Guide to Handling, Gas Fires, Leaks, and Carbon Monoxide Emergencies
Acknowledgements

“Safety in the public interest”
Production of this video was made possible
by a grant from PSE&G

Many thanks to the production team:
Jim Driscoll
Parish Smith

Advisors:
William Pomeroy
Scott DeGraw
Neil Davis
Rick Stelligwerf
Paul Pirro
Kevin Carr
GMP Consulting, Inc.
Wyckoff Fire Department

And special thanks to the
Bergen County Law & Public Safety Institute
for allowing the use of their training facilities for filming.

Copies of the video and training guide are available from the
Public Safety Foundation
281 Campgaw Road • Mahwah, New Jersey 07430
(201) 785-6075 • Fax (201) 785-6093
**Introduction**

This booklet has been prepared for use by Emergency Service Personnel as a guide when encountering gas fires, leaks, and carbon monoxide incidents.

Since the Emergency Services usually arrive at the scene before gas emergency crews, they should know in advance how to eliminate or control potential hazards.

There is also information about fenced-in properties, such as unmanned metering stations, that are usually located in suburban areas.

The booklet contains a brief background on gas distribution, its characteristics, and how it is delivered to the communities it serves.

Suggestions are given on what to do when fighting a fire where natural gas facilities are involved… either as a precautionary measure… or when gas is actively contributing to a fire. Fires from any cause may be aggravated by gas flowing from broken pipes or other facilities located near a fire.

There are also some suggestions for Emergency Services when called to a scene where gas odors or leaks are believed to exist where no active fire is involved.

You will find basic information on typical meter and regulator installations made in accordance with accepted standards.

Gas utility employees are not fire-fighting experts, but because of their day-to-day working knowledge of the characteristics of gas and its manner of distribution, they can impart vital and helpful information. This will make your job easier if, and when, the need arises.
The gas industry stresses safety at all times. This is a major reason why it has earned the enviable position of safely delivering its product for customers to enjoy the benefits of gas and gas appliances.

This booklet, too, strives for that goal. Remember, Gas Company personnel may be available for meeting with emergency personnel to discuss problems of mutual interest.

The first part of the booklet will discuss gas leaks and fires. The second part will discuss carbon monoxide.
Part I

What to Do . . . First

• When there is a possibility that gas may be involved in a fire or actually is contributing to a fire, notify the Utility immediately. For direct contact, call the special utility emergency telephone number.

• Gas emergency service is available 24 hours a day, seven days a week. Provide the location and give details – whether inside or outside – as well as your name and location.

When Gas is Escaping Outside a Building

• If gas is escaping from the ground, excavation, or an open pipe outside a building, notify the Utility immediately.

• Areas surrounding the location should be cleared, roped off, or barricaded to make the location safe.

• Extinguish all open flames. Prohibit smoking. Restrict use of electronic devices (i.e., pagers and cellular telephones) while working in the vicinity of the gas leak. Check surrounding buildings, basements in particular, for any presence of gas odor. Restrict or reroute all traffic until personnel from the Gas Company are able to control the gas flow.

• If a fire or gas leak situation requires gas to be shut off immediately and the Fire Department cannot wait any longer for Gas Company personnel to respond, shut the above-ground service valve.

• Emergency responders should never operate underground valves. Only Gas Company personnel should operate underground valves.
• For services feeding multiple dwellings, it is preferred that aboveground service valves are not operated without utility assistance.

**Damage to Gas Facilities**

• Under the New Jersey Underground Facility Protection Law (a.k.a. “Call Before You Dig”), all excavators are required to call 1-800-272-1000 to have utility facilities marked out prior to excavating.

• While responding to any damage to gas facilities, Fire Department personnel should make every effort to keep the area safe while waiting for Gas Company assistance. This includes checking the extent of the gas leak in the immediate area and monitoring buildings on both sides of the street, since multiple leaks could become active at the same time.

• Under no circumstances should the Fire Department attempt to make a repair of any damage to gas facilities. Only Gas Company personnel have the proper personal protective equipment and knowledge to safely control the gas flow.

• After any damage has occurred, excavators should be reminded of their responsibility to use the One-Call Program for all future excavating.

**When Gas is Burning Out of Doors**

• Personnel, other than those from the Gas Company, should make no attempt to extinguish a gas fire unless life is in jeopardy.

