Hydraulic Fracturing 101

Federal Regulatory Perspective – SDWA/CWA

Presentation for the

ADEM Ground Water Conference

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Hydraulic Fracturing 101

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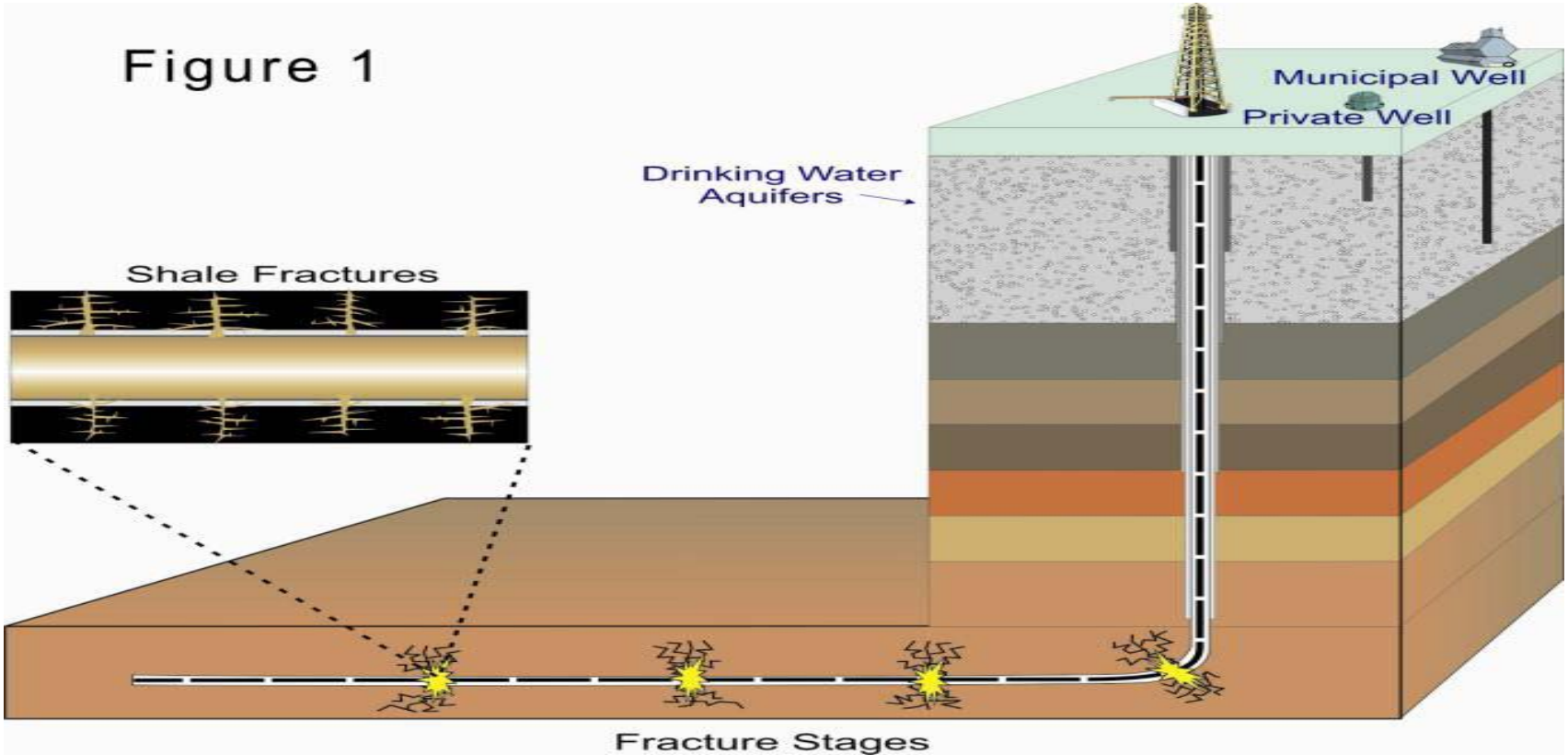
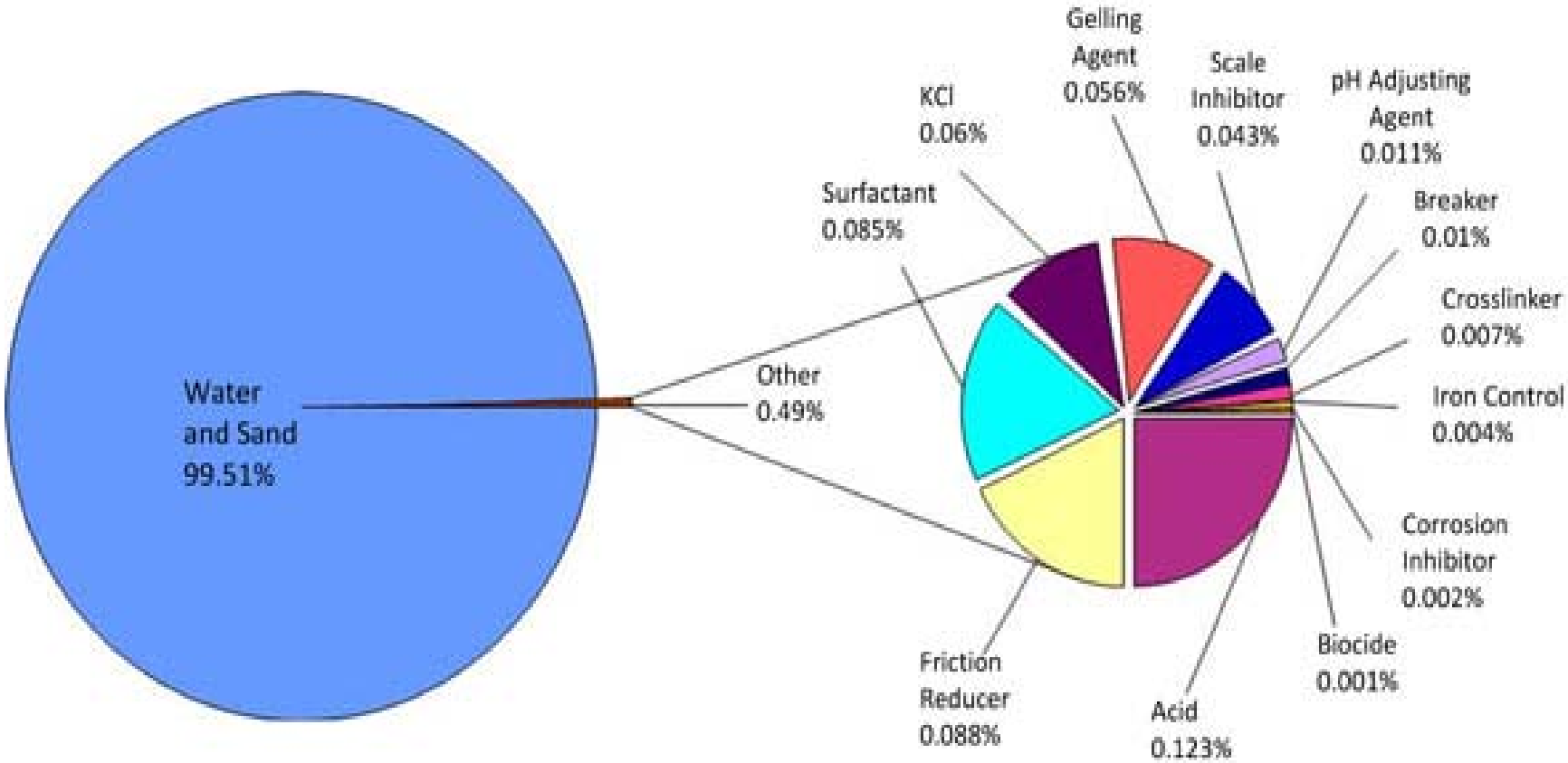
Hydraulic Fracturing 101

