PVC PIPE ASSOCIATION
TECHNICAL BRIEF

PVC WATER MAINS: NOT A SOURCE OF BENZENE FROM WILDFIRE EVENTS

In 2017 and 2018, forest fires devastated the California municipalities of Santa Rosa and Paradise. A study of Santa Rosa's municipal water system showed that benzene had been detected in their drinking water. Some media reports incorrectly suggested PVC water mains were the source of the benzene. This is not possible since both communities confirmed that no PVC water transmission or distribution mains were affected by the fires and remained in service throughout the events.

HOW BENZENE IS PRODUCED IN WILDFIRES

The primary source of benzene in forest fires is from the combustion of wood. Burning homes and other structures are secondary sources. Benzene cannot be produced from PVC combustion in an open-air fire. Some reports suggest trace amounts of benzene can be released in a process known as pyrolysis, when it is heated in a highly controlled environment in which air is completely absent. However, pyrolysis of buried PVC water mains does not occur during wildfires. For these additional reasons, PVC water pipes could not have released the benzene found in the drinking water in these communities.

BENZENE ENTERS WATER SYSTEMS VIA DAMAGED SERVICE LINES

The most likely source of benzene in municipal water systems after a wildfire is not from burning or melting water mains but from outside contaminants entering the system via damaged service lines. When a building burns, the service lines that connect to the water mains break, burn and melt — creating gaps where contaminants can enter into the water system. As water in the system is used to fight the fire, suction draws in contaminants. This process, as defined by AWWA Manual M14, is called backflow and can occur regardless of pipe material.

BENZENE DOES NOT PERMEATE THROUGH PVC PIPES

It has also been suggested that benzene can permeate through PVC pipes after accumulating in the soil following wildfires. However, published studies such as the AWWA Water Research Foundation's (WRF) report entitled, "Impact of Hydrocarbons on PE/PVC Pipe and Pipe Gaskets," confirm that gasketed PVC pipe is highly resistant to permeation from a wide range of chemicals, including benzene.

PVC WATER MAINS ARE RESILIENT IN WILDFIRES

Santa Rosa and Paradise have confirmed that PVC water transmission and distribution mains were unaffected by the forest fires that impacted their communities. This fact alone makes it impossible for PVC pipe to have been a source of benzene contamination in these localities. Both utilities have kept PVC pipe in their specifications and continue to use it. According to Kevin Phillips, District Manager of Paradise Irrigation District, Paradise's PVC pipelines "performed not only during the fire but after they were depressurized and then refilled." Also, information provided in this document on PVC in open-air combustion and during pyrolysis, as well as its resistance to permeation, confirm that PVC water mains cannot be a source of benzene in drinking water following wildfires. Further evidence of PVC pipe's resilience during fires is the fact that PVC water mains are used by the U.S. National Forest Service for its underground infrastructure in forested regions across the country – areas which are regularly affected by wildfires.

References: Berens, A. R. (1985). Prediction of Organic Chemical Permeation Through PVC Pipe. Journal American Water Works Association, 77(11), 57–64; Center for Disease Control and Prevention. (2018, April 18). CDC | Facts About Benzene; City of Santa Rosa Water. (2018). Technical Memorandum 1, Post-Fire Water Quality Investigation: Analysis of Cause of Water Contamination; DeCaria, D. (2019, May 23). Forest Fires Produce the Benzene Contaminating Water; NSF International. (2015). Environmental Product Declaration for PVC Water and Sewer Pipe; NSF International. (2016). NSF/ANSI 61: Drinking Water System Components – Health Effects; Ong, S. K., et al. (2008). Impact of Hydrocarbons on PE/PVC Pipes and Pipe Gaskets (Report #91204); Macler, B., et al. (2020). Smoke and Water Don't Mix. Opflow, 46(3), 10-15

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