

RESPONSE TO OIL & GAS WELL INCIDENTS INCLUDING HORIZONTAL DRILLING & HYDRAULIC FRACTURING

Prepared by Members
of the Stark County LEPC

Traditional Well vs Horizontal Well

- ▣ Traditional Well
 - Vertical bore
 - Usually shallower, less than 1 mile

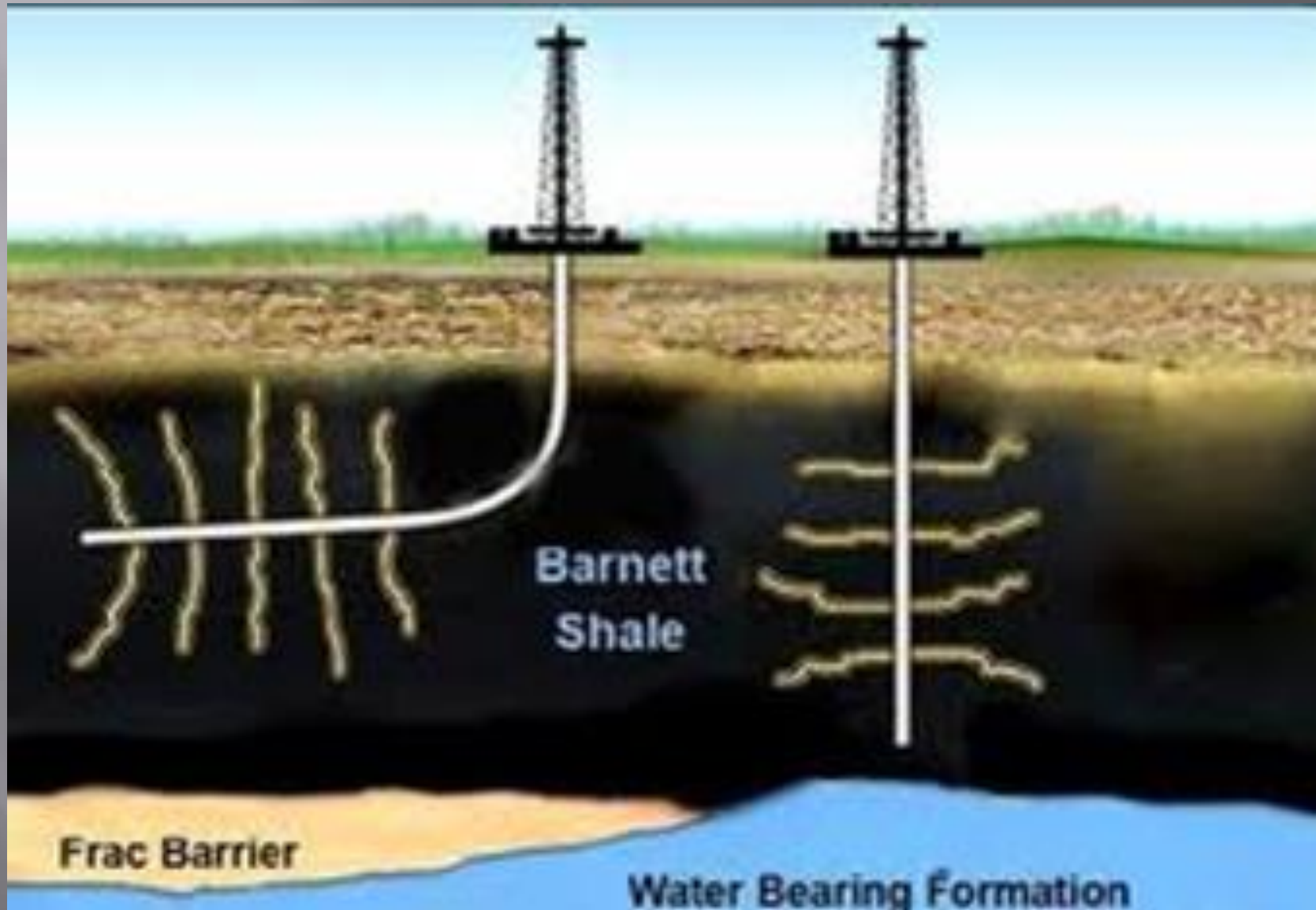
Horizontal Well

Deeper than traditional wells

Horizontal leg drilled off of vertical bore

Horizontal bore may be 1 – 2 miles in length

Traditional vs Horizontal



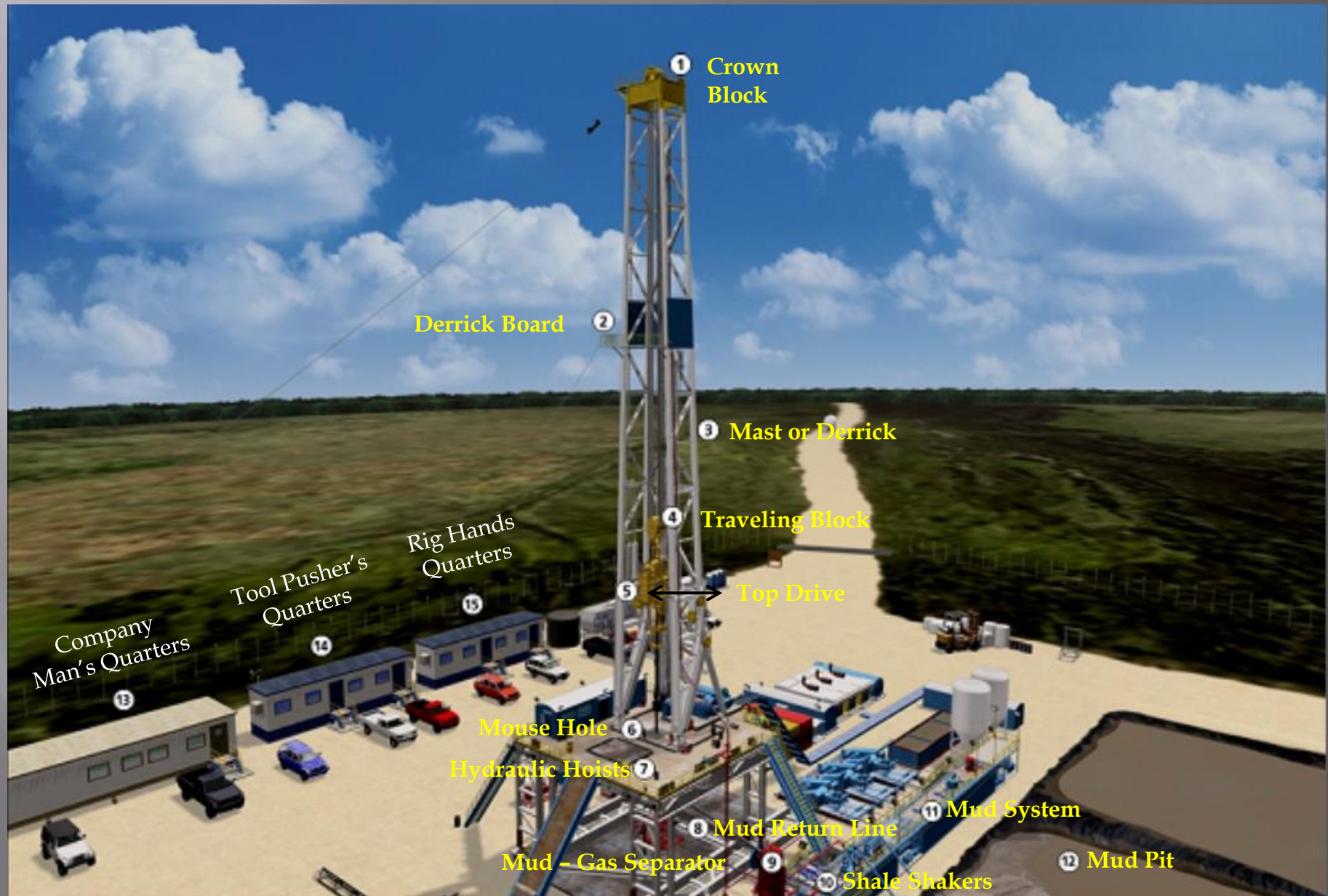
Traditional Oil Well Site



Video



Drilling Rig Chart



Terminology

- ▣ Company Man
Employee of an operating company who supervises operations at drilling or well site. May be company employee or contractor hired by company.
- ▣ Hydraulic Fracturing
Use of sand, water, chemicals & explosives to access shale layer that contains hydrocarbons.
- ▣ Kick
Over pressure from wellbore caused by high pressure of gas within rock formation.

Wellbore

The hole drilled by a bit. Will have steel & cement liners installed to protect the environment & provide a path for gas & oil to be extracted from the well.



