

ENCOUNTERING ODORS, GASES, AND VAPORS

Fall 2020



The Disclaimer

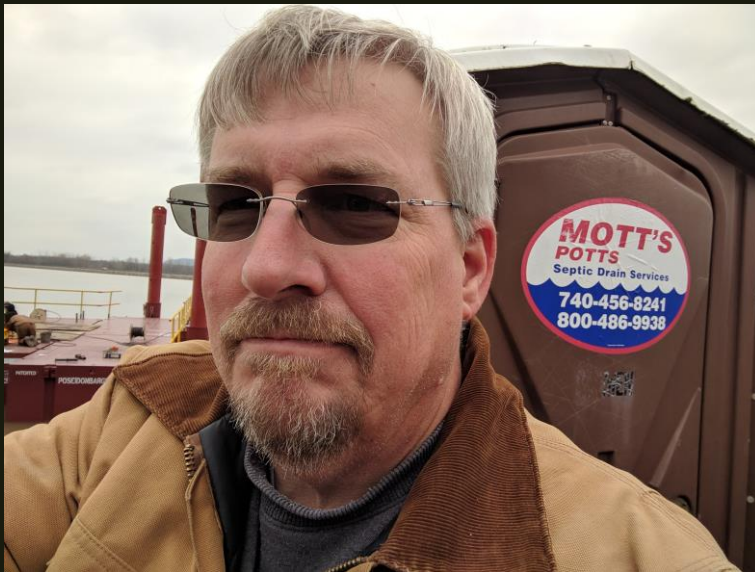
- The following is presentations for information purposes and contains observations based on the presenter's experience with the relevant safety regulations as well as antidotal information from their experiences and federal regulations regarding safety when encountering odors, gasses, and vapors while drilling. Your company's safety policies and procedures may differ from these presented here and supersede the information presented.





The Presenters

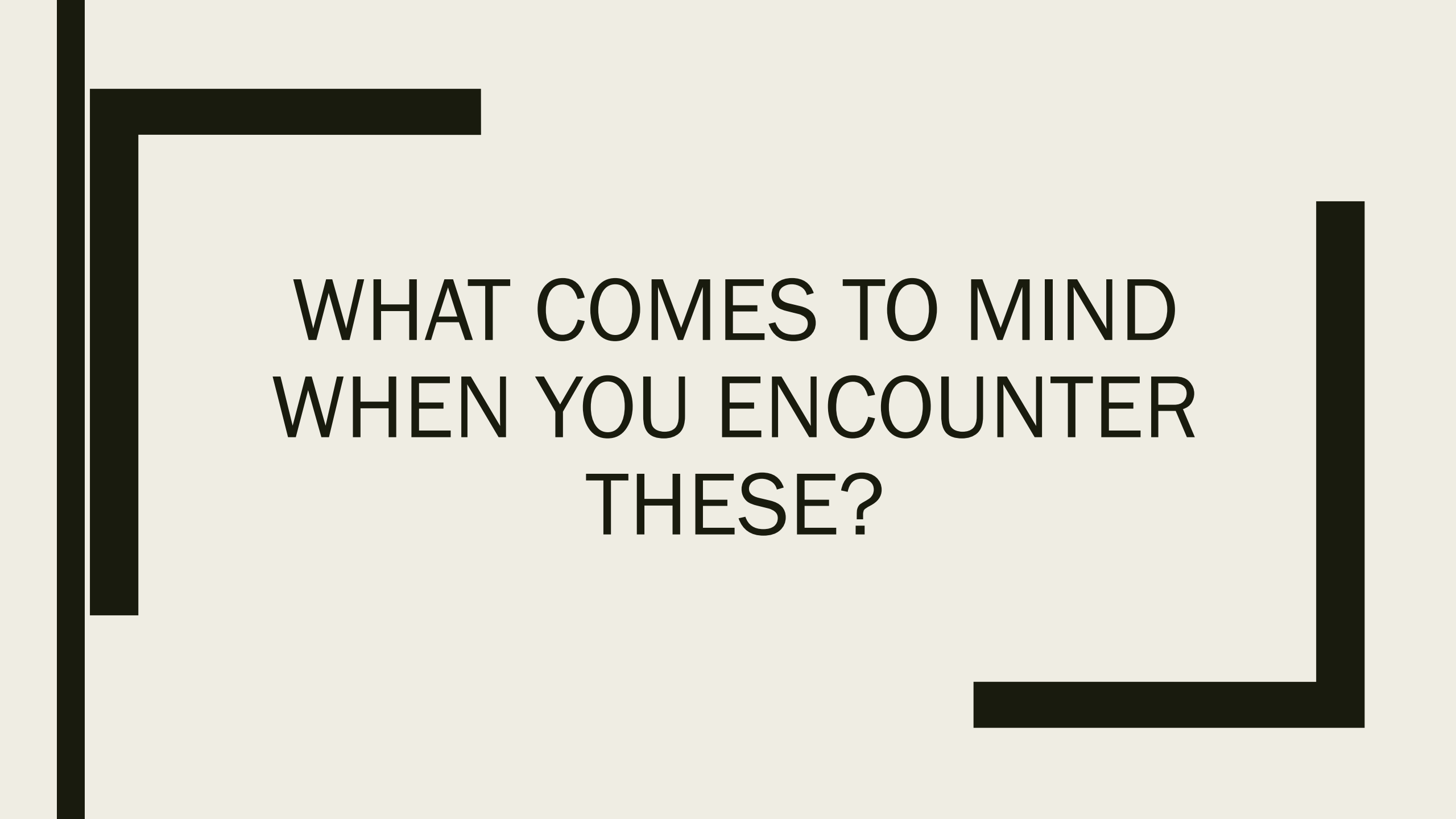
- Steve Larimer, Geologist, Safety Office and Regional Exploration Manager, Terracon and President of the NDA Buckeye Chapter.



