Comprehensive Hazardous Material Assessment Post Structure Fire Conflagration

A standard four-gas meter is an essential life safety instrument; however, it is designed to monitor only a limited group of atmospheric hazards—typically oxygen (O_2), carbon monoxide (CO), hydrogen sulfide (H_2S), and combustible gases expressed as a Lower Explosive Limit (LEL). While invaluable for immediate responder safety, it **cannot identify or quantify the broad range of hazardous chemicals and particulates produced during modern structural and wildland-urban interface fires.**

Comprehensive post-fire hazard characterization requires Hazardous Materials Specialists equipped with advanced monitoring and analytical instrumentation, including:

Hazard	Typical Monitoring Equipment
Volatile Organic Compounds (VOCs)	**Photoionization Detector (PID)** (e.g., MiniRAE)
Hydrogen Fluoride (HF) from lithium-ion batteries	**Electrochemical HF Sensor**, **Colorimetric Detection Tubes**, or **Fourier Transform Infrared (FTIR) Spectrometer**
Hydrogen Cyanide (HCN)	**Dedicated Electrochemical HCN Sensor** or **FTIR**
Chlorine, Ammonia, Sulfur Dioxide, Nitrogen Oxides	**Specific Electrochemical Sensors** or **Colorimetric Detection Tubes**
Unknown chemical mixtures	**Portable FTIR Spectrometer** or **Portable Raman Spectrometer**
Hazardous industrial chemicals	**FTIR**, **Raman**, or **Portable Gas Chromatography/Mass Spectrometry (GC/MS)** where available
Radiation hazards	**Personal Radiation Detector (PRD)** or **Radiation Survey Meter**
Heavy metals in ash	**Laboratory analysis** following field sampling (portable field screening instruments may be used in limited applications)
Asbestos fibers	**Certified asbestos sampling** with laboratory analysis using PCM or TEM methods
Crystalline silica	**Industrial hygiene air sampling pumps** with laboratory analysis
Airborne particulate concentrations (PM2.5/PM10)	**Real-time particulate monitor/aerosol monitor** (e.g., TSI DustTrak or X-Sites or equivalent)

Lithium-Ion Battery Hazards

The Spokane Area Fires likely impacted electric vehicles, e-bikes, scooters, battery-powered tools, residential battery energy storage systems (power walls), solar installations, backup power supplies, and consumer electronics. Damaged lithium-ion batteries present hazards that extend well beyond fire suppression.

Potential hazards include:

- Delayed thermal runaway and reignition.
- Release of **hydrogen fluoride (HF)**, an extremely toxic and corrosive gas.
- Release of flammable electrolyte vapors and other volatile organic compounds.
- Production of toxic combustion byproducts that cannot be detected by a standard four-gas meter.

Identification of these hazards requires specialized monitoring equipment such as **HF-specific electrochemical sensors, FTIR spectroscopy, PID monitoring for VOCs, and other chemical identification technologies operated by trained Hazardous Materials Specialists.**

Health and Safety Considerations

Exposure to hazardous decomposition products released from lithium-ion batteries following thermal damage.

Metals

Lithium-ion battery fires release toxic smoke and soot containing fine particulate matter and heavy metals like cobalt, nickel, manganese, lithium, and lead. Inhaling these metal-enriched particles can cause acute lung inflammation, cellular oxidative stress, DNA damage, and long-term respiratory diseases like pulmonary fibrosis.

Hydrogen Flouride

When inhaled or absorbed through the skin, HF turns into hydrofluoric acid, destroying deep tissue, causing pulmonary edema, and stripping calcium and magnesium from the blood, which can trigger cardiac arrest or death.

Operational Recommendation

Post-fire recovery operations should include deployment of Hazardous Materials Specialists capable of performing comprehensive atmospheric monitoring and hazard characterization using advanced detection technologies. Reliance on a four-gas meter alone may identify immediate oxygen deficiency, carbon monoxide, combustible atmospheres, or hydrogen sulfide, but **it does not identify many of the toxic combustion products, lithium-ion battery off-gassing, hazardous industrial chemicals, or contaminated airborne particulates that pose significant risks to responders and the public.**

Providing Incident Command with scientifically defensible hazard assessments enables informed decisions regarding reentry, public health advisories, debris removal operations, worker protection, environmental mitigation, and long-term community recovery.