



# Burlington Fire Department



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<b>Section: 04 - Special Operations</b>	
<b>SOG Number: 04.03</b>	<b>Effective Date: Oct. 6, 2017</b>
<b>Subject: Multi Gas Meter Use</b>	
<b>By Order of Fire Chief Steven A. Locke</b>	

## I. Purpose:

The purpose of the following guideline is to ensure Burlington Fire Department (BFD) personnel are safely, properly, and effectively operating the Air Monitoring Equipment, and to define a procedure for proper detector operations, maintenance and record keeping.

## II. Scope:

These procedures apply to all BFD personnel who may operate Air Monitoring Equipment at an incident. As with any emergency situation, necessity may require flexibility to deviate from this policy at the discretion of the Burlington Fire Department Incident Commander.

## III. Definitions:

Lower Explosive Limit (LEL) – The lower explosive limit is defined as the minimum concentration of gas or vapor in air that will ignite in the presence of a source of ignition.

Permissible Exposure Limit (PEL)- is a legal limit in the United States for exposure of an employee to a chemical substance or physical agent such as loud noise. Permissible exposure limits are established by the Occupational Safety and Health Administration (OSHA).

Time Weighted Average (TWA)- is used to calculate a workers daily exposure to a hazardous substance (such as chemicals, dusts, fumes, mists, gases, or vapors) or agent (such as occupational noise), averaged to an 8-hour workday, taking into account the average levels of the substance or agent and the time spent in the area.

Short Term Exposure Limit (STEL)- is the acceptable average exposure over a short period of time, usually 15 minutes as long as the time-weighted average is not exceeded. STEL is a term used in occupational health, industrial hygiene and toxicology

Carbon Monoxide (CO) – Colorless gas or liquid; practically odorless. Burns with a violet flame. Specific Gravity 0.967. Sources include un-vented kerosene and gas space

heaters; leaking chimneys and furnaces; back-drafting from furnaces, gas appliances, gasoline powered equipment and automobile exhaust. Average levels of Carbon Monoxide in homes without gas stoves may vary from 0 ppm up to 5 ppm. Levels near properly adjusted gas appliances are often 5 ppm to 15 ppm. Cal/OSHA PEL for Carbon Monoxide is 25ppm with a Ceiling of 200ppm.

Hydrogen Sulfide (H<sub>2</sub>S) – Hydrogen Sulfide is a colorless, very flammable gas. In low concentrations it smells like “Rotten Eggs”, however, the smell is lost after 2-15 minutes of exposure. Hydrogen Sulfide is considered a very toxic gas that is heavier than air. Hydrogen Sulfide has a 15 minute Short Term Exposure Limit (STEL) of 15ppm. An atmosphere consisting of 300 ppm is considered IDLH. Its flammable range is between 4.3% (43000 ppm) and 45% (450000 ppm).

Oxygen (O<sub>2</sub>) – a colorless, odorless reactive gas, the chemical element of atomic number 8 and the life-supporting component of the air. Oxygen forms about 20 percent of the earth's atmosphere, and is the most abundant element in the earth's crust, mainly in the form of oxides, silicates, and carbonates.

Calibration – the action or process of calibrating an instrument for experimental readings.

#### **IV. Guidelines:**

- A. Fire department personnel may be called to a wide variety of incident types, each presenting different types of hazards. Air Monitoring Equipment are designed to detect combustible gases and certain combustible vapors, oxygen-deficient or oxygen-enriched atmospheres, carbon monoxide, and hydrogen sulfide. The monitor will alert personnel to the presence of these atmospheric hazards by going into an auditory, visual, and vibrating alarm.
- B. The following are the thresholds at which all Burlington Fire Department Air Monitoring Equipment will go into alarm:
  1. Lower Explosive Limit (LEL) – 10% of the Lower Explosive Limit being monitored. *Personnel will evacuate any area where a reading 40% LEL or more is observed.*
  2. Carbon Monoxide (CO) – 25 parts per million (ppm) of Carbon Monoxide in air. *Personnel shall not operate in an environment of 25-99ppm for longer than 10 minutes without SCBA. Personnel will immediately don their SCBA in environments greater 100ppm.*
  3. Hydrogen Sulfide (H<sub>2</sub>S) – 10 parts per million (ppm) of Hydrogen Sulfide in air. *Personnel will don SCBA in any area where a reading of 15 ppm of Hydrogen Sulfide is observed.*
  4. Oxygen (O<sub>2</sub>) – 19.5 % deficient and 22 % enriched atmospheres. *Personnel will don SCBA when operating in atmospheres of 19.5% O<sub>2</sub> or less.*
- C. Maintenance:
  1. Daily-Drivers will perform a daily check to ensure the unit's readiness and proper operation. Drivers will document that it has been completed on the DPW-4a form.

2. Weekly- Drivers will place the unit in the Test Stand to check the function and parameters of the unit and sensors. Drivers will document that it has been completed on the DPW-5.
3. Exposure- Drivers will place the unit in the Test Stand to check the function and parameters of the unit and sensors.
4. Removal from Service- Any physical damage to the unit or function failure will deem the unit out of service. All issues shall be reported to the program manager.

**V. Responsibility:**

It is the responsibility of all members to read, understand and follow this Standard Operating Guideline.

Revision History			
Revision Date	Section	Summary	Principal Author
A	TBD	TBD	

**Combustible Gas Cross Reference Factors for  
General-Purpose Calibration Using Calibration Cylinder (Part No. 10053022)**

<b>Combustible Gas</b>	<b>Methane Calibration 1.45 Vol % CH<sub>4</sub> Set 33 % LEL</b>	<b>Pentane Simulant Calibration 1.45 Vol % CH<sub>4</sub> Set 58 % LEL</b>
Acetone	1.09	0.62
Acetylene	1.07	0.61
Butane	1.37	0.79
Cyclohexane	1.94	1.11
Diethylether	1.43	0.82
Ethane	1.27	0.73
Ethanol	1.16	0.66
Ethylene	1.09	0.62
Gasoline	1.63	0.93
n-Hexane	1.86	1.06
Hydrogen	0.98	0.56
Isobutane	1.63	0.93
Isopropyl Alcohol	1.55	0.88
Methane	1.00	0.57
Methanol	0.93	0.53
Methyl Ethyl Ketone	1.69	0.97
Nonane	4.48	2.56
Nonane with EX-H sensor	3.03	1.73
Pentane	1.90	1.00
Propane	1.39	0.79
Toluene	1.14	0.93
Xylene	2.09	1.19
Isobutane	4.83	2.76
Xylene with EX-H sensor	3.57	2.04

**Response notes**

- (1) Some compounds may reduce the sensitivity of the combustible gas sensor by poisoning or inhibiting the catalytic action or by polymerizing on the catalytic surface.
- (2) Multiply the displayed % LEL value by the conversion factor above to get the true % LEL.
- (3) These conversion factors should be used only if the combustible gas is known.
- (4) All factors are based on the IEC 100 % LEL levels
  - a) i.e. Methane 100% LEL = 4.4 Vol %,
  - b) Pentane 100% LEL = 1.1 Vol %
  - c) Propane 100% LEL = 1.7 Vol %
- (5) These conversion factors are typical. Individual units may vary by ±25 % from these values.
- (6) The results are intended for guidance only. For the most accurate measurements, a device should be calibrated using the gas under investigation.

