

Post-Fire Water Quality and Impacted Materials Investigation

INTRODUCTION

An increase in the frequency of large wildfire events is a new reality in the western United States and comes with a new set of environmental concerns, largely due to the complexity of materials contributing to smoke, ash and debris in impacted urban areas compared to impacts from forest fires. Apex Forensics' work to define fire-related contaminants and contaminant sources in drinking water infrastructure has contributed to subsequent fire response remedial plans.

MATERIALS EVALUATED/METHODS

Water samples from fire-impacted infrastructure were tested for thousands of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) using a Gas Chromatograph fitted with a Mass Spectrometer (GC/MS). Leach testing of high temperature distressed HDPE and PVC and associated components (wedges, gaskets, valves and meters) was also conducted, in addition to microscopic inspection.

RESULTS

The most common constituents detected in water samples from fire-impacted infrastructure are identified in Figures 1 and 2. Eighty-four unique volatile organic compounds (VOCs) and 129 unique semi-volatile organic compounds (SVOCs) were detected. These suites of compounds are characteristic of those expected following an urban fire event and when organic materials burn in an oxygen-starved environment.

CONTAMINANTS DETECTED IN WATER SAMPLES FROM FIRE-IMPACTED INFRASTRUCTURE

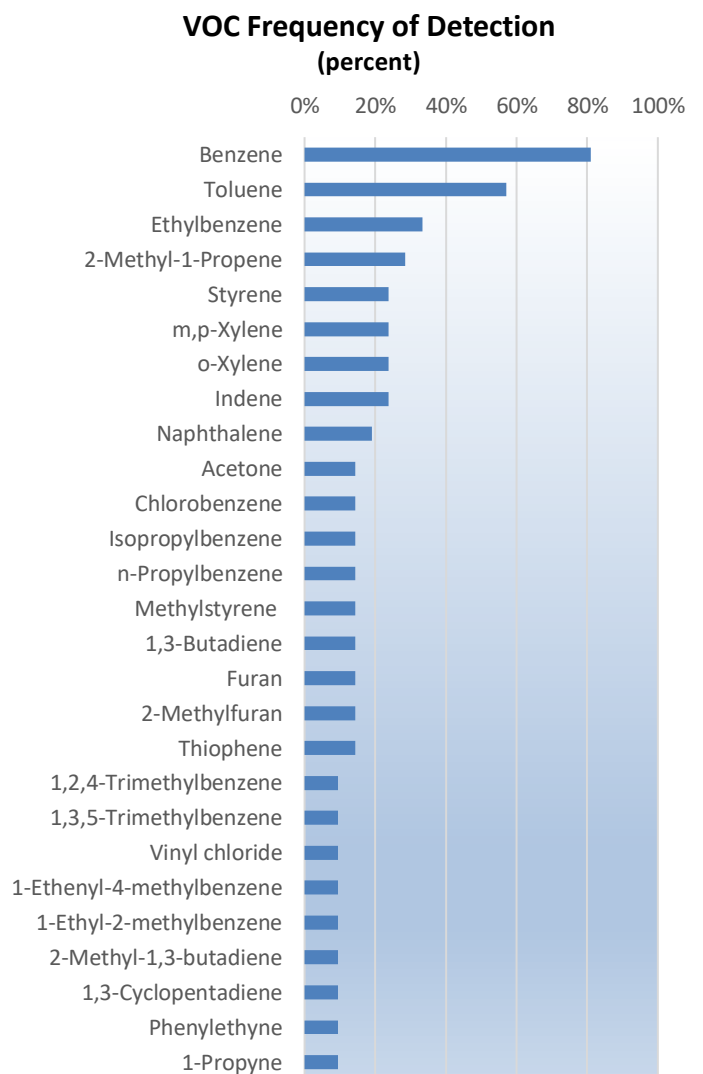


FIGURE 1. Most Frequently Detected VOCs

SVOC Frequency of Detection (percent)

