Hydraulic Fracturing

Unlocking America's Natural Gas Resources

America's Oil and Natural Gas Industry

February 2017

For the latest report, please visit www.api.org/hydraulicfracturing and http://www.hydraulicfracturing.com

Table of Contents

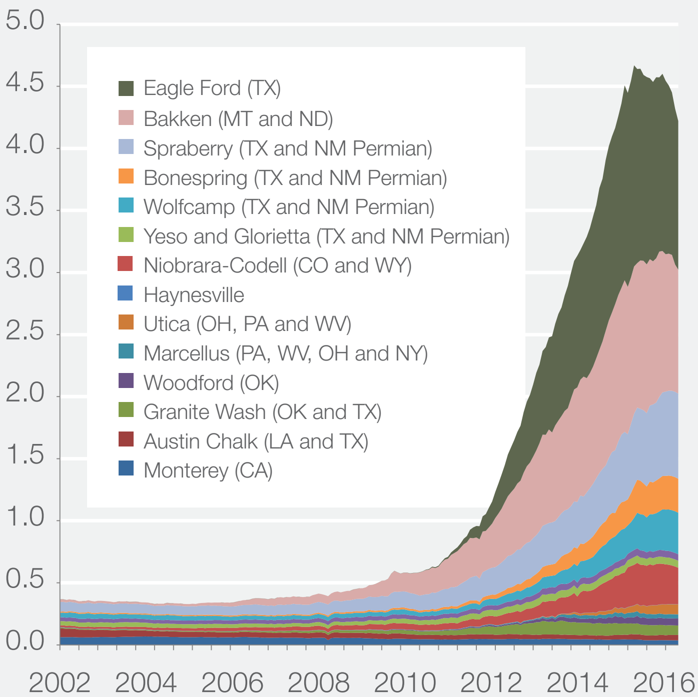
What is Fracking?

Hydraulic fracturing and horizontal drilling are safely unlocking vast U.S. reserves of oil and natural gas found in shale and other tight-rock formations. Developing energy from shale is an advanced process that uses the latest drilling technologies and equipment. As for what fracking means to the United States – the answers, are security, economic growth and jobs, jobs, jobs.

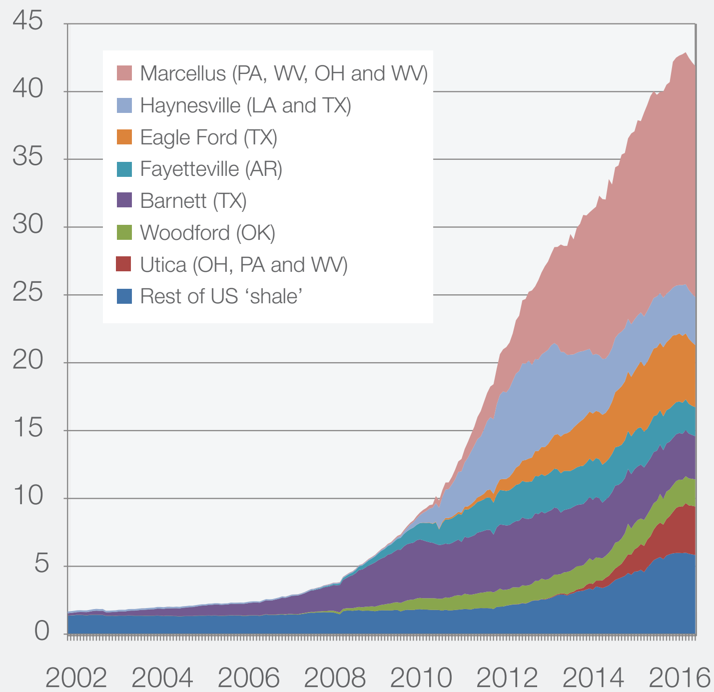
Energy and Opportunity

This change is driven by production from unconventional reserves using fracking and horizontal drilling.

Shale And Tight Oil Production
million barrels per day



Dry Shale Gas Production
billion cubic feet per day



The United States depends on oil and natural gas for the majority of its energy needs, and is projected to do so for decades to come. The good news is over the past decade the U.S. has experienced an energy revolution, with domestic production of crude oil up over 80%, and U.S. natural gas production up nearly 50%. This energy revolution has been led by shale energy development, extracting oil and gas from rocks at a scale and efficiency level that was unthinkable not long ago.

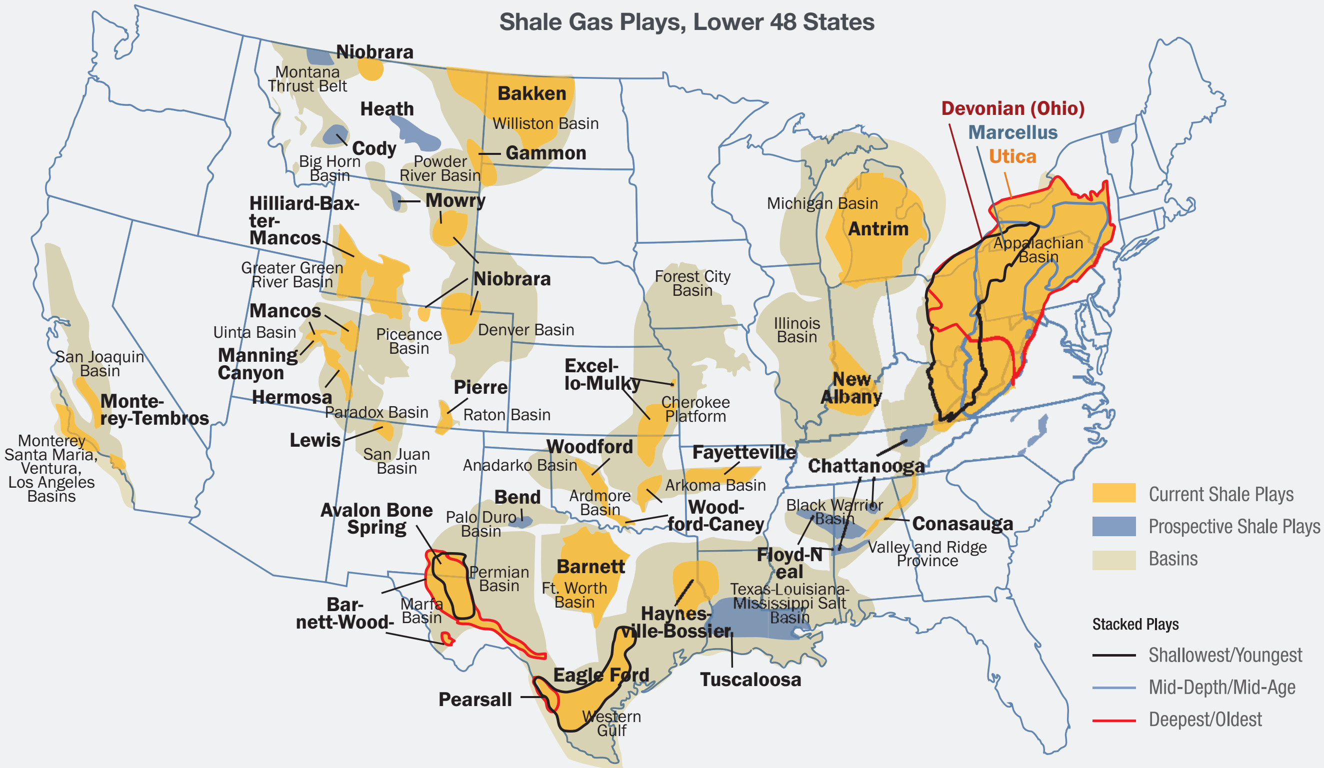
Hydraulic fracturing and horizontal drilling are safely unlocking vast U.S. reserves of oil and natural gas found in shale and other tight-rock formations. Developing energy from shale is an advanced process that uses the latest drilling technologies and equipment. As for what fracking means to the United States – the answers are security, economic growth and jobs.The U.S. oil and natural gas industry is a case study for how we can grow our economy, create jobs and protect the environment through market-driven innovation. The industry has been a leader in advancing innovative technologies both for production and emissions reductions and stands as a willing partner with the government in the development of industry standards and best practices – using this as an effective means to meet the mutually shared objective of safe and responsible operations that protect our air, water, workers, and communities.

By continuing to rely on industry innovation, basing decisions on sound science and providing for oil and natural gas opportunities, we can build on the success of the past decade and continue to supply the energy we need while protecting the environment.

The federal government should not use direct or indirect means to limit the innovations that have safely launched an energy revolution in the United States while reducing the environmental impacts of energy production.

Shale Plays in the Lower 48 States

Unlocking shale gas now guarantees the U.S. more than a 100-year supply of clean-burning natural gas.



Source: Energy Information Administration based on data from various published studies. Updated: May 28, 2009.

