GAS EMERGENCIES

NATURAL GAS
LPG

OIL BURNERS

ODORS OF SMOKE

CO ALARMS
CO FORMS

GAS LEAKS

I. Natural Gas

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 if 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. A lea, at the odorant area is a flammable liquid spill and a very odorous one at that.

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 and 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 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 suspect 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 the 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. Something small as 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. Also, beware of the district's portable radios. Do not use a radio to call for help from within the gas area because most radios are not rated for flammable atmospheres. 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 ther eis 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, 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 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. 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, as not as common as inside leaks, can be just as dangerous. That is because if the 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, 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 indicator, 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 cause 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 doen only as a last resort. Under no circumstances, however, should department personnel ever attempt to stop a leak on <u>plastic</u> 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. <u>Tactics at Fires Involving Natural Gas</u>

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 Halon 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 evacuations 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. <u>Unusual Situations Involving Natural Gas</u>

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.

II. Liquified Petroleum Gas

Liquified petroleum gas is a mixture of several of the hydrocarbon gases, mostly propane but with quantities of butane and possibly ethane, mixed in as well. Pure propane is colorless and odorless. In order to make leaks detectable by humans, an odorant is added, similar to natural gas. Unlike natural gas, however, propane is heavier than air and will collect in low points, possibly traveling great distances, hugging the ground as it seeks a point of ignition. Propane has a wider explosive range than gasoline, 2.1% lower explosive limit (LEL) to 9.5% upper explosive limit (UEL), and since it turns into a gas at minus 44 degrees fahrenheit, it is always ready to ignite if it finds the conditions correct.

Liquified petroleum cylinders, as their name applies, contain propane in the liquid and the gaseous state. Propane gas can easily can be compressed by putting it under pressure. If it is compressed enough, the gas turns into liquid. In doing so, it shrinks to 1/270th of its original volume as a gas. When the pressure is released, such as by opening the valve, liquid begins to boil off into a vapor. As it does, it expands back into a gas, at a rate of 270 parts for each part of the liquid that evaporates. It is this rapid expansion of liquid into gas that can wreak havoc in a confined space. Consider a leak of only one single quart of liquid propane (just slightly larger than the "bernz-o-matic" torch) in a closed area. One quart of liquid propane evaporates into 270 quarts of pure propane vapor. This vapor mixes with air in an amount up to 47 to 1 ratios (2.1% LEL) to produce 12,857 quarts of explosive gas air mixture that requires only the slightest spark to detonate. For this reason, firefighters must be extremely cautious whenever there is a leak of propane within any enclosed structure.

With reference to the vapor-air explosion previously described, most firefighters think of a BLEVE. BLEVE's are particular threats to firefighters, since they often occur after arrival of the fire department, unlike most vapor-air explosions. However, propane gas usually ignites nearly immediately, which results in a fire and no explosion, or else the occupants take steps to stop the leak and prevent ignition. Once the gas leak is ignited, however, a chain of events begins to unfold that has been repeated many times. The outcome of the event depends on the timing (and training) of the responding firefighters. Almost always, the first thing that happens after ignition of the gas is that fire exposes either a gas cylinder involved or nearby cylinders. This starts the clock ticking.

As the gas cylinder is exposed to heat, the gas within the cylinder continues to rise, as the liquid propane boils faster. At 70 degrees fahrenheit, the pressure in a propane cylinder is usually 100 psi. If the temperature goes up to 100 degrees, such as on a very hot day, or if the cylinder is heated by sunlight or fire, the pressure in the cylinder sky rockets to a 190 psi. If the temperature of the liquid were to continue to rise, so, too, would the pressure until the cylinder reached its failure point. At this point, a BLEVE would occur. A BLEVE occurs when a liquid above its boiling point is released suddenly from its container and the super heated liquid expands rapidly to its vapor. The resulting energy released is tremendous and may launch parts of the container in any direction. BLEVE's can occur with any liquid in a closed container, even water. If flammable or combustible liquids are involved, there is the additional damage caused by the fire ball. Even without this, however, the container shrapnel and scalding liquid can kill all in its path. These items can travel great distances.

