WESTERN RESERVE JOINT FIRE DISTRICT
SOP FOR RESPONDING TO
NATURAL GAS EMERGENCIES

Natural gas is primarily Methane (over 90%) and will behave much like pure Methane. It contains other gases as well, including Ethane (up to 5%), carbon dioxide and nitrogen. The presence of Ethane in natural gas can sometimes be used by fire departments and utility companies to pin point the source of persistent "gas" odors that have no apparent source.

Natural gas coming from a well is colorless and odorless, and yet everyone has yet smelled gas. That is because an odorant is added at a precise rate, so that as little as 1% of gas in the air can be detected. This odorant is generally mercaptan compounded with sulfides. As little as one quarter pound of odorant can treat up to one million cubic feet of natural gas.

However, firefighters must remember that the odorant tends to be "lost" as it travels long distances with the gas. Some of it breaks down chemically, while some of it condenses on the inside of the pipeline. At various points along its route, odorant must be added.
Additionally, firefighters should remember that natural gas is lighter than air, as its density is .60. For that reason, as gas travels across land, it can also lose its odor.

Natural gas emergencies can be divided into three basic categories: Inside leaks, outside leaks, and leaks resulting in fires. While each kind has its own dangers and unusual concerns, the greatest danger results from gas leaks inside structures, because of the potential for an explosion. Outside leaks are the next most dangerous, as gas may enter buildings or utility manholes with the potential for possible explosions.

A. Tactics at Inside Leaks (No Fire)

In the event natural gas is leaking inside a structure, the Incident Commander must:

- Notify the utility and request an estimated time of arrival;
- Determine the intensity of the leak, and when first noticed;
- Determine the extent of evacuation required;
- Eliminate all sources of ignition;
- Locate the sources of ignition;
- Conduct search and ventilate.

Generally, the determination of the intensity and the need for evacuation will be determined by the Incident Commander. Expect the worst if met by a heavy odor of gas. Expose as few people as possible, meaning prompt evacuation where necessary. For faint odors, always check the condition of pilot lights as the first action. If a leak is suspected, pouring soapy water over the

suspected area can confirm its presence. When a leak is found, always try to isolate the area as close to the leak as possible. The problem can be stopped by turning the quarter-turn appliance valve nearby, leaving the rest of the premises unaffected. If that is not possible, move back along the supply piping to the next point of control, generally another quarter-turn valve just past the meter, called the meter wing cock.

In multiple-tenant occupancies, such as an apartment houses or shopping centers, the service should be turned off for the area of the leak. While the master valve can be used to stop the flow of gas to all tenants, this valve should not be used with indiscretion. A minor leak at an appliance does not warrant shutting off the gas to multiple tenants. Conversely, if there is a major leak and difficulty is experienced in determining which meter controls which apartment or tenant area, the service cock provides the fastest means of control.

Since natural gas has a flammable (explosive) range of 4 to 14 percent in the air, the mixture must be kept out of this range. Remember, the odorant permits us to smell as low as one percent gas in the area, but one percent is still 25 percent of a lower explosive range of gas - 4 percent. Only three percent more gas is needed to create the danger of explosion. All that is required to ignite an explosive gas/air mixture is the tiniest of sparks or an open flame. A spark that occurs inside a light switch when it is thrown on or off, or the static spark created from walking across the carpet and touching a metallic object can ignite this gas/air mixture. Do not thrown any switches or ring doorbells in gaseous areas. Do not use a radio to call for help from within the gas area. It is best to leave the radio outside.

Anything electrical is a potential source of ignition. Attempt to disconnect power to the building if it can be done safely. This may involve tripping the main breaker (if it's remote from the gas area), or cutting the service entrance wires outside of the building. It is best not to attempt pulling the meter, because it is usually connected by pipe to the inside of the building where the gas is located. Gas sometimes drifts to the meter pan and can be ignited by the meter being pulled. Remember, don't throw a switch inside the area with gas around. When outside at the meter, always assume there is gas inside the pan.

Locating the source and stopping the flow, and searching and venting, require a great deal of input at the scene. Generally, venting should be done at the upper areas, as gas is lighter than air. Don't forget to vent blind spaces at the top of the structure, including attics or cocklofts. Opening windows is generally sufficient. If additional help is needed, positive pressure ventilation (only) may be used.

Those searching the building for occupants, the source of the leak, and the location of the shut offs can usually vent at the same time. Do not over commit manpower - send in only sufficient personnel to do the job. Everyone else should remain at a safe location, such as on the opposite side of a pumper from the building.

