



Pennsylvania
Public Utilities Commission
Gas Pipeline Safety
&
Damage Prevention Seminar

October 7 & 8, 2008

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Associated **A**lectric **E**nergy **G**as **I**nsurance **S**ervices

AEGIS

Background Information

- Utility Mutual Insurance Company (member owned)
- Formed in 1975 by 22 gas utilities
- Electric Utilities began joining in 1977
- 490 members – 95% utilities and related energy



Our main job is *not*
finding & fixing leaks

Our main job is
public safety

Major Causes of Leaks

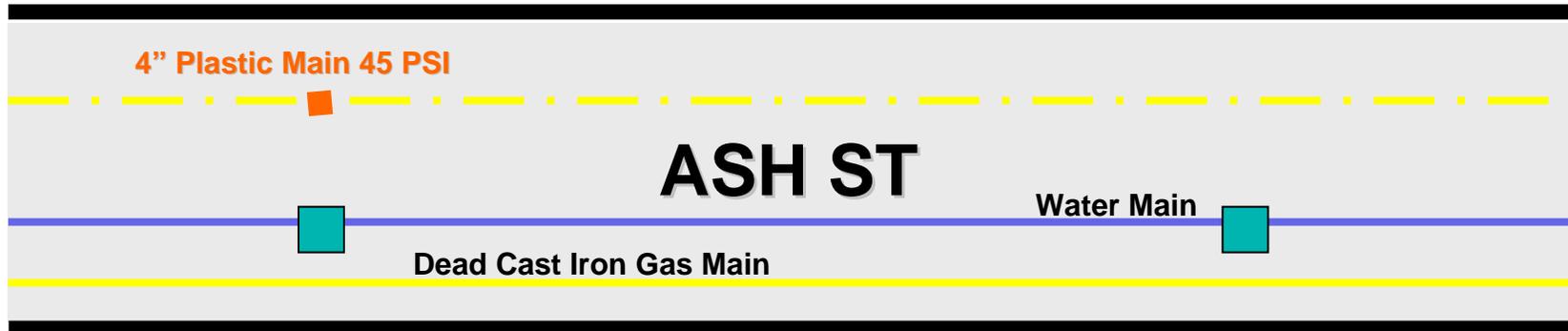
- Corrosion
- Mechanical failure
- Improper installation
- Improper design
- Faulty materials
- Outside damage - “Dig-Ins”

- In the last 20 years, over **35%** of natural gas-related incidents/explosions have been a direct result of “dig-ins” or outside damage!
- This is the major reason why we should always promote the **“Call Before You Dig Program.”**



#682

#686



Incident (1998)

Company Retention \$5M

- A contractor working on a highway reconstruction project struck the service line to a house, causing the service line to separate from a compression coupling near the gas main.
- The gas company was called at 11:15 am; a serviceman arrived on the scene at 11:45 and immediately called for a crew. Thinking the gas was venting out into the street, he sat in his truck for 20 minutes until the crew arrived. Although the damage location was only 32 feet from the incident site, no attempt was made to check nearby buildings with a combustible gas indicator for the presence of migrating gas.

Incident (1998)

Company Retention \$5M

Cont'd.

- The leaking gas migrated to the house where an explosion occurred killing an elderly woman and severely burning 3 children, the explosion occurred at 1:00 pm. The children received burns to over 45% of their bodies with most of the burns occurring in the facial areas.
- In the settlement the contractor also paid more than \$15,000,000.00 in claims.

AEGIS Incurred \$15 Million

What Happened?

- First Responder failed to recognize the gravity of the situation and made the assumption that the pulled line was leaking in only one place.
 - The First Responder’s main job on a reported gas leak is to determine “Where is the gas?” and “Is it affecting people or property?” The appropriate way of determining this is with a combustible gas indicator (CGI) – Test Don’t Guess!
- Our first priority must always be focused on
Public Safety

The Combustible Gas Indicator

- **CGI should be used to:**
 - Classify an atmosphere
 - Inside a building or in a confined space
 - Classify underground leakage
 - Determine “Where is the gas?”
 - Pinpoint underground leakage
 - Determine “Where is the leak?”
- **You must know:**
 - How to properly use it
 - What readings might constitute a hazardous condition



Proper Operation and Maintenance of CGIs

Batteries/Voltage Tests



Air Tightness Tests



Filters



Zero Tests



Span Gas Tests

Treat your combustible
gas indicator with respect.

It could save
your life someday!



Combustible Gas Indicator

Basic 2 Scale (LEL/GAS)



Combustible Gas Indicator

Sophisticated Unit

- Pump
- 3 Ranges automatically
 - 0 - 1000 ppm
Hydrocarbons (Methane)
 - 0 - 100 LEL
 - 0 - 100% Volume Gas
- CO (Carbon Monoxide)
 - 1000 ppm

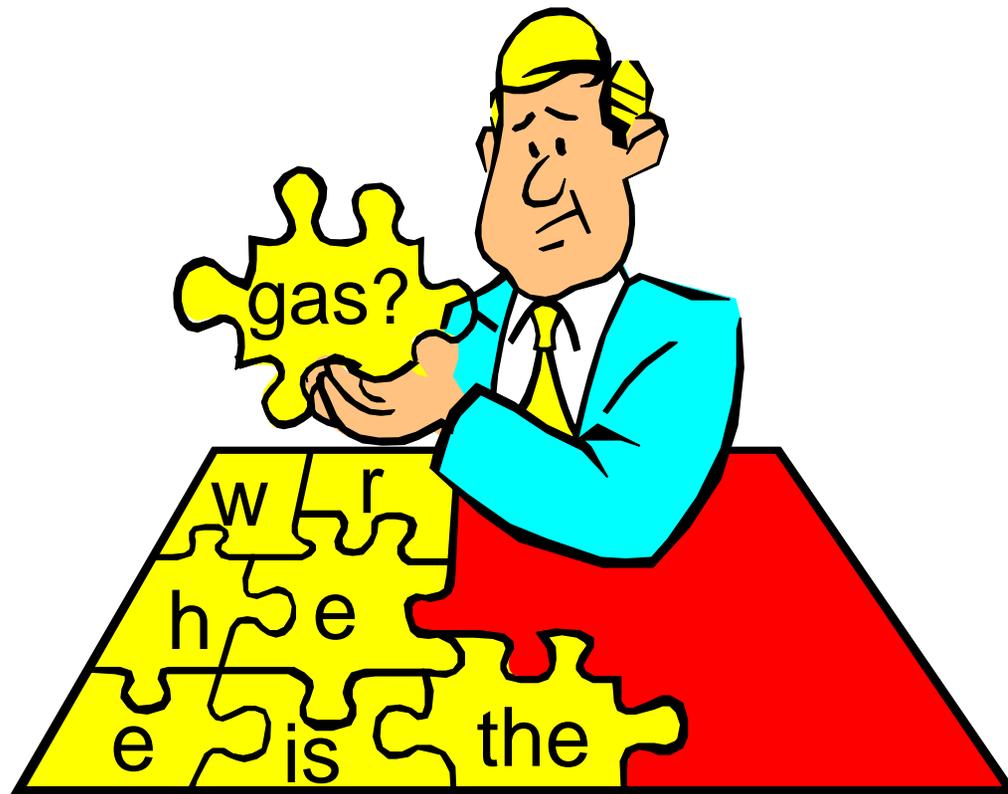


Instrument Calibration

- **Technician** must be trained
- **Sample delivery system** suited for the instrument
- **Gases** must be certified
- **Certain gases** (CO & H₂S) have a shelf life/check date
- **Documentation**/separate form for each instrument

Evaluating The Leak

Where is the gas?



Evaluating The Leak

- **W**here is the gas?
- **H**ow much is there?
- **E**xtent of hazard (migration)
- **R**elation to other structures
- **E**valuate/evacuate

Factors Affecting Gas Migration

- Soil type
- Soil moisture
- Surface cover/frost
- Line pressure
- Depth of burial
- Leak size and age
- Change in elevation=slope
- Path of least resistance

Remember:

- The biggest built-in safety factor of natural gas is that it is lighter than air; however...
it will vent to the atmosphere someplace!

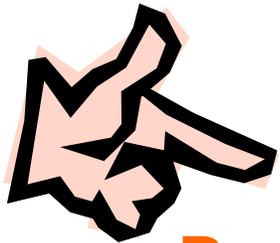




“Centering” = Where is the Gas?

Centering The Leak

- Probe holes must be of sufficient depth
- Test all available openings
- “Zero out” N-S-E-W
- You must have sufficient information to make a good judgement



Be Careful – “Don’t make a leak, looking for a leak.”