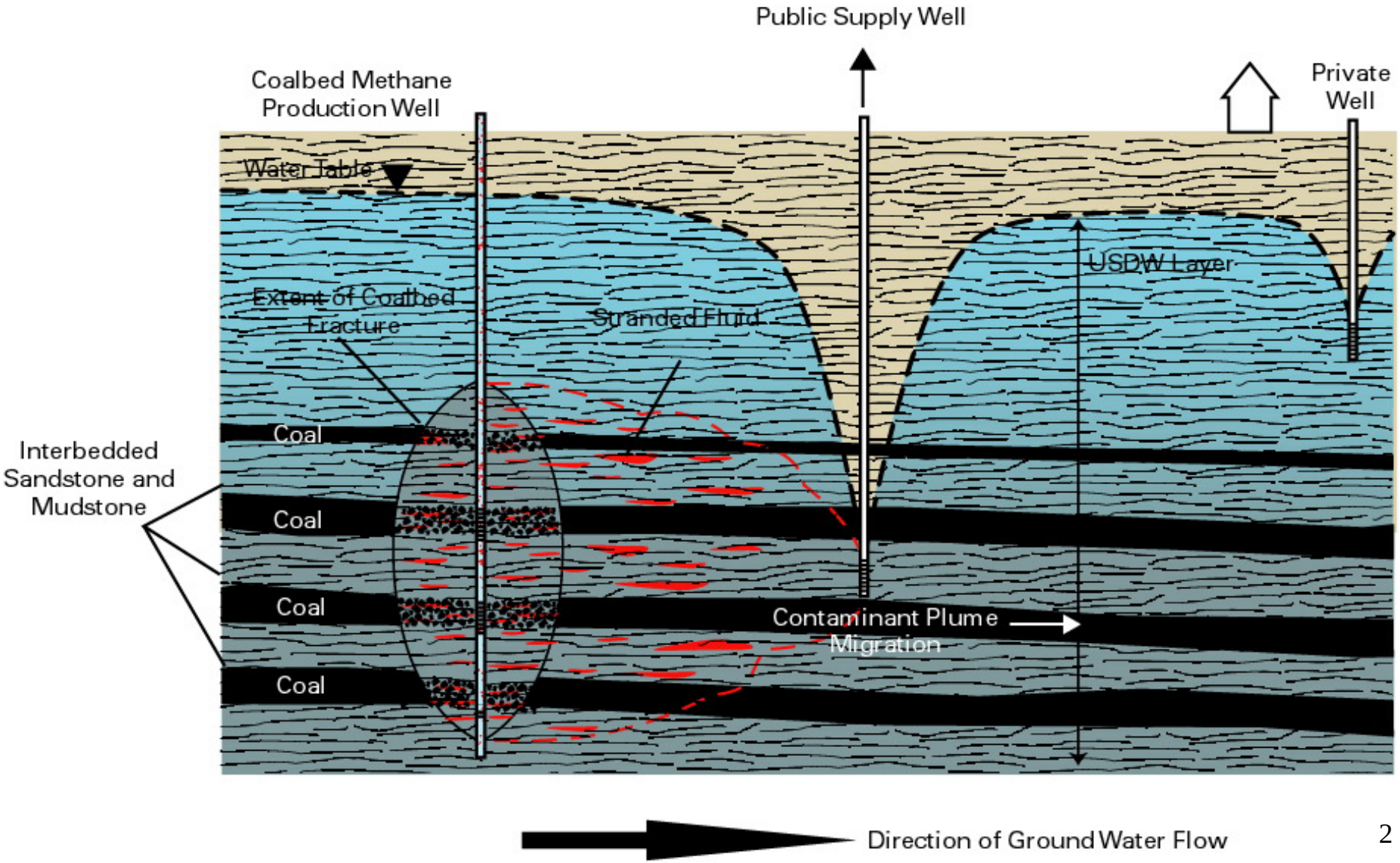
Hydraulic fracturing is a well stimulation process used to maximize the extraction of subsurface resources – oil, **natural gas**, and geothermal energy. The process includes the acquisition of source water, well construction, well stimulation, and waste disposal.



