1. Purpose

The accidental release of natural gas is a common incident. Damage to regulators, meters, piping and appliances will precipitate the release of natural gas. The following procedures have been established for use in such incidents to ensure appropriate and safe incident stabilization.

2. Properties of Natural Gas

85% to 95% of natural gas being delivered to residents and businesses is comprised of methane (CH4). Other components include ethane, propane, and nitrogen. Natural gas is colorless and odorless, however and odorant called mercaptan is added to give it a distinctive rotten egg odor. Natural gas is non-toxic; however, it will displace oxygen in concentrations which can lead to asphyxiation. It is lighter than air; it will follow the path of least resistance and will travel upward through any available space. When underground or in an enclosed space, natural gas will move laterally or "migrate". It will burn/explode when the gas in air is between 5% and 15%. In concentrations less than 5% it will be too lean to burn/explode, and in concentrations above 15% it will be too rich to burn/explode.

3. Delivery System

Natural gas goes through various pipelines before reaching the end user.

- From the wellhead the gas will enter the gathering pipeline.
- From the gathering pipeline the gas will move into the transmission lines.
- From the transmission line it will move to the distribution mains.
- From the distribution mains it will move into the service laterals which brings it to the end consumer's meter.

In general, the closer natural gas gets to the end user, the smaller the pipeline and the lower the pressure.

4. Uses of Natural Gas

- Furnaces and boilers
- Stoves and ovens
- Air conditioners (large commercial units)
- Hot water heaters
- Barbecues
- Fireplaces
- Dryers

5. Recognizing gas leaks

As previous stated National Grid adds an odorant to natural gas called mercaptan, which smells like sulfur or rotten eggs. Although mercaptan often aids in detection of natural gas leaks, you may not be able to smell this odorant if you have been exposed to it for too long, or if the mercaptan odor is masked by other odors. Mercaptan may also be stripped from the gas due to chemical and physical process. For example, an underground pipe leak, the mercaptan may be "scrubbed" out as the gas is migrating through soil, concrete, etc. This effect is known as "odor fade".

You should never rely on your nose alone to detect a natural gas leak. In any gas leak incident, use a combustible gas meter to be certain a flammable atmosphere does not exist. In addition, stay alert for any of these gas leak warning signs:

- A distinctive sulfur-like odor
- A hissing, whistling or roaring sound
- Dirt blowing into the air from a hole in the ground
- Continuous bubbling in water
- Dead or dying vegetation (in an otherwise moist area) over or near a pipeline
- An exposed pipeline after a fire, flood, or other disaster
- A damaged connection to a gas appliance

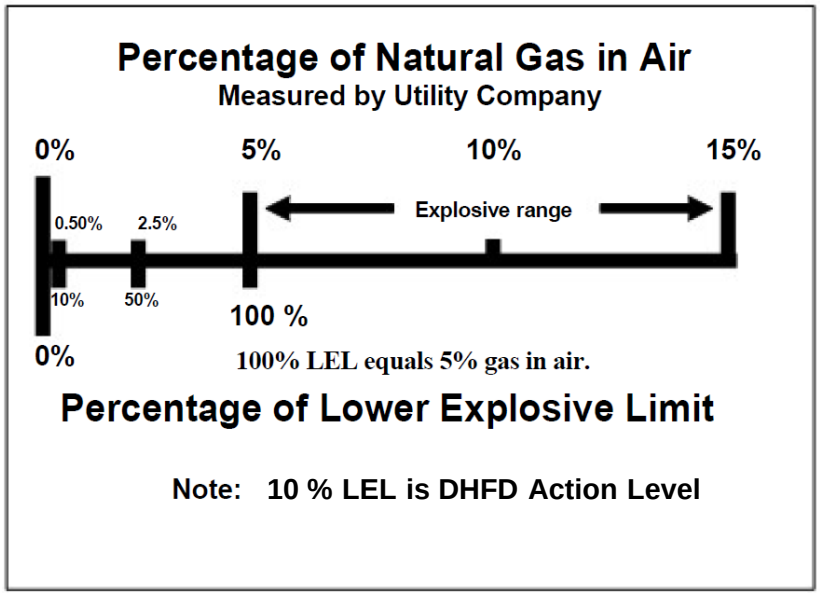
Often gas leaks are the result of damage caused by excavation, construction, farming activities, or careless driving. Use the homeowner, occupants, or contractors to gather information that can narrow down the cause and location of the leak.

