



**STATE OF CONNECTICUT  
DEPARTMENT OF EMERGENCY MANAGEMENT  
AND HOMELAND SECURITY  
URBAN SEARCH AND RESCUE  
CT-TF1**



**STANDARD OPERATING PROCEDURE**

<i>Effective Date:</i> <b>May 10, 2006</b>	<i>Number:</i> <b>S-002</b>	<i>Revision:</i>
<i>Title:</i> <b>CARBON MONOXIDE</b> <b>(Safety)</b>		
<i>Approved by:</i>	<i>Reevaluation Date:</i> <b>May, 2008</b>	<i>No. of Pages:</i> <b>4</b>

**PURPOSE**

Rescue operations often require the use of various gasoline-powered tools to breach, break or otherwise gain access to entrapped victims. With the use of these tools comes the distinct possibility that the carbon monoxide that is produced may impact the health and safety of both the rescuer(s) and the victim(s). The purpose of the document is to establish response guidelines for monitoring, controlling and minimizing exposure to carbon monoxide during rescue operations.

**SCOPE**

All active CT-TF1 personnel who participate in or support, rescue operations will follow this procedure.

**HAZARDS OF CARBON MONOXIDE**

Carbon monoxide (CO) is a poisonous, colorless, odorless, and tasteless gas. Carbon monoxide is harmful when breathed because it displaces oxygen in the blood and deprives the heart, brain, and other vital organs of oxygen. Large amounts of CO can overcome a victim in minutes without warning, causing the victim to lose consciousness and suffocate.

**PROCEDURE**

1. As part of any rescue assignment, a rapid assessment must be performed to determine the best method and tools necessary to accomplish the rescue assignment.
  - a. During the course of this assessment, should the space that the victim is entrapped within give the appearance of a confined space that may compromise the viability of the victim, then the Rescue Squad Officer shall request HAZMAT support to perform baseline monitoring of the space.
    - i. Based upon the HAZMAT Specialists findings the need for continued monitoring and ventilation shall be determined and communicated.
    - ii. The HAZMAT Specialist shall record all atmospheric readings to document the conditions in and around the space.
    - iii. Should additional monitoring be required, then the HAZMAT Specialist shall record all atmospheric readings at regular intervals to document the conditions in and around the space.

- b. Should the rapid assessment reveal that use of any gasoline powered tool (i.e. rotary saw, Hurst tool generator, etc.) is required, then the Rescue Squad Officer shall request HAZMAT support to perform baseline monitoring of the space.
    - i. The HAZMAT Specialist shall perform continuous monitoring any time a gasoline-powered tool is utilized. This monitoring shall continue even if use of the gasoline-powered tool is discontinued or until the victim has been extricated.
    - ii. The HAZMAT Specialist shall record all atmospheric readings at regular intervals to document the conditions in and around the space.
  - c. If at any time during the rescue effort, it is determined that the use of any gasoline powered tool (i.e. rotary saw, Hurst tool generator, etc.) is required, then the Rescue Squad Officer shall request HAZMAT support to perform monitoring of the space.
    - i. The HAZMAT Specialist shall perform continuous monitoring any time a gasoline-powered tool is utilized. This monitoring shall continue even if use of the gasoline-powered tool is discontinued or until the victim has been extricated.
    - ii. The HAZMAT Specialist shall record all atmospheric readings at regular intervals to document the conditions in and around the space.
2. As part of the tool selection process, The Rescue Squad Officer shall ensure that any time a gasoline powered tool is selected, a tool to assist with ventilation shall also be brought to the work area and utilized for the purpose of improving the air exchange cycle for both the victim(s) and rescuer(s) to minimize exposure levels.
- a. If necessary, other measures, such as utilizing Self Contained Breathing Apparatus, Supplied Air Breathing Apparatus, and/or Interspiro Revitox Mask to minimize the exposure level shall be employed to protect the victim(s) and rescuer(s).
3. Rescuer Post Exposure Rest Period
- a. The Rescue Squad Officer shall be responsible for minimizing the amount of exposure to carbon monoxide each rescue squad member receives. This can be accomplished by both administrative and engineering controls.
    - i. Administrative Controls are behavioral measures designed to minimize the carbon monoxide exposure level. These include:
      - 1. Limiting the number of personnel performing the task to only those directly necessary to accomplish it.
      - 2. Rotating personnel to minimize exposure time.
    - ii. Engineering Controls are mechanical methods designed to minimize the carbon monoxide exposure level. These include:
      - 1. Redirecting the exhaust produced by gasoline-powered equipment to an area away from the rescue operation.
      - 2. Deploying additional exhaust fans to increase the air flow and air exchange rate for the affected area.
      - 3. Selecting other tools that will accomplish the task.