"More than 4 million oil and gas related wells have been drilled in the United States since development of these energy resources began nearly 150 years ago. At least 2 million of these have been hydraulically fracture-treated…"

—U.S. Department of Energy

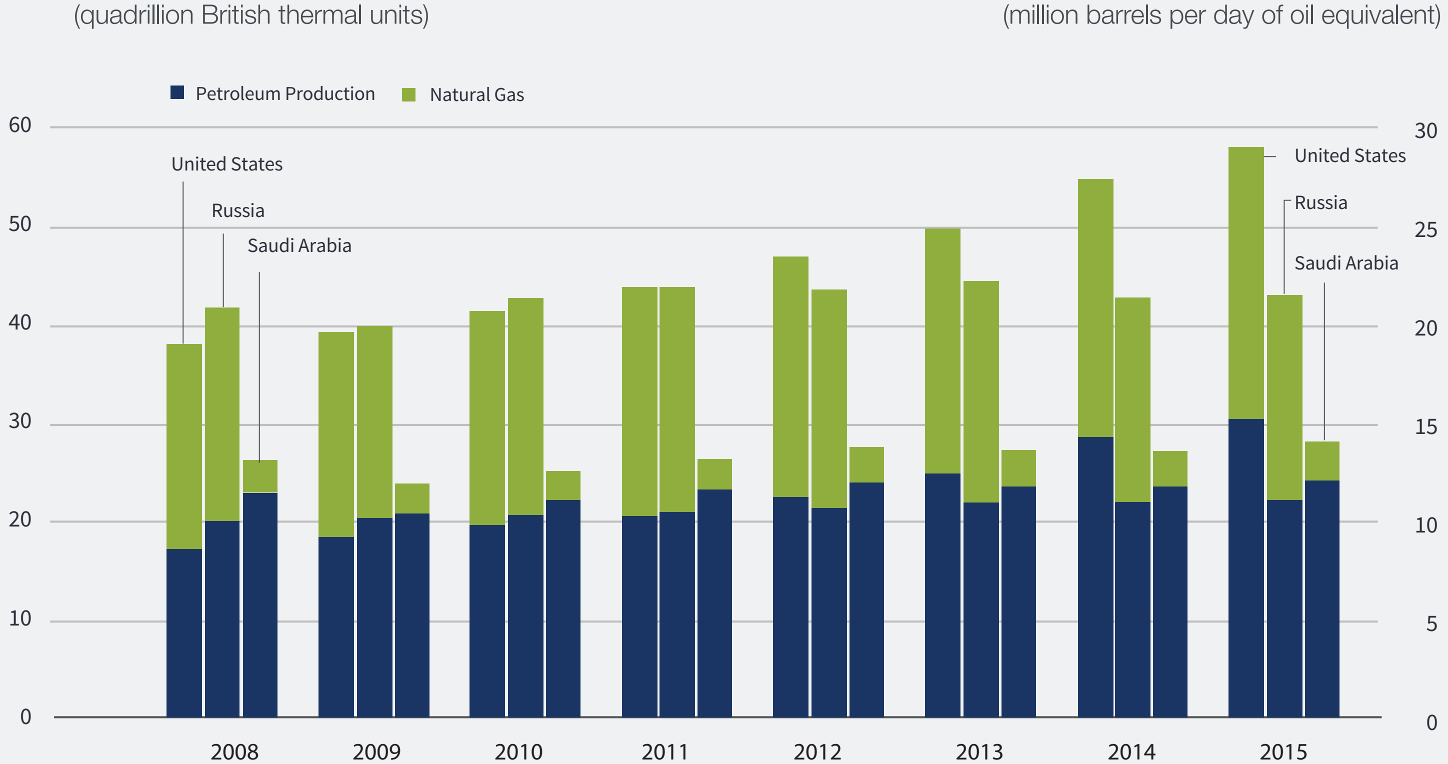
Hydraulic fracturing has been used in the oil and natural gas industry since the 1940s, producing more than 600 trillion cubic feet of natural gas and 7 billion barrels of oil. Used with modern horizontal drilling technology, fracking has unlocked vast U.S. shale reserves, launching a renaissance in oil and natural gas production, creating millions of jobs and generating economic growth. Without these advanced technologies, we would lose approximately half of our domestic oil and natural gas production, crippling our energy revolution.

The U.S. Energy Information Agency (EIA) reports that **over 610 trillion cubic feet** of technically recoverable **shale gas and 59 billion barrels** of technically recoverable shale oil resources currently exist in discovered shale plays. Responsibly developing these resources creates jobs and fuels our economy. And the key to unlocking these resources is through the process of hydraulic fracturing, also known as fracking.

"America has abundant natural resources and recent innovations combined with horizontal drilling in shale formations has unlocked vast new supplies of natural gas, allowing the nation to get to the energy it needs today, and transforming our energy future."

—Daniel Yergin, IHS vice chairman

Estimated Petroleum and Natural Gas Hydrocarbon Production in Selected Countries



Source: EIA.

According to Energy Information Administration estimates in 2015 the United States was the world's largest producer of petroleum and natural gas hydrocarbons. For this we can thank hydraulic fracturing. Fracking has unlocked vast reserves of shale and other tight-rock formations to produce an American energy renaissance that has seen a dramatic lowering of oil imports while shifting America from needing to import natural gas to potentially rank as one of the world's leading natural gas exporters.

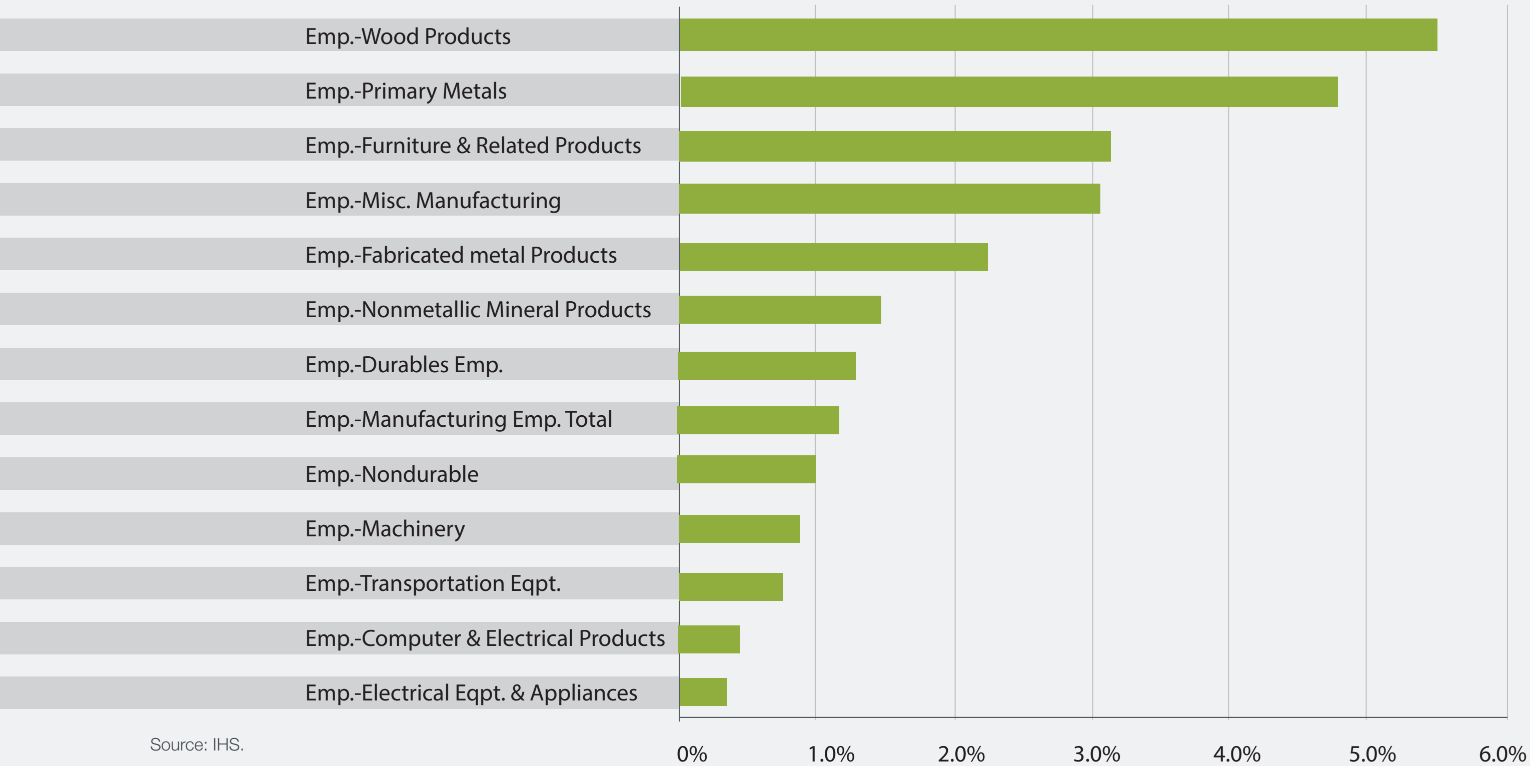
As a U.S. State Department official put it: **"…the U.S. will be a reliable, market-based supplier to global markets. And that's not only good for our energy security. It's good for the energy security of our partners and allies around the world.**

"Every barrel of oil or cubic foot of natural gas that we produce at home instead of importing from abroad means … More jobs … Faster growth … A lower trade deficit."