6. Meters

The Dix Hills Fire Department has two meters at its disposal to aid in determining the existence of a flammable atmosphere as well as narrowing down the location of a leak. The two meters are the PS200 Portable Gas Monitor and the Sensit HXG-2d Combustible Gas Detector.

When it comes to combustible gas both Dix Hills Fire Departments meters measure %LEL (lower explosive limit). The previous stated flammable/explosive level of between 5% and 15% is a gas in air reading. The below chart shows how that translates into %LEL. That lower limit of 5% is equivalent to 100% LEL on DHFD meters.

% Gas in air	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
% LEL	1	2	3	4	5	6	7	8	9	10	20	30	40	50	60	70	80	90	100



PS200 Portable Gas Monitor

Introduction

The PS200 Portable Gas Monitor is a warning device for continuous monitoring of Combustible Gas LEL, Oxygen O2 and Toxic Gas Carbon Monoxide CO and Hydrogen Sulfide H2O in the ambient air. Use of the instrument is intended to alert the user to the four gases listed above in the environment. A visual display shows the amount of each gas present in parts per million and /or percentages in the atmosphere.



If any of the four mentioned gases in the atmosphere are found in levels too high or too low, the monitor will alternate between the levels and an alarm display as described below while the backlight turns red.

- Combustible Gas LEL Alarm Display – HI or HIHI – 10%> evacuate
- Oxygen O2 Alarm Display – HIHI, LO, or LOLO
- Carbon Monoxide CO – 35ppm SCBA must be used
- Hydrogen Sulfide H2S – 10ppm

The PS200 Portable Gas Monitor should always be ready for operation with a fully charged battery.

The PS200 Portable Gas Monitor should always be turned on prior to the user entering any area of questionable atmosphere.

The PS200 Portable Gas Monitor can be used in any position; however, it is recommended that the Instrument be used in an upright position, so the audible and visual alarms are directed toward the users face.

The intake port should NOT be obstructed by any object preventing proper operation of the Instrument.

Operation and Use

Turning on
Press and hold the R Button for one second to switch the monitor ON. The flash screen appears, and the monitor begins its warm-up routine, which lasts approximately 30 seconds. During the warm-up, a countdown timer appears in the top right corner of the display. During warm-up the following is displayed:

a) Monitor identification
b) Date and time
c) Calibration due date
d) Sensor confirmation check
   - The ✓ symbol appears next to each sensor type to confirm that the sensor has been zeroed correctly
e) When warm-up is completed successfully, the backlight switches off and the normal operating screen is displayed.

Alarms Reset or Acknowledge
When the monitor reaches an alarm set point, the audible, visual, and vibrating alarms will be activated to alert the user.

Alarms are individually programmable to be either:

- Latching - alarms are active until the user resets by pressing and holding the R button after the gas readings have returned to a safe level.
- Non-Latching - alarms will reset automatically when the gas readings have returned to a safe level.

The audible alarm on each pre-set alarm can be muted for 60 seconds by pressing and holding the R button. After this time, should the gas value remain out with the pre-set alarm limit, the non-latching audible alarm will become active again. If latching, the audible alarm will become active again regardless of gas value

Confidence Signal
During normal operation, the monitor sounds a confidence beep and illuminates the green LED's briefly every 15 seconds. This function informs the user that the monitor is operating correctly

Turning Off
Press and hold both the L and R buttons to switch the monitor OFF. The monitor display starts a countdown from 3 to OFF

High Flammable Gas Over-Range Alarm
An over-range alarm protects the user and the LEL sensor during exposures to high concentrations of flammable gas. If the LEL reading exceeds 100% LEL:

- monitor vibrates.
- displayed value changes to 4 rising arrows.
- display turns red.
- audible alarm tone changes.
- LED's flash quickly.
- DANGER OVERRANGE flashes on the display.