• Burning gas will not explode. When gas is believed to be involved in a fire, don’t assume the fire is consuming all of the gas. Always check nearby buildings and sewers to make sure gas is not migrating. Clear the danger area and rope or barricade it. Notify the Gas
Company Immediately. **Never** operate an underground gas valve. Operating the wrong valve could further endanger life or property. Leave the decision to operate valves to Gas Company personnel. They are properly trained in operating gas valves and handling gas emergency procedures.

- Spray any surrounding combustibles if there is danger of ignition. If it is necessary to extinguish a fire because life is in jeopardy, use dry chemical and water fogging equipment. Do not direct a solid water stream onto burning gas at the source of ignition.

**Remember - burning gas will not explode.**

**When Escaping Gas Is Found In Buildings**

- When escaping gas is found in buildings, shut off the meters and notify the Gas Company immediately. Ventilate the building by opening the doors and windows. Do not turn electrical switches or appliances on or off. Rubber boots should be used when entering a building where a gas leak is suspected. Shoes with nails could create a spark. Walking across a carpet could result in the development of a static electrical charge or spark. Turn on flashlights before entering the building. Clear the buildings of occupants if a strong odor is found.

**When Escaping Gas Is Burning In Buildings**

- When escaping gas is burning in buildings, notify the Gas Company immediately. The official in charge should determine if gas can be shut off at the service entrance inside the building, at the regulator (in pressure systems), or at the meter, depending on the type of installation. *(Refer to Pages 10-12)*. If there is an above ground valve at one or more of these locations, the valve can be shut off with a wrench.
• Reliance on the Gas Company to help evaluate the proper action is the best procedure. If the supply cannot safely be shut off, keep the surrounding combustibles wet by spraying until the Company emergency crews can control the flowing gas.

• It is possible that turning off the gas in certain industrial or commercial areas might create further hazards or seriously interrupt important and costly industrial processes.

• Never turn on a valve that was previously shut off. Leave this to the Gas Company.

When Inside Gas Piping or Meters Are Endangered

• If it appears that the inside gas piping or meter may be endangered from the fire, notify the Gas Company immediately. The Gas Company is best equipped to shut off the supply of gas. However, if safety requires immediate action, the official in charge may proceed with shutting off the gas supply at an inside shut-off valve, if it can be done without exposing the person to undue hazard.

When Gas Burning Is Out Of Control

• In rare cases, gas may be found to be burning out of control at an appliance. In such cases, shut off the valve on the line to the appliance if it is accessible, or shut off the gas at the meter. In an apartment house where there may be difficulty in selecting the proper meter there is usually a valve where the gas service enters the building (service entrance) which can be shut off. Again, notify the Gas Company immediately and explain to the serviceperson upon arrival what you have done. Do not turn on the valve at the service entrance, the meter, or appliance once it has been shut off; leave this to the Gas Company.
Gas in Manholes, Vaults, and Sewers

1. Notify the Gas Company immediately. Company personnel can assist in identifying and determining the source of gas involved. They have the ability to distinguish between pipeline gas, gasoline vapors, sewer gas and cable-burnout gases.

2. Do not attempt to extinguish flames if gas becomes ignited, unless life is in jeopardy. Burning gas will not explode.

3. Do not park near or over a manhole or catch basin where there is a suspected gas leak.

4. Spray any burning or combustible material in the area of the vault.

5. Rope or barricade a safe area around the vault. Keep bystanders away. Prohibit smoking. Restrict or reroute traffic.

6. Take precautions to prevent sparks that may be caused when manhole covers are removed.

7. Never enter a manhole, vault, or sewer if gasses or vapors are even suspected to be present. Always have the atmosphere of a manhole, vault, or sewer checked with a combustible gas detector before anyone enters.

8. Ventilate manholes by natural means.

9. If required, entrance should follow. Never enter a manhole without being equipped with a harness and an attached lifeline with standby assistance and monitoring equipment available.
10. Check basements and rooms of adjoining buildings on both sides of the street for any evidence of gas; if found, ventilate by opening windows and doors. Shut off open flame devices but do not operate electrical switches or appliances. If natural gas is involved, then handle as suggested in the paragraph on page 5 titled “When Escaping Gas Is Found in Buildings.”

11. Odors can come from many hydrocarbon-based sources such as gasoline, penetrating oil, marsh and sewer gas, industrial gases, and house paint. Gas distributed through pipes has a distinctive odor and can almost always be recognized by smell. There are many types of gas detection instruments and some municipal departments are equipped with them. In any event, in the investigation of possible gas leakage of any sort, notify the Gas Company immediately. The company will be glad to help. Service personnel are equipped with and trained in the use of combustible gas indicators. Properly used, this device is a positive means of detection.

