Hydrofracking: Where We've Been, Where We Are and Where (Maybe) We Are Headed

Casualty Actuaries of New England

March 23, 2015

Presenters:

Bob Weireter, Swiss Re

Gregory Hoffnagle, Clyde & Co.

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Presenter Information

Robert Weireter, *Swiss Re* - Vice President, Senior Underwriter - Treaty Casualty Reinsurance unit in Armonk, NY

Bob specializes in environmental, energy, and construction liability as well as general casualty. Prior to joining the insurance industry 18 years ago, he spent 12 years in the environmental consulting business working on hazardous waste site investigation and clean up, regulatory compliance, and property transfer due diligence. Bob has a B.S. in Natural Resources Planning, a M.S. in Environmental Science, and a M.B.A. in Management/Finance.

Presenter Information

Greg Hoffnagle, Esq., Clyde & Co.

Greg is a senior associate in the New York office of Clyde & Co US LLP. He has extensive experience handling complex international insurance and reinsurance litigations and arbitrations involving energy, environmental, privacy and data protection, pharmaceutical and securities related matters. He has also considerable experience representing domestic and international clients in various aspects of commercial litigation as well as government regulatory and enforcement actions along with internal investigations. Greg has authored, presented and been quoted on numerous topics in the U.S., U.K. and Bermuda regarding environmental and energy related underwriting risks most recently issues related to hydraulic fracturing and renewable energy.

Agenda

- Overview of Fracking Process
- Key Regions and Economic Drivers
- Key Risks
- Insurance Liability Issues
- Industry Best Practices
- Insurance Market Response
- Future Outlook

Photo source: http://www.eia.gov/forecasts/aeo/tight_oil.cfm

Introduction

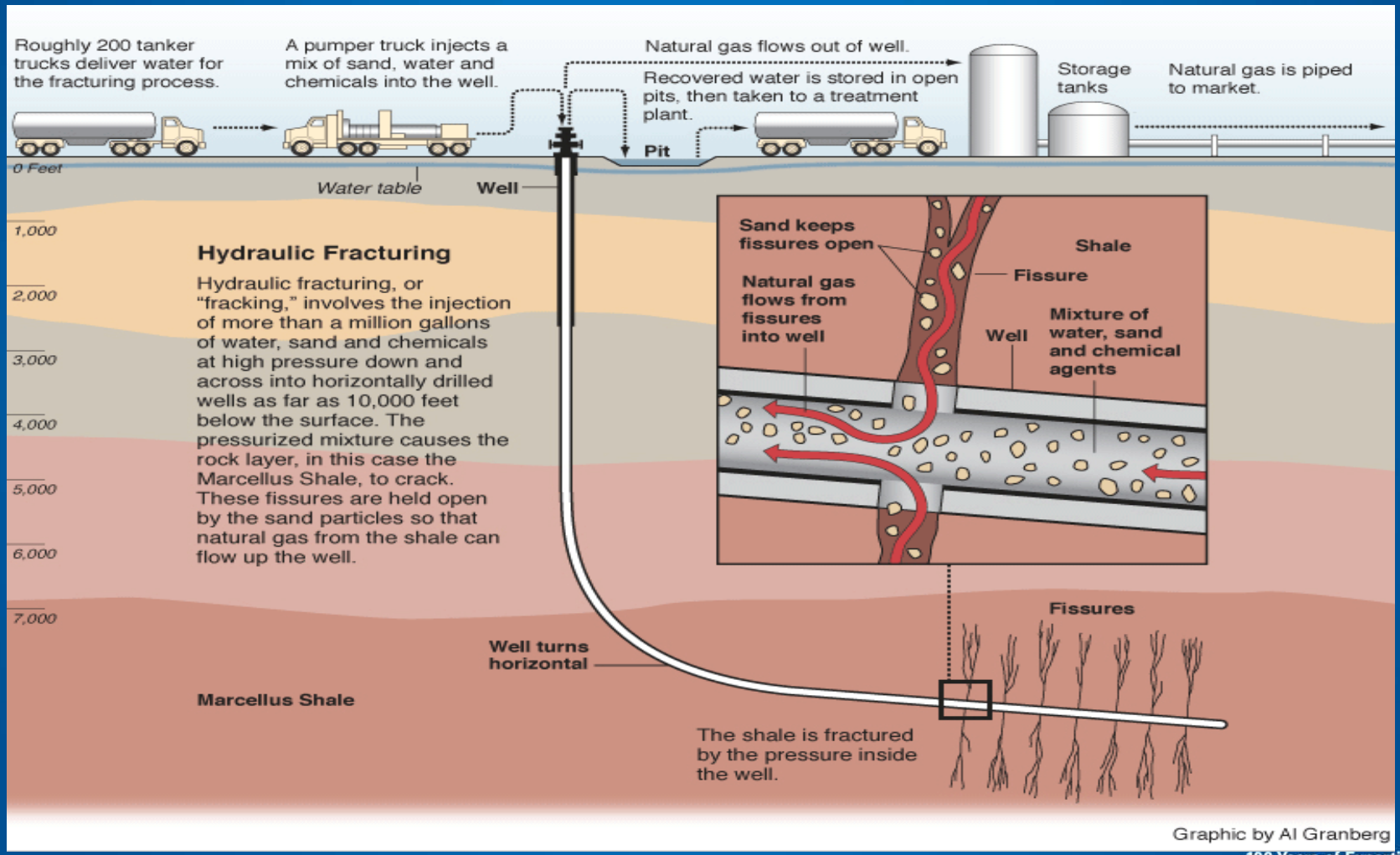
- The new generation of environmental claims
- Why focus on hydraulic fracturing (fracking)?
  - EPA study currently underway
  - Media/political attention
  - Lawsuits and allegations
  - Public scrutiny
- While the risks are “new” the coverage issues are familiar

Overview of Hydraulic Fracturing

History and Process

- Unconventional?
  - Injecting pressurized liquids to fracture rock and recover hydrocarbons dates back to the 1940s
  - Over the past six decades, has helped deliver over 600 trillion cubic feet of natural gas from more than 1.1 million separate and successful applications
  - Almost nine out of every ten onshore wells require fracture stimulation