When to vent depends on several factors that must be determined in the field. Generally, begin venting as soon as possible, but weigh how large a leak is present. The IC must determine the sources of ignition and their ability to be controlled, and the status of the gas/air mixture - is it below, within, or above the flammable range? If the combustible gas indicator shows a ratio above

the explosive range, venting should be delayed until all sources of ignition are removed.

Of all the decisions to be made, where to stop the leak - inside or outside - has the most variables. The practicality of either means must be determined, and a curb cock is not always present. The decision to send personnel inside should be made after considering the risks. Whether it is natural gas, LP gas, gasoline vapors or any other flammable vapors, unless there is a known life hazard present, treat the situation as the potential time bomb it is and expect the worst. Again, use a minimum number of people needed to do the job, and make sure they are properly trained and equipped with SCBA, forcible entry tools, lights (explosion proof), and an 18 or 24 inch pipe wrench.

At any gas emergency, a fire line should be stretched and manned. The line should be long enough to cover the entire building. It should not be placed where it is exposed to potential blast damage. With this in mind, the apparatus should be positioned to provide the most shielding effect for the pump operators and nonessential personnel. The water supply should be consistent with the expected involvement. Remember, the building is being filled with a flammable gas and heavy fire should be expected, although it may be localized near the source or gas after any blast.

B. Tactics at Outside Leaks

Leaks outside structures, although not as common as inside leaks, can be just as dangerous. Gas takes the path of least resistance as it tries to escape to the atmosphere. Quite often the path is along the gas service pipe or other underground lines into buildings or manholes. This migration is insidious because, as the gas travels through the ground, it intends to be deodorized as the soil filters out the odorant. Underground leaks tend to migrate great distances before discovery. This is especially true in areas that are largely paved over. A well maintained combustible gas indicator (explosion meter) is the only way to safely check suspected areas. If possible, District firefighters should use two separate meters to check each area, since any single meter could unknowingly be broken.

Winter is particularly dangerous. During periods of repeated freeze and thaw cycles, the gas lines are subject to great stress and may fail more often. In the event of an underground leak, basements of all buildings in the surrounding area should be checked. Use a reliable gas meter, and pay particular attention to the areas where service lines penetrate the foundation. When positioning apparatus, make sure that neither the apparatus nor the operator is over a manhole.

Many outside leaks are caused by contractors excavating in the area. Generally, the safest course of action is to:

- Notify the utility;

- Approach from upwind;
- Stop sources of ignition;

- Await the utility.

Do not touch any valves located in the street. If absolutely necessary, you can stop leaks in smaller, low pressure steel lines by using various pluggings and patching devices, but this should be done only as a last resort. Under no circumstances, however, should department personnel ever attempt to stop a leak on plastic pipe. Whenever any fluid travels through piping, it creates a static electric charge on that pipe. On steel pipe, the current is drawn off and safety dissipated to ground by the conductive pipe itself. Plastic pipe is an insulator, and it is probable that the pipe will have a static charge of up to 30,000 volts. A person grabbing the pipe to apply a plug will likely discharge the current, creating a spark, and igniting the gas.

C. Tactics at Fires Involving Natural Gas

Operations at fires should be similar at in-door or out-door operations. As always, the first steps are:

- Call the utility company;
- Control evacuation;
- Protect exposures;
- Let the fire burn until the supplied gas is shut off.

Small fires may be extinguished with a dry chemical or CO-2 if necessary, to get a valve or save life. For larger fires, fog streams can be used to approach the valves. Use care when placing hose streams where excavations have erupted the gas line. Try to keep unnecessary water out of the pit, because utility crews may need to get in there to stop the leak and the water could compound the problem.

D. Unusual Situations Involving Natural Gas

Firefighters should be aware that natural gas is lighter than air and rises rapidly, most of the time. An extreme and unusual circumstance occurs when "peak shaving gas" (natural gas mixed with LP gas), is encountered. During extremely cold weather, especially for extended periods, the peak demand for gas is reached. In some gases, pipelines and stored gas are unable to meet this peaked demand. During this period, some utility companies mix in LP gas to make up the difference between supply and demand.

The vapor density of Propane is 1.52. For Butane it is 2.01. Depending upon how much of these gases are added to the natural gas, the vapor density of this "peaked shaving" gas will get heavier. At times, it may approach 1.0 which is the weight of the air. This may mean that the gas does not rise as quickly as suspected, or may require mechanical ventilation.

Date: 07/06/2011