

Submission for AWMA Air Quality Measurement Methods and Technology Conference, November 7-9, 2017, Long Beach, CA

Comparison of Air Sampling Methods for Organophosphate Flame Retardants in Small Environmental Chambers

Xiaoyu Liu¹, Mark Mason¹, Matt Allen², Edgar Folk²

¹U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Research Triangle Park, NC 27711

²Jacobs Technology Inc., 600 William Northern Boulevard, Tullahoma, TN 37388

Principle Contact: Xiaoyu Liu, liu.xiaoyu@epa.gov, phone: 919-541-2459, fax: 919-541-2157

ABSTRACT

Organophosphorus flame retardants (OPFRs), such as tris(2-chloroethyl) phosphate (TCEP), tris(1-chlor-2-propyl) phosphate (TCPP), and tris(1,3-dichloro-2-propyl) phosphate (TDCPP), used as additives in industrial and consumer products are being detected in indoor air, house dust, and other environmental media. Due to the low volatility of these compounds, air sampling of OPFRs is challenging. To evaluate the performance of various configurations of sampling media, polyurethane foam (PUF) cartridges, quartz fiber filters with PUF, PTFE membrane filters with PUF, Tenax TAs, and an OSHA Versatile Samplers (OVS) were compared by collecting gas phase OPFRs from 53L stainless steel small chambers. Tests were conducted in a temperature-controlled incubator with an OPFR source chamber and an empty test chamber connected in series with Teflon tubing. Constant emission sources under 24 °C, 5% relative humidity (RH), and 0.4 air change per hour (ACH) were generated in the source chamber by placing neat TCEP, TCPP, and TDCPP liquids in cups with different diameters. The exhaust of the source chamber was supplied to the test chamber and mixed with humidified air at a T connector resulting in temperature, RH, and flow conditions of 50% RH and 1 ACH at 23°C. There was one sampling port located at the faceplate of the source chamber and three sampling ports at the test chamber. Samples were collected sequentially from the source chamber and simultaneously from the test chamber for each sampling method. A total of 9 samples from the source chamber and 17 samples from the test chamber, including duplicates, were collected. The PUFs, quartz fiber filters, PTFE membrane filters, Teflon tubing used to connect the sampling ports, and OVS samplers were solvent extracted and analyzed by GC/MS. Tenax TA tubes were analyzed by thermal desorption GC/MS. Differences in the OPFRs gas phase concentrations determined from different sampling media are reported and discussed. Our test results provide insight into the comparability of these different methods for sampling gas-phase OPFRs.