Overview of Hydraulic Fracturing



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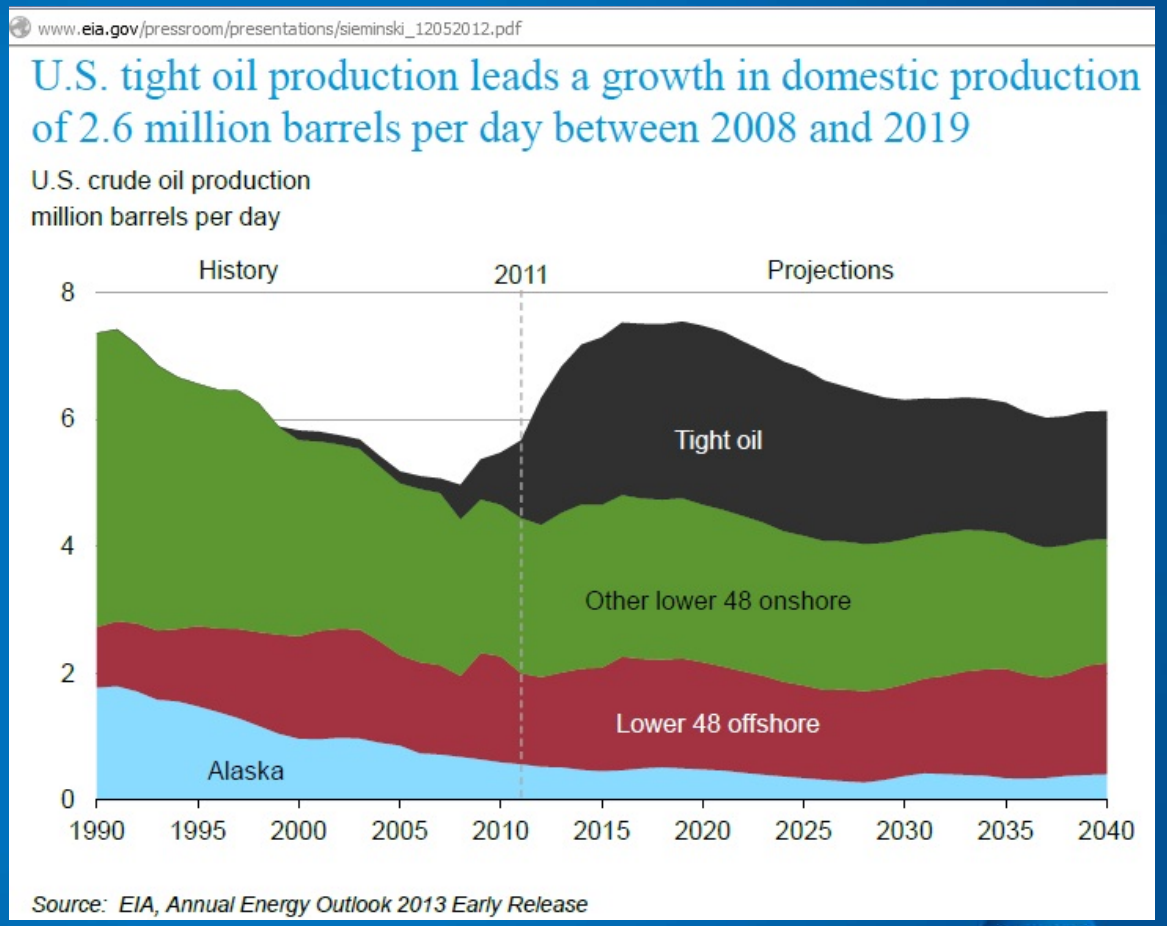
Overview of Hydraulic Fracturing

Not Just for Natural Gas

- Tight light oil production is set to be the single largest driver of U.S. oil production
- Growing by about 1 million barrels per day
- Contributing to overall U.S. supply growth to more than 7 million barrels per day



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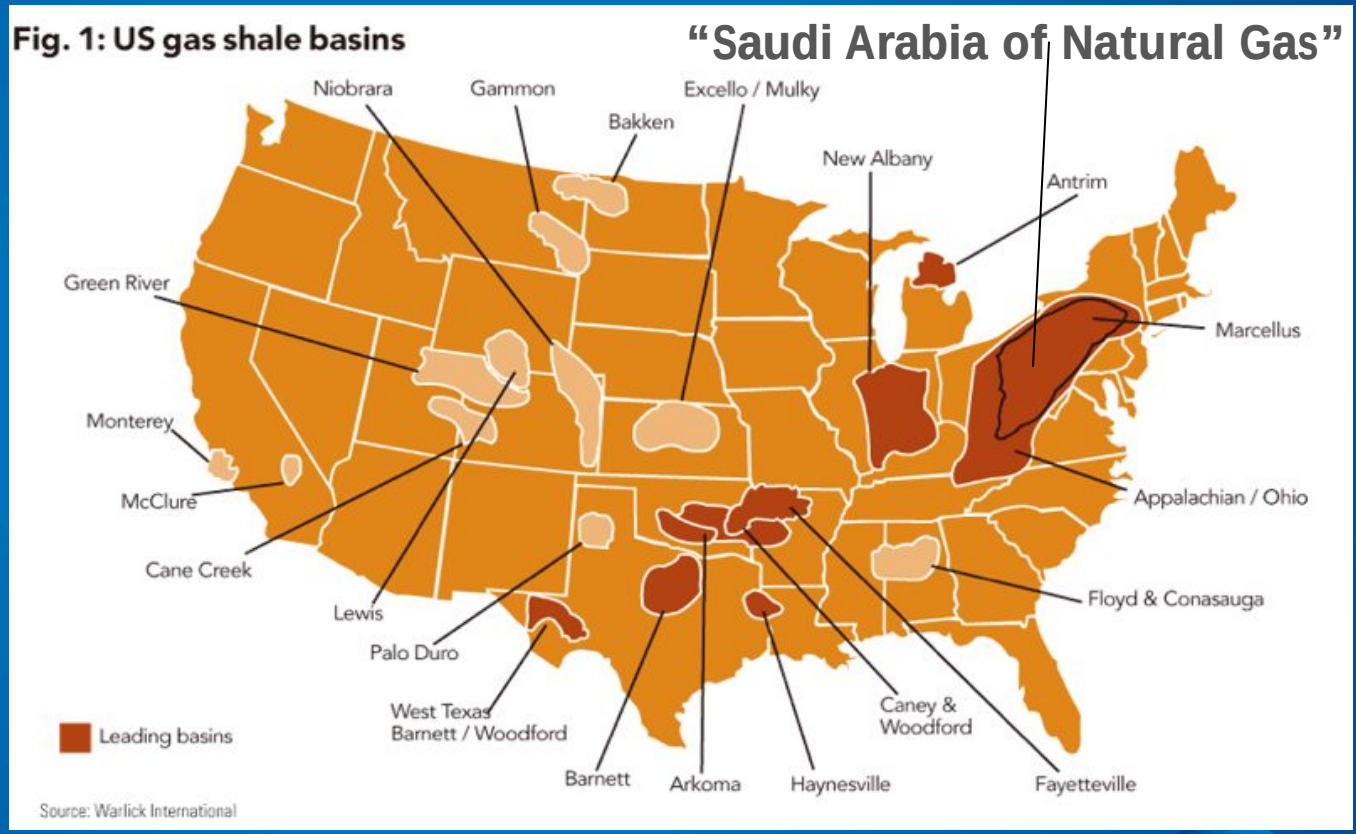
US Shale Gas Basins