—**Jason Furman,** Chairman of the Council of Economic Advisers and **Gene Sperling,** Director of the National Economic Council

Jobs and the Economy

Percent Increase in Manufacturing Sector Employment from Higher Natural Gas Supply
(Average 2013-2015)



Source: IHS.

What is hydraulic fracturing? It's energy and opportunity, for better lives and a stronger, more energy-secure country. It is consumer savings and manufacturing jobs. It is largely responsible for changing America's energy narrative from one of limited options to one of nearly limitless plenty. Hydraulic fracturing means individual opportunity for prosperity and overall economic growth.

> "Expanded energy access generated by the shale boom added 1.9 million jobs in 2015 alone, and demand for these resources, driven in part by new investments in manufacturing, is expected to grow by 40 percent over the next decade."
>
> —National Association of Manufacturers

According to a 2016 report from IHS Economics:

- Natural gas access contributed to 1.9 million jobs economy-wide in 2015.
- Shale gas put an extra $1,337 back in the pocket of the average American family.
- New natural gas transmission lines meant more than 347,000 jobs, with 60,000 in manufacturing.
- Total natural gas demand is poised to increase by 40 percent over the next decade. Key drivers will be manufacturing and power generation.
- U.S. supply is expected to increase by 48 percent over the next decade to meet new demand.
- Because energy innovation is lowering production costs, IHS expects energy-intensive industries such as chemicals, metals, food and refining to outperform the U.S. economy as a whole through 2025.
- Shale gas production has created new flow patterns that are causing existing pipelines to reverse flow and will necessitate the construction of new pipeline capacity.

With the right policies, strong industry standards and effective state oversight the celebration can continue as we safely and responsibly build on the ongoing shale energy revolution.

What they are Saying

Former Interior Secretary Ken Salazar

"(Hydraulic fracturing) is creating an energy revolution in the United States. I would say to everybody that hydraulic fracturing is safe."

Former Energy Undersecretary David Garman

"We are in the midst of a great policy reset. Our energy policy heretofore had been based on scarcity is now confronting tremendous abundance. The shale gas boom … is cause for a tremendous celebration."

Bryan Burrough, New York Times

"One could argue that, except for the Internet, the most important technological advance of the last two decades has been hydraulic fracturing, widely known as fracking. Practically overnight, it seems, this drilling technique has produced so much oil and gas beneath American soil that we are at the brink of something once thought unattainable: true energy independence."

Dan Tormey, Hydrologist, Geochemist, Civil Engineer

"The oil and gas development that's been facilitated by these new technologies – hydraulic fracturing, horizontal drilling, the ability to precisely locate within the (geologic) formation where you're drawing from – has brought undeniable benefits to the United States."

Interior Secretary Sally Jewell

"The Bakken boom is a perfect example of how new and improved technology is allowing industry to tap previously inaccessible or unknown energy resources to create jobs, decrease our dependence on foreign oil and grow our economy. … Working hand in hand with industry, we have an opportunity to use innovative technologies to capture natural gas to power more homes with cleaner American-made energy, while reducing methane emissions and cutting carbon pollution."

U.S. Energy Information Administration

"Recent U.S. production growth has centered largely in a few key regions and has been driven by advances in the application of horizontal drilling and hydraulic fracturing technologies."

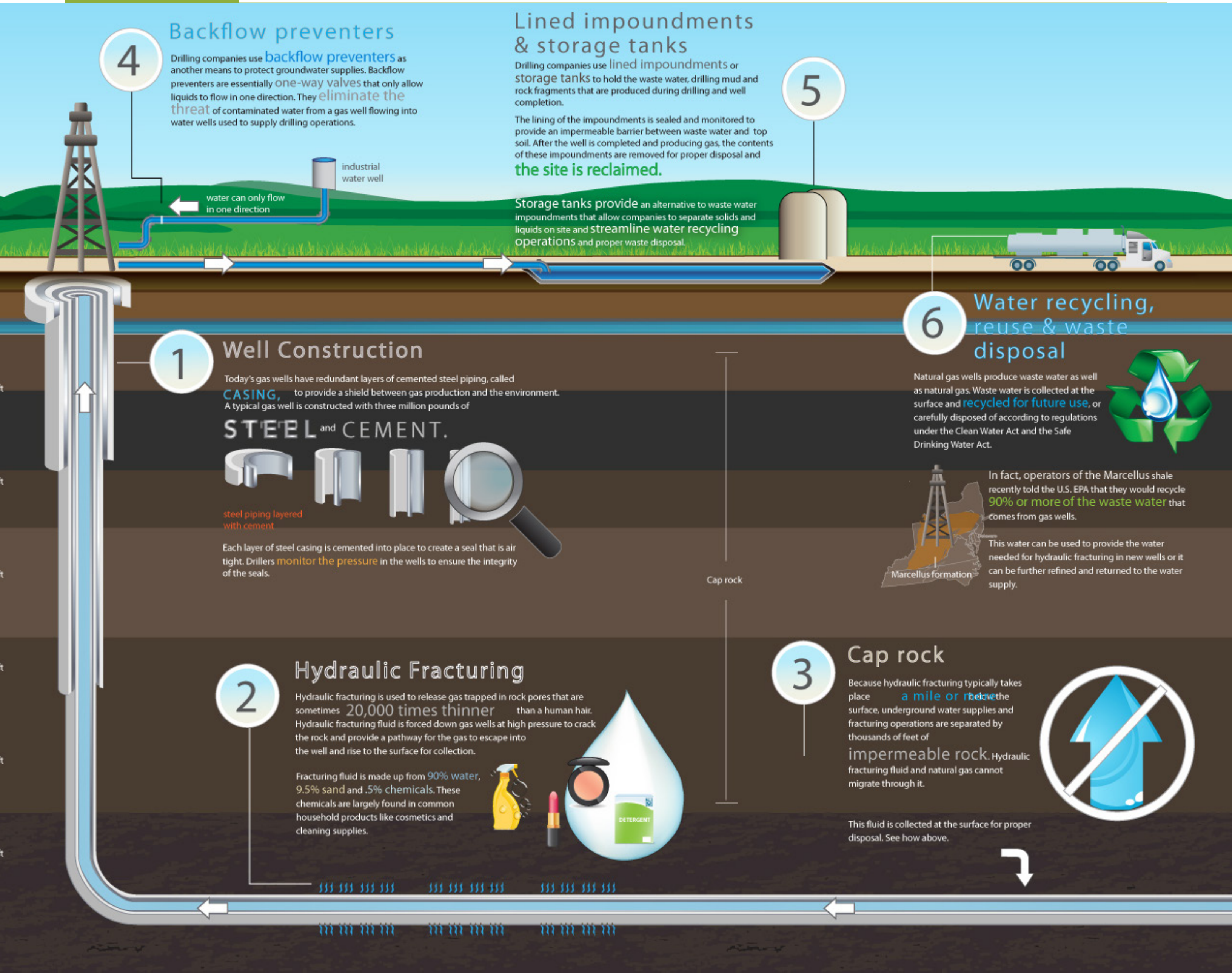
California Department of Conservation Director Mark Nechodom

"In California it has been used for 60 years, and actively used for 40 years, and in California there has been not one record of reported damage directly to the use of hydraulic fracturing. But despite that, given the great nationwide wave of concern, we at the Department of Conservation are treating this as an opportunity to again embrace public demand for knowledge and transparency, and this is an opportunity for people to learn where their oil comes from, just the same way we want to teach people where their milk and water come from."

Process, Safety, and the Environment

The members of the American Petroleum Institute are dedicated to continuous efforts to improve the compatibility of our operations with the environment while economically developing energy resources and supplying high quality products and services to consumers. We recognize our responsibility to work with the public, the government, and others to develop and to use natural resources in an environmentally sound manner while protecting the health and safety of our employees and the public.