BLEVE's are the result of too much heat being applied to the cylinder in the wrong location. While this heat raises the pressure inside the cylinder, it is usually not the pressure rise that directly cause the BLEVE. Most often, the cause of the loss of strength of the metal cylinder is when it is heated. In this case, the pressure pushes through the softened metal just as if it were a much thinner piece of material. Therefore, the insulation of the pressure relief valve on the cylinder will not always present a BLEVE from occurring, even though it operates and keeps the pressure inside the cylinder around 250 psi. If the metal is heated enough, it will fail at even lower pressures than that. The only way to prevent a BLEVE is to keep the metal shell from overheating.

The most likely encountered LP gas incident in the District will be the backyard barbecue.

Tactics at any LP gas incident should focus on the unpredictability of the situation. Cylinders exposed to direct flame contact, particularly when it occurs in the upper vapor spaces, and are subject to BLEVEing in as little as 10 minutes. In addition to the BLEVE hazard, there is a probability of sudden relief valve operation that can shoot a blast of fire at approaching firefighters. As in all firefighting operations, the strategy must be the same: protect life, protect exposures, then worry about extinguishment. The life hazard here may be less apparent than normal. Due to the spectacle that a well involved LP cylinder creates, civilians in close proximity usually back away on their own. The noise level can become uncomfortable in the immediate area. However, backing up 50 to 60 feet is not sufficient - <u>clear the area for at least 150 feet in all directions</u>. Structures directly exposed should be evacuated, and should include the homes on either side as well as any that abut adjoining backyards. Evacuation beyond this point is generally not necessary, since the cylinder fragments are unlikely to penetrate three framed walls. Seek some information from the homeowner regarding the cylinder's state: Home long has it been burning; how full it was and, if not plainly visible from the street, where is it in relation to the house, garage, etc.? Particularly, at leaking cylinder incidents, pay attention to open cellar windows that can let gas enter, looking for pilot lights, etc. The first engine should ensure a continuous water supply, preferably a hydrant capable of supplying three or four one and three quarter inch hand liens as a minimum. (Note: In the event of a serious escalation of the incident, at least one line will be acquired within the exposed incident, one outside protecting the structure, and one controlling the cylinder fire.)

Firefighters should approach the cylinder using all available cover to shield their advance. Firefighters should "hide" behind a parked car, the corner of the house or garage, or any other substantial object until they have been applying cooling water effectively for at least two minutes. Chances are by that time the fire will have greatly decreased the intensity and, if it is working properly, the spring loaded relief valve will have shut itself off as the hose streams cooled the cylinder.

A degree of care is warranted when selecting stream patterns. Use the reach of the stream to place some distance between you and the cylinder, at least initially. For this purpose, a straight stream or narrow fog may be useful. But as the distance between the nozzle and cylinder decreases, the angle of the fog pattern must be widened. In serious cases, where the nozzle can't hit the cylinder until the firefighter is only five or ten feet away (due to the position of the cylinder between houses, etc.), the initial attack may have to begin on a full wide fog. If too tight of pattern is used, there is a very substantial risk of knocking the cylinder over. This may cause the situation to worsen as liquid propane instead of propane vapors discharge. In addition, it is possible to chase a still burning cylinder all around the house with a hose stream, causing it to ignite other exposures.

Assuming all goes well, and the initial water application succeeds in controlling the fire, resist the temptation rush this affair by trying to close the valve manually. Chances are this attempt will not be successful. One of the first things which usually occurs after ignition is the valve handle melting off. Even with a pair of vice grips or a wrench, success is not assured. There is a rubber “O-ring” inside the valve which almost ensures a leak once it is burned away, no matter how much the valve is tight. There is a possibility the valve itself may blow out the cylinder if handled improperly after being highly heated. The best course of action at this point is simply to slow things down.

