



Scarborough Fire Department Scarborough, Maine



Standard Operating Guidelines

Book:	Emergency Operations
Chapter:	Haz-Mat / WMD / Terrorism Emergencies
Subject:	3840 - Flammable Gas Emergencies
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PURPOSE

To establish safe procedures for responding to known or suspected flammable gas emergencies. The primary goal of response personnel is to eliminate the fire or explosion hazard, while minimizing the risk to the public and responders.

POLICY

The following procedures outline the fireground tactics and strategies to be employed when responding to and mitigating flammable gas emergencies.

SCOPE

Fire department units may encounter flammable gas in a variety of situations and incident types, each presenting a different set of hazards and problems. The following procedures present an approach which will be applicable in the majority of situations, but does not replace good judgment and experience in dealing with any particular incident.

DEFINITIONS

Boiling Liquid Expanding Vapor Explosion (BLEVE): A violent explosion caused by the rupture of a vessel containing a pressurized liquid above its boiling point which is accompanied by a release of gas to the atmosphere and propulsion of the container or container pieces.

Emergency Response Guidebook (ERG) – U. S. Department of Transportation (DOT) guidebook intended to provide guidance for hazardous materials response. A copy is to be carried on every response unit.

Flammable Range: The range between the Lower Flammable (Explosive) Limit (LEL) and the Upper Flammable (Explosive) Limit (UFL), where there is a sufficient percent of a flammable vapor in air to support combustion.

Lower Explosive Limit (LEL) – The lowest concentration of a flammable vapor in air that will support combustion.

Natural Gas: An odorless and colorless mixture of flammable gases composed of 80-96% methane; the odorant Tert-butyl Mercaptan is added so leaks can be detected by smell. Natural gas is approximately 40% lighter than air and will dissipate into the air in

the outside environment. Inside buildings natural gas tends to pocket, particularly in attics and dead air spaces. Natural gas flammable limits are approximately 4% to 15% in air.

- **Liquefied Natural Gas (LNG)** – Natural gas stored in a liquid state by cryogenic cooling; when allowed to change from a liquid to a gas, LNG produces 614 cubic feet of vapor for every cubic foot of liquid (liquid to vapor expansion ratio).
- **Compressed Natural Gas (CNG)** – Natural gas stored as a gas under high pressure (3000-4000psi).

Percent LEL (%LEL) – Percent of the Lower Explosive Limit; measurement of a flammable vapor in air; determines relative risk of explosion in a flammable environment.

Propane: Odorless and colorless fuel gas typically stored as a liquefied compressed gas; the odorant Ethyl Mercaptan is added so leaks can be detected by smell. It is also known as LPG or LP Gas (Liquefied Petroleum Gas). In changing from a liquid to a gas, propane produces 270 cubic feet of vapor for every cubic foot of liquid (liquid to vapor expansion ratio). Propane is heavier than air and can collect in low lying areas. Propane gas flammable limits are approximately 2.1% to 9.7% in air.

PROCEDURES

A. General Information

- a. The goal when responding to the release of a flammable gas is to remove the fire or explosion hazard by controlling the flow of gas and ignition sources. This must be accomplished while minimizing the risk to the public and responders.
- b. If gas shutoff is successful use fog spray to dissipate the gas. If gas shutoff is not successful refer to the ERG for the safe distance to stage based on the size of the tank involved and wait for the gas company. This may mean backing the units away from the initial 330 foot staging area to a safer distance. Consider using master streams to dissipate the gas.
- c. After mitigation, restoration of gas service shall be done by gas company personnel only. Allow occupants back into the structure only after gas meter levels have been reduced to 0 % and the gas company concurs.
- d. Consider lock out/tag out procedures.

B. Types of Flammable Gas Incidents

There are many flammable gases that could be encountered. However, there are three (3) general types of incidents. Although the combination of the flammable gas and the situation generates specific considerations, this general incident procedure can be used for all flammable gas responses.

- a. Open Space Release with No Fire
 - i. Flammable gases when released in open spaces may present a flammability hazard, especially if the gas is heavier than air. Examples of such an incident include:
 - a) Incidents involving vehicles fueled by or transporting flammable gases
 - b) Odor of flammable gas outside
 - c) Flammable gas pipeline struck/damaged
 - d) Pressure relief device, or overfill protection device activation or failure