Incident (2005)

- A homeowner contacted the gas company stating that “she smelled a very strong odor of gas in the vicinity of her gas meter”.
- The gas company sent a service technician to investigate the odor complaint. Upon arrival, the technician noticed the smell of gas as soon as he got out of his truck.
- He decided to put a bar hole down near the riser to check the soil atmosphere. The temperature was around 5 degrees and there was frost in the ground making it difficult to make the test hole.

Incident (2005)

Cont'd.

- After a lot of effort, he was able to get a test hole in the ground below the frost layer. When he pulled his probe bar out of the ground, gas started blowing up through the test hole. The escaping gas was making considerable noise so he put the probe bar back in the hole. He ran back to the truck to get a shovel to dig the plastic service up in order to squeeze it off and stop the leak.
- As he was attempting to expose the service, approximately 30 minutes after the line was hit, there was an ignition and two people inside of the home were badly injured.

What Happened?

- Bar testing and checking the soil atmosphere for gas is a crucial part of the overall odor complaint investigation. It is necessary to make the test hole a sufficient depth in order to obtain an accurate reading, thus getting below the frost layer is essential.
- In this case, the bar should have been left out of the bar hole to allow the gas to “vent” and notifying the occupants to leave the house until the line could be shut off.
- The main priority is **Public Safety!**

GPTC Guidelines

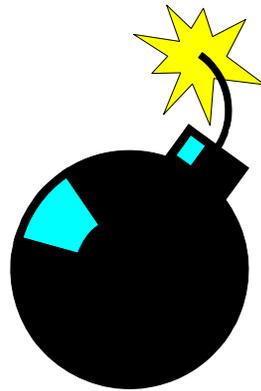
Leak Classification

- The following establishes a criteria by which leakage indications of flammable gas can be graded and controlled. When evaluating any gas leak indication, the initial step is to determine the perimeter of the leak area. When this perimeter extends to a building wall, the investigation should continue into the building.

GPTC Guidelines

Grade 1 Definition

- A leak that represents an existing or probable hazard to persons or property, and requires immediate repair or continuous action until the conditions are no longer hazardous.



GPTC Guidelines

Grade 2 Definition

- A leak that is recognized as being non-hazardous at the time of detection, but justifies scheduled repair based on probable future hazard.



GPTC Guidelines

Grade 3 Definition

- A leak that is non-hazardous at the time of detection and can be reasonably expected to remain non-hazardous.





Detect

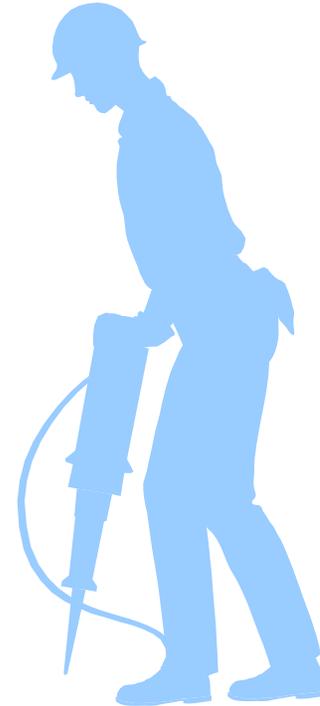
Pinpoint

Repair

Pinpointing

Is not an exact science.

It is a developed skill which is learned and perfected through your mistakes and your successes.



- Centering = Where is the gas?
- Pinpointing = Where is the leak?
- The leak **must** be **centered** before it is **pinpointed**

Methods Of Locating The Line

- Maps
- Records
- System experience
- Electronic locators
 1. Basic principles of operation
 2. Inductive vs. Conductive
 3. Overcoming problems

Consistency = Success



- Exact location of main, services etc.
- Size of test hole (aeration is the key)
- Depth of test hole (must be consistent)
- Location of test holes (same side of main)
- Instrument use (consistency in testing)