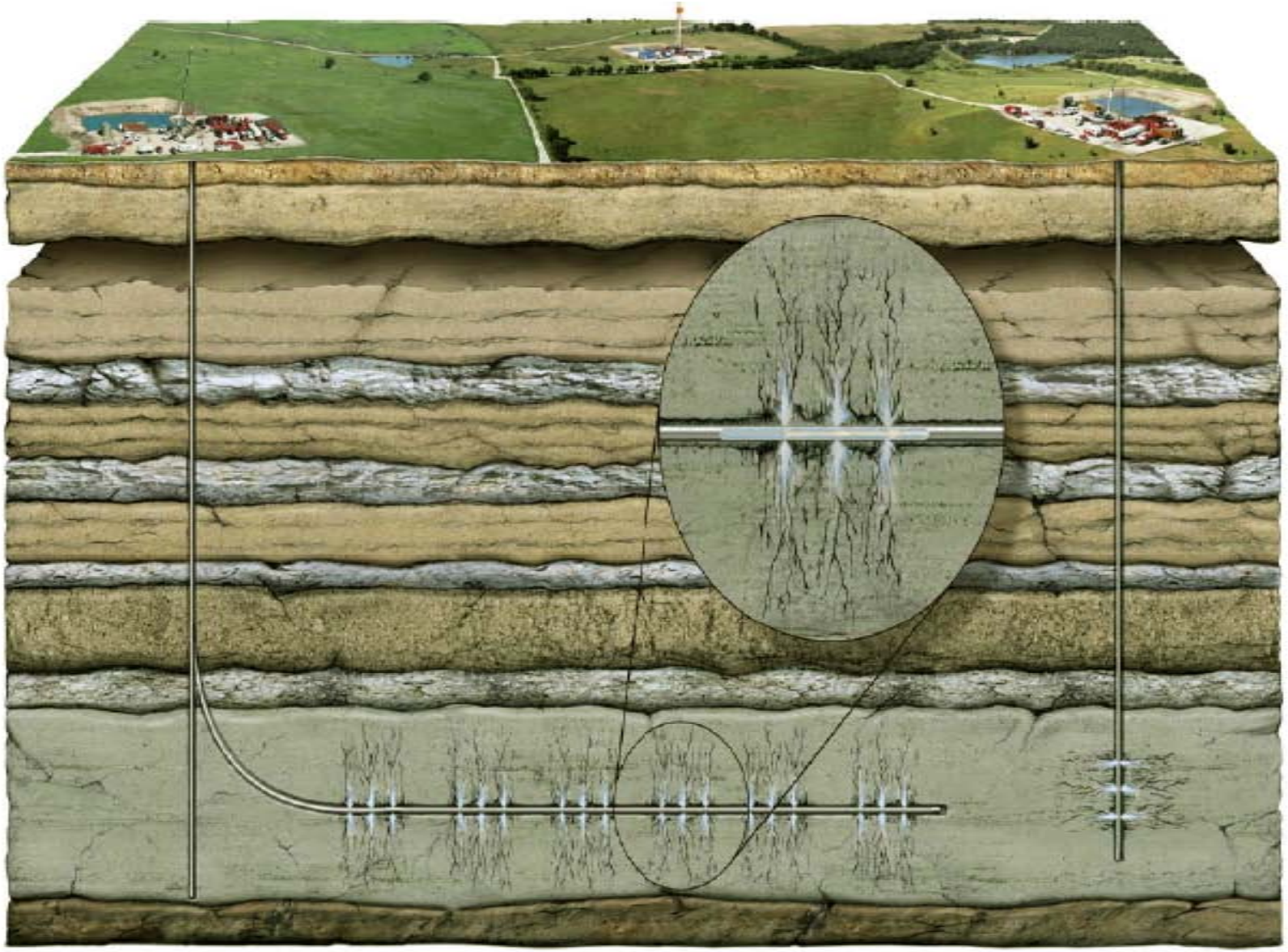
HF Fluid - Typical Chemical Makeup

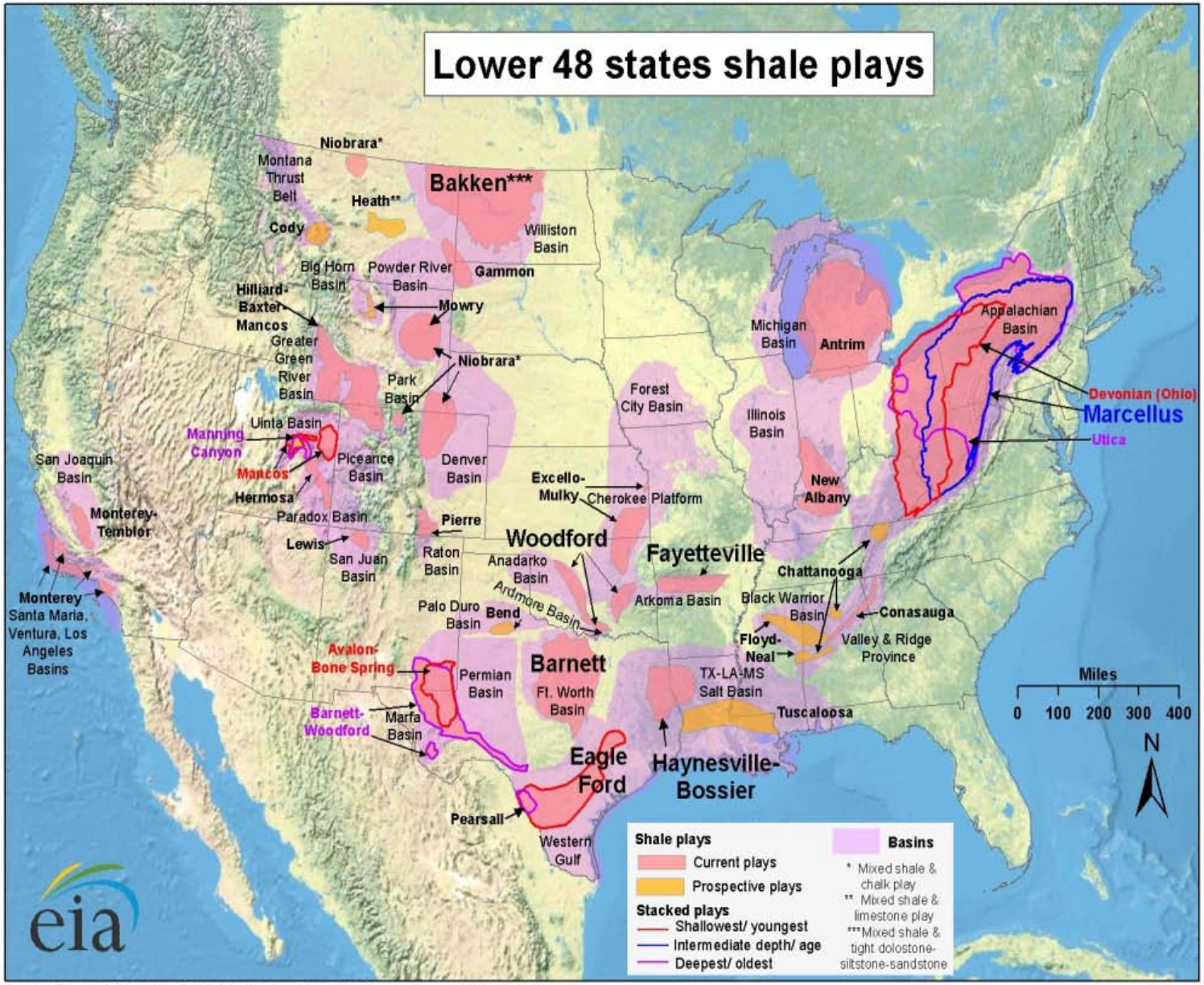


Coalbed Methane - Hydraulic Fracturing

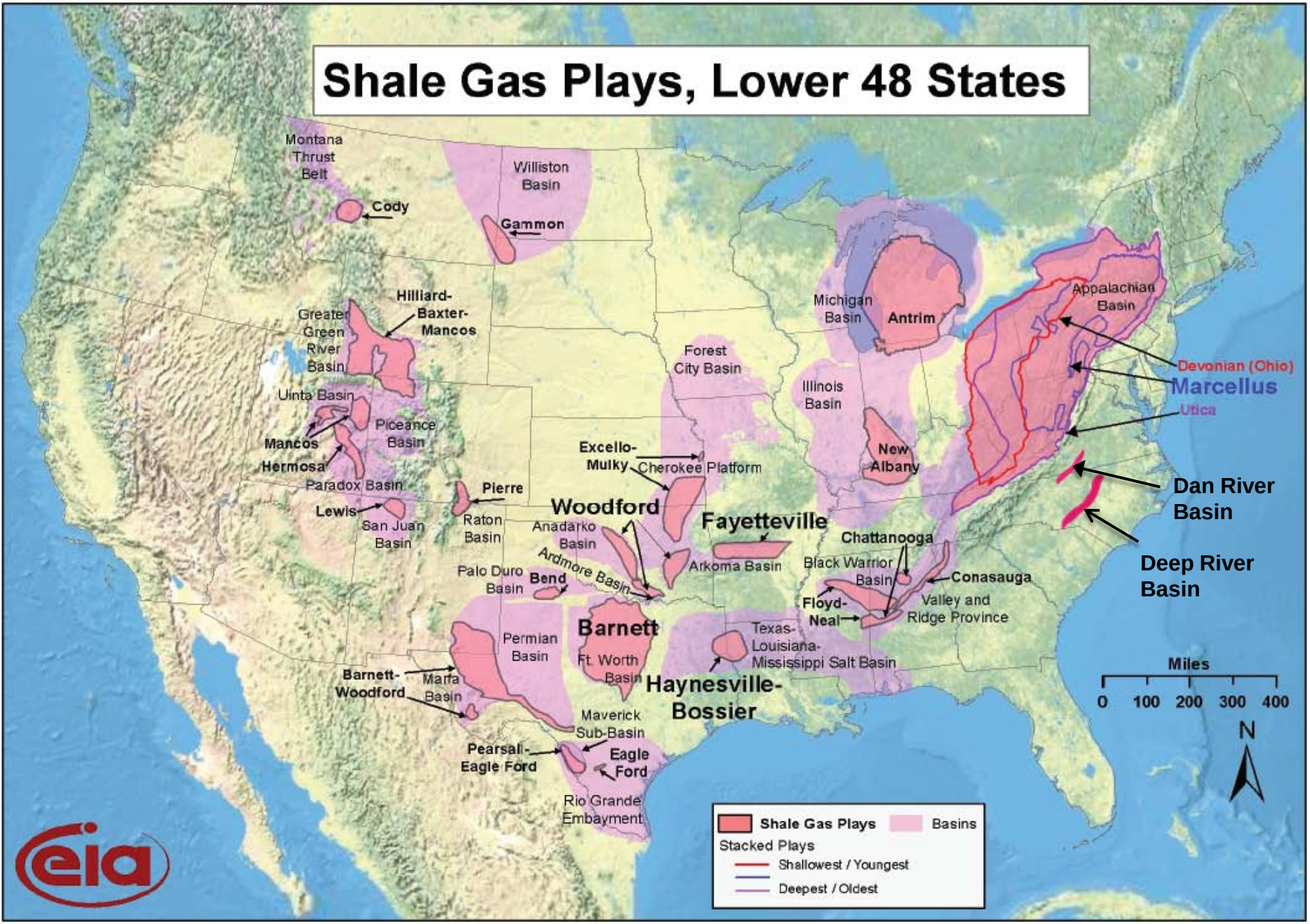


Vertical vs. Horizontal Drilling





Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

