

VOCs in Fire and Smoke Contamination Investigations

Background

Fire and smoke events leave complex particulate and chemical residues that can have a significant effect on health and often leave a lingering smoky odor. These events include intrusion of smoke from wildfires, deposition of smoke residues from indoor fires (structural or affecting a specific area within the structure), and typical indoor sources such as fireplaces and wood stoves, candles, and tobacco smoke.

Problem

Traditional particulate testing can be complicated by secondary sources and does not typically address the issue of the characteristic smoky odor that often lingers for months, or even years, or the potential health hazards of the VOCs. Together with the particulate, understanding the effect of the VOCs from fire and smoke can provide a comprehensive evaluation of the level of remaining fire and smoke contamination, especially in situations where all visible traces of the fire and smoke are gone but the odors remain.

Solution

Fire Check™ identifies and quantifies specific VOCs that are used as surrogates, or indicators, for the hundreds of VOCs that are produced during fire and smoke events. These indicators include VOCs with a range of volatilities from light weight to semi-volatile and incorporate a variety of chemical classes. Fire VOC indicators were selected based on their prevalence in multiple types of fire situations, scarcity of other sources, and ease of analytical determination.

Analysis can be performed on air, bulk, and surface wipe samples depending on the situation. Typically, air samples are most suited to more recent fires or situations where inhalation concerns are the primary

purpose for testing. Bulk and/or surface samples can be used to evaluate the potential persistence of the fire VOCs since re-emission of fire VOCs from materials is typically the cause of long term respiratory irritation and odor.

Results & Interpretation

Typically, chemical residue from recent fires will include a mix of all of the fire/smoke indicators as well as other chemicals produced during the combustion process. Because of the potential for other sources to impact the results, detection of several Fire VOCs is typically necessary to provide a positive result, indicating the presence of fire and smoke residue. As time passes, the more volatile components will dissipate leaving only the heavier compounds. These heavier compounds can also be adsorbed by porous materials in the vicinity of the fire and will be slowly re-emitted, causing the lingering smoky odor characteristic of fires. The detection of the more persistent heavier VOCs and SVOCs suggests that fire and smoke residues remain, and may be perceived as lingering odors or health impacts under certain conditions.

Fire VOC Indicators

Volatility	Primary	Secondary
Light VOCs	N/A	Formaldehyde Acrolein Acetonitril
Medium VOCs	o,m,p-Cresol 2-Furaldehyde Guaicol	N/A
Heavy VOCs	Creosol 4-Ethylguaicol	2,4-Dimethylphenol
Light SVOCs	Acenaphthylene	Naphthalene 2-Methylnaphthalene Biphenyl Methylbiphenyl
Heavy SVOCs	N/A	Other PAHs