The Incident Commander must take a moment to evaluate options. What if the fire is put and the leak continues? Where will the gas accumulate? Are there any sources for re-ignition? How is the fire behaving? Is it burning steadily or subsiding slowly? Depending on the circumstances, the Incident Commander may elect to continue to allow a controlled burn, or he may elect to extinguish the fire. A fire should not be extinguished in built-up areas where gas can accumulate and find sources of ignition. On the other hand, where there is plenty of space and a good breeze blowing away from the exposures, it may be perfectly acceptable. All members should be aware of the consequences of an uncontrolled leak and know what to do about it, since quite often the fire is advertently extinguished the initial attack. In this event, continue application of fog streams to divert the gases away from danger spots (cellar windows, etc.), and dilute the gas concentration with air that is carried in the fog stream. Remember the one ally on the firefighter’s side, the container size. While 20 pound tanks can produce a sizeable fire, they are not the “eternal flame”. They have a limited supply of fuel, and without a BLEVE may burn themselves out in less than 20 minutes.

III. Oil Burners

Heating systems account for a significant number of all fires. Oil burners are also subject to failure. Most homes within the District operate on natural gas or electric heat. Nonetheless, some residential or commercial structures, especially on the North Hill utilize an oil burner.

Fuel oils come in several grades, from No. 1 to No. 6. Among the factors that determine the grade is the flash point of the oil. It would be very undesirable to have a 257 gallon tank of highly flammable liquid inside of a person’s home. Fuel oils, therefore, have flash points that are relatively safe. No 2 oil is the most common oil for one and two family homes. It has a minimum flash point of 100 degrees, but more impurities. No 4 oil may be used in mid-size applications, apartment buildings to factories, with a somewhat higher minimum flash point of 130 degrees. Even with this relatively high flash point, No. 4 oil requires no preheating. No. 5 oil also has a flash point of 130 degrees, but has more impurities than No. 4. It may be preheated to get the oil to flow easily. The heaviest heating oil is No. 65, with a minimum flash point of over 150 degrees. This requires heating to get it to burn as well as to flow smoothly. Both numbers 5 and 6 are primarily industrial oils used in large plants and apartment complexes. When the oils are stored, unused stream or hot water from the boiler is piped to heating coils within the oil storage tank. These heating pipes serve to preheat the oil at times to over 212 degrees fahrenheit. Firefighters should be very cautious when operating around these high temperature tanks and piping, as they can cause burns. Also, these oils are often above their flash point, and any release will result in flammable vapor travel looking for a source of ignition.

Since the oil burner is a relatively complex machine that requires maintenance, there are several possible problems the fire department may be called to handled. The first, probably the easiest, problem to handle is the smoking burner. Conditions that cause smoking include clogged nozzles, clogged air supplies, worn-out pump and fan motors and improper or contaminated oil supplies. The smoke may back up out of the fire box, prompting the owner to contact the fire department.

Procedures for firefighters at such an incident are relatively simply. On approach, observe the chimney for thick smoke - remember, properly operating burners burn fairly clean. On arrival, verify from the occupants the cause for alarm, make a quick size-up, and locate and turn off the emergency switch. Turn off the oil tank valve, make an examination to assure the cause was minor, and advise the owner/occupant of the need for adjustments by a qualified serviceman.

The second condition to which firefighters are called is delayed ignition, or "kick back". In this case, the thermostat calls for heat and begins the start cycle, oil and air are discharged into the fire box, but for some reason ignition does not occur immediately. Oil and vapors fill the chamber and travel up the smoke pipe, while the primary control is trying at the same time to recycle the start-up. If it is successful and does produce this source of ignition, the entire oil vapor cloud ignites almost at once. This will be accompanied by a loud thud, similar to an explosion, which may knock the smoke pipe loose from the chimney or blow open the burner door. Either one will allow smoke to enter the burner room. Burning oil may have pooled in the bottom of the fire box or run out onto the floor. If fire has extended to nearby combustibles, handle the incident as any cellar fire, keeping in mind that the burner must be controlled by shutting down power and fuel.

More often, though, the fire is confined to the burner in the immediate area. Occupants frequently report "an explosion in the cellar". Arriving units are often met by occupants reporting a loud bank and black smoke showing. At such an incident, firefighters should taken the following steps:

- Enter the basement to examine area;

- Stretch a hand line as a backup;

- Use a portable extinguisher (AFFF, dry chemical or CO-2) only if oil is burning <u>outside the burner</u>;

- Ventilate the area;

- Shut off oil at the tank;

- Examine the area for extension of fire;

- Advise the owner to call a serviceman.