SAVE

ANOTHER

MISSED

EXCAVATION



60% Gas



Curb

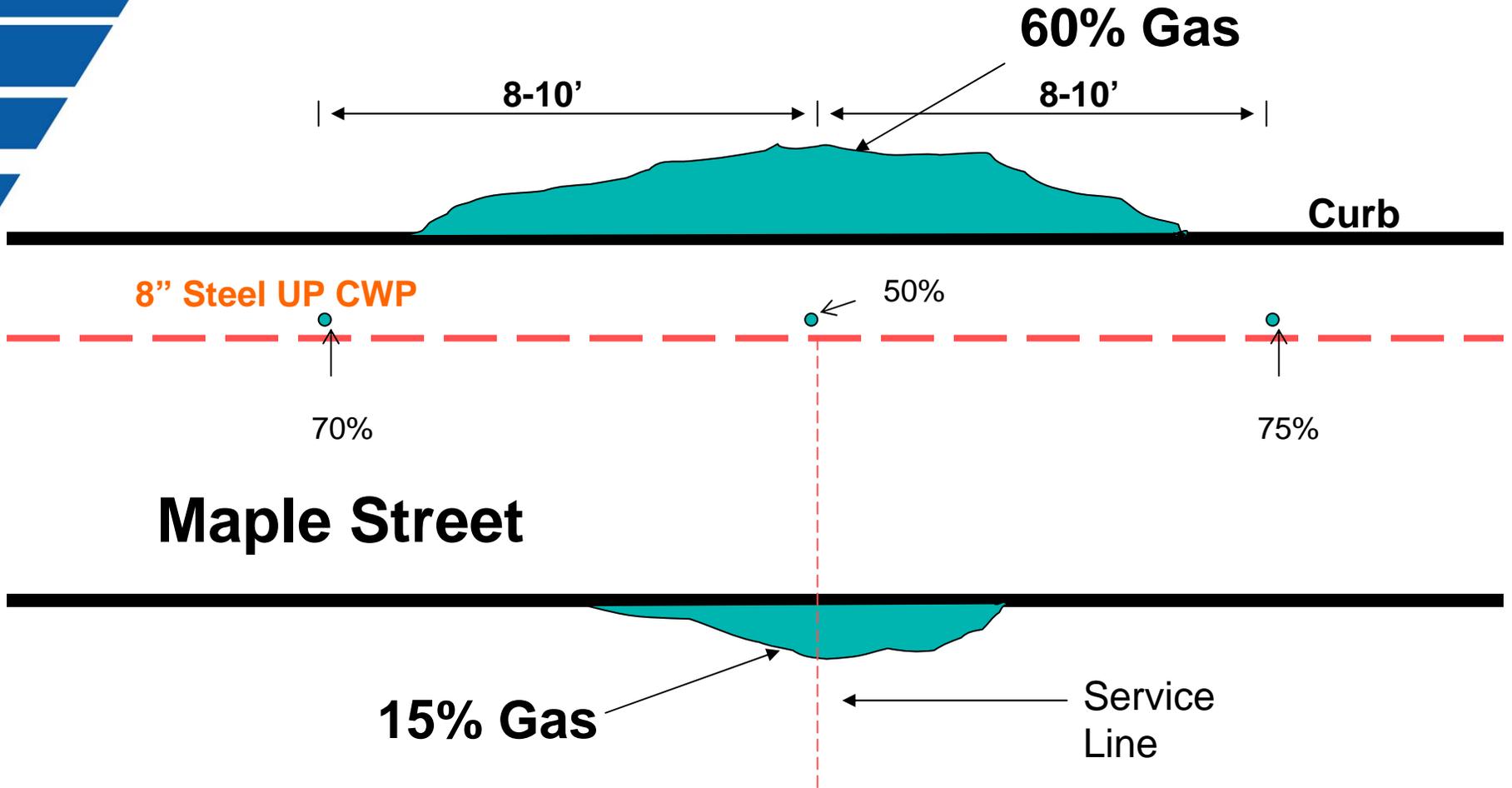
8" Steel UP CWP



Maple Street

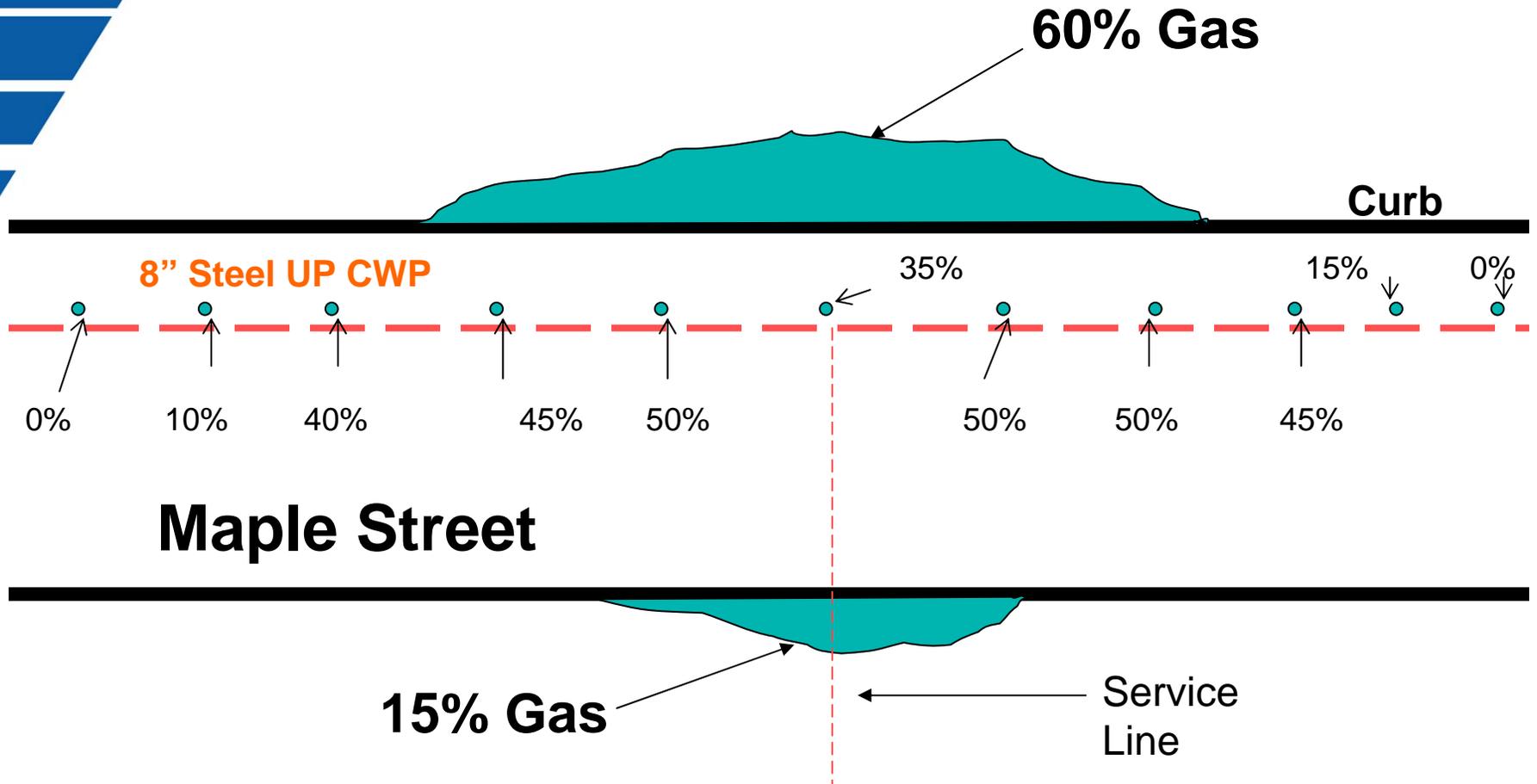
15% Gas





Test Methods

- Combustible gas indicator
 1. Top & bottom of hole
 2. Time the readings
- Natural ventilation
 1. Wait...let holes vent
- Blow pipe – vapors/soap top of hole
- Odor



Using The Soil Purger In The Pinpointing Process

- Purge from a hole where you know that the leak is not
- Plug holes near purge point
- *Dense soil or moisture* – time the purge/purge each hole
- Use it only when all other methods have failed



 AEGIS™



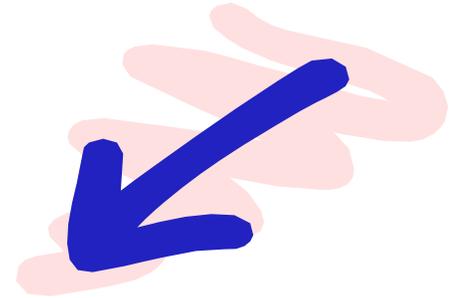
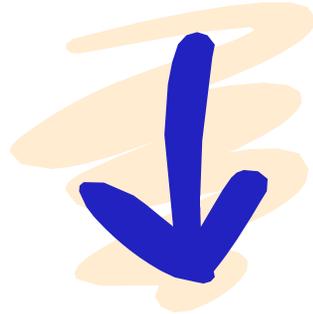
Use Of Soil Purger

- Should not be used on every leak
- Operation:
 1. In the pinpoint process
 2. As a safety tool –
Never use near foundation of building
 3. Residual gas
- Choosing a purge point is the *key*
- Techniques

Use Of Soil Purger (cont'd)

- The soil purger is your best friend or worst enemy, depending on **where** and **how** it is used

“Make Your Mark”



Using Your Experience

Using Test Results

Using System Design

Remember:

- It is much cheaper to drill than to dig.
- Do you have enough holes to give you enough information about the leak?

The Dry Hole



- Probe along the pipe
- Expose *all* of the pipe, not just the top
- Learn from your mistakes
- Use the hole to your advantage...
no one “hits” them all
- Is it our gas?

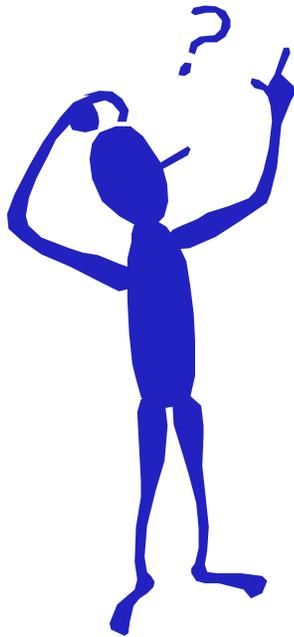
Checking After The Repair



- Did we find “*the*” leak?
- Residual gas – when will it go away?
- Cleanup/plugging the test holes
- Importance of proper documentation

Stray Gas

- Is it lighter or heavier than air?
- Is there ethane in the sample?
- Is it a hazard?
- What is sewer gas/decomposition gas?

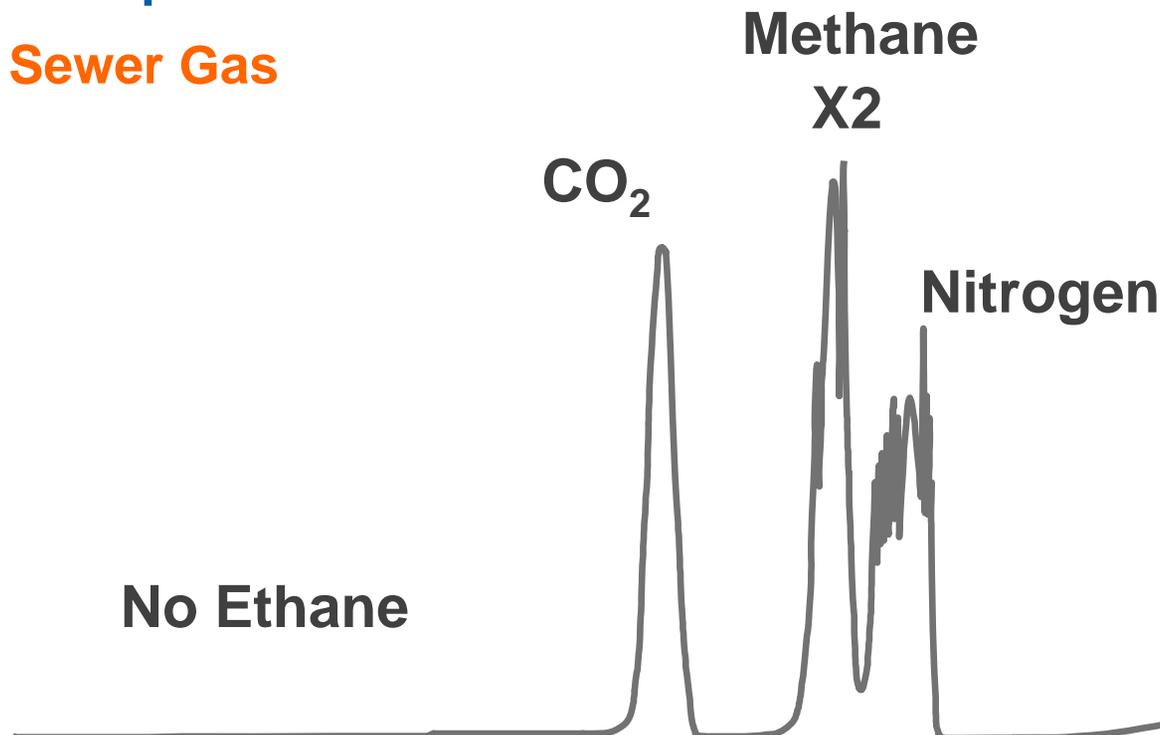


- Natural gas vs. stray gas
- Use of charcoal filter
- Use of collection bottles/bags
- Responsibilities regarding stray gas
- “Reasonable person concept”