Dos and Don’ts When Gas Is Involved:

Do… communicate openly with utility representatives, EMS and other emergency response personnel.

Do… provide a summary of Fire Department actions taken prior to arrival of other emergency responders.

Do… discuss respective responsibilities and recommended actions with other emergency responders.

Do… keep the public away from the vicinity of gas leak hazards.
Don’t… Forget to notify the Gas Company immediately for emergency response!

Don’t… allow open flames, smoking or spark-producing devices in open or closed areas where the presence of combustible gas is suspected.

Don’t… ring doorbells, operate electrical switches or appliances, or use the telephone in areas where the presence of combustible gas is suspected.

Don’t… open or close an underground gas valve at any time. (Leave this to the Gas Company)

Don’t… under any condition use canister-type gas masks when gas is involved. Only self-contained (SCBA) gas masks should be used.

Don’t… make any effort to extinguish gas flames unless life is in jeopardy (Use spray only to protect surrounding area.)

Some Illustrations for Your Convenience

• The diagrams on the following pages illustrate national standards in the installation of meters and regulators.

• Because conditions vary, it is best to rely on your local gas distribution department for more specific information. They will be glad to describe the types of arrangements most common to the locality and any special additional facts you might need to know about local problems.

• It should be noted also that there are rural and suburban areas where gas utilities do not distribute gas. Here the usual gas service is by bottled gas companies—distributing liquefied propane gas. The information contained in this booklet is not applicable in these instances.
• This booklet does not attempt to cover problems that might arise from the facilities of interstate natural gas pipeline companies or those companies distributing liquefied propane gas. These companies, too, welcome coordination with police and fire fighting units, and they have their own special equipment and service to place at your disposal.

**Remember… gas under control is harmless**

**Single Meter Installation**

• Typical service and meter facilities on low (utilization) pressure system (approximately 1/4 lb. per square inch).

**Single Meter Installation (no basement slab type construction)**

• This type of service installation will be found in residences which have no basement. The meter may be located in a utility room, kitchen, or garage.

**Multiple Meter Installation**

• Service and meter facilitation on low (utilization) pressure system (approximately 1/4 lb. per square inch) – most commonly found in multiple household dwellings.
• Shutting off the valve at the meter would control the gas supply to the apartment, but the shut-off valve at the service entrance should be closed to control the gas supply to the group of meters or the building as whole.

**Meters in Upper Room**

• Service and meter facilitation on low (utilization) pressure system (approximately 1/4 lb. per square inch) where service enters the building through the basement wall and meters are in an upper room such as a utility room, pantry, or kitchen.

• Shutting off the valve at the meter would control the gas supply, but the shut-off valve at the service entrance should be closed to control the gas supply to the group of meters or the building as whole.

**Intermediate and High Pressure Services (with single meter installation and service regulator)**

• In this type of service, gas enters the basement at intermediate or high pressure. It goes through a regulator that reduces the pressure to approximately 1/4 lb.
per square inch and then goes through the gas meter prior to entering the house piping.

• On indoor meters, this type of gas service van is recognized from the outside by a vent extending through the foundation wall as well as at the regulator inside the building.

• For outdoor installations the regulator is clearly visible.

• Gas can be shut off at the shut-off valve at the service entrance (in multiple meter installations, the shut-off at the meter controls the gas supply to the apartment or area only.)

Gas Metering and Regulating Stations

• Throughout the area supplied with gas by the Gas Company, there are many metering and regulating stations. The facilities at these stations — including the measurement and regulating systems, the electronic computing and data transmission equipment, and the miscellaneous auxiliaries, are installed in fireproof...
structures. The entire property is surrounded with fencing and locked gates.

- These stations, which are unattended, are equipped with controls and instruments which transmit operating data and certain emergency alarms to the attention of the gas dispatcher located at a central headquarters. It should be noted, however, that fires or the functioning of blow-off valves in certain parts of the installation might not, in some instances, be monitored by the dispatcher. The safety blow-off valves make a loud whistling noise if they operate. If fire or police personnel notice this condition, they should notify the Gas Company immediately. Trained specialists will be dispatched to the station to correct the problem.

- Should fire be detected, the Gas Company should be notified immediately. Because the operation of these stations involves specialized procedures, the Company requests fire fighting personnel cooperate with its representatives to control the situation in such a manner as to minimize inconvenience to our customers and damage to the facilities. It is essential that the control and operation of valves, electric switches, and the auxiliary equipment be left to the Gas Company employees.