- Brian Mott P.G., DLZ, Geologist, Safety Officer, and Drilling Technical Advisor

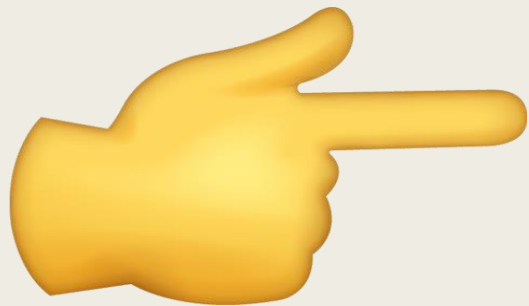
Odors, Gases, and Vapors Encountered While Drilling

Most of us have
encountered them
while drilling borings



WHAT COMES TO MIND
WHEN YOU ENCOUNTER
THESE?

THIS?



Drill Rig



FOR THE
EX-MILITARY
PEOPLE,
MAYBE THIS?



OR YOU'RE
STUCK IN THE
TRUCK WITH A
HELPER WHO
HAD CHIPOTLE
LAST NIGHT



OR
FINDING YOUR CREW
LIKE THIS

10/28/91

The last slide was from 1991

The crew was drilling at a landfill

- Pre-cellphone days
- The Geologist left the site to call the office
- No Drillers or Helpers were injured or harmed
 - *before or after this photo was taken*
- They were napping

Do you or your company have a policy or a plan?

- If you don't, you need one
- If you do, do you know what it says and what you should do?



You are drilling and you encounter Odors, Gases, or Vapors.

- What do you do?
 - *Shut down?*
 - *Call the safety guy?*
 - *Call the office/client?*
 - *Keep drilling?*
 - *Get in the truck and call it a day and leave?*

Many factors
influence
what
happens
next.

It depends,
right?



Was this expected by the Boss,
the Owner, the Client



Are gas or odors common in
the area?



Is the job for a chemical release, at a
gas station, or manufacturing facility?



Did the job instructions indicate
that there was a potential?

Are the odors, gases, and vapors potentially dangerous?

- To the drill crew?
- To other workers on site?
- To the public?



UNDERSTANDING THE
HAZARDS AND RISK OF
ENCOUNTERING ODORS,
GASES, AND VAPORS IS
IMPORTANT

HAVING A PLAN
CAN SAVE YOUR LIFE

Understanding odors, gases, and vapors



Odors, gas, and vapors come from two sources

- Natural



- Man Made (human made)



Natural

- Methane (natural gas, swamp gas, coal bed gas, manure gas)
- Hydrogen sulfide (rotten eggs)
- Natural Petroleum
- Dust and Particulates



Methane

- Naturally occurring as the result of decaying materials
 - *Plants*
 - *Animals*
 - *Other dead things*
- Also known as Swamp or Marsh Gas,
- Flammable
- Odorless
- May be under pressure
- Death by asphyxiation suffocation, toxic effects, fire or explosion



Hydrogen Sulfide (H_2S)

- Rotten egg odor
- Poisonous
- Flammable
- At higher concentrations can no longer be smelled (Nose Blind)
- Death by asphyxiation, suffocation, or toxic effects
- Heavier than air – sinks to ground

Map of Major H₂S-prone Areas in the Continental United States



Source: Energy and Environmental Analysis, Inc. for Gas Research Institute. p.1-13 and p.A-5.