If fire is burning inside the fire box, allow it to burn itself out - the use of water or dry chemical inside the fire box may cause unnecessary damage. Remember, the fire box is supposed to have fire in it; this is not abnormal. Water is particularly dangerous - water cooling hot cast iron could cause the box to crack and allow stream, hot water or both to spray firefighters.

The least common oil burner response is also the most dangerous. In the case of the "white ghost", a truly life-threatening emergency exists for both occupants and firefighters. The white ghost is a cloud of vaporizes oil and air mixture heated above its flash point and out of its container, looking for a source of ignition. It is usually produced when a burner that has been running at a peak for a long period shuts down and is very shortly called on for more heat. This is fairly common in severe cold spells. If there is a delay in the ignition, however, the air/oil mixture in a fire box is vaporized by the high heated walls of the burner, creating a fog-like mist with the smell of fuel oil. The vaporization causes the mixture to expand, often filling its surroundings with a highly flammable combination of heated oil vapor and air. If it finds an ignition source, it will cause an explosion and can blow down walls and floors.

Fire units encountering this kind of situation should take the following steps <u>immediately</u> to prevent ignition and protect life:

- Immediately evacuate the entire building;

- Do not enter the cloud for any reason;

- Shut down remote control, using SCBA and fog nozzle open in a wide pattern as protection;

- Us the fog nozzle to saturate and cool the cloud;

- Vent the area;

- Secure any other sources of ignition;

- Shut off fuel.

As with all oil burner responses, the responsible person in charge of the building should be directed, preferably in writing, to have the burner inspected by a qualified repairman.

DETERMINING ORIGINS OF "ODORS OF SMOKE"

Smoke is often regarded as one of the firefighter's worst enemies, and, in many cases, it is. Knowledgeable firefighters, however, can use smoke to their advantage if they read its message: Smoke can help firefighters determine the location and intensity of the fire and suggest possible firefighting strategies.

Black smoke suggests a presence of burning petroleum-base products. However, large volumes of dense, black smoke at the roof level of the building could signal the involvement of burning roofing materials. Lighter volumes of smoke at the same level could be the result of a defective oil burner. Light to moderate quantities of black smoke found in basements often indicate an oil burner malfunction and should prompt firefighters to bring a Class B extinguisher with them. Historically, black smoke from the interior of residential buildings often meant the presence of an accelerant, but this premise is no longer reliable because of the extensive use of plastic furnishings, appliances and piping.

Common Class A materials produce grey to light brown smoke when oxygen is present. When reduced amounts of oxygen are present, large amounts of dark grey or yellow smoke are produced. This is an indication of a potential backdraft, especially if the smoke is issuing under pressure and being drawn back into the building. Many materials produce smoke of other colors, such as compounds containing oxides of nitrogen, which give off red/blue hue, but these are likely to be found at residential or routine commercial fires.

Smoke movement can tell a firefighter about the intensity of the blaze. Heavy, rolling clouds violently twisting skyward indicate extremely hot smoke from an intense fire deep in the building. This is frequently followed by the fire igniting through openings the smoke is pouring through. Firefighters should use extreme caution when entering, to prevent being caught in the flashover.

Wispy smoke, usually light in color, indicates a fire in the incipient stage; quick use of an extinguisher should solve the problem before it poses a danger. However, be prepared to stretch a line to back up the extinguisher. Smoke settling or hanging in the low spots is known as cold smoke. It is found that fires in sprinklered areas, or where a fire is fully or partially extinguished. Fires that are partially extinguished give off great amounts of carbon monoxide, often an unrecognized danger to firefighters. The necessity of wearing SCBA is not always obvious at these kinds of fires, but is essential to protect against the odorless carbon monoxide.

Smoke often masks the seat of the blaze, making it difficult to determine the fire area. Since smoke normally rises, the lowest floor of visible smoke will usually have some fire on it. However, firefighters should make a point of checking at least one floor below this level. A small fire often originates on the lower floor, and smoke and fire spread upward before breaking out. A heavy smoke condition present throughout the building with no fire visible frequently indicates a cellar fire.