- b. Enclosed Space Release with No Fire
 - i. Flammable gases present an increased risk for a catastrophic explosive ignition when released into a confined area. Examples of such an incident include:
 - a) Odor of flammable gas inside a structure
 - b) Flammable gas migrating into a structure
 - c. Flammable Gas Release with Fire
 - i. Fires that are fed by a flammable gas should not be extinguished until the gas supply is controlled. In some cases, this may not be recognized until after normal fire suppression operations are undertaken. Examples of such an incident include:
 - a) Flammable gas fed fire in a structure
 - b) Flammable gas fed fire outside a structure including vehicles
 - c) Reported explosion involving flammable gas
- C. Initial Apparatus Placement
- a. Apparatus should be positioned outside the hazard area (Hot Zone) so that fire suppression and rescue operations can be rapidly undertaken should an explosion or ignition occur. **The recommended initial isolation distance (DOT ERG Guide #115) is 100 meters or 330 feet.** Units should not be committed inside the Hot Zone where an explosion might kill or injure responders. Collapse zones and overhead hazards must be considered. Positioning should combine barrier protection and water supply considerations. Formal, remote staging should be considered for significant incidents.
 - b. 1st Engine - Initially stage upwind and uphill outside of the hot zone (330Ft./100M) with a view of the incident if possible.
 - c. 2nd Engine should stage at a water source upwind and uphill outside of the hot zone (330Ft./100M).
 - d. 1st ambulance - Position with the 1st engine for operations but in such a way the vehicle can be used for treatment/transport of potential patients.
 - e. 1st Ladder truck - Initially stage upwind and uphill outside of the hot zone (330Ft./100M) in a manner that allows for a rapid transition to defensive fire suppression tactics if necessary.
 - f. Members responding directly to the scene are to park outside of the hot zone (330Ft./100M) in a manner not to impede apparatus.
 - g. All other apparatus is to stage 500' prior to the reported incident in their direction of travel.
- D. Establish Hazard Zones
- a. An initial Hot Zone should be established and all unprotected persons removed from this area.
 - b. The size of this Hot Zone should include the entire structure and any attached structures and/or at least 330 feet (100 meters) from the release (as recommended by the DOT ERG, Guides "Gases NOS").
 - c. A Warm Zone should be established at logical control points for pedestrian and vehicle traffic, but at least twice the size of the Hot Zone.
- E. Take steps to identify flammable gas and its properties.
- a. Natural gas - presence of gas distribution such as meters and pipelines.
 - b. Propane - presence of compressed gas cylinders
 - c. Industrial gases such as acetylene
 - d. Notify appropriate utility/fuel supplier**

- F. Incident Operations (leak without fire)
- a. Conduct/coordinate building and area evacuation if an odor of flammable gas is confirmed or any release is suspected. Any patients found within the Hot Zone should be extricated rapidly and removed to an EMS treatment area.
 - b. Structural Firefighter Protective Clothing (SFFPC) and Self-Contained Breathing Apparatus (SCBA) are required when conducting operations within the established Hot Zone area.
 - c. Maintain required “2-in, 2-out” personnel or establish Rapid Intervention Crew while personnel operate within the Hot Zone.
 - d. Utilize proper detection equipment - Combustible Gas Instruments (CGI), to measure flammability hazard. Standard 4 gas meter with LEL/LFL (properly start the meter in fresh air)
 - i. LEL values > 10% - SFFPC and SCBA required.
 - ii. LEL values > 20% - Fire/EMS Department personnel shall evacuate the area and defensive tactics and ventilation will be undertaken.
 - e. Conduct initial operations to affect immediate rescues and protect egress; attack lines should not be initially committed within the Hot Zone, and remote master streams should be considered.
 - f. Eliminate possible ignition sources systematically and safely from the area of highest hazard to the area of lesser hazard.
 - g. Determine location of emergency shut-offs or control valves.
 - h. Control the source of the release from a remote above ground control valve; below ground valves are only to be used by gas utility personnel.
 - i. Fire/EMS Department personnel are not authorized to dig for, clamp, pinch, or otherwise control the flow of gas from the point of the release. Static discharge from the point of the release may ignite the released gas causing an explosion. If needed, this control will be completed by personnel from the gas utility or hazardous materials units.
 - i. Using CGI’s, evaluate surrounding structures for migration of flammable gas; if found, consider additional resources and adjust tactics accordingly.
 - j. When the gas release is controlled, ventilate buildings by opening doors and windows. Use of any powered ventilation appliances such as fans shall be after area is cleared using CGI.
- G. Incident Operations (flammable gas fed fire/post explosion fire)
- a. Structural Firefighter Protective Clothing (SFFPC) and Self-Contained Breathing Apparatus (SCBA) are required when conducting operations within the established Hot Zone area.
 - b. Maintain required “2-in, 2-out” personnel or establish Rapid Intervention Crew while personnel operate within the Hot Zone.
 - c. Conduct initial operations to affect immediate rescues and protect egress;
 - d. Fires that are fed by a flammable gas shall not be extinguished until the gas supply is controlled.
 - i. If gas flow cannot be shut off, do not attempt to extinguish fire.
 - e. Protect exposures until flow of gas can be controlled or product is expelled.
 - i. Consider use of unmanned monitors and master streams.
 - f. Cool any exposed flammable gas cylinders with direct application of water. Concentrate streams at the top of cylinders where the vapor space exists.
 - i. Don’t assume that operating relief vents will prevent a BLEVE. A BLEVE can occur any time direct flame impinges on a vapor space.

- ii. If the relief valve is operating, do not extinguish the flame. If fire is impinging on the tank, withdraw crews.

H. **Guide #115 of the Department of Transportation Emergency Response Guide (ERG)** and the attached **Flammable Gases Response Checklist** can be used to guide incident operations.

RESPONSIBILITY

It is the responsibility of all Scarborough Fire Department members to adhere to this policy.

REFERENCES

- A. Norwich Fire Department
- B. Phoenix Fire Department
- C. Prince George's County Fire/EMS Department
- D. Rules of Engagement for Structural Firefighting
- E. 2016 Emergency Response Guide