Hydrogen Sulfide Effects on Humans at Various Concentrations

<u>PPM</u>	<u>Effect</u>	<u>Time</u>
■ 1 -2	Odor Threshold	immediate
■ 10	Permissible Exposure Level	8 Hours
■ 50 - 100	Mild Irritation - eyes, throat	1 Hour
■ 200 - 300	Significant Irritation	1 Hour
■ 500 -700	Unconsciousness, Death	1/2 - 1 Hour
■ >1000	Unconsciousness, Death	Minutes

Level C respiratory protection (cartridge respirators) **IS NOT** allowed for working in H₂S atmospheres.

Work **REQUIRES** Level B (supplied air)



Natural Petroleum and Coal

- Likely methane but has odor
- May be toxic
- May present a fire or explosion hazard



Dust and Natural Particulates

- Road dust, pollen, smoke
- Irritating
 - *Eyes*
 - *Nose*
 - *Mouth*
 - *Lungs*
- Generally not deadly



Man Made

- Fuels and lubricants (gasoline, diesel, oil)
- Chemicals (solvents, glues, cleaners)
- Landfill gases and odors





DETECTION
AND
MEASUREMENT

THE
METERS AND
DETECTORS

The Next Disclaimer

- Read and follow manufactures directions
- Use only in accordance with manufactures directions.
- Use for only intended purposes.
- Failure to do so may result in death or injury



The Meters and Detectors

What they do and don't do

- Multi Gas (including 4-gas)
- Single Gas Meter
- PID (Photo-Ionization Detector)
- FID (Flame Ionization Detector)
- Detector Tubes



Multi gas meter (including 4-gas)

Positives

- Have single or multiple sensors to detect various gases
- Sensors can be customized

Negatives

- Only detects what the sensor(s) can detect
- Other gases or moisture may interfere with readings and function



Single gas meter

Positives

- Single gas or vapor specific sensor
- Sensors can be customized
- More than one meter can be used

Negatives

- Only detects what the sensor can detect
- Other gases or moisture may interfere with readings and function

PID (Photo-Ionization Detector)



Positives

- Uses a Ultraviolet light to sense compounds at the sensor
- Responds to many organic gases
 - Gasoline
 - Alcohols
 - Petroleum solvents

Negatives

- Only detects what the sensor can detect
- Sensitive to temperature and moisture
- Dependent on the energy output of the lightbulb
- Blind to methane
- Partly to fully blind of oily petroleum, and compounds containing chlorine

FID (Flame Ionization Detector)

Positives

- Uses a sealed ultra pure flame to detect compounds at the sensor
- Not sensitive to temp. or moisture
- Responds to any vapor that will burn
 - *Gasoline*
 - *Alcohols*
 - *Ammonia*
 - *Methane*
 - *Most solvents and oils*

Negative

- *Can detect natural methane in soil skewing results*





Detector Tubes

Positives

- Single gas or vapor specific tube
- Detector tubes can be customized for a job
- More than one tube type can be used

Negatives

- Only detects the compound that the tube can detect
- Other gases or moisture may interfere with readings and function



Acceptable Concentration and Exposure Levels

- Driven by NIOSH, OSHA, site requirements and Company Policy
- OSHA and NIOSH have exposure levels but not for every chemical or compound. These are generally based on indoor continuous exposure
- OSHA exposure levels are The Law
- Company safety policy generally dictates what is an acceptable exposure beyond OSHA

Know the Abbreviations

- EEGL - emergency exposure guidance level
- IDLH immediately dangerous to life or health concentration value
- LC - lethal concentration
- LC50 - concentration causing death in 50%
- LCLo - lowest concentration causing death
- LD - lethal dose
- LD50 - dosage causing death in 50%
- LDLo - lowest dosage causing death
- LEL - lower explosive limit
- mg/kg - milligrams per kilogram of body weight
- mg/m³ - milligrams per cubic meter of air
- PEL - permissible exposure limit (OSHA)
- ppm - parts per million parts of air
- RD50 - concentration producing a 50% decrease in respiratory rate following a 10-minute exposure
- REL - recommended exposure limit (NIOSH)
- SPEGL - short-term public emergency guidance level (NRC)
- STEL - Short-term exposure limit
- TLV - threshold limit value (ACGIH)
- TWA - time-weighted average