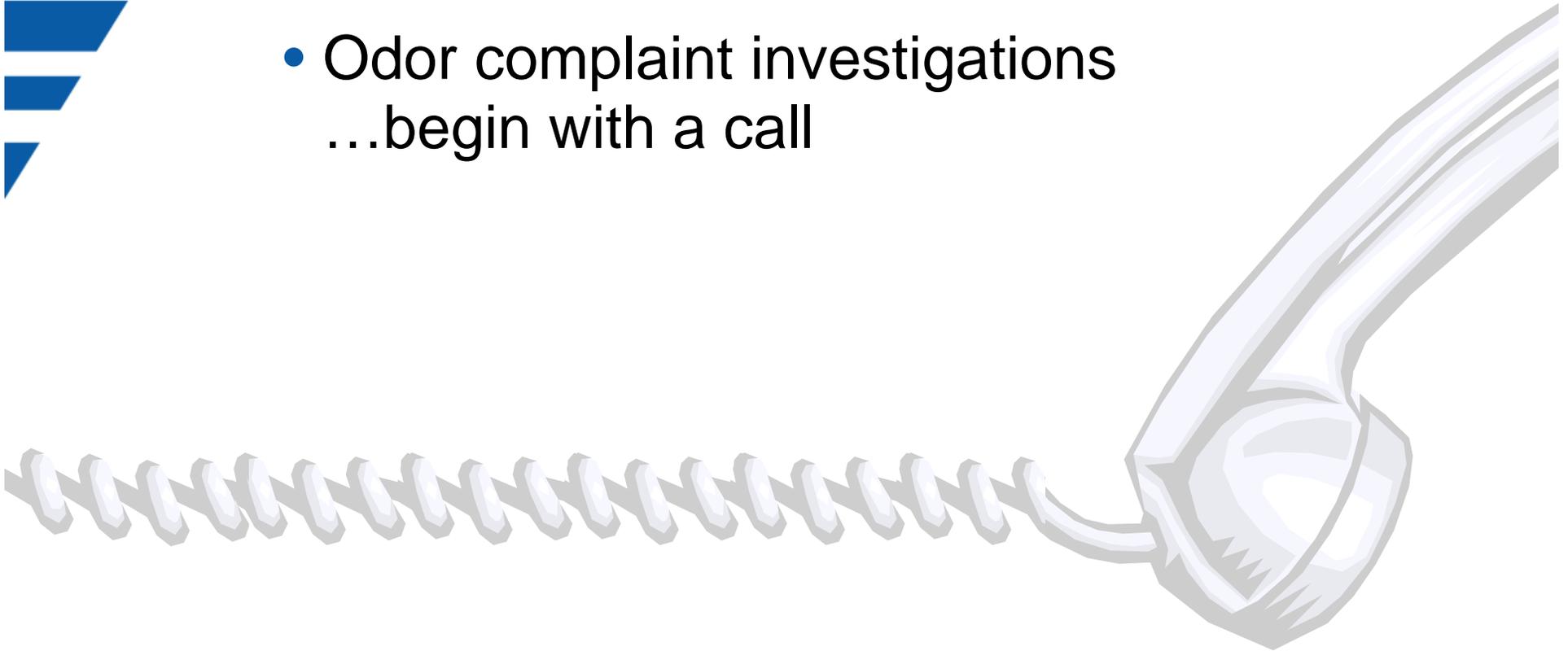
Chromatographic Analysis: Sewer Gas

Barhole Sample

Result: **Sewer Gas**



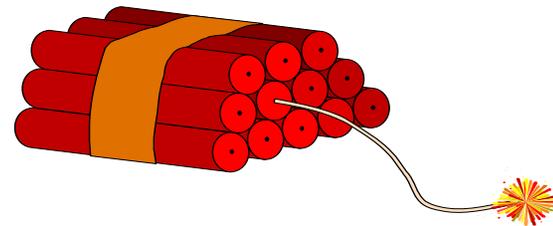
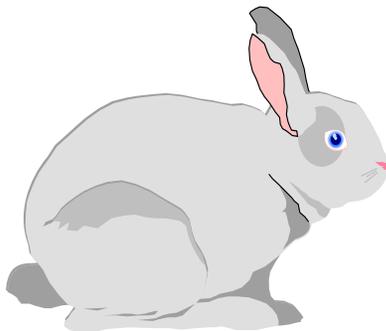
- Odor complaint investigations
...begin with a call



- An odor complaint call should be considered a Grade 1 leak...
until proven otherwise.

Is It Static Or Dynamic?

- Where is the odor? = At gas range vs. **throughout**
- How long smelled? = For a week vs. **just noticed it**
- How strong is the odor? = Barely smell vs. **making me sick**
- Can you hear anything? = No vs. **hissing sound**
- Anyone moved recently? = No vs. **apartment next door moved**
- Any plumbing done? = No vs. **husband just installed range**
- Any construction in area? = No vs. **backhoe digging out front**



Steps to Consider When Receiving a **Dynamic Call**

- Ask the customer to leave the premises until help arrives
- Advise the customer to leave the phone off the hook and not to operate any lights or turn any appliances off or on

Leave things as they are... leave the premises **immediately**



Routine “Stable” Calls

Listen, ask questions, and transfer accurate information

- 1. Where do you smell it?** This information will alert the first responder where to start checking.
- 2. Is the odor constant?** This information may help indicate if the leak is inside or outside or if there may be a problem with an appliance.

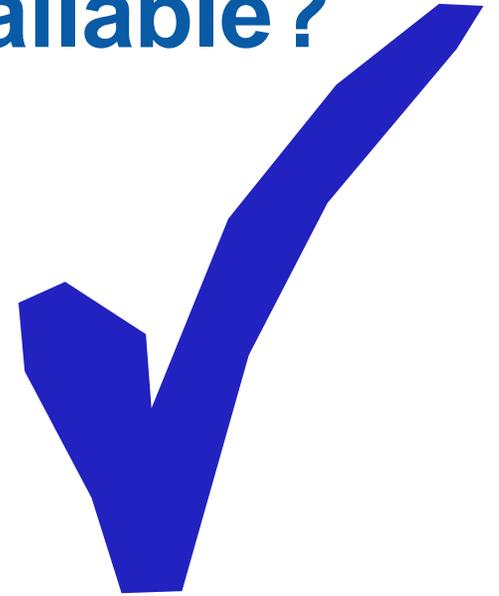
Responding to Odor Complaint Calls

Remember:

- You must consider it to be a hazardous condition until you *prove*, by use of instrumentation, that it is not!

What Equipment Is Available?

- **Combustible Gas Indicator**
- Bead Sensor
- FI Unit (not intrinsically safe)
- Leak Detection Solution
- CO Detector
- Probe Bar
- Wrench/flashlight



Conducting The Investigation

Do Not Assume Anything!

Test, Don't Guess



Approaching The Building

- **Visual observations**
 - Vegetation damage
 - Construction activities
 - Meter observations
- **Olfactory senses**
 - Do you smell anything?



Entering The Building

- CGI zeroed before entering
- Enter on LEL scale
- Check the problem area
- Continue search even if leak is found
- Did you find “*a*” leak or did you find “*the*” leak?



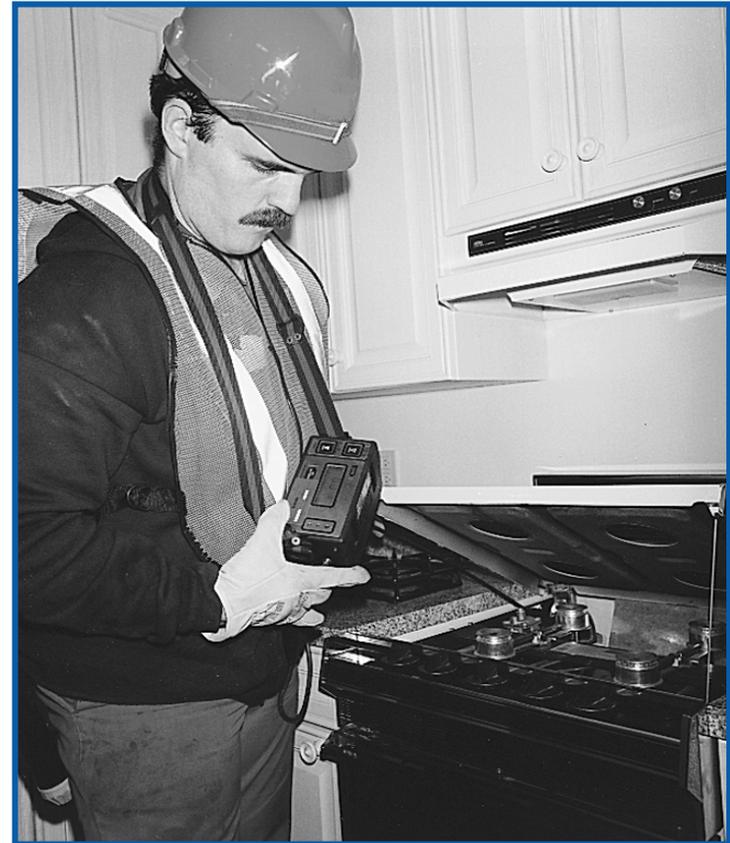
Expanding The Search

- Check the entire gas system
- Visual inspection of appliances and piping
- Check all utility entrances and floor drains



Other Conditions To Observe

- Carbon monoxide
- Other flammables
- Lack of make up air, vent size
- Scalding
- Other code violations



- Natural gas is a simple asphyxiant
- Carbon monoxide is a chemical asphyxiant

It takes far less CO to be deadly!