10-Second Switch Off
The monitor must be returned to clean air. Switch OFF by pressing and holding both L and R buttons. A timer counts down from 10 seconds to 0, and the message GET OUT alternates with HIGH GAS.

Maintenance

- The instrument should be kept clean and dry.
- The instrument should be bump tested regularly.
- Calibration will be performed every three months by authorized personnel. If the user finds any discrepancies with the pre-set warning levels the instrument shall be taken Out of Service and written up describing the problem in detail.
- The Battery should be kept charged at all times.
- Problems found with the Instrument shall result in the following actions:
  - Immediately taken Out Of service
  - Proper recording of the problem via Dix Hills Fire Dept. internet web site for maintenance log in.

Sensit HXG-2d Combustible Gas Detector

Introduction
The SENSIT HXG-2d is designed to detect combustible gases. This instrument incorporates an advanced low power semiconductor sensor to measure a wide variety of combustible gases in both the PPM and %LEL range. The PPM readings auto-range to %LEL when the concentration exceeds 990PPM (2%LEL methane or 4.5%LEL propane).



Audible and visual alarms warn the operator of hazards. The alarms can be set in either the PPM or LEL modes. The default alarm is 10%LEL methane/propane.

Dix Hills Fire Departments Sensit HXG-2d detectors are set up with a primary gas as methane.

Battery Installation and Replacement

1. Battery replacement is necessary when the BAT icon is illuminated, and the green LED is flashing. This warning indicates there is approximately 15 minutes or less operational time before the instrument turns off automatically due to insufficient battery power.
2. Remove the battery sleeve cover by removing the battery sleeve screw with a T-10 screwdriver. Depress the locking tab on the front of the handle with a coin or flat object and pull the battery sleeve handle away from the top or display area of the instrument.
3. Place 3 approved batteries into the battery holder. Observe the polarity markings on the inside of the battery holder for proper battery installation. Improper installation will cause the instrument not to operate.
4. Replace the battery sleeve and allow the locking tab to snap into position. Replace the battery sleeve retaining screw. Check to be sure the handle is secure to the instrument body by firmly pulling the handle away. The handle will remain in place if a proper connection is made.

Operation and Use

1. Push and hold the power button (A) until the display and backlight illuminates.
2. If the display fails to illuminate or the BAT icon is shown on the display, replace the batteries.
3. During successful start-up the instrument will display:
    a) Display all segments
    b) Turn on and off the backlight
    c) Display "S2d" as the model number
    d) Cal Gas (CH4)
    e) Display software version
    f) Display "50.0%" or "10.0%" indicating the LEL Calibration point for the instrument for CH4 gas type only.
    g) Display "dIS" indicating display resolution of PPM / %LEL or both.
    h) Display "AL" followed by the alarm set point.
    i) Activate the alarm sound and red LED for 3 beeps
    j) Continue to flash all segments until proper warm-up attained (no more than five minutes)
    k) Flash "Zro" indicating fresh air zeroing
    l) Working display is shown

NOTE: A failure to properly zero due to the presence of gas is indicated by "bAd" + cal icon illuminated on the display. Pressing the ZERO (C) button for 6 seconds and releasing will restart the zeroing process.

NOTE: If a sensor is completely inoperable or improperly zeroed at start up, the display will show "bAd".

4. All instruments read with a resolution of 10ppm up to 990ppm. The scale automatically switches to LEL when 990ppm is exceeded with a resolution of 0.1% LEL. Optionally all readings may be displayed in LEL only. Readings beyond 100% LEL are indicated by "OL" (overload).
5. It may be necessary to manually zero the instrument based on environmental conditions.
6. When a gas is sensed, the display will update. If an alarm condition exists, based on a preset alarm point, the red LED will flash, and the alarm will sound.
7. During an alarm condition (factory default at 10% LEL methane) the display will flash, and an audible alarm will sound indicating a potentially unsafe environment. To disable the audible alarm press and release the MUTE button (A). To enable the alarm press and release it again.
8. To assist in locating the source of small combustible gas leaks or surveying areas outdoors or indoors, press and release the TICK/CAL button (B). This will start an audible tick preset at 2-3 ticks per second.

