Forensics Division

AGAT Laboratories

Fire Impacted Sites and Structures

Introduction

The air quality after a catastrophic event such as a fire can pose significant health risks. The products from a high temperature fire can leave residues and particulate matter in the form of smoke, soot, and ash. These different categories of materials are general terms for a wide variety of potential compounds including, but not limited to a variety of carcinogenic reduced carbon species such as polycyclic aromatic hydrocarbons (PAHs), oxidized minerals, and liberated metals from various materials.

It's important when doing an investigation on any site where there could be a variety of materials that may have combusted to employ robust and quantitative scans to enable complete characterization of the scene and allow for only the most accurate decisions to be made when regarding the health and safety of others.

AGAT Laboratories fortunately has available a large variety of advanced instrumentation to assist in such a task.

Available Tests

Particulate Sampling

Particulate matter may be present in a variety of manners stemming from smoke, ash, and dust. AGAT laboratories is able to offer sampling via pump and match weight filters to determine quantitative particulate levels of specific particle sizes or onsite determination of PM2.5, PM4, PM10, or TSP utilizing the EVM-3 Dust Monitor. TEOM continuous particulate monitoring systems are additionally available for longer term and/or ambient monitoring requirements.

Advanced Materials Analysis

The recommended instrument for contributing to this project is the QEMScan (using SEM and EDX functions). AGAT can offer a comprehensive Material ID service, which will allow for the identification of any dangerous or harmful contaminants in dust/soot/ash deposits from swabs or filters. Additionally, we can provide semi-quantitative particle size distribution analysis, and particle morphology analysis. This will not provide a full suite of organic compounds in a similar manner to a GCMS, but will give strong identification of general materials present.

Sample Preparation

Swabs: A section of the swab with solid debris will be selected and removed. It will be coated in Au-Pd for conductivity. If sufficient solids are present we can remove them from the swab and apply them to a sample mount, making analysis easier and more accurate.

Filters: This type of collection is common in air quality monitoring to determine the identification of particles actively in the air. Filters are received and analyzed directly providing grain size/morphology, composition, and mineralogy.

Bagged Grab Samples: these can be mounted on SEM-grain mounts for analysis and material identification.

Examples of materials that can be identified (by SEM morphology and/or EDX spectrum):

- Minerals (rock, soil, concrete, etc.)
- Ash/soot
- Charcoal
- Dust, with some ability to distinguish types:
  - Commercial/residential
  - Agricultural/airborne
  - Ash and combustion products
  - Construction debris
  - Asbestos fibers (may be supplemented by optical microscopy)

For the identification of some trace elements, the level of detection with this type of scan may be too high to satisfy all safety concerns. This is of particular importance for heavy metals such as lead, arsenic, mercury, and others. If these and other harmful elements are a concern, AGAT recommends ICP-MS analysis of dusts, swabs and other collected materials.

Advanced Gas Phase Compound Analysis

In regards to inhalable gases, there are two primary methods of sample collection:

- Thermal Desorption (TD) tube sampling using an active pump.
- Summa Canister Sampling.

Depending on the length of time that sampling is to be done, what level of detection is required, and availability of equipment, either method of sampling may be preferred over the other. Both however are analyzed via gas chromatography to produce a long list of volatile, gas phase chemicals that were collected during the sampling. The collected gases will be different from that of the particulate matter (dust, smoke, and ash) in that it will include volatile organic compounds (VOCs) such as benzene, toluene, xylene, and many others; many of which are a concern for human health over certain exposure limits.

Semi Volatile Organic Compound Analysis

During the intense heat that can occur with a fire, a number of compounds may be liberated and spread

throughout the air that under normal temperatures would not be volatile or mobile. These include compounds such as Polycyclic Aromatic Hydrocarbons (PAHs), chlorinated aromatics, and long chain olefinic and aromatic hydrocarbons. Many of these can be toxic if significant exposure is maintained.

The recommended methods of sampling can either be via a swab/wipe sample or directly sampling the solid or liquid that is of concern. The analysis to be conducted after is via GCMS to determine specific compound identities and directly determine exposure limit concerns.

Flame Retardants

Using LC/MS technology, AGAT Laboratories also can analyze material for flame retardants compounds such as Polybrominated diphenyl ethers (PBDEs), perfluorooctane sulfonate (PFOS) and other pollutants.

Forensics Services for Fire and Arson

AGAT Laboratories specializes in chemical analysis of fire debris samples to support investigators with fire and arson cases. Our Forensics Laboratory specializes in the determination of ignitable liquid residues (ILRs) to evaluate the type of ignitable liquid used in arson cases. Our laboratory offers all sampling supplies and analytical services to conduct the chemical analysis of fire debris samples.

Petroleum Forensics

Petroleum products leaked into the environment can be challenging to trace to the source when potential sites of contamination are in close proximity. Petroleum biomarkers and diagnostic ratios of marker compounds are identified to distinguish between petroleum products to match the contamination to the source.

Hydrocarbon forensics can be used to help with liability cases and to identify where the lines of contamination start and end.

Soil and Water Environmental Analysis

AGAT Laboratories offers comprehensive of soil and water chemistry services to test the environment. The destruction left from fires can leave behind contaminated soil and threaten surface and groundwater from rain runoff. We can analyze for heavy metals, salinity, PAHs, dioxins and furans, PCBs, hydrocarbons and other toxic compounds that are released in building fires.

Emergency Response Mobile Laboratories

In emergency contaminated situations, the ability to run data on-site allows for fast accurate decisions to be made, which assists in a quick recovery. AGAT Laboratories has Mobile Air Quality Monitoring and Environmental Laboratories for onsite ambient air, soil and water analysis.

The Air Quality Mobile Laboratory has a continuous power supply that allows the trailer to move easily and quickly from site-to-site without the need for re-calibration. The lab reports live ambient air data for a variety of chemical monitoring configurations. Data is streamed to our online web portal WebAIR for secure access to data anywhere.

The Soil and Water Mobile Laboratory can be customized to the requirements of contamination and can analyse for a range of VOCs, petroleum hydrocarbons, pH, electrical conductivity, saturation % and more. The mobile laboratory meets all provincial and national regulation detection limits and follows our strict Quality Control procedures for approved methods that meet ISO 17025 standards.

Our Emergency Response Services are ready to deploy 24/7 and our team specializes in seamless communication, rush services and technical assistance. Please contact us for more information about mobile laboratory services.