- Pennsylvania
- Ohio
- New York
- West Virginia
- Louisiana
- Wyoming
- Colorado
- Texas
- New Mexico



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A Few of the Major Plays

Marcellus Shale

- Over 14 billion cubic feet of natural gas per day in 2014
- Roughly 18% of total U.S. natural gas production

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A Few of the Major Plays

Bakken

- Over 1 million barrels of oil per day in 2014
- Over 1 billion cubic feet of natural gas per day in 2014
- Roughly 10% of U.S. oil production

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US Outlook

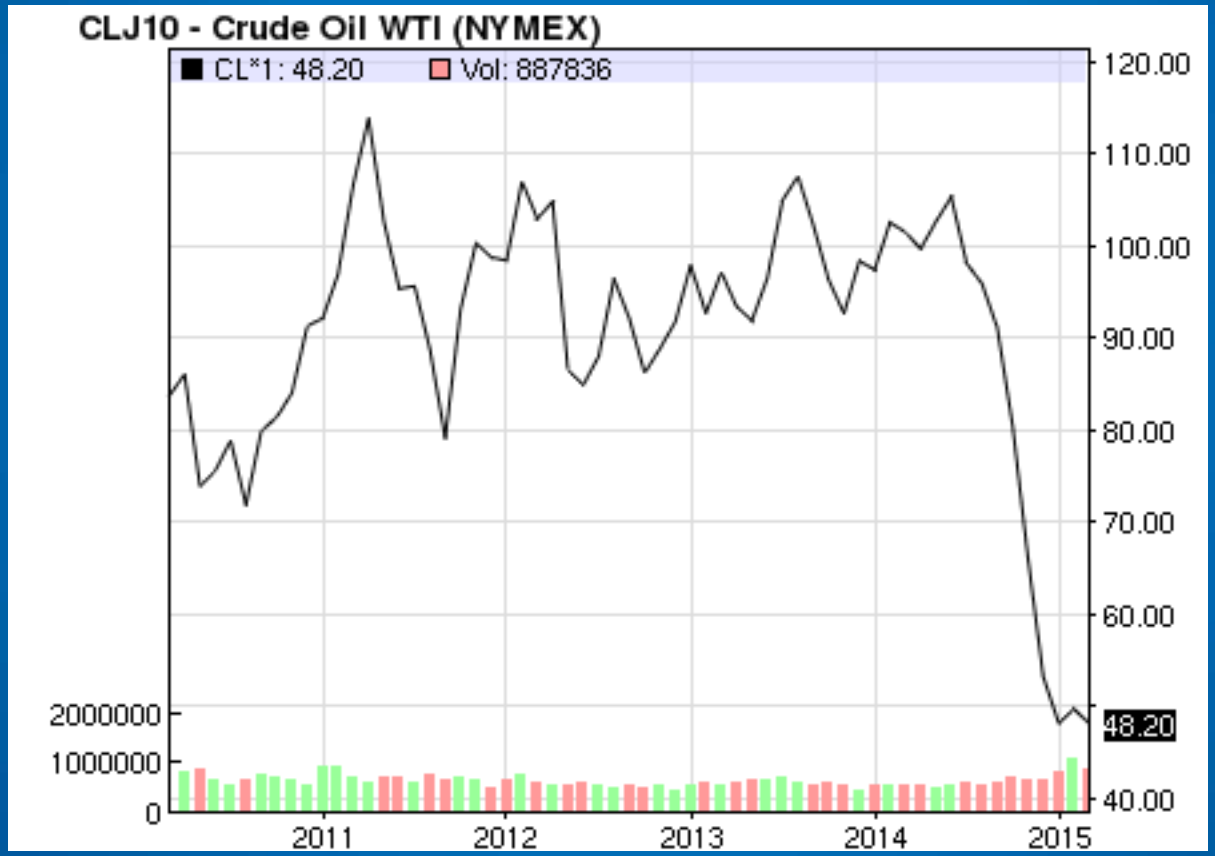
- US proved reserves of oil increased for the fifth year in a row in 2013
- U.S. natural gas proved reserves increased 10% and are now at an all time high
- North Dakota proved oil reserves surpass the Gulf of Mexico
- PA and WV account for 70% of increase in natural gas reserves
- Recent price declines impact the short term outlook but longer term fracking is expected to contribute to increased production to meet growing demand trends

Source: US Energy Information Association, December 2014

US – Recent News

- Drastic decline in oil & gas prices
- 28% fewer wells drilled in the continental US in January 2015 compared to June 2014 … but the amount of oil they can pump only decreased 8.5%
- Producers are able to respond more quickly to both price declines and increases
- One report notes an expected 39% reduction in capital expenditures during 2015 but a 5% increase in output
- There continue to be technological advances, leading to increased efficiency
- What is the break even price?