   Move the sensor toward the area suspected of leakage. As the sensor moves closer to a leak source the tick will increase. When the tick becomes a steady tone press the TICK/CAL button (B) again while keeping the sensor head in the same position. This will slow down the tick and allow the operator to find a higher concentration using the same procedure.

   If there is no tick, press the TICK/CAL button (B) again to reset to the steady ticking sound. For best results always use the leak detector prior to using any liquid leak detection fluids as these sensors will detect their presence.

9. When being used in dark areas press and release the LIGHT/ZERO button (C) to turn on the back light Press again to turn off.
10. To turn instrument off, push and hold the POWER/MUTE button (A) for 5-6 seconds until "OFF" appears on the display.

Maintenance

- The instrument should be kept clean and dry.
- Calibration will be performed every three months by authorized personnel. If the user finds any discrepancies with the pre-set warning levels the instrument shall be taken Out of Service and written up describing the problem in detail.
- The Battery should be kept charged at all times.
- Problems found with the Instrument shall result in the following actions:
  - Immediately taken Out Of service
  - Proper recording of the problem via Dix Hills Fire Dept. internet web site for maintenance log in.

7. General Safety Precautions for Natural Gas Leaks

- All PPE including SCBA should be worn at all times.
- Eliminate ignition sources (Do not use anything that is not intrinsically safe)
  - Do not ring the doorbell, knock on the door instead.
  - If possible, avoid walking on carpeted floors, this can create a static charge.
  - Do not turn on or off building light switches.
  - Use of desktop and cellphones can create a static spark.
  - A furnace or boiler kicking on can provide an ignition source.
  - Turn flashlights on before entering an explosive atmosphere (DHFD's Streamlight right angle lights are intrinsically safe).
- Once you turn a gas valve off, never turn it back on.
- Ventilate structures via natural vents (i.e., windows and doors). DHFD's ventilation fans are not intrinsically safe.
- DHFD's Thermal Imaging Cameras are not intrinsically safe.
- DHFD's portable radios are not intrinsically safe.
- SCBA's should be used at all times while in a natural gas rich atmosphere. At 25% to 30% gas in air, the oxygen deficiency can cause ringing ears, euphoria, and unexplained behavioral changes. At 50%, a person taking in a few breaths will be incapacitated and unable to self-rescue. At 75%, a person is immediately incapacitated, and death will occur in a matter of minutes.

8. General Considerations for Natural Gas Leaks

- Always consider the possibility that leaking gas is migrating into the buildings and other structures.
- The arc from fallen high voltage electric wires can burn through asphalt or concrete down to buried gas lines. The damage this causes to metal or plastic gas lines can result in a leak which can be ignited by the arching wire.
  - If you smell or suspect the involvement of natural gas, request National Grid in addition to PSEG.
- Gas can migrate underground through the soil, electric conduit, or other pipes. If you can't find the source of an indoor leak, take readings at the storm drains and near in ground electrical boxes. Also check storm drains at outdoor leaks to determine where and how the is migrating, and to determine the danger area. National Grid can track gas movement through the ground by inserting probes through concrete and pavement.
- A frost layer on the ground in the colder months could prevent the escape of leaking gas right up to dissipate into the air and can lead the gas to migrating into nearby structures through cracks in the foundation, utility chases, pipes, and so on.

- Using the breaker panel to secure the electricity can generate a spark. Have the power to a gas filled structure removed at the pole by PSEG.
- Before removing power from a structure, ascertain if emergency power or a generator exists. If a structure has emergency power or an emergency generator, it will kick in when the power is cut, possibly providing an ignition source. Have it disabled if safety permits, before cutting power to the structure.
- Position apparatus out of what can become the collapse or blast zone. Do not park directly in front of the structure, consider at a minimum one house away.
- Always check all areas of a structure for gas concentrations, from the basement to the attic, remember natural gas is lighter than air.