Carbon Monoxide

- Odorless
- Colorless and tasteless
- Product of incomplete combustion
- Deadly in very small amounts



Potential Effects of Carbon Monoxide Exposure

Excerpts from OSHA chart based on industrial use

PPM	Effects & Symptoms	Time
50	Permissible exposure level	8 Hrs.
200	Slight headache	3 Hrs.
400-600	Headache, discomfort	1-2 Hrs.
1000-2000	Headache, confusion, nausea, may stagger	1.5 Hrs.
2000-2500	Heart palpitation	30 Mins.
2500-3500	Unconsciousness	30 Mins.
4000	Fatal	30 Mins.

Effects may vary from person to person!

Carbon Monoxide Detection Portable Instruments

- What readings constitute a hazard?
- What if it reads 0 ppm?
- OSHA vs. ASHRAE
- Atmospheric testing
- Stack testing
- Background readings and other gases

Action When A *Hazardous* Condition Is Found

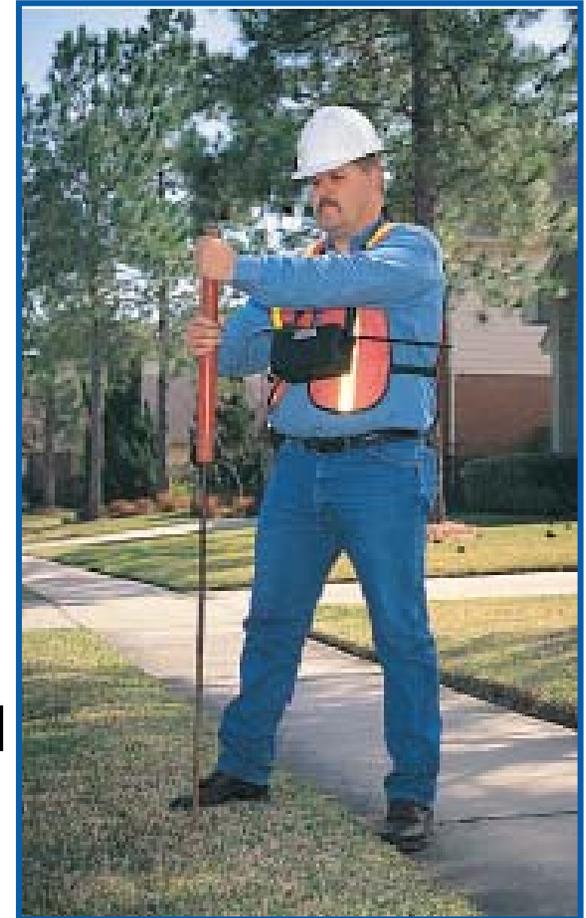
- Red or “Danger” Tag
 - Document
 - Communicate
 - Disconnect
 - Follow up

Policies may vary from company to company



Completing The Investigation

- Shut in test/clock meter
- Test meter/leak detection fluid
- Bar test
 - At the meter (riser), service, along main and check all available openings
- Expand search if odor detected
- Document findings



Incident (2000)

Company Retention \$500K

- A homeowner contacted the gas company to question an unusually high gas bill. The company sent a serviceman to the residence to conduct a “High Bill Investigation.”
- Upon arrival, the technician noticed the smell of gas at the front door. After inspecting the gas appliances and soap testing all of the pipe joints for leakage, a small leak was found at the furnace control and another minor leak was found at the range connector. Both appliances were shutoff and “red-tagged”.

Incident (2000)

Company Retention \$500K

Cont'd.

- Eleven weeks after the visit, an explosion and fire destroyed the home and critically injured 3 individuals. All three were burned on their faces, arms and hands, requiring months of painful rehabilitation – their future employment was doubtful.
- The incident investigation revealed corroded fuel piping running from the meter & beneath the garage's concrete floor served the home's various appliances.
- Experts retained by the gas company concluded the condition existed at the time of the insured's "High Bill Investigation".

AEGIS Incurred \$3.5 Million

What Happened?

- When it comes to unexplained gas usage, customers rely on the gas company for answers. Gas leaks are an obvious explanation for this condition and leakage is typically sought as the cause. In this case, the service technician found not one, but two leaks, which would certainly explain the condition; however, following company procedures and using common sense is critical.

What Happened?

- The company had specific procedures requiring a “meter dial test” and the use of a “U-Gauge” – this procedure was not followed.
- Had the technician followed the established procedure as required, this incident may have been avoided. Common “sense” is also critical in leak investigations – two minor leaks should not have resulted in a high gas bill nor the odor of gas at the front door.
- **Written procedures are written for a purpose – to prevent such mistakes**

Leaks Found On Odor Complaints Must Be:

- Repaired
- Shut off & tagged
- Classified (*is it safe?*)

There should be no other options!

Emergency Response

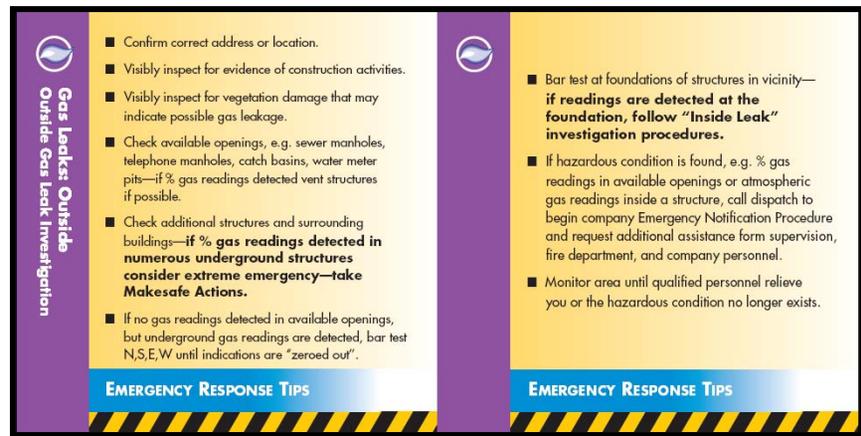
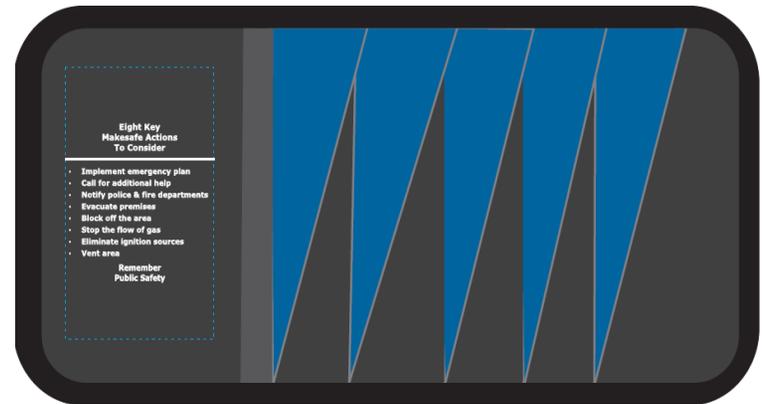
Pre-planning Can Be Extremely Helpful

- Personnel readiness
- Personnel training
- Communication
- Emergency plan
- Coordination with fire service
- Availability of special equipment
- System records
- Involvement of claims & legal depts.
- Public relations - media response