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- b. Any member exposed to a level of carbon monoxide that exceeds the NIOSH REL, but is not greater than the NIOSH Ceiling, shall be required to rehabilitate so that they do not obtain a cumulative dose of carbon monoxide that may be hazardous.
    - i. At a minimum, the affected member shall rehabilitate for a period of one-hour. During this period, the affected member may perform non-strenuous activities, but not in the presence of any carbon monoxide source.
    - ii. The affected member shall be cleared medically to return to work, with the understanding that exposure to any carbon monoxide producing sources shall be kept to the least amount possible
  - c. Any member exposed to a level of carbon monoxide that exceeds the NIOSH Ceiling, shall be required to report to Medical for evaluation and rehabilitate so that they do not obtain a cumulative dose of carbon monoxide that may be hazardous.
    - i. At a minimum, the affected member shall rehabilitate for a minimum period of one-hour. During this period, the affected member shall do so under observation by Medical.
    - ii. The affected member shall be cleared medically to return to work, with the understanding that exposure to any carbon monoxide producing sources shall be kept to the least amount possible.
4. The following exposure levels and corresponding actions have been identified for Carbon Monoxide:

Table 1 – Action Levels

Exposure Level	Action(s)
35 PPM (NIOSH REL)	<ol style="list-style-type: none"> <li>1. HAZMAT Specialist advises Rescue Squad Officer of Carbon Monoxide level.</li> <li>2. HAZMAT Specialist advises HAZMAT Manager of findings.</li> </ol>
50 PPM (OSHA PEL)	<ol style="list-style-type: none"> <li>1. HAZMAT Specialist advises Rescue Squad Officer of Carbon Monoxide level.               <ol style="list-style-type: none"> <li>a. HAZMAT Specialist determines the anticipated amount of time needed to complete the operation and consults Dose Chart to see if the exposure is within acceptable guidelines.</li> </ol> </li> <li>2. HAZMAT Specialist advises HAZMAT Manager of findings.               <ol style="list-style-type: none"> <li>a. HAZMAT Manager advises TFL, Rescue Manager, Medical Manager and Safety of findings.</li> </ol> </li> </ol>
100 PPM	<ol style="list-style-type: none"> <li>1. HAZMAT Specialist advises Rescue Squad Officer of Carbon Monoxide level.               <ol style="list-style-type: none"> <li>a. HAZMAT Specialist determines the anticipated amount of time needed to complete the operation and consults Dose Chart to see if the exposure is within acceptable guidelines.</li> </ol> </li> <li>2. HAZMAT Specialist advises HAZMAT Manager of findings.</li> <li>3. HAZMAT Manager advises TFL, Rescue Manager and Safety of findings.               <ol style="list-style-type: none"> <li>a. TFL, Safety, Medical, Rescue and HAZMAT Managers meet to determine status of continued operations and possible alternative solutions.</li> </ol> </li> </ol>

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200 PPM (NIOSH Ceiling)	<ol style="list-style-type: none"> <li>1. ALL STOP <ol style="list-style-type: none"> <li>a. HAZMAT Specialist advises Rescue Squad Officer of Carbon Monoxide Level.</li> <li>b. HAZMAT Specialist advises HAZMAT Manager of findings and actions.</li> <li>c. HAZMAT Specialist continues air monitoring.</li> <li>d. Rescue Squad Officer reassesses victim status.</li> <li>e. TFL, Safety, Rescue and HAZMAT Managers implement alternative solution.</li> </ol> </li> </ol>
1200 PPM (IDLH)	<ol style="list-style-type: none"> <li>1. For information purposes only</li> </ol>

Table 2 – Medical Effects of Carbon Monoxide

CO in Atmosphere (PPM)	COHb in Blood (%)	Signs & Symptoms
10	2	Asymptomatic
70	10	No appreciable effect, except shortness of breath on vigorous exertion; possible tightness across the forehead; dilation of cutaneous blood vessels.
120	20	Shortness of breath on moderate exertion; Occasional headache with throbbing in temples
220	30	Headache; irritable; easily fatigued; judgment disturbed; possible dizziness; dimness of vision.
350 – 220	40 – 50	Headache, confusion; collapse; fainting on exertion
800 – 1220	60 – 70	Unconsciousness; intermittent convulsion; respiratory failure, death if exposure is long continued
1950	80	Rapidly Fatal

## **DEFINITIONS**

**REL: Recommended Exposure Limit.** Unless noted otherwise, the Recommended Exposure Limit is a time-weighted average (TWA) concentration for up to a 10-hour workday during a 40-hour workweek. The National Institute of Occupational Safety and Health (NIOSH) defines Recommended Exposure Limits.

**PEL: Permissible Exposure Limit.** The Permissible Exposure Limit (PEL or OSHA PEL) is a legal limit in the United States for personal exposure to a substance, usually expressed in parts per million (ppm), or sometimes in milligrams per cubic meter (mg/m<sup>3</sup>). The Occupational Safety and Health Administration (OSHA) define permissible Exposure Limits.

**Ceiling:** A ceiling Recommended Exposure Limit is designated by "C" preceding the value; unless noted otherwise, the ceiling value should not be exceeded at any time. The National Institute of Occupational Safety and Health (NIOSH) define ceilings.

**IDLH.** Immediately Dangerous to Life and Health (IDLH or NIOSH IDLH) is a limit for personal exposure to a substance defined by the United States National Institute for Occupational Safety and Health (NIOSH), normally expressed in parts per million (ppm). This concentration is considered to be the limit beyond which an individual will not be capable of escaping death or permanent injury without help in less than thirty minutes.

## **ATTACHMENT(S)**

1. CT-TF1 Monitoring Strategy
2. CT-TF1 Carbon Monoxide Dose Chart

## **REFERENCES**

OSHA Fact Sheet, Carbon Monoxide Poisoning. 2002. Retrieved on December 12, 2005 from [http://www.osha.gov/OshDoc/data\\_General\\_Facts/carbonmonoxide-factsheet.pdf](http://www.osha.gov/OshDoc/data_General_Facts/carbonmonoxide-factsheet.pdf)

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