9. <u>Priority Order of Gas Line Valves</u>

When possible, and safe to do so the valve closest to the leak should be shut.

- Appliance valve – line going to the appliance itself (dryer, furnace, stove, etc.)
- Meter valve
- Curb valve should only be secured if absolutely necessary and at the direction of the Incident Commander after consultation with the National Grid technician.







Once a gas valve is turned off, it should not be turned back on under any circumstances. Turning the gas valve back on can result in gas leaks at stoves, boilers, and other points that have pilot lights that have gone out.

10. Indoor Gas Leaks

- Wear full PPE including SCBA
- Position the apparatus outside the potential collapse or ignition zone (minimum of one house away) and upwind.
- First Due apparatus will act as a truck and bring both meters to determine if there is a gas leak, and if so what kind. If natural gas is found to be the culprit, the incident commander shall immediately notify dispatch to contact National Grid and have them respond. ***All safety precautions and considerations discussed in sections 7 and 8 should be followed.***
- The occupants of the structure should be removed from the house while the crew uses their meters to monitor the house for concentrations of natural gas.
- The second due apparatus shall take a position on a hydrant and its crew should stand by as an engine.
- Any additional apparatus shall position themselves at a safe distance and await the incident commanders' orders and assignments.
- If the leak is minor and can easily and safely be isolated via the appliance valve, it should be done as close to the leak as possible. Notify National Grid which valve has been shut down.
- Once the leak is secured monitor the structure for concentrations, ventilate as necessary.
- If a large gas leak is found or high concentrations or 10%> LEL prepare to evacuate neighboring homes (National Grid recommends a 330' radius).
- Have the engine stretch a hose line and position it in a safe area.
- If safe to do so secure the gas via the meter valve and notify National Grid. If cannot be done await National Grid and take a defensive approach while ensuring civilians and firefighters are not in the potential collapse or ignition zone.
- Consider having PSEG cut the power from the pole to eliminate potential ignition sources, after ascertaining and having back up power sources disconnected if present.
- Monitor surrounding area and structures for migrating gas concentrations.
- Ventilate in coordination with National Grid. ***Remember if gas is in concentrations above the upper explosive limit (15% gas in air) while you are ventilating, the levels will need to pass through the flammable/explosive range, it is imperative to eliminate all potential ignition sources.***

11. Outdoor Gas Leak

- Wear full PPE including SCBA
- Position the apparatus outside the potential ignition zone and upwind. The apparatus itself can be and ignition source.
- First Due apparatus will act as a truck and bring both meters to determine if there is a gas leak, and if so what kind. If natural gas is found to be the culprit, the incident commander shall immediately notify dispatch to contact National Grid and have them respond. ***All safety precautions and considerations discussed in sections 7 and 8 should be followed.***
- Evacuate the area immediately (National Grid recommends 330' radius) including structures.
- Check and monitor surrounding structures and storm drains. If concentrations are found and it is safe to do so, follow the procedures for indoor gas leaks
- The second due apparatus shall pick up a hydrant and stretch a hose line and position it in a safe area to protect exposures.
- Eliminate any potential ignition sources.
- Once National Grid secures the leak, use a fog stream to dissipate the gas cloud.

12. Natural Gas Fires

- If leaking gas is burning, allow it to burn until the gas supply is shut off. Burning natural gas will not cause an explosion. If burning gas is extinguished prior to the gas supply being shut off, gas will continue to discharge and buildup. This buildup can ignite and cause an explosion.
- Wet down combustible material near the burning gas and protect exposures with a fog stream.
- Avoid spraying water at the point where natural gas is being released.
- Evacuate the area.
- Once gas is off, the fire will burn itself out.
- Remain alert for gas migration and possible reignition.
- Secure gas supply via the meter valve at structure fires.