Tip Cards

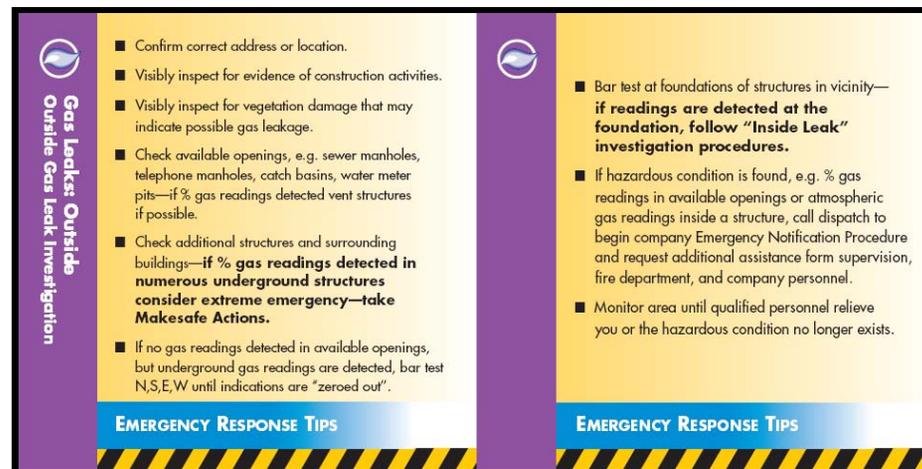
- Designed to assist First Responders in the steps necessary to evaluate a situation
- Focus is on assisting the First Responder in identifying a hazard and the steps necessary to make the area safe i.e.,

MAKESAFE



Tip Cards

- There are 5 different “Tip Cards”:
 - Gas Explosion
 - Outside Damage or “Dig In”
 - Inside Gas Leak Investigation
 - Outside Gas Leak Investigation (shown)
 - Carbon Monoxide Investigation



The image shows two tip cards for "Outside Gas Leak Investigation". Each card has a purple header with a gas leak icon and the title "Gas Leaks: Outside Outside Gas Leak Investigation". The left card lists five investigation steps, and the right card lists three emergency response tips. Both cards have a blue footer with the text "EMERGENCY RESPONSE TIPS" and a yellow and black hazard stripe at the bottom.

Gas Leaks: Outside
Outside Gas Leak Investigation

- Confirm correct address or location.
- Visibly inspect for evidence of construction activities.
- Visibly inspect for vegetation damage that may indicate possible gas leakage.
- Check available openings, e.g. sewer manholes, telephone manholes, catch basins, water meter pits—if % gas readings detected vent structures if possible.
- Check additional structures and surrounding buildings—if % gas readings detected in numerous underground structures consider extreme emergency—take Makesafe Actions.
- If no gas readings detected in available openings, but underground gas readings are detected, bar test N,S,E,W until indications are “zeroed out”.

EMERGENCY RESPONSE TIPS

- Bar test at foundations of structures in vicinity—**if readings are detected at the foundation, follow “Inside Leak” investigation procedures.**
- If hazardous condition is found, e.g. % gas readings in available openings or atmospheric gas readings inside a structure, call dispatch to begin company Emergency Notification Procedure and request additional assistance from supervision, fire department, and company personnel.
- Monitor area until qualified personnel relieve you or the hazardous condition no longer exists.

EMERGENCY RESPONSE TIPS

Makesafe

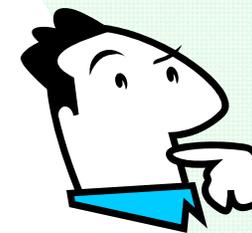
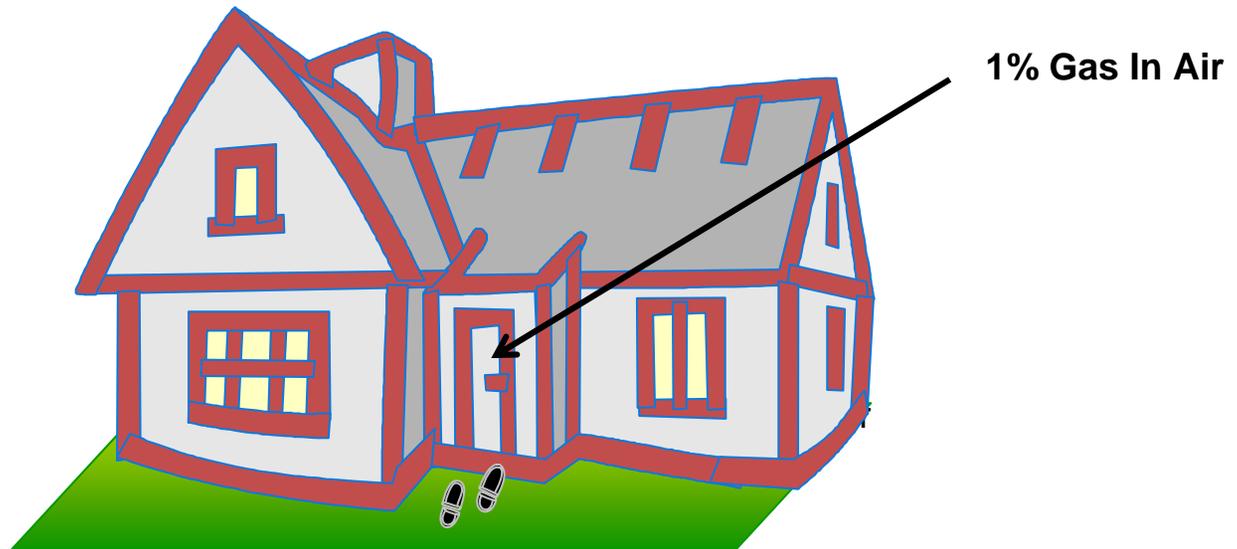
Actions to Consider

- Implement emergency plan
- Call for additional help
- Notify police/fire departments
- Evacuate premises
- Block off the area
- Stop the flow of gas
- Eliminate ignition sources
- Vent area



Table Top Mock Emergency Drills

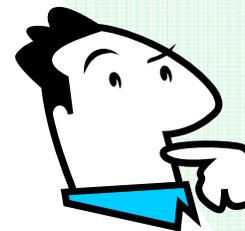
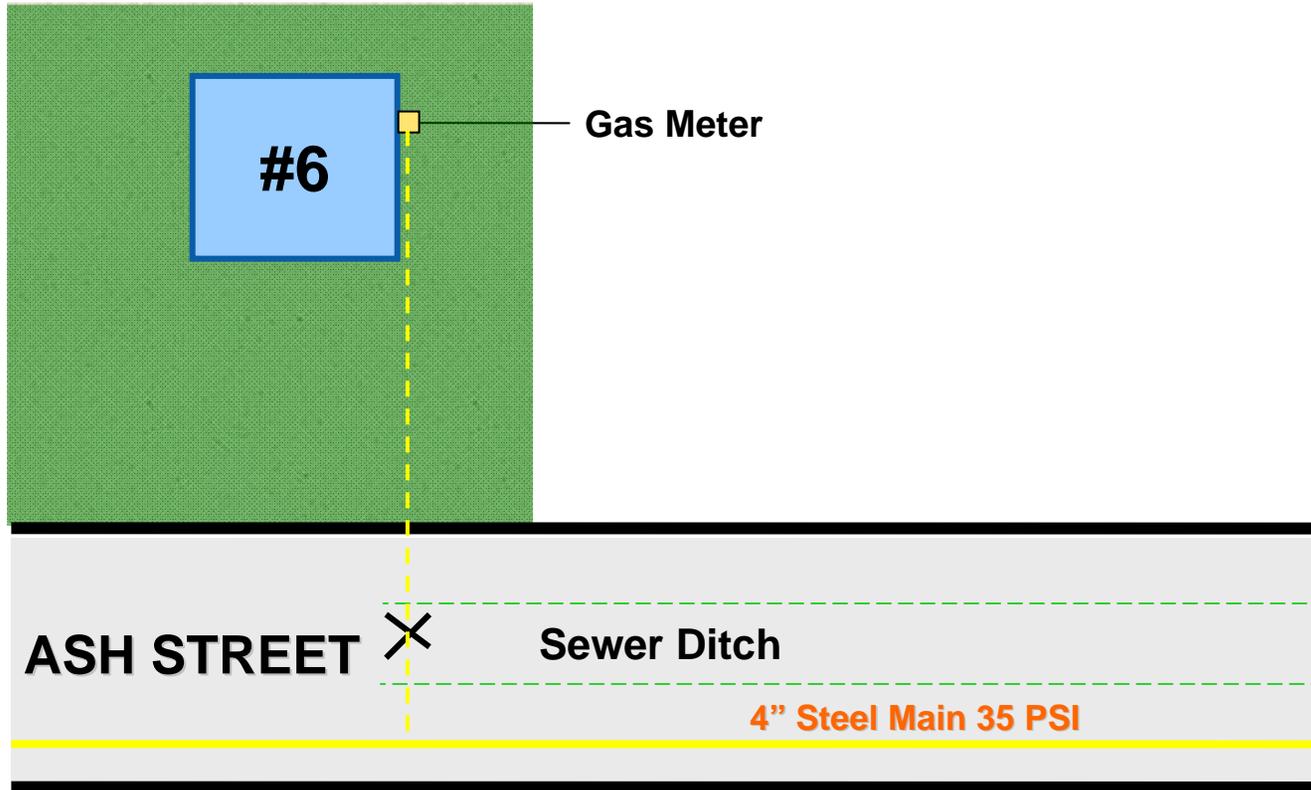
“What would you do?”