Drilling

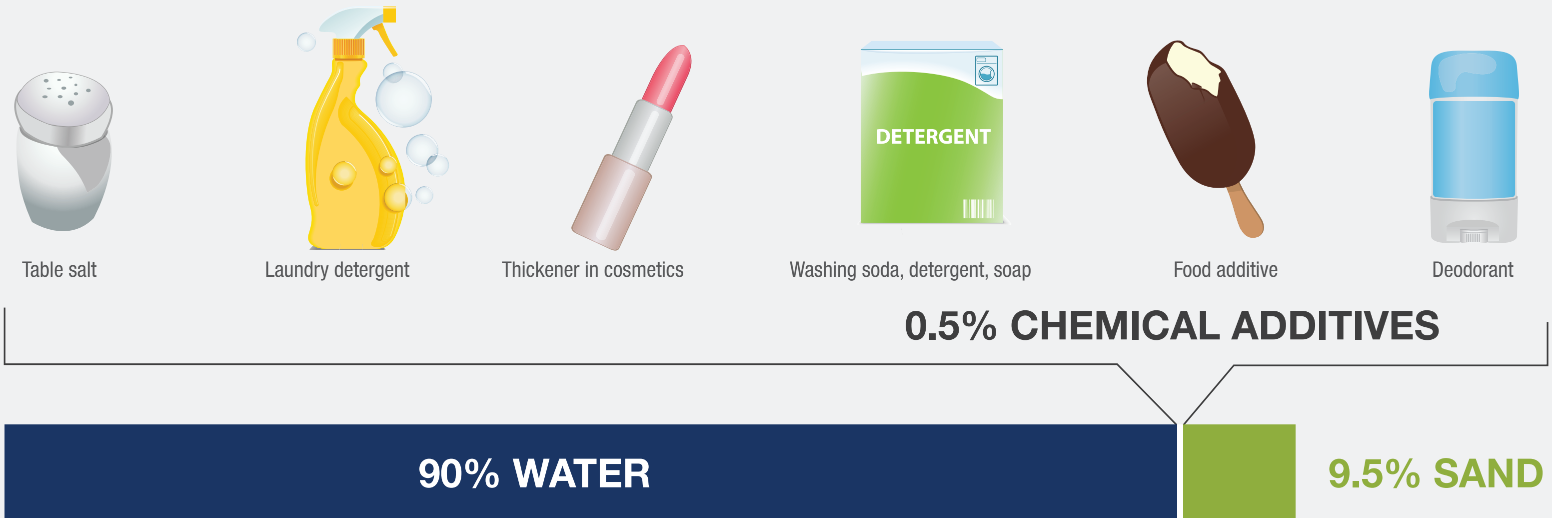


Developing energy from shale (and other tight-rock formations) using hydraulic fracturing/horizontal drilling takes four to eight weeks – from preparing the site for development to production itself – after which the well can be in production for 20 to 40 years. A well can be a mile or more deep and thousands of feet below groundwater zones before gradually turning horizontal from vertical. The horizontal portion then can stretch more than 6,000 feet. A single well site (or pad) can accommodate a number of wells. Steel pipe known as surface casing is cemented into place at the uppermost portion of a well to protect the groundwater.

As the well is drilled deeper, additional casing is installed to isolate the formation(s) from which oil or natural gas is to be produced, further protecting groundwater from the producing formations in the well. There have been no confirmed cases of groundwater contamination from hydraulic fracturing itself in the at least 2 million wells fracked over the past 65+ years. Numerous protective measures are in place at well sites, including liners under well pads, rubber composite mats under rigs, storage tanks with secondary containment measures, and barriers to control any potential runoff.

Stimulation

The fracturing mixture consists primarily of fresh water mixed with some sand and a small proportion of common chemicals.



Compound	Purpose	Common Application
Acids	Helps dissolve minerals and initiate fissure in rock (pre-fracture)	Swimming pool cleaner
Sodium Chloride	Allows a delayed breakdown of the gel polymer chains	Table salt
Polyacrylamide	Minimizes the friction between fluid and pipe	Water treatment, soil conditioner
Ethylene Glycol	Prevents scale deposits in the pipe	Automotive anti-freeze, deicing agent, household cleaners
Borate Salts	Maintains fluid viscosity as temperature increases	Laundry detergent, hand soap, cosmetics
Sodium/Potassium Carbonate	Maintains effectiveness of other components, such as crosslinkers	Washing soda, detergent, soap, water softener, glass, ceramics
Glutaraldehyde	Eliminates bacteria in the water	Disinfectant, sterilization of medical and dental equipment
Guar Gum	Thickens the water to suspend the sand	Thickener in cosmetics, baked goods, ice cream, toothpaste, sauces
Citric Acid	Prevents precipitation of metal oxides	Additive in food and beverages
Isopropanol	Used to increase the viscosity of the fracture fluid	Glass cleaner, antiperspirant, hair coloring

Source: DOE, GWPC: Modern Gas Shale Development in the United States: A Primer (2009).

After the wells on a pad are drilled, cased and cemented, a device perforates the horizontal part of the production pipe to make small holes in the casing, exposing the wellbore to the shale. Then a mixture of water (90 percent), sand (9.5 percent) and chemicals (0.5 percent) is pumped into the well under high pressure to create micro-fractures in the shale and free natural gas or oil. Sand keeps the fractures open after the pressure is released. The chemicals are chiefly agents to reduce friction and prevent corrosion.

State Regulation

Effective hydraulic fracturing regulation can only be achieved at the state level as state regulations can be tailored to geological and local needs. Key state regulations include: Review and approval of permits; well design, location and spacing; drilling operations; water management and disposal; air emissions; wildlife impacts; surface disturbance; worker health and safety; and Inspection and enforcement of day-to-day oil and gas operations.

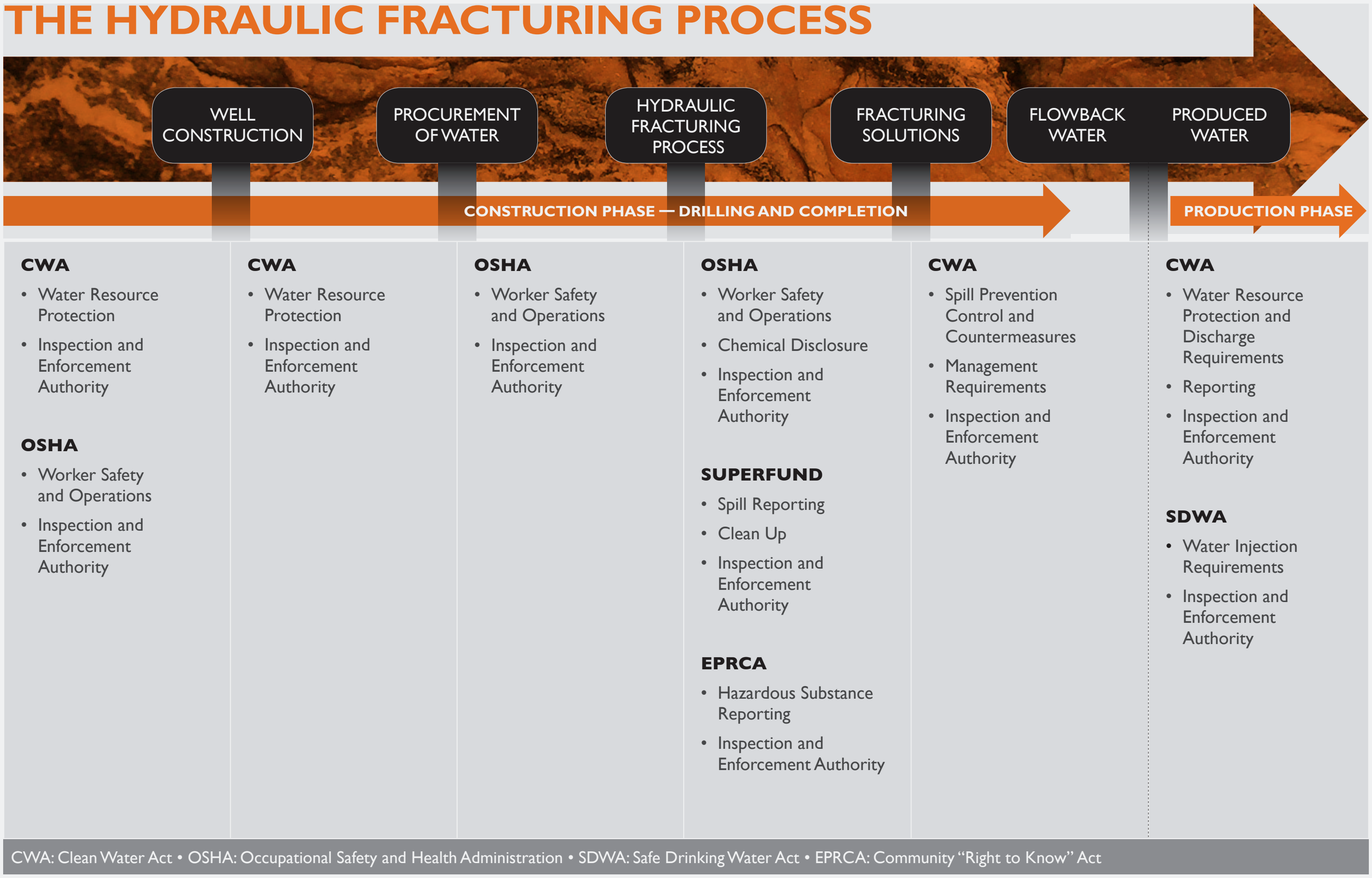
For example, the following are just some of the permits required in Pennsylvania:

1	Well drilling permit (w/ well location plat, casing and cementing plan, PNDI for threatened or endangered species, landowner/water well owner notifications, coal owner or operator notification and gas storage field owner notification)
2	Water management plan for Marcellus Shale wells
3	Proposed alternate method of casing, plugging, venting or equipping a well
4	Bond for Oil and Gas Well(s) (individual or blanket, various bond types allowed)
5	Waiver of distance requirements from spring, stream, body of water, or wetland (to put the well closer than 200 feet)
6	Variance from distance restriction from existing building or water supply (to put the well closer than 100 feet)
7	Proposed alternate method or material for casing, plugging, venting or equipping a well
8	Approval for alternative waste management practices
9	Approval of a pit for control, handling or storage of production fluids
10	Use of alternate pit liner
11	NPDES GP-1 for discharges from stripper oil wells
12	Water Quality Management Permit for treatment facilities
13	Alternative pit liners
14	Inactive status
15	Roadspreading plan approval
16	Transfer of well permit or registration
17	Orphan well classification
18	Off-site solids disposal
19	Residual waste transfer stations and processing facilities
20	Transportation of residual waste
21	Road use permit – construction of access to state roadway
22	Road use bond (PennDOT or municipality)
23	Surface use permit (if in the Allegheny National Forest)
24	PASPGP-3 or PASPGP-4 for pipelines crossing streams (if < 1 acre)
25	Water Obstruction – Encroachment – US Army Corps of Engineers Section 404 Joint Permit
26	Dam permit for a centralized impoundment dam for Marcellus Shale gas wells
27	GP-11 for non-road engine air emissions
28	GP-05 for natural gas compression facilities emissions
29	Earth disturbance permit (if > 5 acres)
30	Erosion and sedimentation control permit (if > 25 acres)
31	NPDES storm water for construction activities
32	Water allocation (SRBC, DRBC or DEP for Ohio River basin)
33	GP-3 for bank rehabilitation, bank protection, and gravel bar removal
34	GP-4 for intake and outfall structures
35	GP-5 for utility line stream crossings
36	GP-7 for minor road crossings
37	GP-8 for temporary road crossings
38	GP-11 Maintenance, Testing, Repair, Rehabilitation or Replacement of Water Obstructions and Encroachments

ENERGYINDEPTH

The Energy You Need. The Facts You Demand.

FEDERAL STATUTES REGULATE EVERY STEP OF THE HYDRAULIC FRACTURING PROCESS



Source http://energyindepth.org/wp-content/uploads/2009/03/Federal-Hydraulic-Fracturing-Process.pdf

Federal regulations provide a broad regulatory foundation for energy development in the United States, including hydraulic fracturing. Key federal regulations governing shale development include: Clean Water Act; Clean Air Act; Safe Drinking Water Act; National Environmental Policy Act; Resource Conservation and Recovery Act; Emergency Planning and Community Right to Know Act; Endangered Species Act and the Occupational Safety and Health Act.

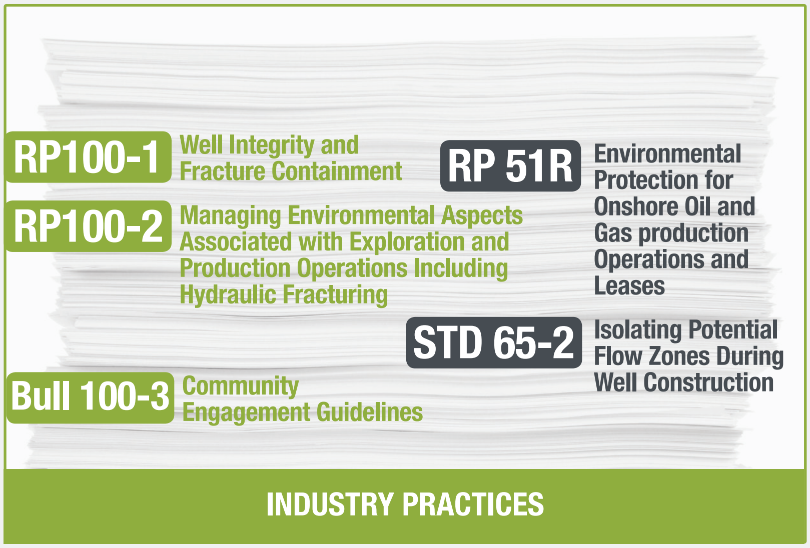
Industry Standards

Existing regulations covering well design requirements and hydraulic fracturing operations are specifically formulated to protect groundwater.

Working through API's standards program, accredited by the American National Standards Institute (ANSI) - accredited standards program, the industry has adopted standards and practices for continuous improvement, hundreds of which are referenced in state regulations thousands of times.

The documents are currently available in a "**Read Only**" format for interested regulators and the public via this hyperlink on the API website: http://publications.api.org/.

Some 65 additional API standards and recommended practices support industry's onshore operations, including hydraulic fracturing.

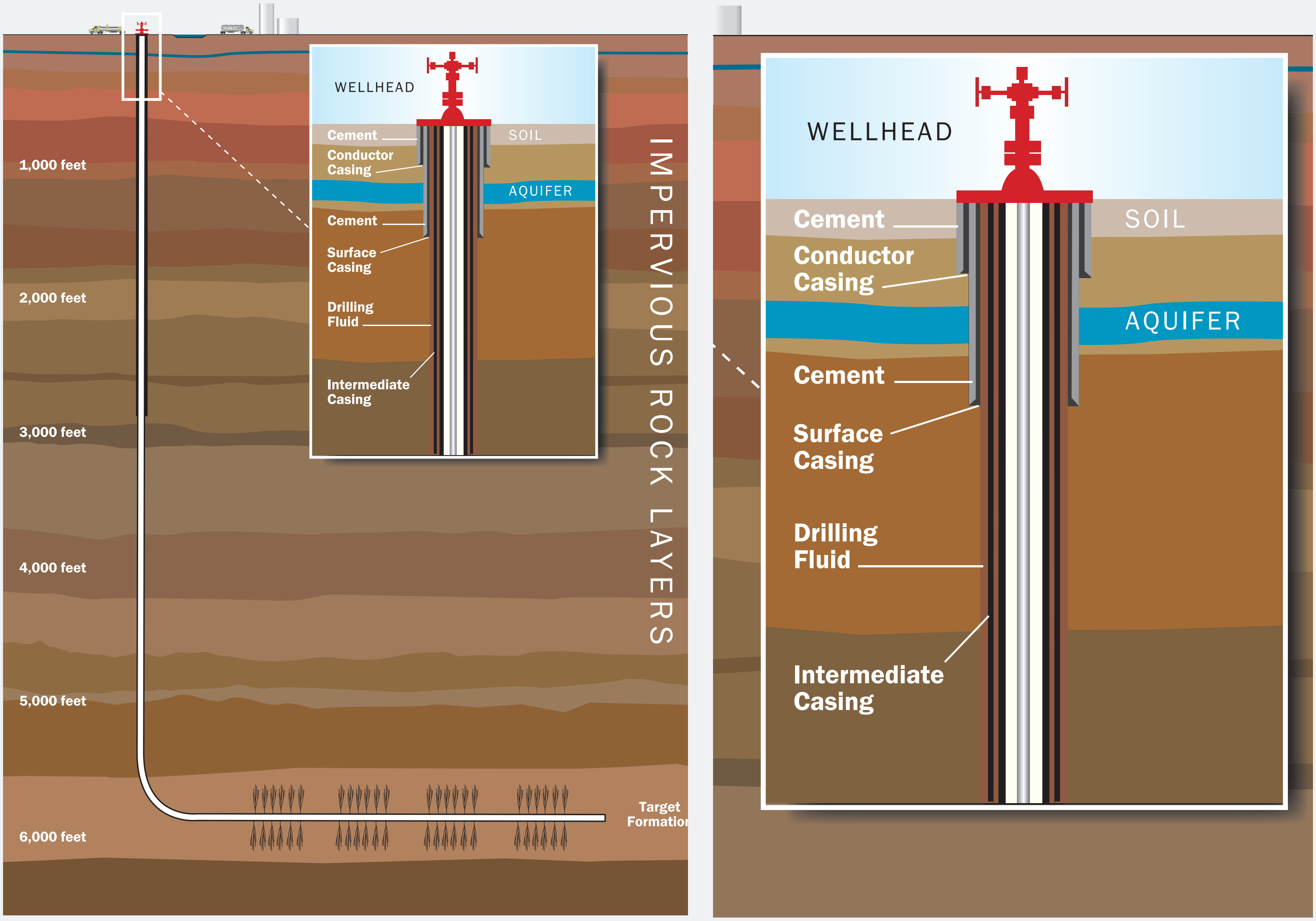


Source: http://www.api.org/policy-and-issues/policy-items/hf/shale-answers

Working through API's standards program, accredited by the American National Standards Institute, the industry has adopted standards and practices for continuous improvement, hundreds of which are referenced in state regulations thousands of times. Several federal agencies, including the Environmental Protection Agency, the Bureau of Land Management and the Occupational Safety and Health Administration, also cite API standards. Industry also works closely with STRONGER, a non-profit organization that helps states formulate environmental regulations associated with oil and natural gas development.