- In cases of an emergency or other condition at a Metering and Regulating Station requiring the attention of the Gas Company, call the special emergency telephone number, which has been furnished to all fire and police departments.
**Background of Natural Gas**

- Except for peak periods, the gas we use comes from natural gas fields in Louisiana and Texas. During the periods of heaviest demand, additional gas is obtained from various company facilities in the form of liquefied natural gas, and propane.

- Natural gas is tapped from vast underground reservoirs created by nature over millions of years. Sometimes it is obtained as a by-product of oil wells. After being cleared of impurities, it is transported by pipeline companies across prairies, swamps, mountains, and rivers. It is then sold to utilities that distribute it through underground systems of cast iron, steel and plastic supply pipes called mains and services. All plastic pipe is installed underground, none inside of buildings. Service pipes run the gas from the mains to the customers.

- In urban areas, the most common distribution is through low-pressure systems *(approximately 1/4 lb. per square inch)*. The gas goes from the main in the street through the service pipe and a meter on the customer’s premise to the gas burning appliances. Gas may also be distributed at medium or high pressure. In these cases, the pressure is reduced by a regulator before the gas reaches the meter and the customer’s piping system.

- Gas is used for residential heating, cooking, water heating, refrigeration, incineration, clothes drying, and air conditioning. Commercial customers such as hotels, restaurants, and schools also use gas for all of these purposes. It is used by experimental scientists and in industry for thousands of purposes ranging from heat treating of metals to the manufacture of chemicals.

- Natural gas is composed principally of methane. It is non-toxic and cannot pose any hazard of asphyxiation.
unless it displaces the oxygen in a confined area. Because it is lighter than air, and thus rises, it will normally escape. In its natural state it is odorless, but chemicals are added to give it a strong odor so it can be detected even when concentrations are very low. It has a heat content of 1020 BTU or more per cubic foot. Mixtures of 5% to 15% of this gas with air are explosive. It can be detected by its characteristic gaseous odor or by gas detection instruments.

• Gas Utilities are subject to the supervision of a Regulatory Board of their state and the federal government. They regulate in such matters as specifications for gas piping and maintenance, heating valve, and gas pressure. The requirements of other regulatory authorities must also be met.

• Gas Utilities are deeply concerned about safety. They are continually meeting technological changes and working with such bodies as the American National Standards Institute, and the American Gas Association to develop safe practices.

• The materials used and the installation of gas mains and related facilities must conform to rigid requirements of state and federal codes, patterned after codes developed by the gas industry in cooperation with the American Gas Association, the American National Standards Institute, the National Fire Protection Association, and other nationally recognized bodies such as the Department of Transportation (DOT), the Office of Pipeline Safety (OPS), and the Department of Labor, through the Occupational Safety and Health Act (OSHA). Where no local or state regulations govern its activities, the industry itself is continually striving to develop and conform to good practices.

• The seal of certification of the laboratories of the American Gas Association is given to appliances that meet the rigid specifications of this national testing organization as to safety and dependability.
• Gas utilities have safety programs that include, among many other things, leak detections and repair. Such programs are part of their daily operational activities. Some of the methods of leak detection are periodic surveys, walking surveys of out services with electronically equipped test units; and testing of exposed pipes and fittings. These programs, coupled with safe practices, around the clock emergency service, and good communications have been instrumental to the industry’s enviable safety record.

**Notice:** The information contained in this booklet is intended to serve only as a guideline for otherwise trained and skilled public safety personnel. While this information is believed to be accurate as of the date written, we do not warrant its accuracy and completeness and specifically disclaim any liability or responsibility what so ever for its application in any given situation.

• The Gas Company asks its customers to call immediately when they detect unusual odors that they suspect may be gas. There should be no delay in making the call. Telephone operators are on duty, and emergency service is available 24 hours a day, every day of the year. Response for emergency service is available 24 hours a day, every day of the year. Fire and police groups are requested to pass along this message to the public when appropriate.
Comparison of Combustible Substances

<table>
<thead>
<tr>
<th></th>
<th>Approximate Flammability (% mix with air)</th>
<th>Specific Gravity (Air=1.0)</th>
<th>Approximate Temperature in ºF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>4.0</td>
<td>0.60</td>
<td>1163</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>4.0-75.0</td>
<td>0.07</td>
<td>1076</td>
</tr>
<tr>
<td>Propane</td>
<td>2.2-9.5</td>
<td>1.56</td>
<td>957</td>
</tr>
<tr>
<td>Butane</td>
<td>1.9 - 8.5</td>
<td>2.01</td>
<td>912</td>
</tr>
<tr>
<td>Gasoline</td>
<td>1.4 - 76</td>
<td>3.00</td>
<td>632</td>
</tr>
</tbody>
</table>

**Note:** A specific gravity of less than 1, the material is lighter than air and will rise. A specific gravity greater than 1, the material will sink and tend to collect in low spots.