4 Phases of Well Site Construction – Part 1

- ▣ Site Selection & Preparation
 - Average Pad Site, 3-5 acres
 - Location – usually rural, can be residential
 - Water Impoundment - adjacent to well site
 - Guard at Access Road - during construction, 24/7

Access to Well Pad Site

- ▣ Responders should be familiar with current condition of access road

- ▣ Construction of Access Road
 - Size of Access Road May Limit Access to Pad Site by Response Vehicles

Water Impoundment for Hydraulic Fracturing Site



4 Phases of Well Site Construction – Part 2

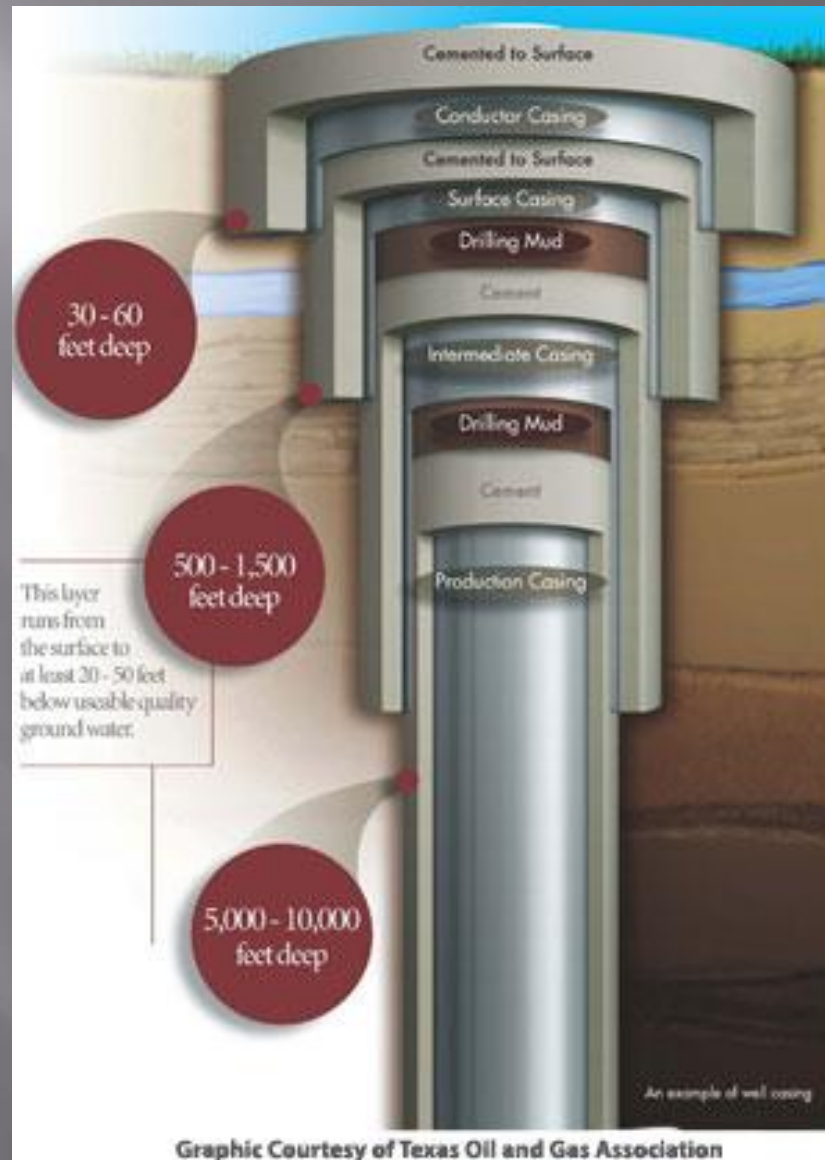
▣ Well Construction

- 2 or 3 Section Derricks – may be 90 ft. tall
 - ▣ Pipe sections approx. 30 ft long & weigh 500 lbs
 - ▣ Wells may be 1 – 2 miles deep, 1 – 2 miles laterally
 - ▣ Metal pipe bends 90 degrees over about $\frac{1}{4}$ mile
- Potential – Underground Pockets of Methane
 - ▣ Possible “kick” or “blowout”
- “Christmas Tree”