A fairly common smoke odor comes from overheated fluorescent light ballasts, which often do not give off visible smoke until late in the emergency. Light ballasts contain cooling oil that gives off an oily smell when overheated. (In older types this was often PCB oil; where SCBA when handling these seemingly “minor” incidents.) While locating the defective unit can be complicated by the height of the fixture, District heat scanner devices can be used to allow firefighters to rapidly search along rows of light fixtures. Without a heat scanner, firefighters must inspect each fixture.

The search can be narrowed by using a few visual hints by the floor level. Begin by looking for fixtures with intact bulbs that are glowing faintly. Fixtures without bulbs will not have a current flow and are not usually the problem. Correctly operating fixtures can be the source of the problem, but this is not as common as dim fixtures. Look at the fixtures for defects. Dark colored oil on the outside of the fixtures, or on the light diffuser of the recessed type fixtures, indicates a problem. On surface-mounted fixtures, a dark smudge around the sides, particularly near vent holes, indicates soot deposits. As a last resort, feel each fixture: A normal ballast is warm to the touch, a defective unit is hot.

Once a defective unit is identified, take steps to isolate it. Ensure that there has not been any ignition of nearby combustibles and prevent any further current flow. Generally, this entails getting access to the ballast, feeling around it for abnormal heating, and opening the electric circuit. Shut off power to the fixture, remove all bulbs, open the cover, and disconnect all wires leading to the ballast. Cover the exposed ends of the black and white wires separately and examine nearby combustibles for hidden fire.

Electric fires are common occurrences that can usually be handled easily. To locate the source of the problem, consider where the smell is first detected, then examine all devices in the area that are on or had been on recently.

Confusion occurs in larger buildings when odors or smoke are reported in several areas. This can happen if elevator motors overheat, or where heating, ventilating, or air conditioning (HVAC) system, dumps smoke out through the duct work. In both cases, a firefighter should be sent, with a radio, to locate the machinery spaces as quickly as possible. Fires usually occur where equipment is found. They do not usually begin in the middle of shafts or ducts. If the electrical equipment is on fire, as opposed to overheated, use nonconductive extinguishing agents, preferably a “clean agent” that will not damage the equipment or compound clean up problems. CO-2 extinguishers are well suited for this. The power should be disconnected as soon as possible.

Other fires that result in reports of smoke on several floors include two other kinds of shafts - incinerator shafts, which become blocked by rubbish, and fires in trash compactor chutes. While these two incidents may appear as minimal live hazards, they have the potential to become life threatening conditions.

Incinerator shafts are common in many older, multi-story buildings. They allow rubbish to be dropped through a fire-resistant door into a “chimney” to be burned at the base of the shaft. The doors to the shaft are located on each floor, most often in or just off the common hallway.

A fire in an incinerator is not necessarily an emergency. Incinerator problems develop when an oversized piece of rubbish is forced into the shaft, blocking escape of smoke and gases up the chimney. The gases start to bank down and push their way out of the chutes through the paths of least resistance, usually the hopper doors on each floor. The solution is to locate the blockage and remove it.

Examine each floor where smoke is reported. The halls in the area must be checked to make sure that smoke is not coming from an apartment fire, and to search for life hazard and fire extension. The amount and toxicity of rubbish generated in even a small-to-medium-size apartment building is often staggering. Large quantities of plastics are often present, as well as aerosol cans and flammable liquid containers. For this reason, the use of SCBA in incinerator fires is mandatory.

While searching floor areas, a quick examination of the chute door will reveal if firefighters are above or below the blockage. If smoke comes out when the door is opened, you are below the blockage. Proceed up until the floor is reached where no smoke comes out when the door is opened; you are either above the blockage or the blockage has freed itself. To free the rubbish, use a hook or several sash weights tied on a retrieval line to try to push it down.

Firefighters should prevent any part of their body getting into the shaft because residents above may unknowingly drop more debris. SCBA also protects the face and eyes should uncommon occurrences like shattering glass or explosion contains shoot out when the door is opened. If all attempts to push a blockage down fail, it might be possible to burn it off, loosening it so it falls. To do so, go to the floor just above the blockage, ignite a newspaper and drop it onto the pile. Should all else fail, put out the fire and have maintenance personnel clear the blockage. It is important to remember that most incinerators have an auxiliary burner (often gas fired) that <u>must</u> be shut down before extinguishing the fire. Otherwise, gas will fill the chute and could explode.