The FracFocus.org chemical disclosure registry provides information on hydraulic fracturing fluid used in over 115,125 wells. Industry activity is subject to a number of federal and state laws including the Safe Drinking Water Act, the Clean Water Act, the Clean Air Act and the National Environmental Policy Act.

Proper well construction provides groundwater protection.

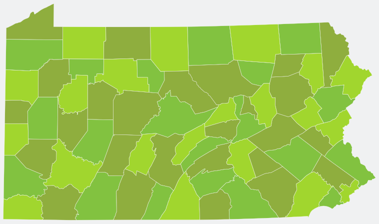


Source: http://www.api.org/~/media/Files/Policy/Exploration/HYDRAULIC_FRACT_ILLUSTRATION_121609.pdf

The key to protecting groundwater is proper well construction, and industry has developed detailed standards for this based on field experience and significant advances in drilling and construction techniques. A typical natural gas well uses 3 million pounds of steel and cement. Each layer of steel casing is cemented in place to create an air-tight seal.

Alternating layers of cement and steel casings are designed to ensure well integrity as is passes through groundwater levels thousands of feet down to the energy-holding layers of rock.

Water Usage



PENNSYLVANIA

Annual Water Usage Example

6.43 BILLION GALLONS PER DAY
THERMOELECTRIC POWER

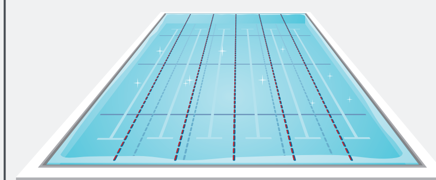
1.42 BILLION GALLONS PER DAY
PUBLIC WATER SUPPLY

61.8 MILLION GALLONS PER DAY
LIVESTOCK

24.3 MILLION GALLONS PER DAY
IRRIGATION

SITE LEVEL

The amount of water used during hydraulic fracturing for one well is typically the equivalent of the volume of three to six Olympic sized swimming pools



EACH AMERICAN GOLF COURSE USES MORE THAN **4 MILLION** GALLONS OF WATER PER SUMMER MONTH

Sources: U.S. Geological Survey Circular 1344. 52p. and Marcellus Shale Development Water Use: June 1, 2008 - May 21, 2010; Energy In Depth, October 8, 2012; Aboutnaturalgas.com

Industry is mindful of the amount of water needed for hydraulic fracturing, which is why a number of companies are working on new technologies that reduce needed volumes as well as ways to fracture wells without water. Some perspective is helpful. In Pennsylvania, for example, all shale energy development across the state uses 1.9 million gallons per day, which is small relative to the water needed for livestock (61.8 million gallons/day) and irrigation (24.3 million gallons/day). It's also less than the 4 million gallons of water the average U.S. golf course uses per summer month.

Water Treatment Technologies

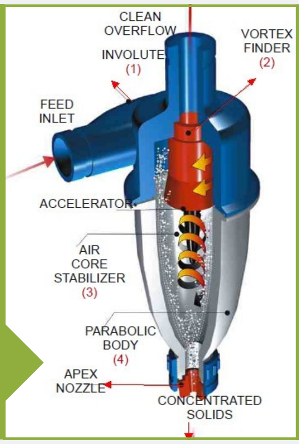
1.Chemicals

2.Ozone Oxidation

5. Deionization

3. Nano-filtration

4. Hydrocyclones



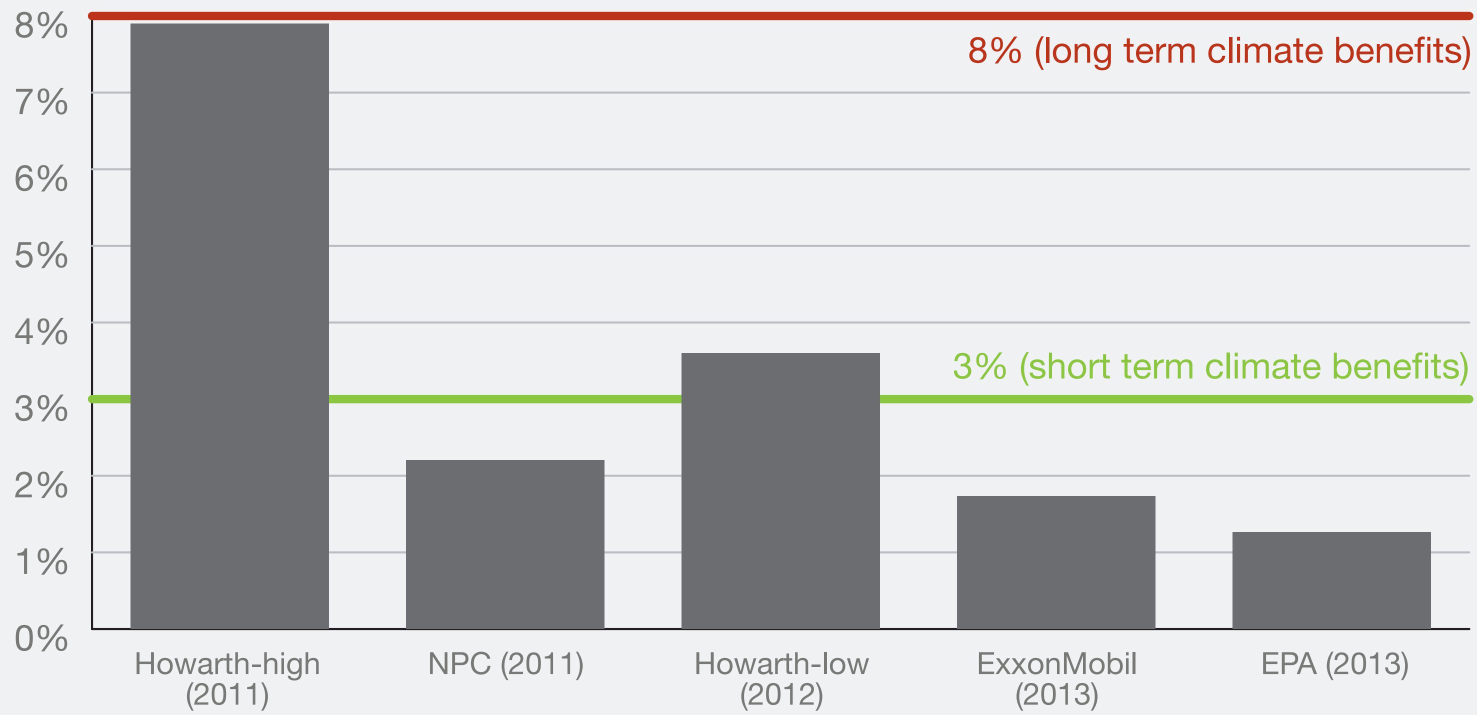
6. UV

MVR Evaporator, RO, EC…and many more

Sources: http://www.apachecorp.com/index.aspx

The development of advanced hydraulic fracturing and horizontal drilling has been accompanied by safe and responsible water management strategies employing innovative technologies to allow reuse of fluids produced during the fracturing phase of well development. According to the Penn State Marcellus Center for Outreach and Research, during the first half of 2013 in the Marcellus shale play, 90 percent of the more than 14 million barrels of produced fluids from fracturing was reused. That represents a significant savings in the amount of new water needed for hydraulic fracturing elsewhere. It illustrates industry's focus on environmental issues and efforts to reduce energy development's impacts on resources and communities.