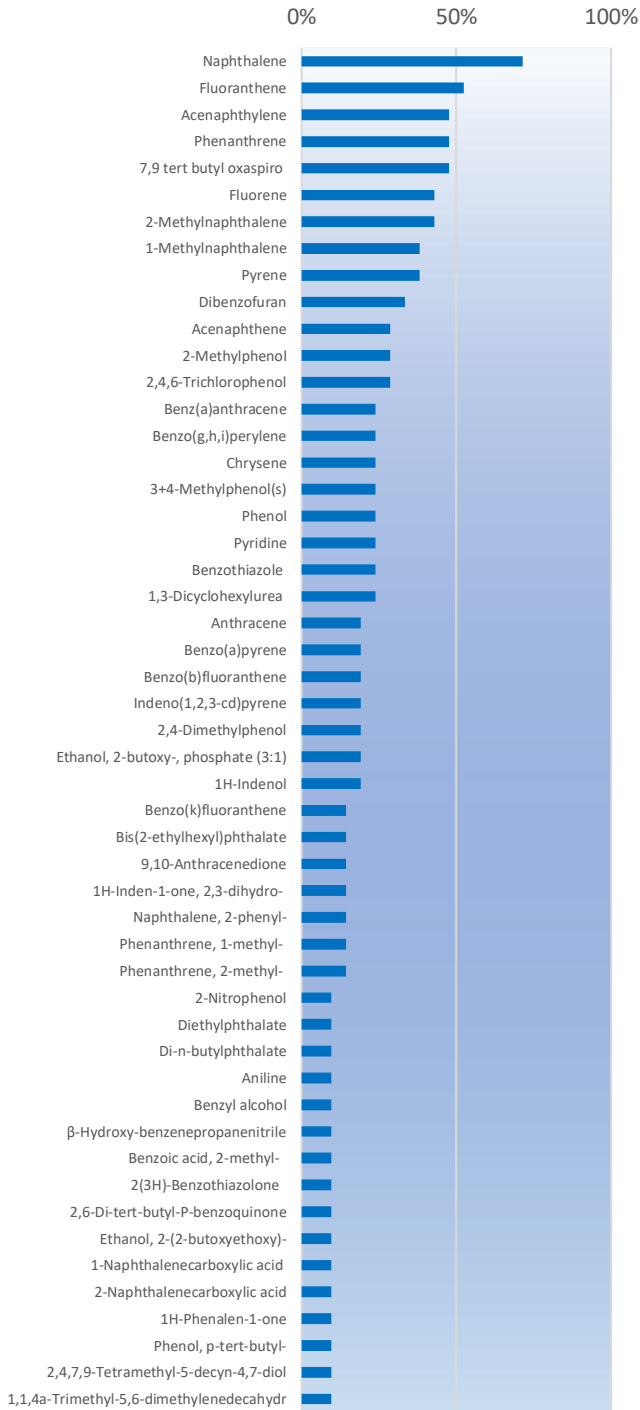


FIGURE 2. Most Frequently Detected SVOCs

DISCUSSION

Thousands of materials including numerous polymers, glues, wood, paint, solvents, rubber, metals, textiles, and countless other natural and synthetic materials are impacted in urban fire situations. The combustion of these materials results in the formation of smoke and particulate residues referred to as soot, char and ash. The microscopically observed presence of soot, char and debris in water piping indicates this material as one likely source of water contamination.

The suite of VOC and SVOC compounds identified in water and leach testing includes both aromatic (BTEX) and polyaromatic hydrocarbons (PAHs) typically associated with forest fire events, and numerous additional non-hydrocarbon VOC and SVOC constituents were identified that, at least in part, are inconsistent with those typically expected during forest fire events. Some of these constituents are known chemicals generated during the pyrolysis and/or combustion of PVC, HDPE and rubber. The leachate testing demonstrated that desorption of many of these contaminants from the pipe may continue for an extended period of time.

FOR FURTHER READING

1. Austin, C., Wang, D, Ecobichon, D & Dussault, G. (2001). *Characterization of Volatile Organic Compounds in Smoke at Municipal Structure Fires*. Journal of Toxicology and Environmental Health, Part A, 63(6), 437-458.
2. Denberg, M., Arvin, E., Hassager, O., & Mosbæk, H. (2009). *Release of organic compounds from polymer pipes used in drinking water distribution*. Kgs. Lyngby, Denmark: Technical University of Denmark (DTU).