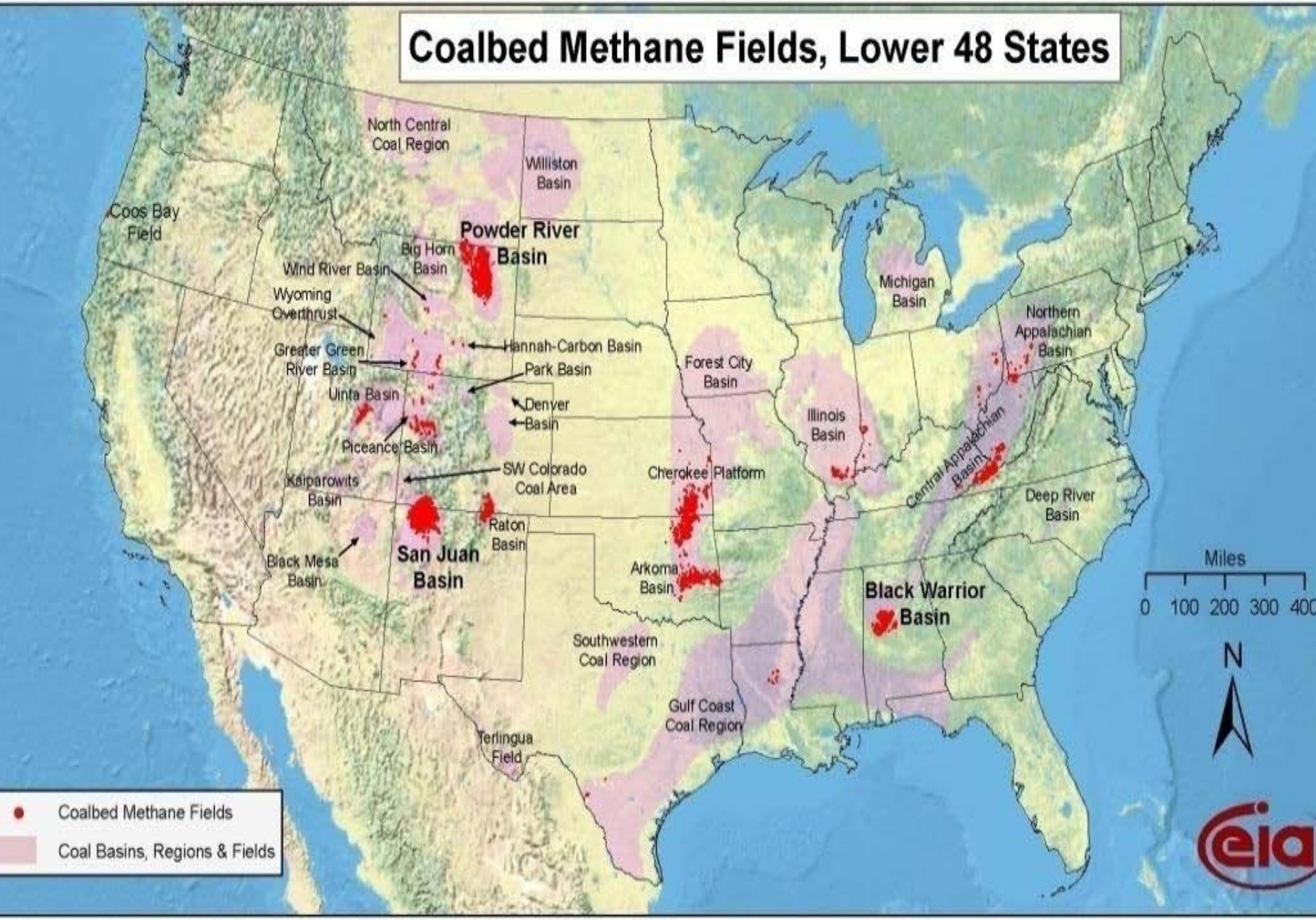


Source: Energy Information Administration based on data from various published studies. with modifications by Bill Holman
Updated: March 10, 2010

Importance of Natural Gas

- U.S. Energy Independence
  - U.S. has some of the largest shale gas plays in the world
  - 95% of natural gas consumed in the U.S. in 2011 was produced domestically*
  - Natural gas production expected to increase by 44% by 2040; primarily due to shale gas*
- Cleaner burning – 45% less CO_2 than coal
- Used to heat homes, generate electricity, industry, etc.