ALL THE TERMS CAN BE CONFUSING

An Example of Exposure Levels Benzene

- The LAW

- OSHA

- PEL: 1 ppm TWA
 - 5 ppm STEL

- Other Recommended Exposure Limits

- National Institute for Occupational Safety and Health (NIOSH)

- REL: 0.1 ppm
 - TWA, 1 ppm STEL;
 - IDLH: 500 ppm

- *American Conference of Governmental Industrial Hygienists (ACGIH)*

- TLV: 10 ppm (32 mg/m³)
 - TWA, A2

- *Emergency Exposure Guidance Levels (EEGLs) NRC (National Research Council)*

- 1-hour EEGL: 50 ppm
 - 24-hour EEGL: 2 ppm

- *LEL: 1.2% (10% LEL, 1,200 ppm)*

*The Next Disclaimer

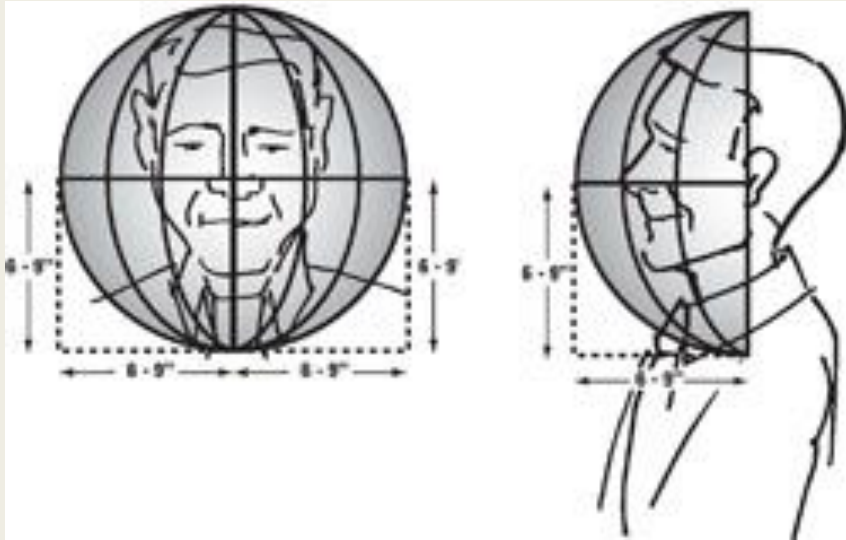
- The minimum requirement is established by OSHA
- A company MAY opt for permissible exposure levels to be LOWER than OSHA
- A company MAY NOT opt for permissible exposure levels to be HIGHER than OSHA
- Other recommended levels are presented for guidance



Know where to measure

- Breathing Zone
 - *6 - 12 inches from face*
- Exclusion zone
 - *Area around rig where the public is excluded*
- Work Zone
 - *Designated area inside exclusion zone where work is occurring*
- Top of hole, augers, or casing

Breathing Zone



Top of hole, augers, or casing (Typically highest readings)

- Typically the maximum concentrations occur here
- May not be indicative of working conditions in the breathing or work zone

Drill Method	Location	Frequency
Auger / Probe	in auger / rod, at cuttings	every 5 feet
Air / Mud Rotary	at discharge	5 feet or 15 minutes
Sonic	during extrusion	every sample
Development	discharge	15 minutes, zonal



Control or Elimination

- Mechanical or natural ventilation (dilution)
- Reposition crew/rig to mitigate exposure
- Control conditions (suppress with water or mud)
- Allow to vent



A photograph of an emergency scene. In the background, a red fire truck from the City of Sunrise Fire Rescue, unit 59, is parked. To the right, the rear of a black police car is visible, with 'POLICE' and 'FLORIDA XF9149 CITY' on its back. In the foreground, several emergency responders in high-visibility vests and hard hats are attending to a person lying on the ground. A semi-transparent dark box with white text is overlaid on the left side of the image.

Notifying Emergence Management Services (EMS)

- Notifying EMS is a company choice except for:
 - *If there is a fire or medical emergency/injury*
 - *If there is a defined danger to health and welfare of the public*

EMS may not have any understanding of how to address drilling related releases of gas odors or vapors

- Be able to explain in clear and concise detail what has occurred
 - *What the hazard or danger is.*
 - *What the types of injuries are and how many people are injured if applicable*
 - *Provide location address, intersection or other reference to EMS*

Notifying Safety Officer, Manager, and Client



- Follow THE PLAN including
 - *Follow Your Training*
 - *Use The Emergency Contact List*
 - *Follow Company Policies*
 - *Follow The Contract Requirements*

Thank You