Crude Oil Price Trend - Five Years (NASDAQ)



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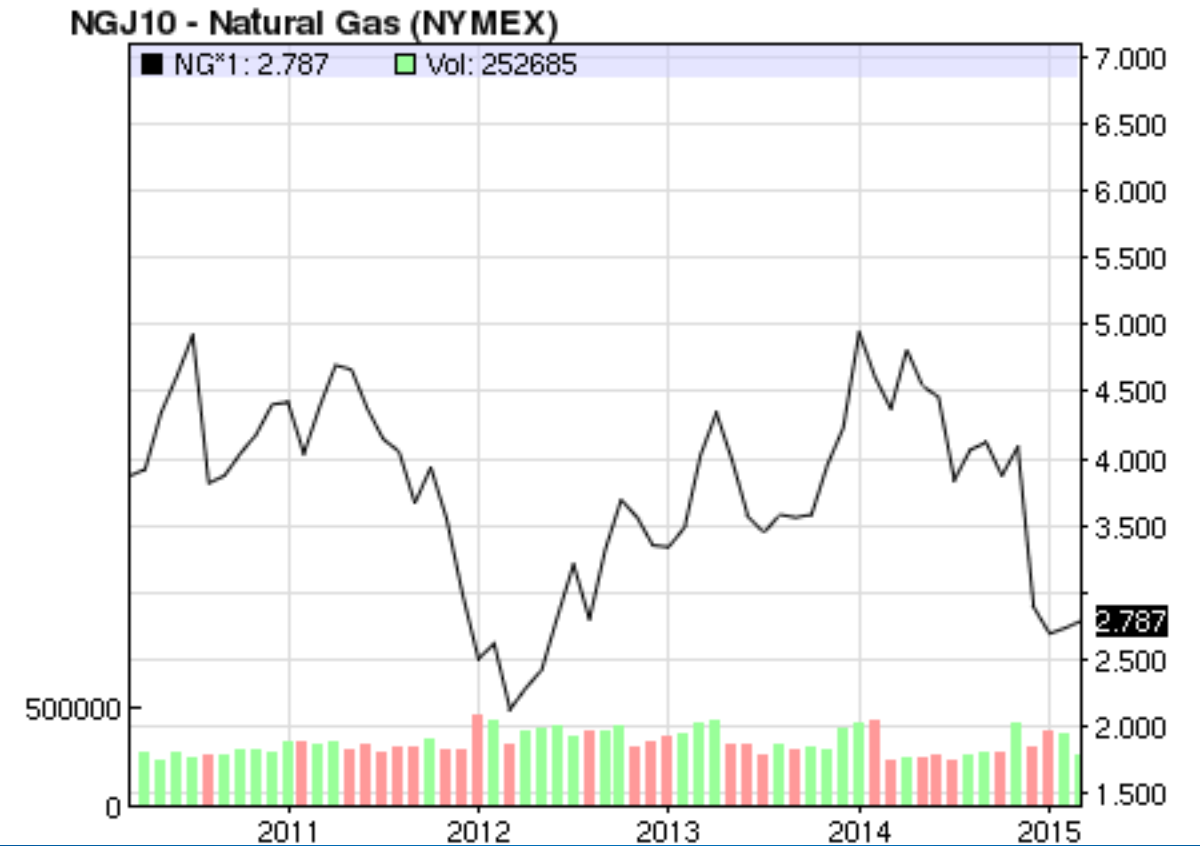
Natural Gas Price Trend, Five Years (NASDAQ)



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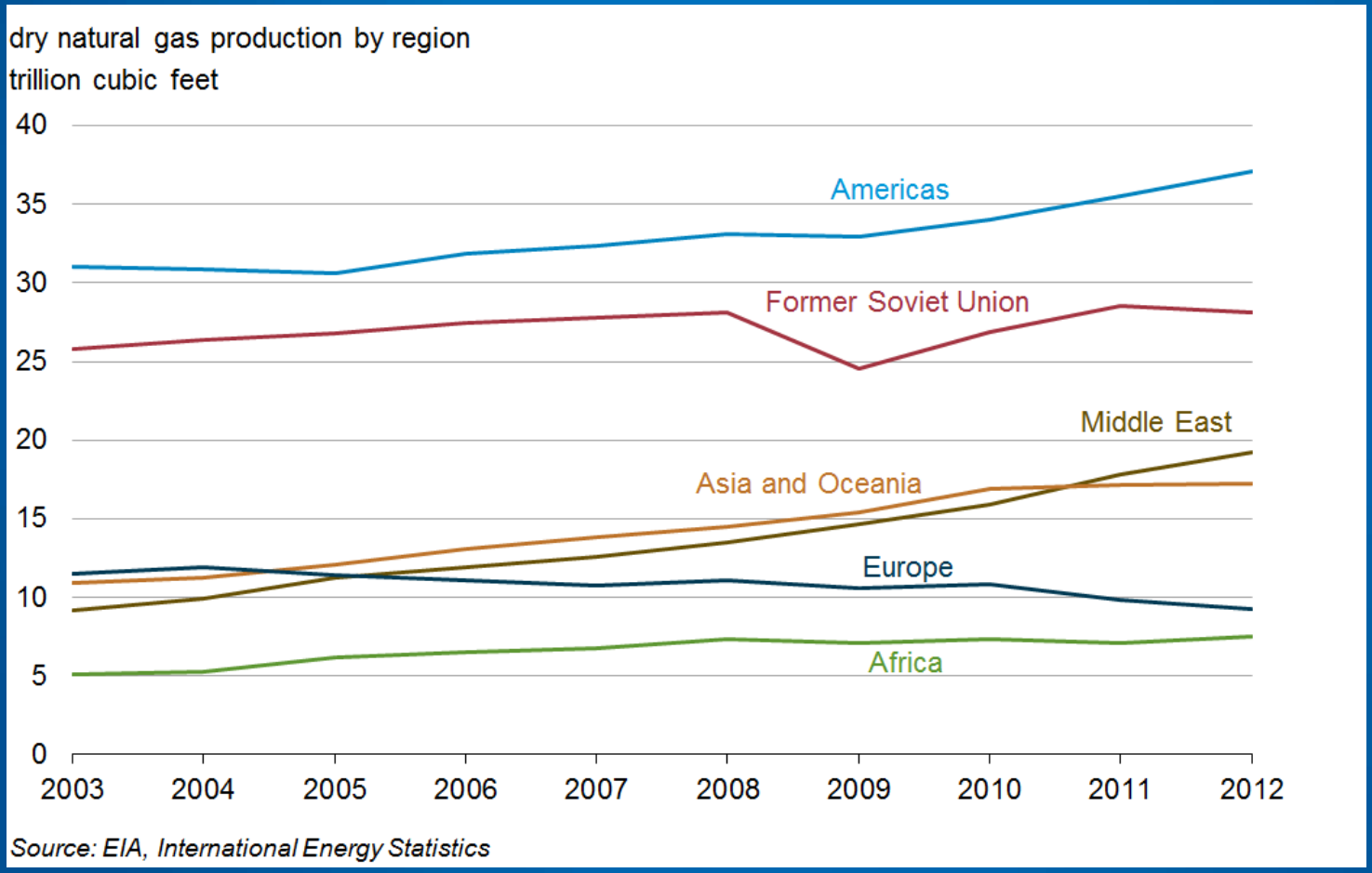
America's natural gas production is pulling away from other regions



