Fracking in Kentucky

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To Frack or Not to Frac

- Frac – no “k”, industry shorthand for hydraulic fracture stimulation
- But without the k
  - Fraced, fracing rhymes with braced, bracing
- So
  - Fracked and fracking
- But not “frack” – euphemism for an expletive
To Frack or Not to Frac

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Plural is anybody’s guess; I’m using “fracks.”
What is Fracking?

- Inject high-pressure fluids underground
- Induce new fractures
- Connect to existing natural fractures
- Create
  - A larger stimulated reservoir volume
  - Permeable pathways for oil and gas to flow into the well bore
EPA 2015: Fracking in the U.S.

- **Water (68% to 99%, median 88%)***
  - <30,000 gal. to >8,000,000 gal.
- **Chemicals (2% or less, median 0.43%)**
  - Control fluid properties
  - Maintain well integrity
- **Sand (2.4% to 24%, median 11%)**

*Composition by mass, data from 2015 EPA analysis of frac fluid data from FracFocus 1.0*
U.S. Crude Oil Imports

Percent of Total Consumption

0% 25% 50% 75%


www.eia.gov/dnav/pet/pet_sum_snd_d_nus_mbbl_a_cur.htm
Changes in U.S. Crude Imports

- Iraq: 4%
- Nigeria: 9%
- Saudi Arabia: 11%
- Venezuela: 10%
- Canada: 18%
- Mexico: 11%
- Other: 37%

2007:
- 4.9 billion barrels

2013:
- 3.6 billion barrels
- 31%
- 32%
- 9%
- 8%
- 32%

www.eia.gov
Horizontal wells minimize surface impact of drilling.

Many surface locations

32 wells on 20 acre spacing

Many underground laterals

1 well on 640 acre spacing
The Litany of Rogues

- Flaming water
- Secret toxic chemical mix
- Earthquakes
- Radon
- Poisoned water
- STDs
- Traffic accidents
- Noise

Call for ban or moratorium “until they do the science.”
Burning Tap Water

Weld County, CO: Investigated and not due to fracking or shale gas drilling.

Parker Co, TX: Staged, not hooked to a water supply, leaking from shallow natural sources into water.
Salt, Burning, and Oil Springs

Does not include places like Big Bone Lick, Ky
Does indicate naturally “impaired” groundwater
Does Fracking Cause Earthquakes?

No!
Maybe
What the Science Says

“The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events.”

“Injection for disposal of wastewater ... into the subsurface does pose some risk.” And, “Reducing injection volumes, rates, and pressures has been successful in decreasing rates of felt seismicity.”

National Research Council (2013) Induced Seismicity Potential in Energy Technologies, nap.edu
U.S. EPA Review Draft

Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources

- 5-year study
- 998 pages

www.epa.gov/hfstudy
What EPA Did: Follow the Water

- Withdrawal
- Mixing of water, chemicals, proppant
- Injection of fracturing fluids
- Management of flowback and produced water
- Reuse, treatment and discharge, or disposal of wastewater
EPA Concluded HF Could Impact Drinking Water

- Water withdrawal (supply)
- Spills
  - Hydraulic fracturing fluids
  - Produced water
- Fracturing directly into USDW
- Below ground migration of fluids and gas
- Inadequate treatment and discharge of wastewater
EPA Finding

“We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States. ... [W]e found specific instances where one or more mechanisms led to impacts on drinking water resources, including contamination of drinking water wells. The number of identified cases, however, was small compared to the number of hydraulically fractured wells.”
How is water protected?
A well is constructed using nested pipe, “casing”, that is cemented into place.
Spill Prevention Control and Counter Measures (SPCC)

www.epa.gov/osweroe1/content/spcc/index.htm
What's happening in Kentucky?

At least 100’ thick and 1,000’ deep
History of Fracture Stimulation in Kentucky

- 1806: Explosives to improve water wells
- 1888: 1st Kentucky oil well to be “shot”
- 1950s: Hydraulic fracturing
  - 1946: 1st in U.S. (Kansas)
- 1972: Nitrogen (and foam) frac
- Shale gas wells in Kentucky are nitrogen fracks
- Hydraulic fracks
  - Berea (Lawrence and Greenup Counties)
  - New Albany shale (Breckinridge County)
Fracked Wells in Kentucky

More than 11,000 since 1980
Typical Completions

Depth and thickness varies across Kentucky

Pennsylvanian

Lawrence & Greenup
1,200 ft to 1,800 ft

East Kentucky
2,000 ft to 5,000 ft

- C Coal
- Water
- Oil
- Gas
- Brine

Berea

Cleveland

L. Huron

Ordovician

Big Lime
Water Use in Kentucky Fracks

- **Berea**: “Slickwater” (hydraulic) frac
  - Sand (lbs) and Water (gal)
- **Huron**: Nitrogen-foam frac
- **New Albany**: Hydraulic frac