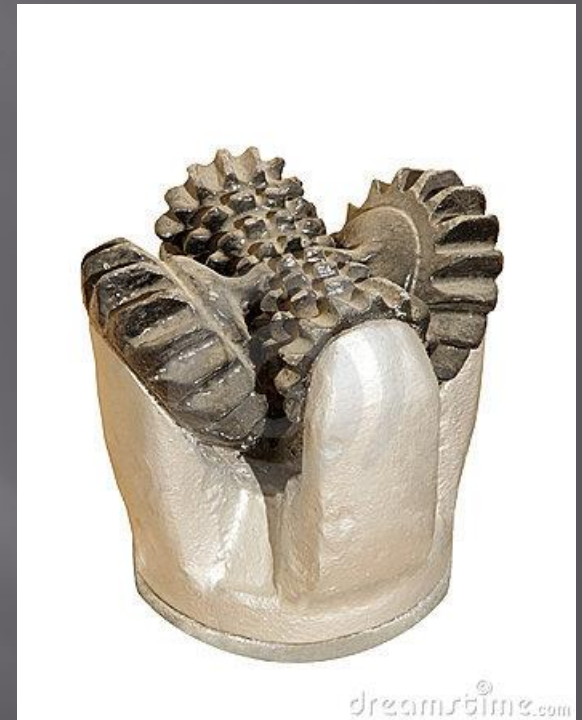
Preparing for Vertical Bore



Wellbore



Examples of Drilling Bits



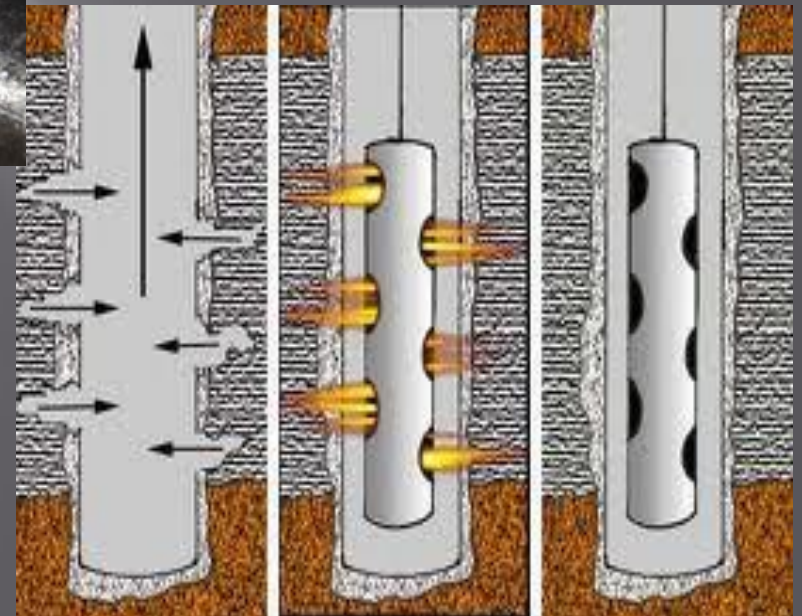
Multi-Stage Derrick Hydraulic Fracturing Site



4 Phases of Well Site Construction – Part 3

- ▣ Completion
 - Perforating – Explosives Used
 - ▣ FD – to be advised when/where explosives stored and used
 - Hydraulic Fracturing
 - ▣ High pressure pumping trucks delivering sand, water and chemicals into wellbore
 - ▣ One of the Most Hazardous Phases – high pressures used. Pressures of 4,000 - 10,000 psi not uncommon. Physical hazards at this stage are obvious.

Perforating Guns



Effects of Explosives

- ▣ The explosive charges within the perforating guns are intended to open the plug in the pipe casing and fracture the cement around the pipe.
- ▣ It may fracture the shale or rock formation a short distance, approximately 4'.
- ▣ The fracturing fluids pumped under pressure then cause the formation to fracture into very small channels out to distances of 250' to 500'.
- ▣ The sand then holds these fractures open.

Perforating Guns Regulations

▣ ATF / Dept. Of Justice

- 18 USC 842J Storage of Explosives
- 27 CFR 555.222 Alternate Methods or Procedures
- 27 CFR 555.205 Movement of Explosive Materials
- ATF Rule 2010-7

Perforating guns used primarily to pierce oil & gas wells may measure up to 70 feet in length & weigh in excess of 150 pounds when loaded with explosives (this may vary between companies). Explosives are shaped charges that explode to pierce the well casing and into the rock formation. Each charge typically contains between 25 & 45 grams of high explosives & is initiated by detonating chord and a detonator.

During transportation of perforating guns DOT regs require detonator interrupter device to be placed between detonators and detonating chord.

