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.

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

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.

2625 Denison Drive, Mt. Pleasant MI 48858

PRISM Analytical Technologies

Analytical Report Sample Report

Client: Air Quality Inspections
3212 NW 12th St.
Baltimore, MD 21224

Sampled By: Alex Carter
Project: Recent renovation.
Location: 123 W. Maple Ave.
Boston, MA 25478

Client Sample ID: Office
Volume: 24.4 L
Date Sampled: 12/01/2014
Sample Type: TDT 112J

COC: 6010
Laboratory ID: 6010-1

Received Date: 12/03/2014
Approved Date: 12/03/2014
Scanned Date: 12/05/2014
Report Date: 12/08/2014

A2-MSX Fire TDT Analysis

Primary and Secondary Fire/Smoke indicators are listed below. Secondary indicators may have significant additional sources or insufficient instrument response. Results reported semiquantitatively are determined based on an internal standard ratio only. Results displayed in order of decreasing volatility as indicated by the Retention Index (RI). Analysis performed via NIOSH method 2549 and ISO method 16000-6 (modified).

General Notes

The Fire VOC results below indicate that fire/smoke residue is present.

Primary Fire Indicators

		Sample Concentration		Reporting Limit	
Compound	**CAS**	**ng/L**	**ppb**	**ng/L**	**Additional Information**
2-Furaldehyde	98-01-1	0.7	0.2	0.2	Furfural
o-Cresol	95-48-7	< 0.2	< 0.05	0.2	
2-Methoxyphenol	90-05-1	1.1	0.2	0.2	Guaicol
m,p-Cresol	108-39-4 & 106-44-5	0.6	0.1	0.4	
Creosol	93-51-6	0.7	0.1	0.4	
4-Ethyl-2-methoxyphenol	2785-89-9	< 0.4	< 0.06	0.4	4-Ethylguaicol
Acenaphthylene	208-96-8	0.2	0.04	0.2	

Secondary Fire Indicators

		Sample Concentration		Reporting Limit	
Compound	**CAS**	**ng/L**	**ppb**	**ng/L**	**Additional Information**
Methylbiphenyl	N/A	< 1	< 0.1	1.0	Cannot determine isomer; Reported Semiquantitatively
Acrolein	107-02-8	< 1	< 0.4	1.0	Reported Semiquantitatively
Acetonitrile	75-05-8	< 0.2	< 0.1	0.2	
Salicylaldehyde	90-02-8	< 0.4	< 0.08	0.4	
Naphthalene	91-20-3	0.3	0.06	0.2	
2,4-Dimethylphenol	105-67-9	< 0.2	< 0.04	0.2	
2-Methylnaphthalene	91-57-6	< 0.2	< 0.03	0.2	
Biphenyl	92-52-4	< 1	< 0.2	1.0	Reported Semiquantiatively

These results pertain only to this sample as it was collected and to the items reported.
These results have been reviewed and approved by the Laboratory Director or authorized representative.

Alice E. Delia, Ph.D., Laboratory Director

Prism Analytical Technologies, Inc.
2625 Denison Dr.
Mt. Pleasant, MI 48858
989-772-5088