You arrive and get a 20%
LEL (1% Gas/Air reading)
in the atmosphere, just
as you enter the front
door.

What would you do?

Figure # 1



A contractor has snagged the 1" steel service and bowed it in the ditch. A small hole was made in the line and gas is blowing in the ditch.

What would be your actions?

CURB LINE

ASH STREET



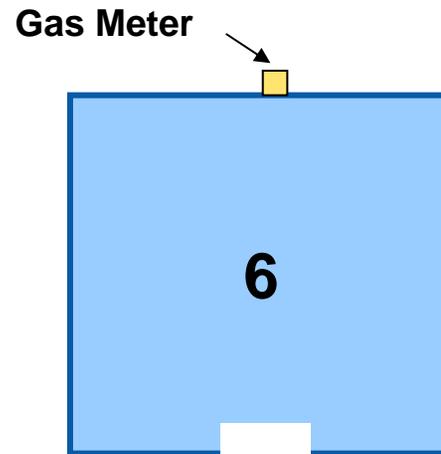
← 20% Gas In Telephone Manhole

6" Steel UP

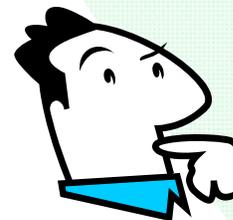
You are called to investigate an odor complaint and find 20% gas in a telephone manhole.

What would you do?

Figure # 2

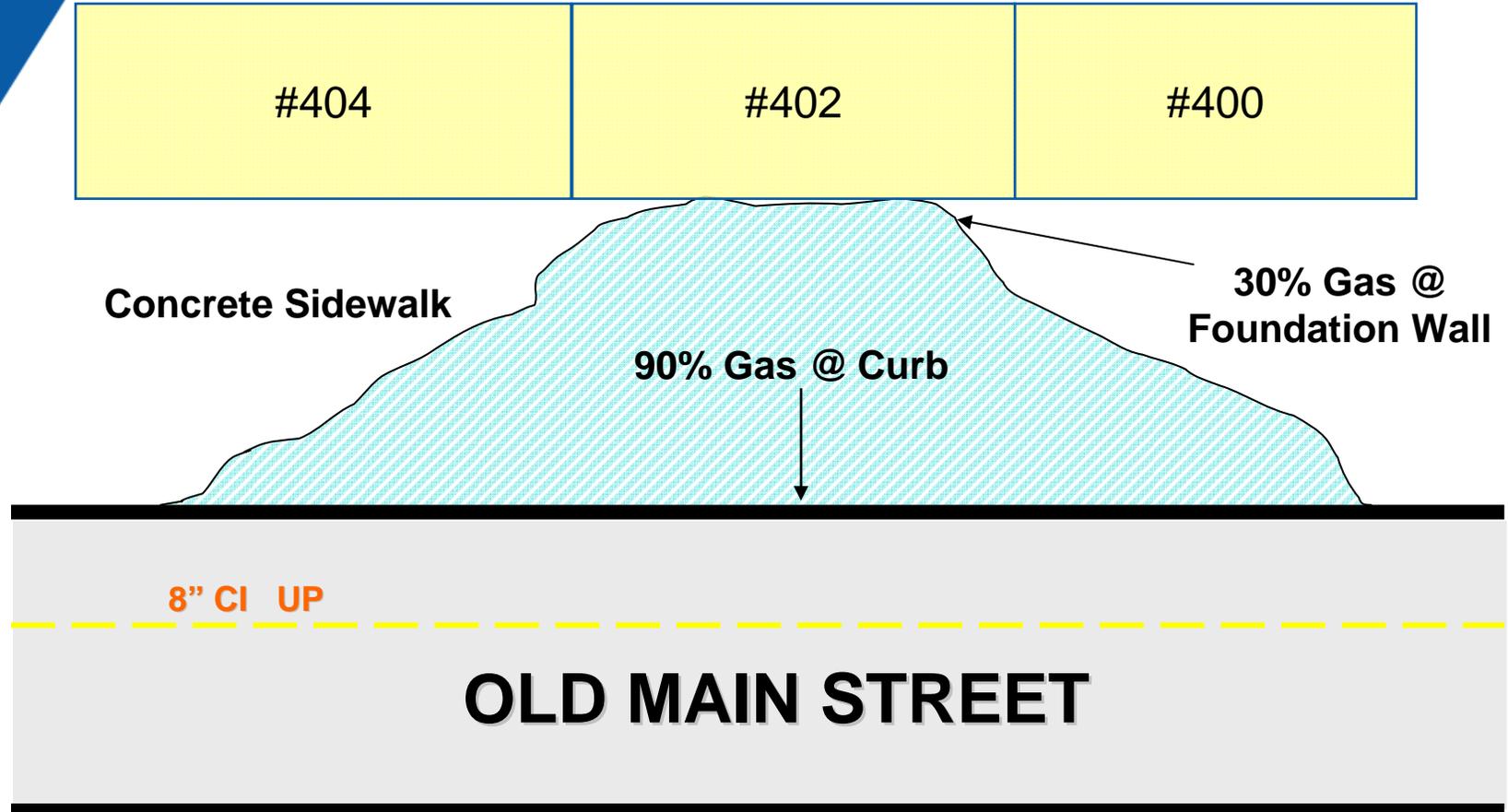


PINE STREET

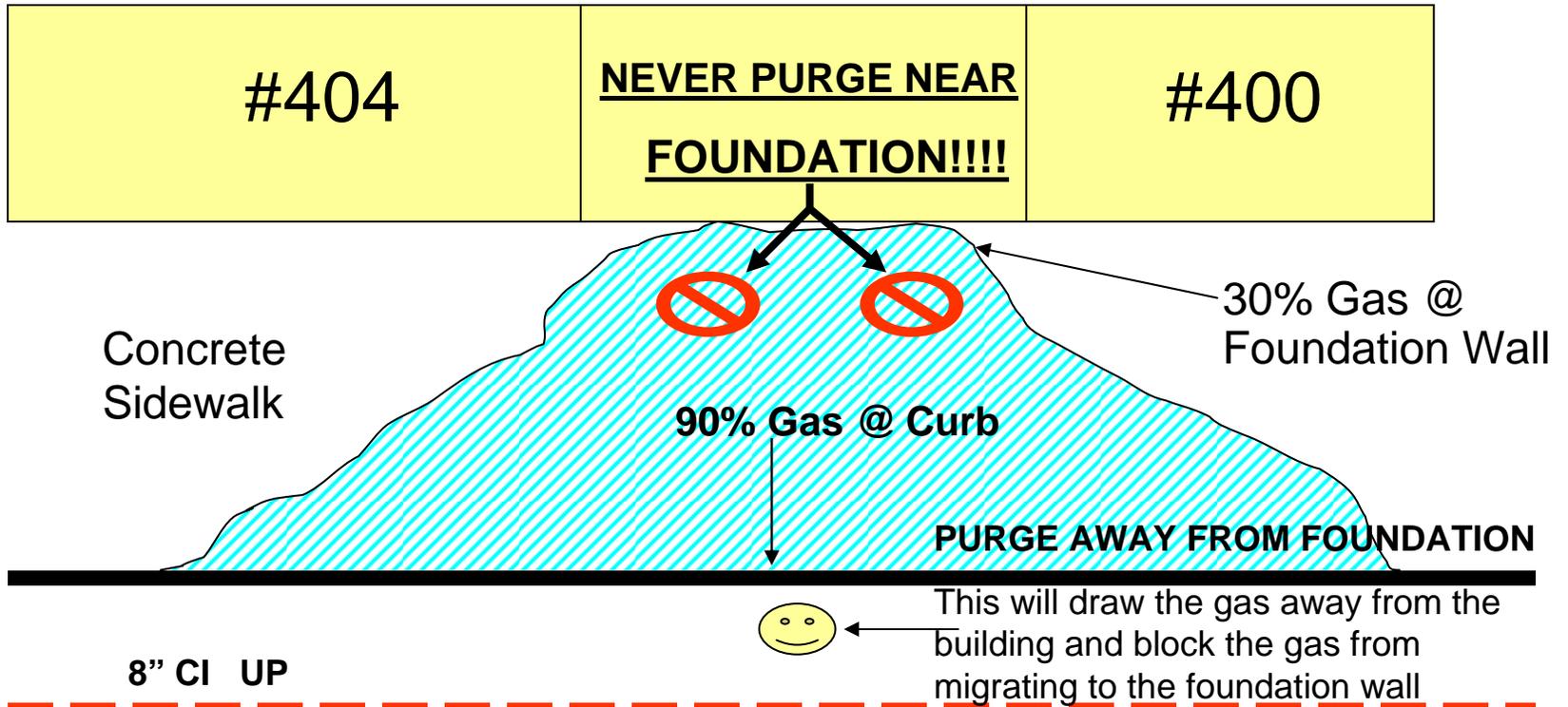


Dispatch reported to you that the homeowner reported smelling a strong odor of gas after moving their gas range. They were asked to leave their house, but refused. You arrive and smell a very strong odor of gas as you approach the house.