Refer to above codes for exact requirements for transportation, storage, usage of explosive materials at well sites.

Handout referring to these rules is available from the LEPC.

Fire Department Notification

▣ Use of Explosives

- Well Companies are required by law to report quantity & storage location of explosives used during perforation operations. These are generally high grade explosives but quantities are limited. Exact amounts may vary with each pad site. Depending upon amount of fracturing, there may be 30 – 35 lbs of explosives on site.
- Officials at DNR are in conversation with State Fire Marshal to promote rules relative to this topic. DNR officials state that the jurisdictional fire department will have access to pad sites to address fire suppression equipment & other safety issues.

Pad Site During Hydraulic Fracturing



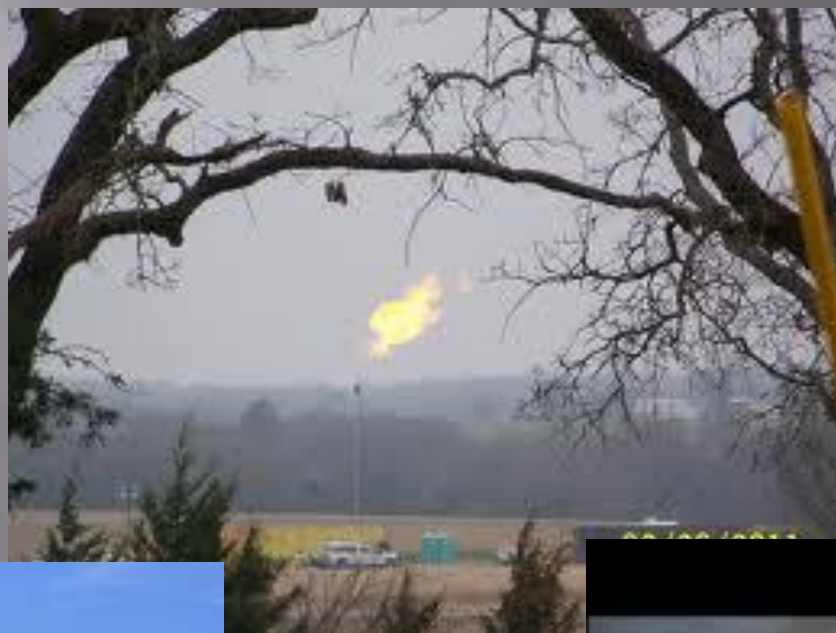
Piping Used During Fracturing



Blowout Preventor



Flares



4 Phases of Well Site Construction – Part 4

- ▣ Production
 - Storage Tanks
 - ▣ Hold product (condensate) & waste water
 - Extremely flammable/explosive
 - ▣ Tanks to be labeled, describing hazardous materials
 - In some cases, trucks transfer product from site to refining facility
 - Most wells will be connected to underground pipe infrastructure to move product off site.
 - ▣ Fire fighters should be familiar with underground piping
 - Workers Visiting Site Periodically
 - ▣ Insuring proper working of equipment
 - ▣ Many sites monitored remotely, using solar powered instruments

Completed Site



Tanks



Separator, Compressor, Tank



BREAK



Injection Wells

- ▣ Oversight by DNR
- ▣ 16 Currently in Stark County
- ▣ Reportedly must be located adjacent to State Routes

Physical Hazards at Pad Sites

- ▣ Similar to other “Construction Sites”
 - Slip, Trip and Fall
 - Collapse – Confined Space, Amputations, Fractures, other Trauma
 - Heart Attacks, Stroke, Heat & Cold Injuries, General Medical Issues
 - Electrical Hazard – Diesel generators on site supply power to facility. They present significant hazard.

Chemical Hazards at Well Sites

These Chemicals May Be Stored in Bulk

- ▣ Wide Variety of Chemicals Used
- ▣ Types of Chemicals Used
 - Water – 94%
 - Sand – less than 6%
 - Gel – thickens water to suspend sand
 - Friction Reducer (petroleum distillate)
 - Hydrochloric Acid – dissolves minerals & initiates cracks in shale
 - Biocide – eliminates bacteria
 - Others - extremely small quantities

Additional Chemical Hazards

- ▣ Significant quantities of diesel fuel stored on site
- ▣ Explosives used during hydraulic fracturing processes. Stored on site for limited time.
 - Location for storage & quantities stored at site are regulated by other agencies
 - Fire Dept is to be advised of these locations & quantities

Toxic Vapors

▣ Hydrogen Sulfide (H₂S)

Hydrogen sulfide is a naturally occurring gas mixed with natural gas or dissolved in oil or brine and released upon exposure to atmospheric conditions. It has been recorded by gas well producers that H₂S is not as common in Ohio as in other locations but it has been found.