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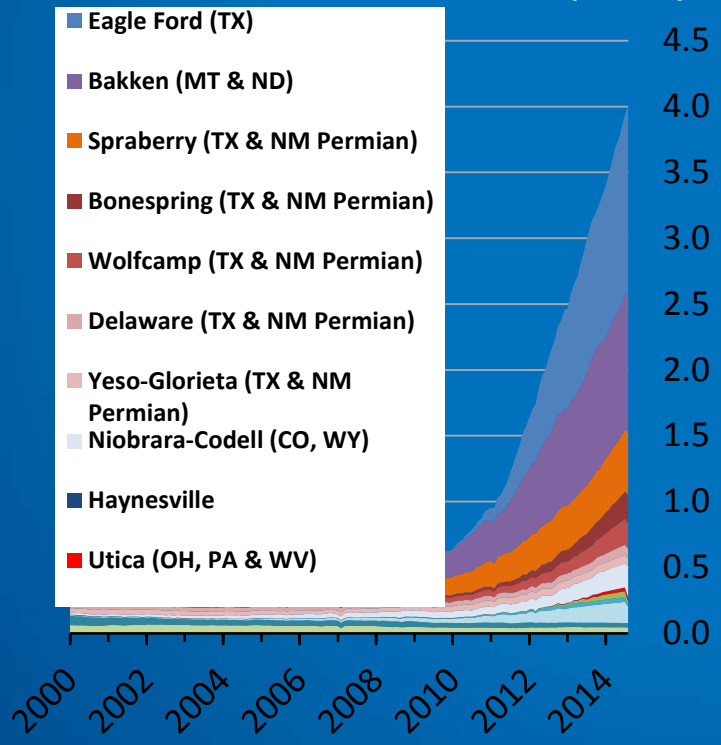
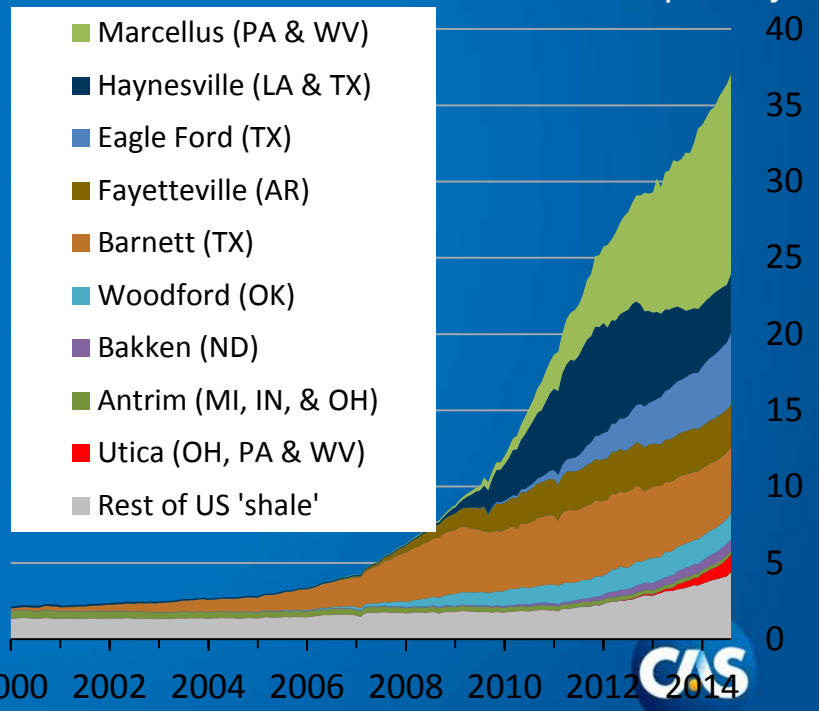
Rapid increase in US natural gas and oil production from shale and other tight resources