*Source: Energy Information Administration, Annual Energy Outlook 2013

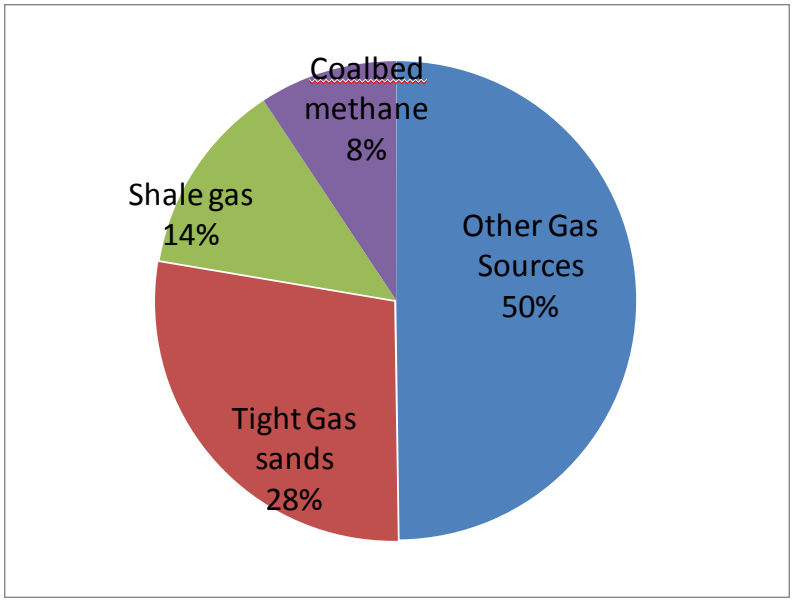


e: Energy Information Administration based on data from USGS and various published studies
ed: April 8, 2009

Shale Gas - Statistics

- Currently accounts for **14%** of the U.S. natural gas supply
- Projected to make up **20%** of the U.S. natural gas supply by **2020**
- Projected to make up **45%** of the U.S. natural gas supply by **2035**

Coalbed Methane Statistics & U.S. Gas Supplies 2009



Coalbed methane provides
8.0%
of natural gas supplies

Typical CBM Well:

Eastern basins, wells receive 2-3 fractures over lifetime
Life of well is between 4-15 years
Fracture event lasts approximately 1-2 hours;
Fracture heights and length are usually measured in 10s - 100s of feet
Average gas production is 97 MM cubic feet per year (enough to heat approximately 1,164 homes/year)
Cost of well: $500,000; Cost of fracture: $50,000

Note: Most, but not all CBM wells are hydraulically fractured

Source: U.S. Department of Energy; EPA Study of Hydraulic Fracturing

Alabama Coalbed Methane Activity

- Alabama - Over 7,500 wells drilled/HF

  - Hydraulic fracturing used to enhance methane production from coal seams

  - Nearly 35% of the total gas production in the State

  - Cumulative production exceeds 2 TCF

  - Coalbed methane production HAS averaged from about 86 to 125 BCF annually

Kentucky Shale Gas Activity

- 6,000+ shale gas wells in southeastern KY (Upper Devonian - Huron and Cleveland)

  - Liquid nitrogen and hydrochloric acid (500 gal.) are fracturing fluids

  - Mostly dry gas but some saltwater is produced

  - Produced water/brine disposed via UIC Class II permitted injection wells

  - Initial production about 750 MCF/day

Kentucky Shale Gas Activity

Kentucky Shale Gas Activity

"TWIN-WELL PAD"

PERRY COUNTY, KY

AL, MS, TN, GA Shale Gas Activity

- 20 exploratory wells in AL Conasauga shale
  - No sustained commercial production
- 41 exploratory wells in Floyd/Chattanooga shale in 5 counties in north/western AL
  - No sustained commercial production
- About 10 exploratory wells in north MS - Floyd/Neal shale
  - No sustained commercial production
- Exploratory wells in southwestern MS
  - Tuscaloosa marine shale
  - Initial production 500-1,000 BOD + Gas+ Water

AL, MS, TN, GA Shale Gas Activity

- About 100 wells in the Chattanooga shale in TN
  - Primary fracturing agent is nitrogen
  - Minimal produced water
- One rank wildcat well drilling and one proposed in the Conasauga shale play of northeast GA
  - Wells are vertical
  - No plans to hydraulically fracture the formation at this time

Potential Environmental Issues/ Areas of Concern

- Drilling/hydraulic fracturing requires 2-20 million gallons water
  - Alteration of hydrologic regime
- Propagation of fractures in confining layer
  - Fracturing fluid into overlying USDW
  - Lower quality, more saline water into higher quality USDW
- Flowback fluids (brine, hydrocarbons, "chemicals", surfactants, minerals/metals, radionuclides)
  - Improper treatment/disposal
  - Difficult for POTWs to treat
  - Pre-treatment may not be adequate
  - Negative impacts to DW/PWSs (disinfection by-products)

Potential Environmental Issues/ Areas of Concern

- Seepage/runoff/leaks
  - Bad casing/cementing jobs and other inappropriate drilling/hydro-fracing/production methods (lack of BMPs)

CWA – Current NPDES Regulation

- For direct dischargers of unconventional oil and gas wastewaters from onshore oil and gas facilities – with the exception of coalbed methane – technology-based limitations are based on the Effluent Limitations Guidelines (ELGs) for the Oil and Gas Extraction Category (40 CFR Part 435).
- Permits for onshore oil and gas facilities must include the requirements in Part 435
  - A ban on the discharge of pollutants, except for wastewater that is of good enough quality for use in agricultural and wildlife propagation for those onshore facilities located in the continental US and west of the 98th meridian.