**Part II**

**Carbon Monoxide**

- Carbon monoxide, also known as CO, is a poisonous colorless, odorless, tasteless gas that could cause serious illness or death if inhaled over a long period of time. CO is explosive within the range of 12% to 74%, although concentrations as low as 1% (10,000 ppm) are fatal if inhaled over a few minutes.

**How is CO created?**

- Consider the chemical formula for the complete combustion of a burned fuel, such as oil, natural gas, wood, or coal.

\[
\text{CH}_4 + 2\text{(O}_2\text{)} = \text{CO}_2 + 2\text{(H}_2\text{O})
\]

(FUEL) + (OXYGEN) = (CARBON DIOXIDE) + (WATER VAPOR)
• If you take away one molecule of oxygen, then there is not enough oxygen to make CO2, and CO is created as a result of the incomplete combustion. A small percentage of CO is created with every combustion process. With less oxygen available, the percentage of CO significantly increases.

How is CO harmful?

• CO enters the body through the lungs during normal breathing. It becomes attached to hemoglobin in the blood and interferes with the distribution of oxygen to vital organs in the body. Depending upon the amount inhaled, CO may cause flu-like symptoms that worsen over time. These symptoms include headache, fatigue, confusion, disorientation, dizziness and nausea. Age, overall health, length of exposure and concentration of the exposure (measured in parts per million) all determine the degree to which a person will get sick.

The chart below shows typical symptoms based on concentration and time of exposure.

<table>
<thead>
<tr>
<th>Concentration of CO in Air</th>
<th>Inhalation Time and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 ppm</td>
<td>Maximum allowable concentration for continuous exposure in an 8 hour period, in accordance with OSHA standards.</td>
</tr>
<tr>
<td>200 ppm</td>
<td>Slight headache, fatigue, dizziness and nausea after 2 to 3 hrs.</td>
</tr>
<tr>
<td>400 ppm</td>
<td>Frontal headaches within 1 to 2 hours. Life threatening after 3 hrs.</td>
</tr>
<tr>
<td>800 ppm</td>
<td>Dizziness, nausea and convulsions within 45 min. Unconsciousness occurs within 2 hrs. Death occurs within 2-3 hrs.</td>
</tr>
<tr>
<td>1,600 ppm</td>
<td>Headache, dizziness and nausea within 20 min. Death occurs within 1 hr.</td>
</tr>
</tbody>
</table>
Creation of CO Hazards

Warning signs that CO may be present include:

- Presence of aldehydes, which produce an acrid odor similar to vehicle exhaust.
- Condensation on walls and windows.
- Dead houseplants.
- Lethargic pets.
- The best way for an emergency responder to detect CO in the atmosphere is through the use of an approved portable CO detection instrument, calibrated according to manufacturer instructions. This instrument is effective for monitoring for personal safety, measuring atmospheric CO concentrations for further actions, and locating and mitigating major sources of CO.

FD Response for CO

- Prepare to enter dangerous atmosphere (depending on severity of call).
- Determine danger level.
- Evacuate depending on condition of occupants and level of CO in atmosphere.
- Use instrument to monitor increase of CO readings.
- Perform match test to determine if there is flue spillage from a heating appliance.
- Locate and shut off source of CO.
Identification of CO Hazards

- Many causes of CO may be prevented if occupants are able to recognize warning signs in advance.

- The following are examples of CO hazards:
  
  - Improper installation:
    
    Inadequate air supply to an appliance
    
    Appliance out of adjustment
  
  - Chimney and Venting Problems
    
    Flue/Chimney Blockage
    
    Animal Nests in Chimney
    
    Poor Drafting of Flue Products
    
    Disconnected/Corroding Vent Pipe
• Misuse of Fuel-burning Equipment
  
  Distress Heating – using a stove to heat an apartment
  
  Motor Vehicle Idling in a Garage
  
  Charcoal Grilling Indoors

How to Avoid CO Hazards

• Have Chimneys and Vented Appliances Inspected Periodically

• Eliminate Improper Installations

• Recognize Signs of Equipment Failure

• Avoid Misuse

• Install CO Detectors for Additional Protection