U.S. tight oil production
million barrels of oil per day



U.S. dry shale gas production
billion cubic feet per day



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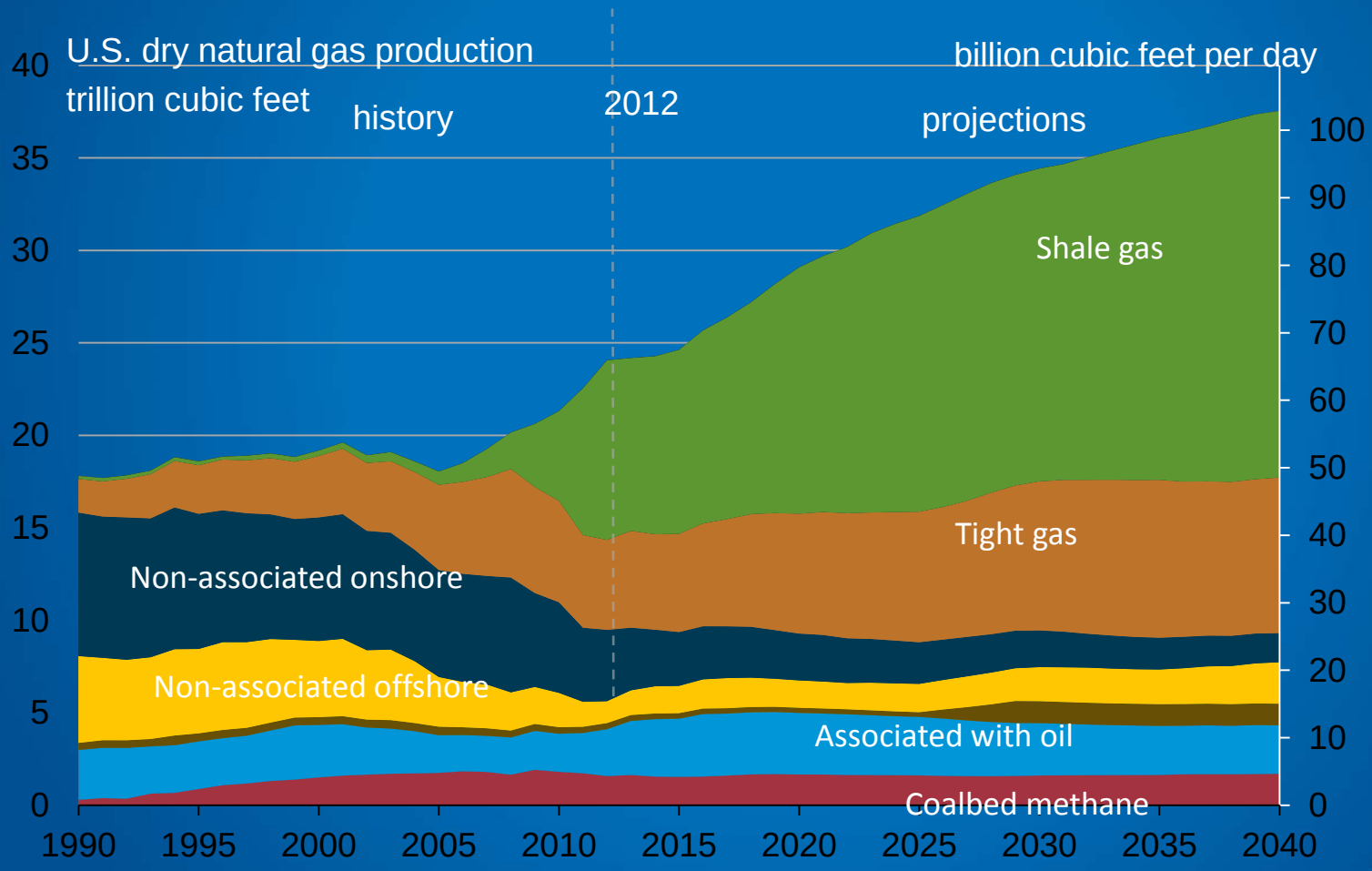
US shale gas leads growth in total gas production through 2040



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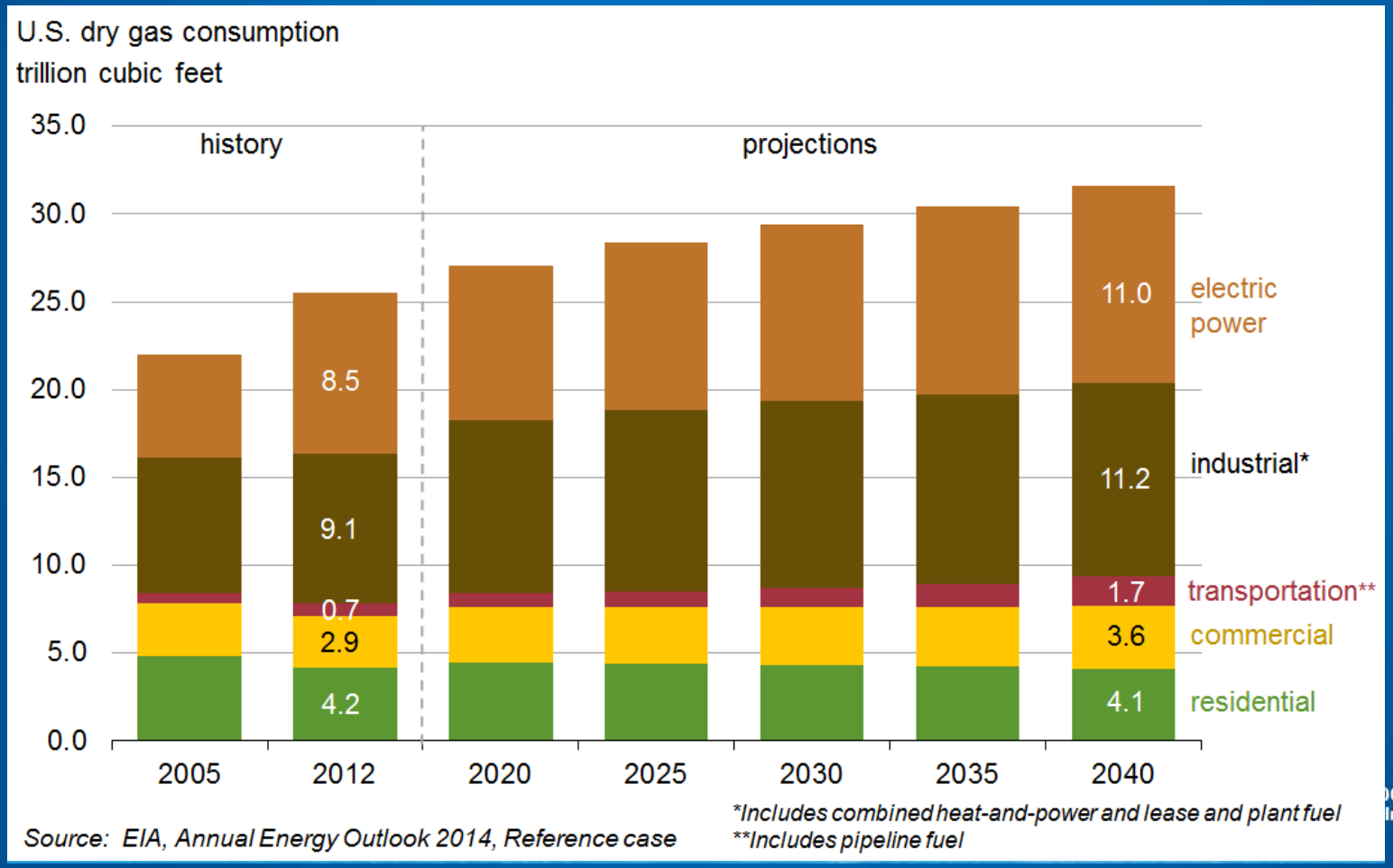
Natural gas consumption growth driven by electric power, industrial, and transportation use



