water Quality and Indoor Environment.

NSF led the development of the American National Standards for all materials and products that treat or come in contact with drinking water to help protect public health and the environment and minimize adverse health effects. In 1990, the U.S. EPA replaced its own drinking water product advisory program with these NSF standards. Today, most plumbing codes require certification to NSF standards for pipes and plumbing components in commercial and residential buildings.