Compactors resemble incinerators, and consist of shafts with hopper doors on each floor that convey rubbish to the basement for removal. Compactors differ from incinerators, however, because they are not designed to hold fire at any time. Smoke coming from a compactor indicates that immediate action is needed, because fire can spread throughout the building. A charged line should be stretched to the first floor above the fire and operated into the shaft, if needed, to prevent extension up the shaft. At the same time, members should go to the basement and work on extinguishment.

Compactor rooms pose several hazards to firefighters: High voltage electrical equipment, high pressure hydraulic hoses, moving rams that can sheer an arm if caught in the compactor, as well as failing debris and exploding bottles or cans. Extreme caution should be used when operating in these rooms. Quick identification of a compactor fire can be the difference between a routine fire and a rapidly spreading multiple alarm.

While some buildings may utilize automatic sprinklers in compactor chutes, they are often turned off due to the frequency of such fires and difficulty of replacing a fused head in the shaft.

Wood burning stoves involved in creosote fires are also possible sources of fire extension. A sever creosote fire rapidly reaches blow torch proportions, and can damage the chimney at the point of allowing fire to the outside of the chimney. Shut off the air intake to the stove, and check for extension along the length of the chimney. Never use water to extinguish a creosote fire in a chimney. Water can damage the superheated brick and mortar, thereby requiring replacement of the entire chimney. Instead, use dry chemical extinguishers.

IV. Carbon Monoxide Detector Alerts

A. General

Carbon monoxide is an odorless, tasteless, colorless gas that is deadly. It is a by-product of a fuel burning process. Many appliances such as furnaces, kitchen stoves, hot water heaters, automobiles, portable heaters, clothes dryers, etc. can produce carbon monoxide. Due to a faulty appliance, blocked or improper venting or other unusual conditions, carbon monoxide may be vented into areas where people are present.

Carbon monoxide poisoning can produce symptoms of headaches, dizziness, weakness of limbs, confusion, nausea, unconsciousness, and fatigue.

The Occupational Safety and Health Administration (OSHA) has established a maximum safe working level of carbon monoxide at 35 parts per million over an 8 hour period in the general work place with a ceiling level of 200 ppm not to be exceeded anytime. The U.S. Environmental Protection Agency has established that residential levels are not to exceed 9 ppm over an 8 hour average.

B. Procedures

All personnel will familiarize the proper operation of the Industrial Scientific TMX 410 for carbon monoxide detection.

- Detector should be zeroed on station in lounge area (or fresh air) before response.

If alarm is received that CO detector has been activated, dispatch should determine if any symptoms are present with occupants in the home. If symptoms are present, advise occupants to exit the house and to make contact with the firefighters on his arrival.

On the scene, the firefighter will again determine if anyone is exhibiting symptoms of possible carbon monoxide poisoning, if so, immediately evacuate residents from premises. Request EMS response if necessary, and begin investigative procedure.

If no one exhibits any symptoms of carbon monoxide poisoning, it will not be necessary to evacuate or ventilate the premises unless a level of over 9 ppm is detected by the meter.

Ohio Gas will be called if over 9 ppm is indicated on the meter and there is a suspected natural gas appliance involved.

C. Recommendations to Occupant

1. Reading of 9 ppm or less

Inform occupant(s) that our instrument did not detect an elevated level of CO at this time.

Recommend to occupants to check their CO detector per manufacturer recommendations.

Attempt to reset detector.

2. Readings above 9 ppm but less than 100 ppm

Any reading above 9 ppm will be considered above normal reading.

Occupants shall be informed that we have detected a potentially dangerous level of CO.

Recommend that all persons leave the premises and begin ventilation after locating the source.

If it is determined that an appliance is malfunctioning and thereby producing CO, it shall be shut down.

Once the premises have been reduced to a safe level of CO, the premises may be occupied - at the direction of the occupant.

Attempt will be made to reset the detector.

3. Readings of 100 ppm or greater

If a reading is 100 ppm or greater, inform the occupants that we have detected a potentially lethal level of CO.

Order the occupants to vacate the structure immediately.