CWA – Proposed Revision to ELGs

- EPA is developing a proposed rule to amend the Effluent Limitations Guidelines (ELGs) for the Oil and Gas Extraction Category, (40 CFR Part 435).
  - Revise Part 435 to address discharges from coalbed methane and from shale gas extraction.
  - The proposed rule is scheduled for publication in 2014.

EPA's Underground Injection Control (UIC) Program

- The UIC Program provides a regulatory framework to ensure protection of USDWs from endangerment related to underground injection activities

  - Class II wells are associated with oil and gas production

  - 2005 amendment to SDWA requires a permit for hydraulic fracturing when "diesel fuels" are used in fracturing fluids or propping agents

  - Diesel fuels may be used as a carrier fluid or added to other HF fluids to adjust fluid properties (e.g., viscosity and lubricity)

  - Chemicals of concern in diesel fuels include benzene, toluene, ethylbenzene and xylenes (BTEX)

2005 Energy Policy Act

- The 2005 Energy Policy Act excluded oil and gas hydraulic fracturing from UIC regulation under the SDWA except when "diesel fuels" are used in fracturing fluids and/or propping agents (SDWA 1421(d)(1)(B)(ii)).
- SDWA 1421 (d)(1)

The term "underground injection" –

- means the subsurface emplacement of fluids by well injection; and <u>excludes</u>

  - the underground injection of natural gas for purposes of storage; and

  - the underground injection of fluids or propping agents (other than diesel fuels) pursuant to HF operations related to oil, gas, or geothermal production activities

Actions to Address Concerns

- EPA's hydraulic fracturing study
- EPA's UIC permitting guidance for HF using diesel fuels (draft)
- EPA's Office of Wastewater Management memo (3/17/11)
- EPA is currently developing a proposed rule to amend ELGs (40 CFR Part 435)
- Congressional investigations/reports
- Inquiries to EPA from Congressmen/Senators

Actions to Address Concerns

- Proposed state legislation
- Media reports
- NC's existing rules prevent directional drilling/hydraulic fracturing; NC study/report and passage of Act
- PA DEP set a deadline of 5/19/11 for operators to stop bringing HF waste to wastewater treatment plants

EPA's Hydraulic Fracturing Study

- The overall purpose of the Study is to understand the relationship between hydraulic fracturing and drinking water resources

  - Scope of proposed research includes the full lifespan of water in HF:

    - Acquisition of water
    - Mixing of chemicals
    - Actual fracturing
    - Post-fracturing stage

EPA's Hydraulic Fracturing Study

- December 2012 - EPA released report on progress in its Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

http://www2.epa.gov/hfstudy

EPA's Draft UIC Guidance for Hydraulic Fracturing Using Diesel Fuels

- Purpose of Guidance

  - Describe current Class II oil and gas injection requirements under SDWA and UIC regulations

  - Provide a description of "diesel fuels" for the purposes of UIC Program implementation

  - Provide recommendations to EPA permit writers for how to apply Class II requirements to HF

EPA's Draft UIC Guidance for Hydraulic Fracturing Using Diesel Fuels

- Draft Guidance Applicability

  - Class II permit is required prior to injection

  - Does not create new regulations: Technical recommendations in guidance intended for EPA UIC program permit writers issuing Class II permits (Region 4 - KY, FL and TN)

  - Technical guidelines generally consistent with state guidelines

  - Not intended to limit or supersede state authority or oversight of oil/gas permitting activities

  - State UIC programs (review and consider)

EPA's Draft UIC Guidance for Hydraulic Fracturing Using Diesel Fuels

- The draft guidance, press release, and link to the Federal Register Notice are available on EPA's website at

  http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/hydraulic-fracturing.cfm

- EPA received 97,000+ comments (2,734 unique)
- Working with stakeholders to finalize the guidance
- Hope to finalize guidance this summer (2013)

Take Home Message

- U.S. demand for energy will continue to grow
- Coalbed methane/shale gas and oil exploration and production activities will continue to increase
- Coalbed methane/shale gas and oil extraction activities have the potential to impact the environment and public health
- Coordination between state and federal agencies to ensure protection of environment (USDWs/sources of DW) and public health
- States/stakeholders utilize guidance documents and participate in review of HF Study results

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Questions?

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