CARVER FIRE DEPARTMENT

Standard Operating Guidelines

Section 4.22 – Hydrogen Cyanide (HCN) Monitoring February 14, 2017

1.0 PURPOSE

The purpose of this guideline is to establish a process of determining readings of hydrogen cyanide (HCN) at structure fires.

1.1 SCOPE

Monitoring HCN levels for all members during structure fire incidents.

1.2 HCN METER PROCEDURE

HCN IS 35 TIMES MORE TOXIC THAN CO AND HIGHLY FLAMMABLE. SCBA MUST BE WORN.

01. The HCN meter shall be mounted in Rescue 1.

02. Power on the HCN meter outside of the IDLH, in fresh air.

03. Action level for HCN is 4.7ppm. All members operating in the IDLH shall utilize SCBA.

04. Command or designee (Operations, Safety, etc.) will assign a member to actively survey all operating areas for HCN. This will include the interior of the structure, as well as the immediate perimeter of the scene, including accountability (door man)as well as adjacent locations such as rehab, RIT, manpower, command post, etc.

05. Ventilate the building to readings below the action level prior to coming "off air." Off gassing of burned materials may not allow ventilation to be effective.
Non fixed exterior positions such as manpower, RIT etc, shall be re-positioned such that HCN is not present.

06. Decontamination- Upon exiting the structure, the possibility exists of HCN off gassing from turnout gear. If turnout gear has a reading greater than 5 ppm, briefly rinse the gear with a soft fog pattern. Personnel should practice good hygiene by cleaning hands, face, and neck ASAP, and prior to eating at rehab. CFD has provided wipes for this purpose.

HCN Air Quality Monitoring Checklist

Location of Incident: _____ Date: _____

Quick Checklist

Action Level – 4.7 PPM

---Levels over 135 PPM are fatal---

Structure Survey	Location	PPM Reading
Accountability/Door Man Location	_____	_____
Fire Room	_____	_____
	_____	_____
	_____	_____
	_____	_____
Uninvolved Rooms	_____	_____
	_____	_____
	_____	_____
RIT Staging Area	_____	_____
Command Post Area	_____	_____
Manpower Staging Area	_____	_____
Rehab Area	_____	_____
Turnout Gear Off Gassing	_____	_____

PPM Acceptable Yes_____ No_____ MAX PPM Reading_____

Firefighter Survey – Acute Symptoms

Headache	Yes_____	No_____
Fatigue	Yes_____	No_____
Anxiety	Yes_____	No_____
Dizziness	Yes_____	No_____
Confusion	Yes_____	No_____
Respiratory Distress	Yes_____	No_____

Name of individual handling HCN Monitor: _____

Officer Completing Checklist: _____

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Following are some facts about hydrogen cyanide:

- HCN is 35 times more toxic than CO.
- HCN is produced when products such as wool, silk, cotton, nylon, plastic, and polymers, foam, melamine, polyacrylonitriles, and synthetic rubber burn.
- HCN can enter the body by absorption, inhalation, or ingestion and targets the heart and brain.
- HCN can incapacitate a victim within a short time.
- HCN has a half-life of one hour in the blood.
- HCN is highly flammable, and most of it will burn away during combustion.

Where Does Hydrogen Cyanide Come From?

Hydrogen cyanide is a by-product of the combustion of materials used in products used in everyday life (insulation, carpets, clothing, and synthetics). Smoke from the combustion of grass clippings, green wood, tobacco, cotton, paper, wool, silk, weeds, and animal carcasses will likely contain some hydrogen cyanide gas. But the real offender is the combustion of manmade plastic and resins containing nitrogen, especially if the fire is hot and in an enclosed space. Common manmade materials that generate cyanide gas during combustion include nylon, polyurethane, melamine, and acrylonitrile.

Despite burning away during combustion, objects within a fire continue to produce cyanide as long as their temperature remains elevated. Given that HCN is 35 times more toxic than CO, firefighters should give serious consideration to this deadly gas. Until research is definitive, firefighters must protect themselves against the effects of HCN. The question is: When do firefighters remove their SCBAs? HCN may still be present in the atmosphere in high concentrations during overhaul. Firefighters must wear their SCBAs until HCN levels have been assessed with atmospheric air monitoring.

How Much Hydrogen Cyanide Gas Can Kill?

The American Conference of Governmental Hygienists reported that workers exposed to hydrogen cyanide concentrations ranging from 4 to 12 ppm for seven years reported increased headaches, weakness, changes in taste and smell, throat irritation, precordial pain, and nervous instability. Workers exposed to low concentrations developed enlarged thyroid glands. The following permissible limits have been established:

- OSHA's permissible HCN exposure is 10 ppm on an 8-hour time-weighted average (TWA).
- The National Institute for Occupational Safety and Health (NIOSH) lists a short-term exposure lower limit of 4.7 ppm for workers. The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned 4.7 ppm as a worker ceiling limit.

SYMPTOMS OF EXPOSURE

Firefighter and victims inhaling hydrogen cyanide associated with smoke often experience cognitive dysfunction and drowsiness that can impair the ability to escape or to perform rescue operations. Exposure to low concentrations (or initial exposure to higher concentrations) may result in stupor, confusion, flushing, anxiety, perspiration, headache, drowsiness, tachypnea. Exposures to higher concentrations of HCN result in prostration, tremors, cardiac arrhythmia (which can be delayed two to three weeks after the fire exposure), coma, respiratory depression, respiratory arrest, and cardiovascular collapse.