OVERVIEW

Today, with the proliferation of plastics and synthetic polymer building materials, the risk of a significant Hydrogen Cyanide (HCN) poisoning component in victims of enclosed space fire smoke inhalation has increased.\(^{(1)}\)

Recent studies in the US reveal that firefighters face an increased risk of certain cancers, such as testicular cancer, non-Hodgkin's lymphoma, prostate cancer, and multiple myeloma, a cancer that begins in the plasma cells in bone marrow.

These and other studies reveal new, blunt warnings regarding the health dangers of fire smoke, as well as the danger of breathing fire smoke toxins in the fire overhaul process.\(^{(2)}\)

HIGH HCN LEVELS AT FIREGROUNDS

In the late stage of a fire-suppression process, the burned area is carefully examined for remaining sources of heat that may rekindle the fire. This activity often coincides with salvage operations to prevent further loss of structures or their contents, as well as fire-cause determination and preservation of evidence. During this stage of firefighting, there is no fire and little to no smoke in the environment. However, the smouldering fumes of a recently doused fire can be filled with dangerous toxic gases and vapours such as Carbon Monoxide (CO), Sulfur Dioxide (SO2), Hydrogen Cyanide (HCN), Nitrogen Oxides (NO and NO2), Formaldehyde, Benzene and Phosgene.

HCN AND CO, THE “TOXIC TWINS”

All firefighters are aware that where there is smoke, there is CO. But more recent studies have revealed that high HCN concentrations are found in fire smoke. Even worse, firefighters are routinely exposed to dangerous levels of cyanide at fires without realising it.\(^{(3)}\)

A 2007 NIOSH publication, “Preventing Fire Fighter Fatalities Due to Heart Attacks and Other Sudden Cardiovascular Events,” noted that HCN is formed by incomplete combustion of any substance that contains Carbon and Nitrogen (both naturally occurring and synthetic) and that airborne concentrations exceeding those of established occupational exposure limits occur in structural fires. It also acknowledges that HCN impairs cellular use of oxygen, which can result in cellular hypoxia and a variety of cardiac manifestations.\(^{(4)}\)

HCN is created when materials such as laminates, synthetics, foams, plastics and wood burn. Many of these materials are found in furniture and upholstery in homes and offices, and as a result, the smoke of a typical residential or office fire today is more toxic than ever.

Cyanide and CO are both invisible gases that are only detectable using a sensor device. The tables opposite show the medical implications to a human body when exposed in isolation.

HEALTH EFFECTS OF TOXIC TWINS (CO AND HCN)

While HCN and CO are toxic in isolation the effect of both in combination can even be worse. This means that there might be a synergistic effect leading in a greater toxicity than predicted from the concentrations of either toxicant alone. Clinically, this was observed in smoke inhalation victims in the classic Paris, France, study, where some fatalities were associated with blood CO and HCN concentrations, neither of which were predicted to cause death.\(^{(5)}\)
After the flames are out, HCN might still be present, but we cannot see it or test for it. Should SCBA be worn until the atmosphere is completely free of HCN? The answer is yes, but how do firefighters know if or when the air is clean, since the four most commonly used gas detectors generally do not have an HCN sensor in them?

A FIREGROUND IS A HAZARDOUS AREA

Because a growing number of firefighting experts consider structural fires HazMat hot spots, calls for greater teamwork between HazMat and firefighters during common structural fires are increasing. Many departments now have a standard operating procedure (SOP) for using gas detection equipment during structural fires, including using stand-alone instruments or wireless systems that allow on-scene agencies with compatible systems to share data.  

While fire, HazMat and special operations teams utilise a variety of detection instruments today, wireless gas detectors offer key benefits to fire-service agencies. These include fast deployments, centralised command monitoring and data sharing with other on-scene units or off-site experts.

QRAE 3: VERSATILE 4-GAS MONITOR

The RAE Systems QRAE 3 is an affordable, personal protection gas monitor developed by RAE Systems with a dedicated configuration for fire overhaul applications, with CO and HCN sensors (model GM2530).

This model is available either with an integrated pump (as shown in the picture) or as a natural diffusion model. QRAE 3 also provides the following features: datalogging capability, policy enforcement features and man down alarm capability with real-time remote wireless notification.

QRAE 3 (model PGM-2530) allows firefighters to be aware of risks in their environment by measuring the presence of CO and HCN. Its unique wireless option provides extra safety when working in extremely dangerous environments, as real-time data are available on EchoView Host or on a computer running ProRAE Guardian software. This means that firefighters in the safe area can monitor their peers and work together with them to provide enhanced situational awareness and support.

RAE Systems has characterised the cross-sensitivity of its sensors in oxidative environments by measuring the presence of CO and HCN. Its unique wireless option provides extra safety when working in extremely dangerous environments, as real-time data are available on EchoView Host or on a computer running ProRAE Guardian software. This means that firefighters in the safe area can monitor their peers and work together with them to provide enhanced situational awareness and support.

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QRAE 3 WIRELESS SOLUTION

QRAE 3 ToxiRAE

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(2) News Release from UC Health News, University of Cincinnati (10 Nov 2006) “Firefighters Face Increased Risk for Certain Cancers.” Release on findings reported in the Journal of Occupational and Environmental Medicine about a study by Grace LeMasters, PhD, Ash Genaidy, PhD, and James Lockey, MD.
(3) http://inletemergencyservices.files.wordpress.com/2010/07/hydrogencyanide1.pdf
(6) News Release from UC Health News, University of Cincinnati (10 Nov 2006) “Firefighters Face Increased Risk for Certain Cancers.” Release on findings reported in the Journal of Occupational and Environmental Medicine about a study by Grace LeMasters, PhD, Ash Genaidy, PhD, and James Lockey, MD.