HIGH RISK/LOW FREQUENCY

HUDSON FIRE DEPARTMENT Standard Operating Guidelines	GUIDELINE NO: 200.08 **SUBJECT:** AIR MONITORING
APPROVAL: Scott St. Martin, Fire Chief	Effective Date: 5-16-16 Revised Date: n/a

PURPOSE

The purpose of this guideline is to establish a procedure for air monitoring at structure fires.

RESPONSIBILITY

1. All Chief and Company Officers have the responsibility to comply with and ensure that the personnel under their command are adequately trained, fully understand, and comply with this guideline.

2. All firefighters have the responsibility to learn and follow this guideline.

PROCEDURE

A. Information
   1. Fire smoke and its many bi-products of combustion present a serious health risk to responders. Hydrogen Cyanide (HCN) and Carbon Monoxide (CO) are just a few of the deadly gases that when exposed to can pose immediate and long term health effects. HCN is produced when materials such as insulation or synthetic materials are burned or heated. The symptoms closely mirror those of carbon monoxide exposure; therefore personnel must be cognizant of its presence.
   2. Vehicle fires and trash fires also generate high levels of HCN and CO, but because they normally occur in an open environment the products of combustion dissipate quickly into the atmosphere. However, when smoke is present the need for SCBA is vital for responder protection.

B. Safety
   1. Safety of responders is the first priority, therefore SCBA are required until a safe atmosphere can be determined by the use of meters.
   2. HCN exposure may be difficult to determine. Its symptoms are similar to that of CO exposure, which may include headache, nausea, fatigue and dizzy spells at low levels and respiratory problems, unconsciousness, and cardiac arrest for high levels. If exposure is suspected transport to a health care facility should not be delayed.

C. Personal Protective Equipment
   1. Self Contained Breathing Apparatus
      a. SCBA is the best preventive measure for smoke exposure, as inhalation is the primary route of entry for exposure.
      b. SCBA is required on **all** structure fires that present a smoke condition, to include kitchen and cooking fires, until monitoring has taken place.
      c. SCBA is required on **all** vehicle fires until completely extinguished and all smoke has dissipated, or monitoring has taken place.
      d. SCBA is required on **all** large trash receptacle fires until completely extinguished and all smoke has dissipated.

2. Structural Turnout Gear
    a. Turnout gear helps protect personnel from absorbing smoke, including HCN and CO through the skin, which is a secondary route of exposure.
    b. Personnel are to wash turnout gear following structure fires that heavily soil and saturate gear with products of combustion.
    c. If a second set of turnout gear is available personnel should switch gear as soon as possible.

D. Air Monitoring
1. All structure fires are to be monitored by utilizing 4 gas detector
2. Engine 3162 and 3163 carry the 4 gas detector.
3. The 4 gas detector should be turned at the earliest convenience to ensure its timely usage.
4. SCBA are **not** to be removed until the atmosphere can be monitored, and deemed safe.
5. The following conditions will warrant atmospheric monitoring:
    a. When SCBA have been used during a working structure fire, ventilation is complete, and the removal of SCBA is requested.
    b. Any personnel are found operating inside the structure without SCBA.
    c. The 4 gas detector is to be used immediately in the area where crews were found to be operating.
    d. The HCN and CO level is to be communicated to the IC along with the personnel who were found to be operating in the area.
    e. The IC must then determine the length of time the personnel were operating in the environment without SCBA, and the reported readings.
    f. If readings and operating time period is of sufficient length, and signs of exposure exist then personnel are to be transported to the hospital for immediate evaluation (see Section G
    g. Vehicle fires within a structure.
    h. Whenever deemed necessary by the IC.
    i. Adjacent apartments or structures where smoke is reported.
6. Air monitoring will be continuous until the scene is cleared.
7. The following conditions will **not** warrant atmospheric monitoring. This does not dismiss the need for SCBA, and if the 4 gas detector is readily available monitoring is still encouraged.
    a. Vehicle fires in the open atmosphere.
    b. When a burning odor is detected and there is no visible smoke i.e. light ballast

E. Action Levels
1. The action level in an environment where HCN is present will be **4.7ppm**. In order to operate without SCBA readings of HCN must be below this level.
    a. 4.7 ppm is the Short Term Exposure Limit (STEL) for HCN as recommended by NIOSH.
    b. STEL as defined by NIOSH is a 15-minute TWA (Time-Weighted Average) exposure that should not be exceeded at any time during a workday.
2. Immediately Dangerous to Life and Health (IDLH) for HCN is 50 ppm.
3. The action level for CO will be 35ppm.
4. The atmospheric readings must be below the action level for HCN and CO in order for personnel to operate without SCBA.

F. Decontamination
1. Personnel should practice good personal hygiene by washing hands prior to drinking and eating in rehab or back at the station.
2. If turnout gear has a reading higher than 5 ppm of HCN decontaminates the gear.
3. Use a PPV fan to blow off the large particulates on the gear, and if needed use a soft bristle brush.
4. If a fan is not available briefly rinse with a soft fog pattern to prevent saturation.

5. All personnel operating inside the structure should be decontaminated.
6. All personal protective equipment should be washed as soon as possible in the extractor.
7. Gloves should be washed by hand with hose or in sink.

G. Exposure

1. The following three indicators are to be used to determine if a person has been exposed to HCN:
    a. Exposed to fire or smoke in an enclosed area
    b. Soot found around the mouth and nose
    c. Altered mental status
2. Hydrogen cyanide can cause rapid death due to metabolic asphyxiation. Death can occur within seconds or minutes of the inhalation of high concentrations of hydrogen cyanide.
3. Sources report that 270 ppm is fatal after 6 to 8 minutes, 181 ppm after 10 minutes and 135 ppm after 30 minutes [Hathaway et al. 1991].
4. These levels are not uncommon during routine structure fires.
5. Acute exposure symptoms including weakness, headache, confusion, vertigo, fatigue, anxiety, dyspnea, and occasionally nausea and vomiting.
6. Respiratory rate and depth are usually increased initially and at later stages become slow and gasping.
7. Coma and convulsions occur in some cases.
8. If cyanosis is present, it usually indicates that respiration has either ceased or has been inadequate for a few minutes.
9. If large amounts of cyanide have been absorbed, collapse is usually instantaneous; unconsciousness; often with convulsions, is followed almost immediately by death [Hathaway et al. 1991].
10. If personnel are found to have been operating in an IDLH atmospheres or experiencing severe health effects it is strongly recommended they be transported for advanced medical evaluation.
11. The following information needs to be reported to the hospital:
    a. HCN has a half life of one hour, therefore it is imperative that the exposed personnel be given immediate medical attention to include blood work and tested for HCN levels in the blood.
    b. It is important that when transported the hospital be advised that the firefighter was operating in a known hazardous environment containing hydrogen cyanide.

H. Reporting

1. The IC will be responsible for recording any significant exposures during a structure fire.
2. The following information will be supplied in the narrative of the incident report:
    a. The HCN and CO levels during the time of operation
    b. Areas monitored with corresponding reading
    c. How long personnel operated in the atmosphere
    d. The personnel operating in the hazardous atmosphere
    e. Specifics concerning the call. i.e. major materials that burned or were greatly heated
3. Exposure reporting
    a. Anytime personnel are operating outside the safe range without SCBA a notation is to be made in the Firehouse (NFIRS) report under the Fire Personnel Casualty section.

I. Calibration

1. The Fire Chief or his/her designee is responsible for completion of the calibration on regular schedule following manufacturer's recommendations.

References – Risk and frequency classification information - http://firefighterclosecalls.com/sopsog.php and Fire Smoke Coalition.