- ▣ Quantities in OH – may differ from other locations
- ▣ IDLH at 100 ppm
- ▣ LEL/UEL: 4-40%

▣ Those working on well sites in OH have been required to wear H₂S monitors.

▣ Methane Releases

- ▣ Probably More Likely in this Area
 - ▣ LEL/UEL: 5-15% If no H₂S, utilize **ERG Book – Guide 115 (Natural Gas)** to initiate response actions
 - ▣ If H₂S, present or suspected utilize **ERG Book – Guide 117** to initiate response actions
 - ▣ If unknown, utilize **ERG Book – Guide 117** to initiate response actions

Incidents that May Require 1st Responders

- ▣ The following few slides will discuss the types of incidents that may require well companies to call 911.
- ▣ There has been some question as to accessibility to the pad site by 1st Responders. Established response guidelines should be followed when responding to a well site. Safety of workers and 1st Responders will take precedence.
- ▣ Attempt to gather as much information as to “cause” prior to arrival of 1st in units as possible. What is the nature of the call?

EMS Response

- Victims may be transported to hospital by fellow workers or they may be transported to the fire station
- If EMS is requested, coworkers may move victim to access point (entrance) of pad site.
- Victim condition may dictate this movement.
- The Company Man may choose to allow 1st Responders to enter the pad site without PPE. This will be dependent upon the situation.

Fire Response

- Is There A Vapor Release?
- Is There an Actual Fire?
 - Fire may be associated with diesel generators, trucks, mobile homes used by site personnel, etc.
- Is Well Site Evacuated?
- Fire Units Respond to Pad Site or stage at another location? (predetermined if possible)
- Evaluate Current Weather
 - Weather conditions may impact accessibility to site
 - Wind direction & speed
- Air Monitoring – done or needed?
- Consider need for HazMat Team?

Considerations for 1st Responders

- ▣ **Blowout or Well Control Incident (without Fire)**
 - Contact “Company Man” – well workers should be wearing H₂S monitors
 - Establish Site Security
 - If Well is Uncontrolled Wait on Well Control Specialists
 - Request Haz Mat Team especially if air monitoring is required

Considerations for 1st Responders

- ▣ **Blowout or Well Control Incident (with Fire)**
 - Contact “Company Man”
 - Respond & Treat Injuries If Able
 - Establish Site Security
 - Contact HazMat and Monitor Air Quality
 - If Fire Deemed Controllable Responders may Fight Fire
 - If Fire is Uncontrollable – Wait on Well Control Specialists

Blowout











**Typical American City FD
Pumper has a 1000 GPM
capacity**

**Gas wells take 3000 to 6000
GPM for water curtain**





Ground fire Ignites

The superheated ground and oil combust

Considerations for 1st Responders

- ▣ **A Release from Something other than the Well (e.g., tanks, pits, etc.)**
 - Contact “Company Man”
 - Determine Source of Release (tank, pit, drums, etc.)
 - Utilize ERG Book
 - Establish Site Security
 - Utilize Company’s Spill Control Response Plan

Disruptive Activities

▣ Demonstrators

- May block truck routes, access road
- May be peaceful but potential for physical disruption of vehicular traffic or activities at pad site.
- Active drilling sites will have limited physical security on site.
- Once in production security provided by fencing and real-time monitoring.

Regulatory Oversight

- ▣ Ohio Dept of Natural Resources
 - DNR Inspectors
 - EPA reviews preliminary permitting & will respond to releases
 - As per EPA, HS releases at pad site are by definition “off site” as drilling company does not own the land the well sets on.
 - “Tier II Report” Information will not be submitted to the LEPC, but information regarding chemicals used on site is available to 1st responders.

Chemical Reporting

- ▣ FracFocus – chemicals used at sites will be listed here. Uncertain at this time how timely chemical usage will be reported to DNR – before, during, or after drilling.

Q & A



Acknowledgements

- ▣ Information contained in this presentation has been obtained from the following:
 - Chesapeake Energy
 - Enervest
 - The Office of the State Fire Commissioner – PA
 - OOGA, OOGEP
 - FracFocus
 - Ohio DNR
 - Ohio EPA

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