Methane Leakage

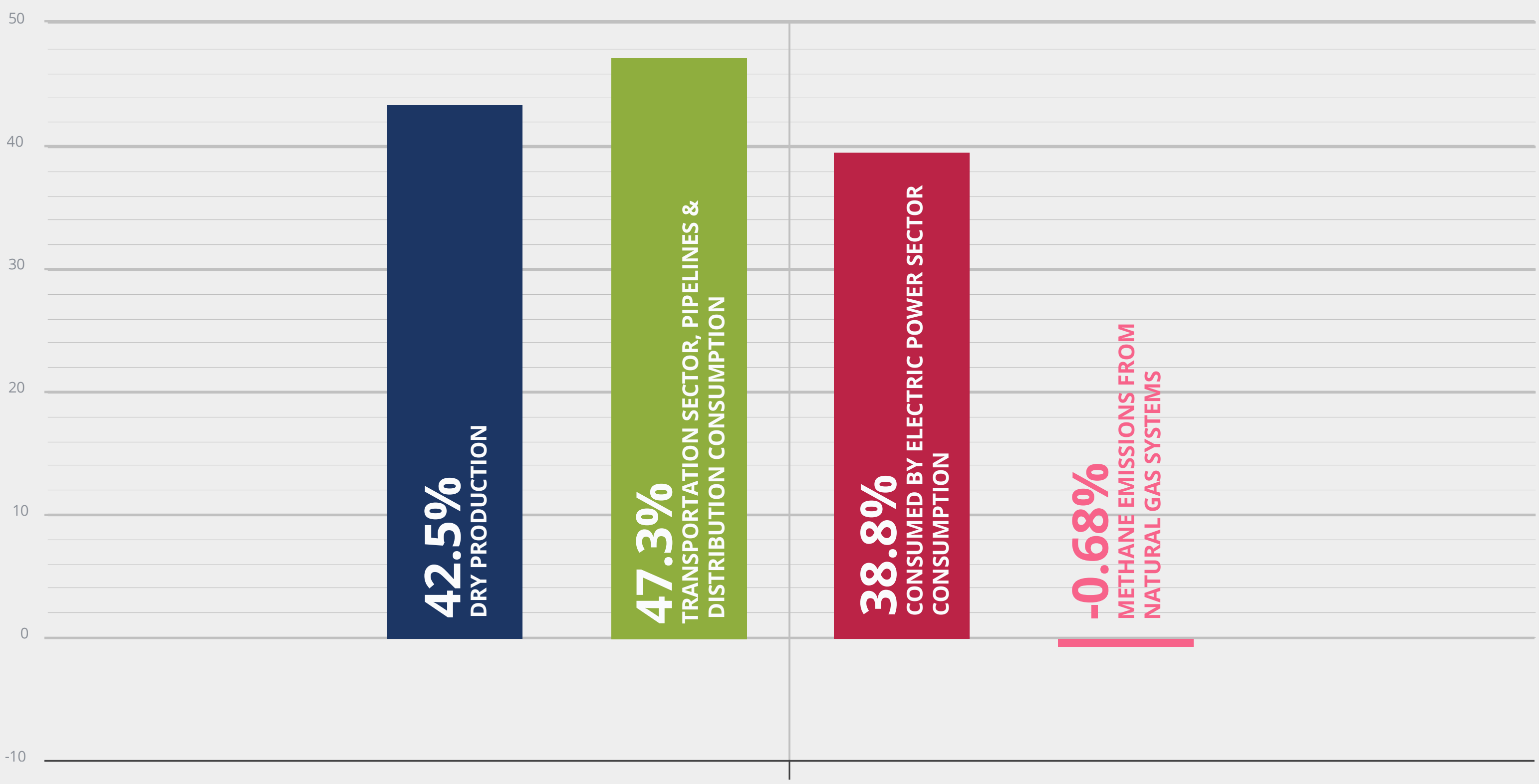


Source: IEA, U.S. EPA, ExxonMobil and WRI. All leakage rates, except ExxonMobil's are based on estimates and empirical; Exxon's leakage rates include actual measured data from some production and gathering operations in the Marcellus; EPA estimates are computed based on gross production reported from the EIA.Aboutnaturalgas.com

Thanks to increased use of natural gas, U. S. energy related emissions of CO2 are at their lowest point in two decades. At the same time, industry is developing and implementing new technologies to reduce methane released during production. By January 2015, for example, all new natural gas wells are required to include green completions measures to reduce emissions. Additional new requirements also will impact tanks, pneumatic devices, leak detection and leak control. EPA's current inventory estimates show the methane leakage rate for natural gas systems well under 2 percent. This is less than the 3 percent cited as necessary for immediate climate benefits for the use of natural gas in power plants and well under the 8 percent estimate cited for delivering long-term benefits as compared to coal. Industry measures are working. The EPA recently reported that methane emissions from hydraulically fractured natural gas wells have fallen 73 percent since 2011.

Methane Emissions

U.S. Natural Gas 2005 to 2014



Sources: EPA, Emissions Data. EIA, Production Data

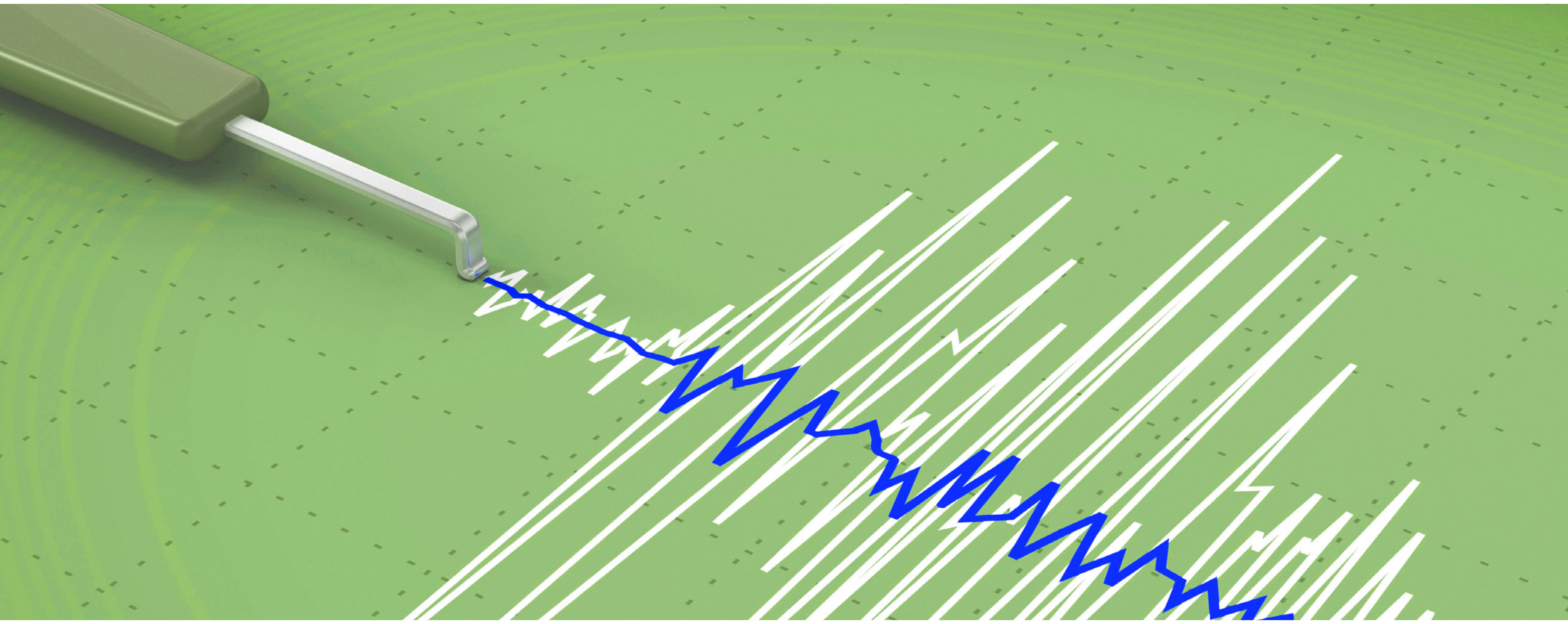
While natural gas production has risen, methane emissions have actually declined slightly thanks to the oil and natural gas industry's investment in new technologies.

Recent EPA data shows that industry initiatives to capture methane are effective. According to EIA data, from 2005 to 2014 dry production of natural gas increased 42.5 percent, with consumption by the transportation sector, pipelines and distribution increasing 43.1 percent, all while methane emission from natural gas systems fell 0.68 percent.

Methane emissions from the oil and natural gas industry make up just 4 percent of total U.S. greenhouse gas emissions.

Hydraulic Fracturing and Seismic Activity

Seismicity Associated with Wastewater Disposal Wells



Advanced hydraulic fracturing and horizontal drilling are the technology engines driving America's ongoing energy renaissance – surging oil and natural gas production that ranks first in the world. This oil and natural gas production, enabled by hydraulic fracturing, strengthen U.S. energy security, boost the economy and lower consumer energy costs. In addition, the increased use of cleaner-burning natural gas is the main reason U.S. greenhouse gas emissions from electricity generation are at their lowest level in 25 years. For decades hydraulic fracturing has been used safely – thanks to proven engineering, effective industry risk management practices and standards as well as federal and state regulations.

Industry takes seriously earthquake incidents that may be associated with the disposal of produced water from energy development – salty brines and other fluids that come to the surface during oil and natural gas production. On average, about 10 barrels of brine are produced with each barrel of crude oil. Once separated from the oil, brine typically is returned to the underground formation it came from (or a similar formation) via disposal wells managed under EPA Class II Underground Injection Control (UIC) regulations. In the U.S. there are approximately 30,000 active Class II wells used to dispose of these fluids that are a byproduct of oil and natural gas production. These are a subset of more than 800,000 permitted UIC wells nationwide that serve the needs of many different industries and governmental entities. The majority of disposal wells in the United States do not pose a hazard for induced seismicity, but under some geologic and reservoir conditions a limited number of injection wells have been determined to be responsible for induced earthquakes with felt levels of ground shaking. (Hydraulic fracturing itself is not the issue here. It is understood that certain unique and limited geologic conditions combined with hydraulic fracturing may induce an earthquake felt at the surface of the earth but such events have been rare.) To evaluate the need for mitigation and management of the risk of induced seismic events, it is important to understand the science.