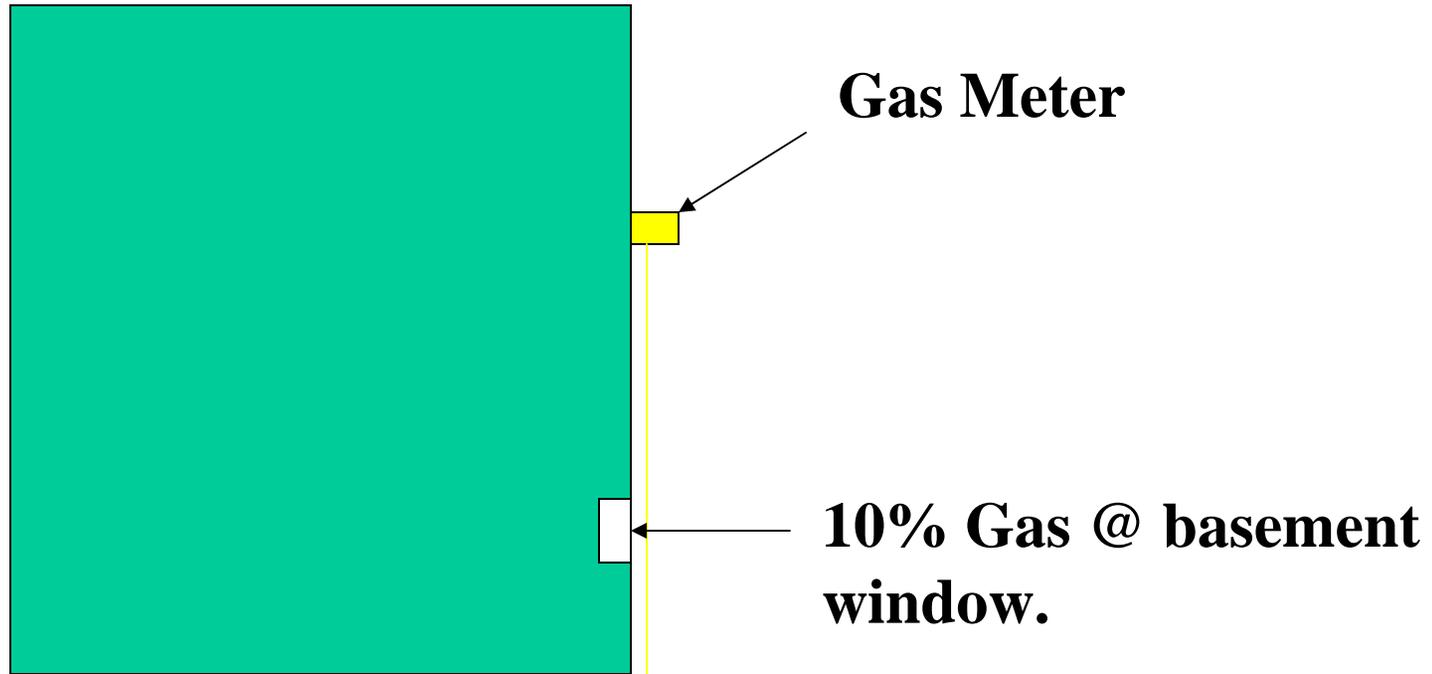
What would be your actions?



A service technician was called to investigate an odor complaint. You are called to pinpoint and make the repair. She says that she found the above readings, what would you ask her? What would you do as far as the pinpointing the leak and making a repair?

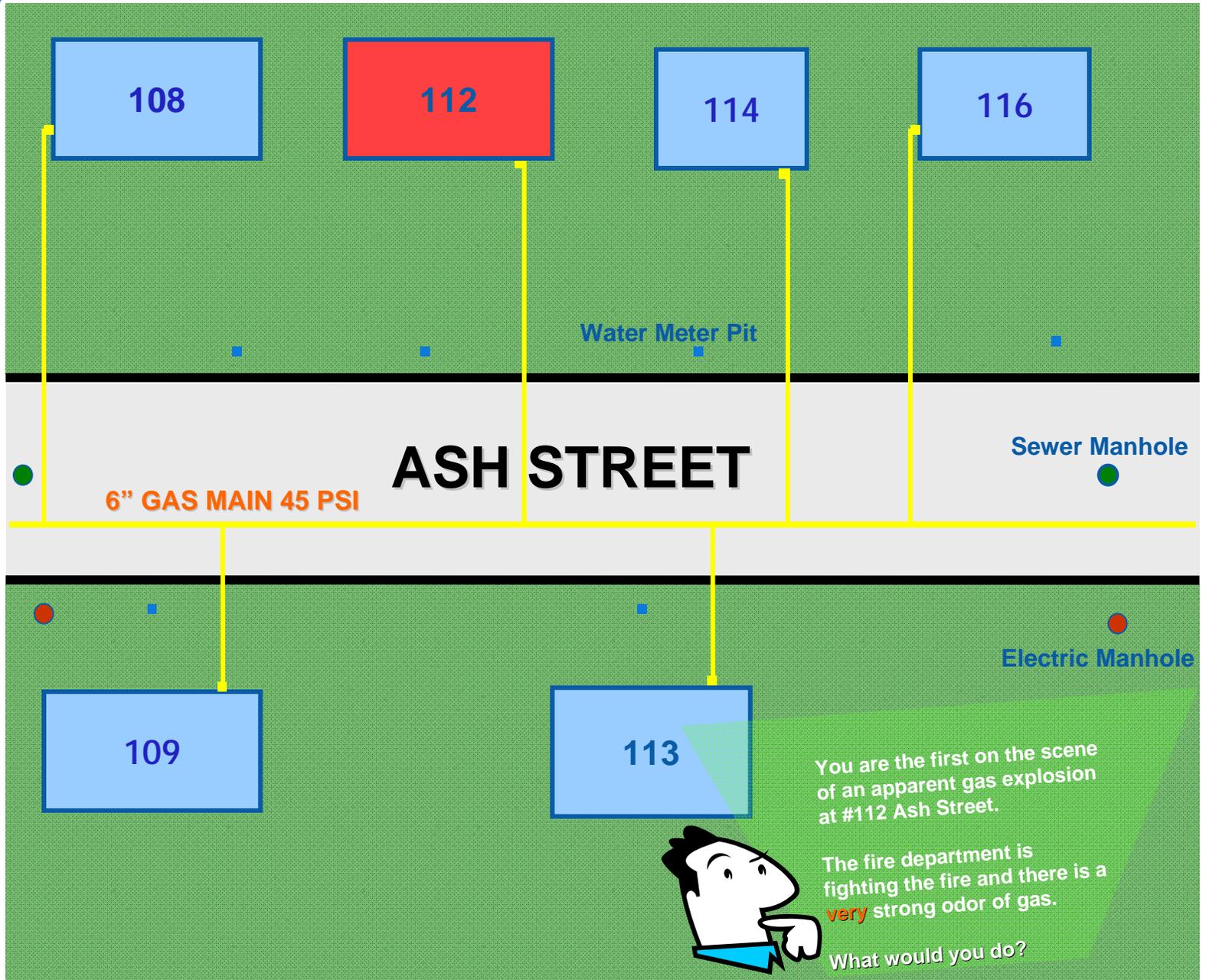


Old Main Street



Called out at 2:00 AM to investigate an odor complaint which was called in by a passing motorist. You arrive and smell a very strong odor of gas, no lights are on in the house. It is a two-story house with a basement in a residential neighborhood. It is June and temperature is around 70 degrees.

What would you do?



Reference Information

- **Pipeline Failure Investigative Report**

Located on the Pipeline and Hazardous Materials (PHMSA) website:

PHMSA www.phmsa.dot.gov in the search box type: Pipeline Failure Investigation Report

- **“Root Cause Analysis For Beginners”**
(Free article)

American Society For Quality www.asq.org in the search box type: Root Cause Analysis for Beginners

- **NFPA 921 Guide for Fire and Explosion Investigations** (\$50.00)

NFPA <http://catalog.nfpa.org> in the search box type: NFPA 921



Investigating Natural Gas Incidents Workshop

December 3, 2008

New Orleans, LA

Free to AEGIS Member Companies

To Register go to:

www.aegislink.com

(Limited space so register early)



Our main job is *not*
finding & fixing leaks

Our main job is
public safety