Drivers/Key Market Factors

Growth/Expanded Use of Natural Gas

- Projected to overtake oil as most used fuel by 2027
- Significant growth in the next decade:
  - on going efforts to reduce greenhouse gas emissions >> coal-fired plants expirations and conversions
  - Increased demand for industrial use
  - Increasing adoption for vehicles, primarily bus and truck fleets

Drivers/Key Market Factors

Transportation Issues

- Need for pipeline infrastructure in Northwest and elsewhere
- Over 100,000 miles of pipelines either planned or under construction worldwide. About 42,000 miles in North America
- Rail emerging as primary transporter of crude from the Bakken
- Rail also emerging in Western Canada
- The pipeline vs. rail conundrum

Drivers/Key Market Factors

Regulatory and Legal Factors

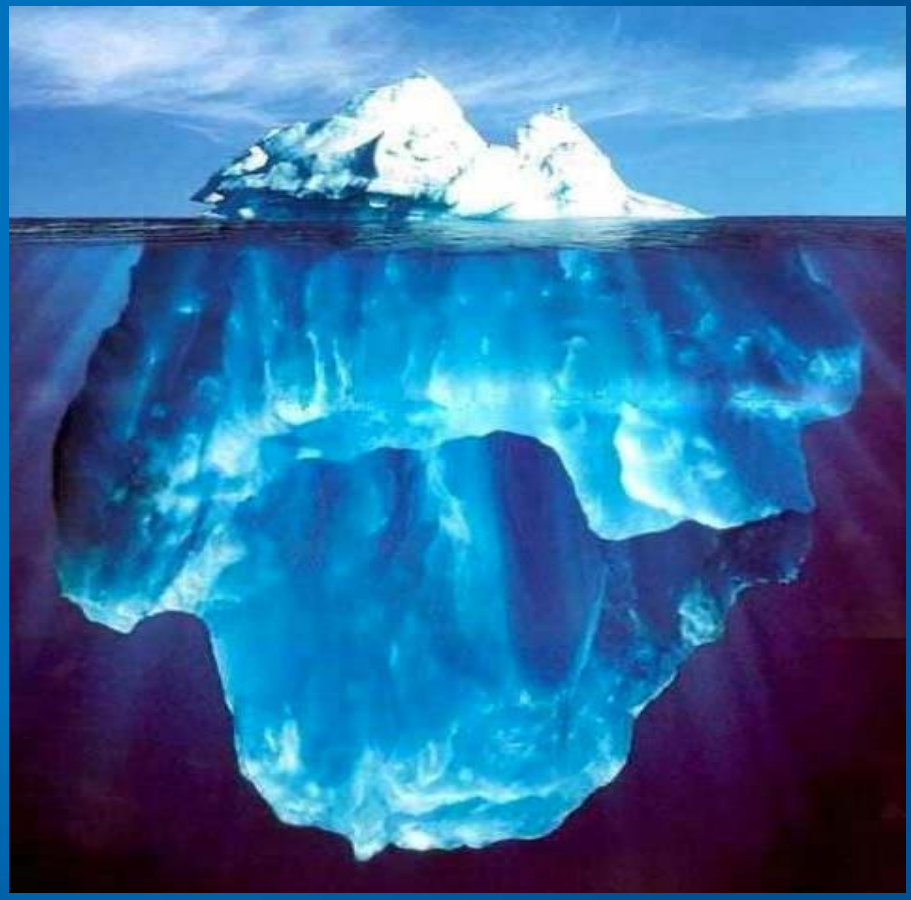
- Since 2012, uptick in CFTC and FERC investigations for alleged energy market manipulations and trading rule violations
- Class action lawsuits increasing
- In September 2013, California passed a law providing a comprehensive regulatory program concerning oil and gas well stimulation treatments
- In December 2013, the Pennsylvania Supreme Court invalidated portions of a 2011 state law that effectively restricted the power of local governments to regulate fracking by trumping local zoning rules
- NY State ban adopted December 2014

What Are the Risks?

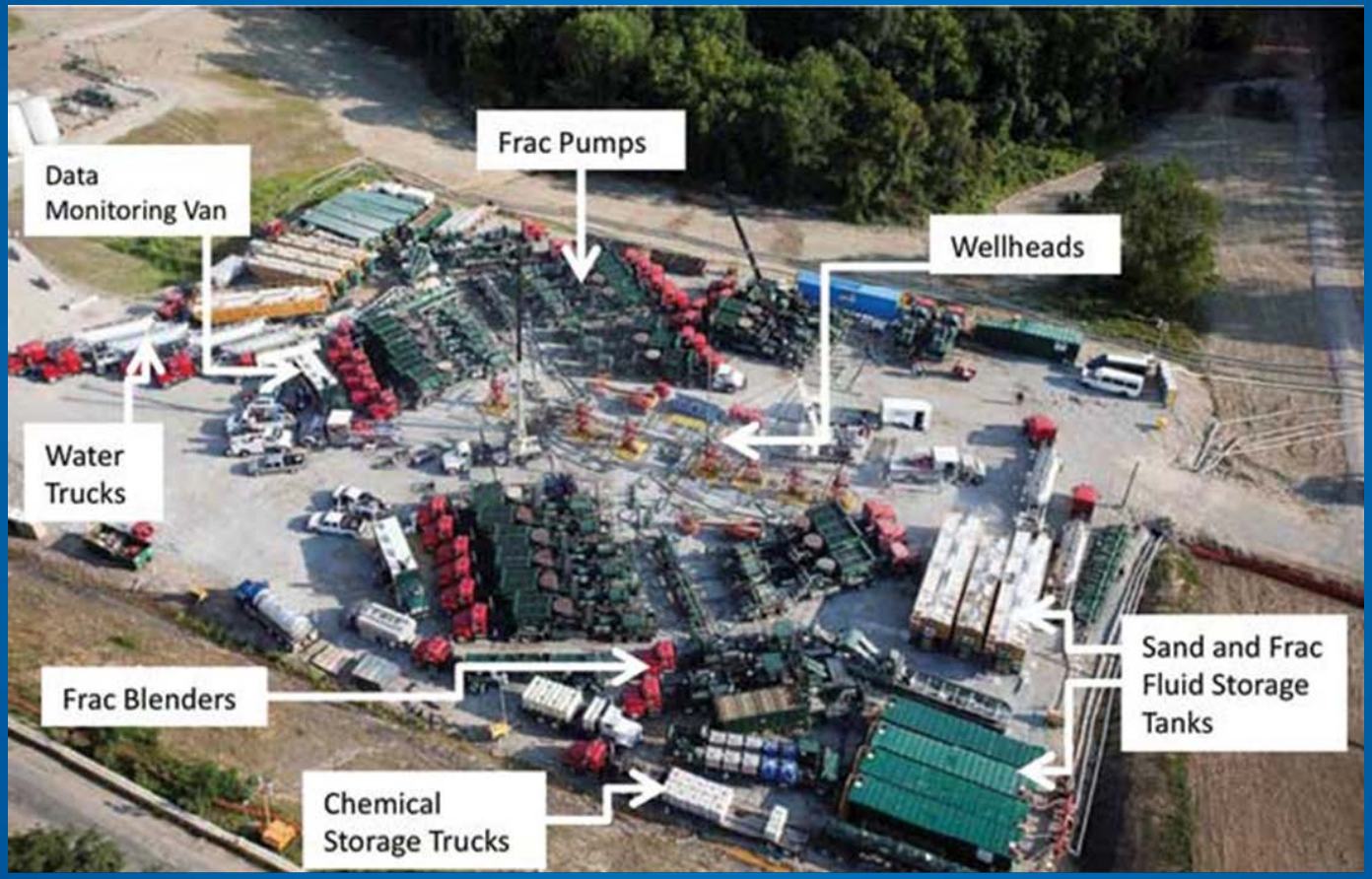
… it's bigger and more complicated than you think