If it is determined that an appliance is malfunctioning and thereby producing the CO, it shall be shut down.

Once the air in the premises has been reduced to a safe level of CO and the source has been identified and secured, the residence may be occupied - at the discretion of the occupant.

It will be the homeowner or occupant's responsibility in contacting a repair technician to fix any appliance (furnace, stove, water heater, etc.) that has contributed to a carbon monoxide build-up.

Any reading above 400 ppm in the residence shall dictate the immediate use of SCBA by the firefighter before he continues his investigation.

4. Carbon Monoxide Facts

Danger Levels:

- IDLH (immediate danger to life hazard) is at 1500 ppm.

- TWA (time weighted average) is at 35 ppm (up to 10 hour work day during 40 hour work week)

Toxicology Levels from Sax Manual:

- 400-500 ppm for one hour with no appreciable affects.

- 600-700 ppm for one hour with barely appreciable affects.

- 1000-1200 ppm for one hour is dangerous.

- 4000 ppm and over is fatal in less than one hour.

CARBON MONOXIDE (CO) RESPONSE PROTOCOL

1. Purpose

This Order:

A. Establishes a procedure for the fire department's response to reports of carbon monoxide (CO) incidents.

B. Becomes effective immediately.

2. General

Carbon monoxide is an odorless, tasteless, colorless gas that is deadly. It is a by-product of a fuel burning process. Many appliances such as furnaces, kitchen stoves, hot water heaters, automobiles, etc., can produce carbon monoxide. When faulty or unusual condition exists, carbon monoxide may be vented into areas where people are present.

Carbon monoxide poisoning may be difficult to diagnose. Its symptoms are similar to the flue, which may include headache, nausea, fatigue, and dizzy spells.

The Occupational Safety and Health Administration has established a maximum safe working level for carbon monoxide at 35 parts per million (ppm) over an 8 hour period in the work place. The U.S. EPA has established that residential levels are not to exceed 9 ppm over an 8 hour average.

Effective October 2, 1995 East Ohio Gas will respond to carbon monoxide (CO) investigations.

3. Procedures

A. The fire department will respond to carbon monoxide (CO) situations when requested.

B. The type of response will be determined by our dispatch center. The dispatcher will determine what type of response is needed during their taking of the call. They shall attempt to verify if the detector that is sounding is a smoke detector or a carbon monoxide detector.

1. If it is a smoke detector, the dispatcher will dispatch as a structure fire.

2. If it is a carbon monoxide detector, they will determine if any persons at the scene are exhibiting symptoms of carbon monoxide poisoning. If yes, they will dispatch the fire department (Code 3) for possible rescue and an ambulance. If no, they will dispatch the fire department on a community service call (Code 2).

C. The first arriving unit shall establish scene control.

1. Verify that the alarm is coming from a smoke detector or a carbon monoxide detector. Determine the cause of the alarm, i.e., true alarm, low battery indication, poor location of device, etc.

2. If it is smoke detector alarm:

   a. Investigate the cause of the alarm;
   b. Take the necessary action to mitigate the situation;
   c. Advise the dispatcher of the situation.

3. If it is a CO detector:

   a. Determine if anyone is exhibiting any symptoms of carbon monoxide poisoning; if so, immediately evacuate and ventilate the premises;
   b. Request necessary EMS response (if not on scene);
   c. Begin investigating the cause.

4. If no one exhibits any symptoms of carbon monoxide poisoning, it is not necessary to evaluate or ventilate the premises unless a level of over 9 ppm is detected.

5. The incident commander shall request that the gas company respond to the scene if:

   a. A CO level of over 9 ppm is indicated on their meters;
   b. The responding company shuts off gas appliance;
   c. Someone is showing signs of being ill due to carbon monoxide;
   d. The incident commander feels a response by the gas company is needed.

6. Carbon monoxide investigations (procedures)

   a. Zero the meter in fresh air and comply with all other start up procedures as recommended by the manufacturer of the metering equipment.
   b. Initiate a survey of the premises to determine if there are any amounts above 9 ppm of carbon monoxide present.
   c. All members shall use SCBA in any atmosphere that is in excess of 35 ppm of CO.
   d. Reading of 9 ppm or less.

Effective: November 8, 1995