Thousands of gallons or thousands of pounds
Nitrogen Frac, Eastern KY

Courtesy Brint Camp, NGAS
1,464 horizontal wells since 2006
Horizontal Wells By Year

East Kentucky shale wells
Nitrogen-foam frac

40 Total


OIL  O&G  GAS  D&A  LOC  Other
Kentucky Natural Gas Production

2014: 256 Bcf

99%

34 Kentucky counties
2014 Oil Production: 4.1 MMbo

75% increase over 2011

East Kentucky 58.5%

31.7%

9.8%

63 Kentucky counties
Oil production (barrels) x 100,000

- Greenup
- Lawrence
- Henderson
- Union

Devonian Berea Activity

- 675,000 bbls

- 2000
- 2005
- 2010

Miles

0 2 4 8 12 16

UK UNIVERSITY OF KENTUCKY®
Division of Oil and Gas

The mission of the Division of Oil and Gas is to regulate the crude oil and natural gas industry in the Commonwealth; protect the correlative rights of mineral owners, fresh water zones and minable coal seams; and conserve and protect oil and gas reserves in Kentucky.

The Division of Oil and Gas maintains a well history database for each well containing data relative to the permit, operator, well location, pertinent dates and well completion. Currently, there are 136,286 wells stored online. This information is shared with the Kentucky Geological Survey (KGS) to assist in the compilation of oil and gas data.

Quick Links

- Kentucky Geological Survey
Oil and Gas Regulatory Update

• Energy & Environment Cabinet Workgroup
  – Dept. of Natural Resources
    • Div. Oil & Gas
    • Div. Water
  – KOGA
  – Ky Resources Council
  – Ky EQC

– Economic Development
– Department of Ag

• Kentucky Oil and Gas Regulatory Modernization Act
• Signed by Governor Beshear 19-Mar-2015
• Law 24-Jun-2015
KRS 353: Hydraulic Fracturing

- “High-volume” (HVHF) defined
  - >80,000 gallons for any stage
  - >320,000 gallons in aggregate for all stages
- Baseline water quality testing, post-frac monitoring
- Notification (surface owners within 1,000’)
- Disclosure at chemical registry, FracFocus.org
  - Trade secrets must be available to health professionals on request
- Site reclamation, BMP
WWW.UKY.EDU/KGS

- Water wells & springs
- Earthquakes
- Coal
- Minerals
- Mapping
- Karst
Energy & Minerals

Oil and gas well map service

Specialty map services

Data searching

Scanned images (converting to PDF)
Public records

Scanned documents are available for browsing, printing, or downloading.

Completion and stimulation

**WELL TREATMENT**
- Type of Frac.: SHOT
- Type Shot: Select Fire & HSC
- Shot Interval: Shale(1) = 4197-4361, Shale(2) = 3673-4064
- Shot Amount: Big Lime(3) = 3420-3448

**COMPLETION INTERVAL, PERFORATIONS OR OPEN HOLE**
- Formation: Shale(1) Interval: 4197-4361 20H
- Formation: Shale(2) Interval: 3673-4064 20H
- Plugged: Big Lime (3) SHUT-IN 3420-3448 22H

**TREATMENT**
- Type of Treatment: Shale(1) & (2) = N2, Big Lime = 650 Foamed Acid

**ACID AMOUNT**
- (1) = 12.2(2) = 6 BBLs. (3) = 95.3 BBLs.

**TOTAL FLUID**
- (1) = 12.2(2) = 6 BBLs. (3) = 95.3 BBLs.

**TOTAL NITROGEN**
- (1) = 901,400 (2) = 801,100 (3) = 271,000 SCF

**TOTAL SAND**
- LBS
Summary

- **Fracking**
  - Used for decades
  - No systematic, widespread impact on drinking water
  - Horizontal wells
    - Ohio Shale (natural gas)
    - Berea Sand (oil)
    - Rogersville (?)

- **HVHF regulations (KRS 353)**
  - Notification
  - Water testing
  - Mandatory disclosure
  - Reclamation
Thank you

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- www.uky.edu/KGS

Scan these tags with your smart phone.
Rogersville Play Area

(Based on data available in 2004)

Rogersville Shale Absent

Rogersville Shale Present

Vertical Rogersville Shale test well

Horizontal Rogersville Shale test well

Rome Trough (deep basin)

1.5-1.6 million acres

2+ million acres

No deep well data

 Courtesy Dave Harris, KGS
KGS Seismic Monitoring Project

Map courtesy of Seth Carpenter
https://www.youtube.com/watch?v=YemKzEPugpk