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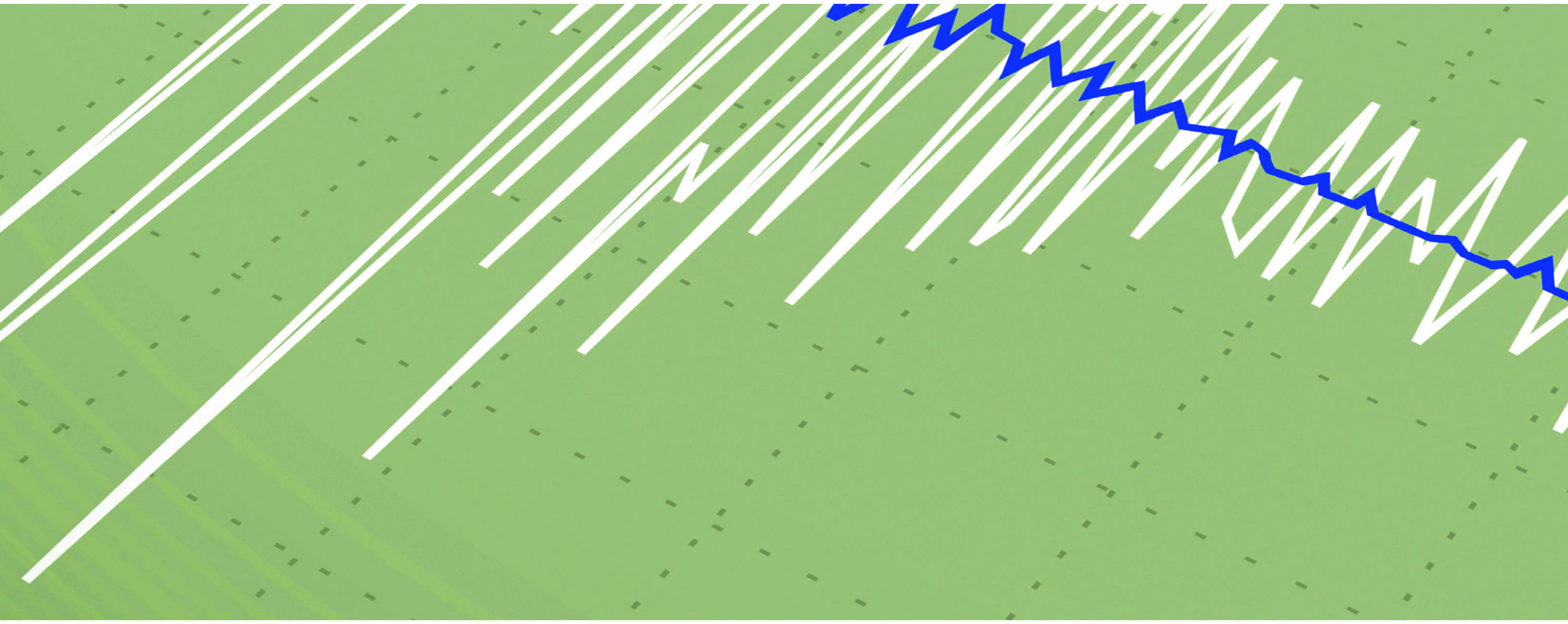
Hydraulic Fracturing and Seismic Activity (continued)

Seismicity Associated with Wastewater Disposal Wells



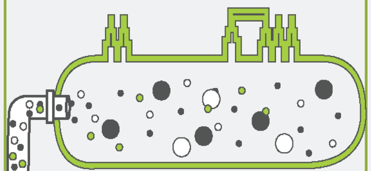
Documented since at least the 1920s, induced seismicity also has been attributed to a number of other human activities, including impoundment of large reservoirs behind dams, geothermal projects, mining extraction, construction and underground nuclear tests. In that context, the science of seismicity should be understood when discussing quake mitigation measures and/or risk management. Induced seismicity may occur when a geological fault is present and under stress. Increased pressure from fluid injection may unclamp the fault and allow slippage, resulting in surface shaking.

BOTTOM LINE: Induced seismicity is a complex issue, and the knowledge base surrounding it is rapidly changing. A onesize- fits-all approach isn't practical because of the significant differences in local geology and surface conditions – population, building conditions, infrastructure, critical facilities and seismic monitoring capabilities. As such, state regulators are best positioned to address potential issues linked to oil and gas injection wells in their state.

States are developing diverse strategies for avoiding, mitigating and responding to potential risks as they locate, permit and monitor Class II disposal wells. Many state regulators work with experts from government agencies, universities private consultants and industry experts on these issues. Effective planning involves identifying where there's risk of harm from a seismic event because people and property are located nearby. Again, state regulators are best able to make these assessments and plan adaptive responses in the event of a quake, such as adding seismic monitoring, adjusting injection rates and pressures, suspending injection well operations or halting injection altogether and shutting in a well.

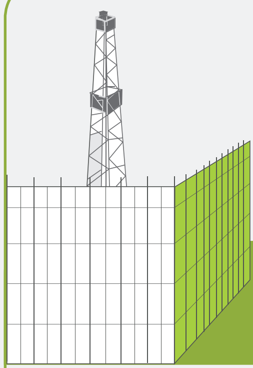
Both hydraulic fracturing and the underground disposal of produced waters from oil and natural gas operations have proven safe and environmentally reliable. Industry, academia, and government entities are clearly committed to pursuing further research to better understand the complex science and physical mechanisms associated with induced quaking events. Our companies are committed to science-based measures to reduce risk. It's an integral part of making energy development as safe as possible.

Innovations Promote Safe & Environmentally Friendly



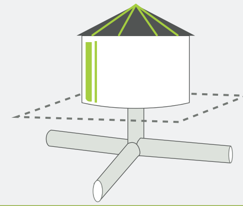
"PITLESS" DRILLING

Use of aboveground tanks for managing well fluids so that there is limited danger of well fluids getting into groundwater



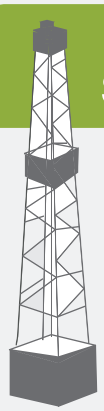
SOUND CONTROL

Sound control and surface management allows for safe drilling in close proximity to people



WATER SYSTEMS

Centralized water management systems that remove trucks from roads



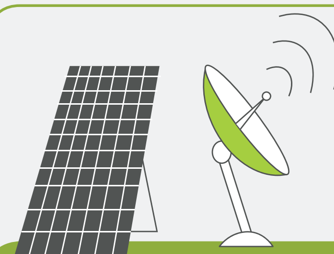
DRILLING SYSTEMS

1) Closed loop drilling systems; all drilling fluid stored in steel tanks

2) Whole site liners

"GREEN" FLUIDS

"Green" frac fluids (Example: Environmentally benign components)



SOLAR PANELS

Photovoltaic solar telemetry to transmit well date from remote locations to central office (reduces use of diesel fuels)

America's shale energy revolution is built on innovation that produced advanced hydraulic fracturing and horizontal drilling technologies and techniques. And that innovation continues, working on ways to make fracking even safer for the surrounding environment. Safe and responsible drilling means site management – from multi-layer surface liners that protect the entire drilling area to closed-loop systems to maintain control of drilling fluids. Safe operating practices and water management are just two areas for which API has developed standards to protect the environment. The shale energy surge also is spurring innovation: waterless hydraulic fracturing fluid, methods to decontaminate and recycle water used in fracking and more.

Resources

1 IHS Global: http://www.ihs.com/info/ecc/a/americas-new-energy-future.aspx?ocid=anef-21350:consulting:print:0001

2 IHS Unconventionals: http://www.api.org/~/media/Files/Policy/American-Energy/Americas_New_Energy_Future_Mfg_Renaissance_Main_Report_4Sept13.pdf

3 FracFocus: http://fracfocus.org/

4 STRONGER: http://www.strongerinc.org/

5 Shale Answers: http://www.api.org/~/media/Files/Policy/Hydraulic_Fracturing/Shale-Answers-Brochure.pdf

6 Methane Management Answers: https://remote.api.org/~/media/Files/Oil-and-Natural-Gas/Natural_Gas/,DanaInfo=www.api.org+MethaneBrochure.pdf

7 UT Methane Study: http://www.pnas.org/content/early/2013/09/10/1304880110.full.pdf+html

8 CardnoENTRIX Study: http://www.inglewoodoilfield.com/res/docs/102012study/Hydraulic%20Fracturing%20Study%20Inglewood%20Field10102012.pdf

9 API Groundwater Protection PDF: http://www.api.org/policy-and-issues/policy-items/exploration/hydraulic-fracturing-well-construction

10 United States Department of the Interior (USDI), 2011, Oil And Gas Produced Water Management And Beneficial Use In The Western United States: Science and Technology Report No. 157: https://www.usbr.gov/research/AWT/reportpdfs/report157.pdf

11 EIA Shale Gas projection: http://www.eia.gov/energy_in_brief/images/charts/nat_gas_production_1990-2040-(large).jpg

12 EIA 2013 Annual Energy Outlook Early Release 2014: http://www.eia.gov/forecasts/aeo/er/

13 Apache Corporation, Safe and Responsible Water Management: http://www.apachecorp.com/index.aspx

14 EPA, GHG Reporting Program Inventory of Greenhouse Gases, September 2014: http://www.epa.gov/ghgreporting

For more information, please visit

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