Focus Areas

- Water
- Fracking Fluids
- Well Construction
- Surface Water and Soil/Land
- Seismic Disturbances, Health & Safety, Emissions
- Transportation
- Regulations



Density of a Drill Well Pad



Fracking Technology Moving Very Fast

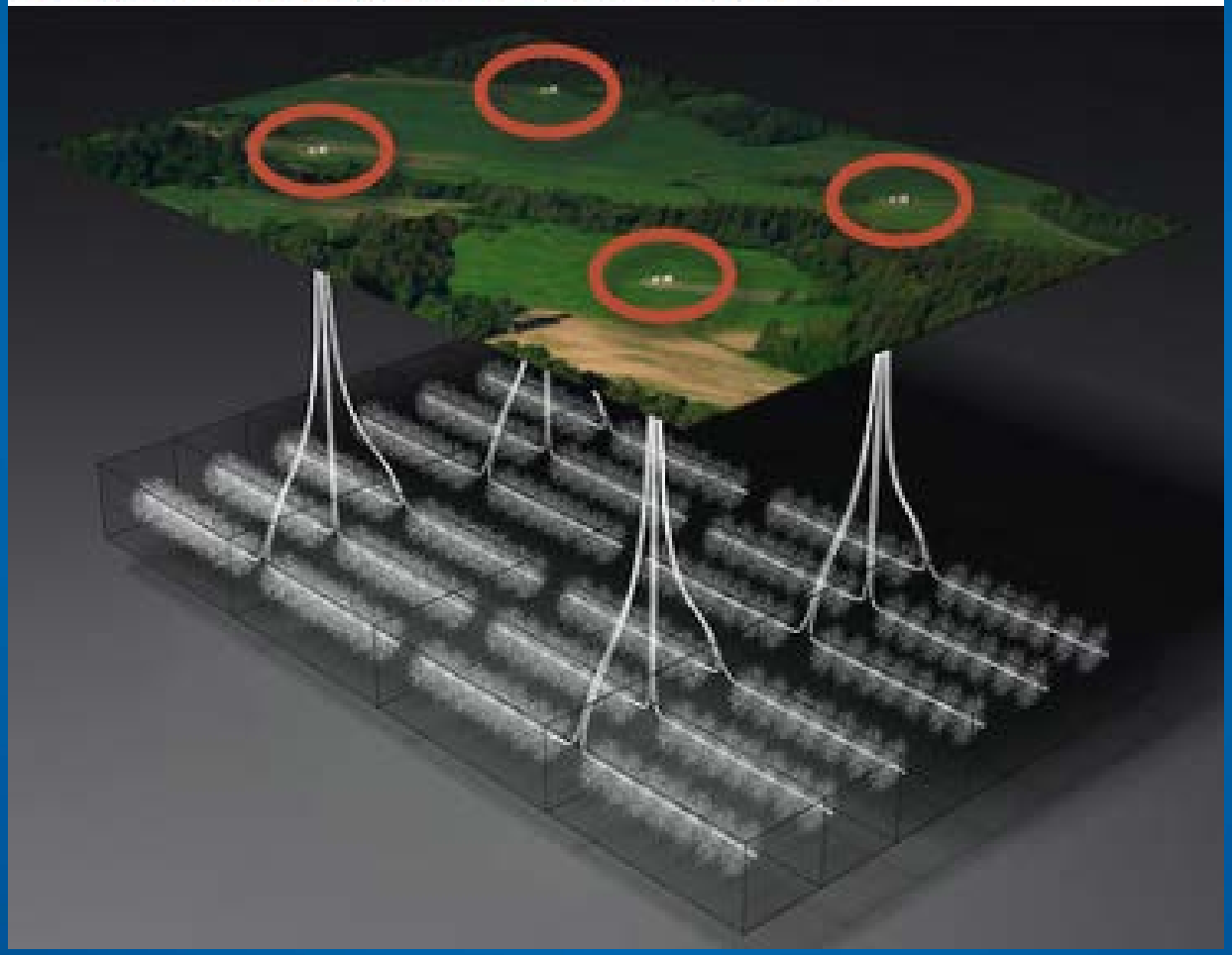
- New technology is rapidly expanding in its complexity (and efficency).
- Often six to ten, now perhaps even dozens of separate wells on a single well drill pad (there are 52 wells on a single 4.2 acre pad in Colorado).
- Drilling depths are ever increasing; some contain nearly eight miles (40,000 or more feet) of piping.
- Various intricate well operations occur side-by-side: drilling, fracking, flow back wastewater collecting, gas production, connection to pipeline systems, other well servicing operations.
- "Zipper fracking" - adjacent wells are fractured in sequence that enables non-stop round the clock fracking to reduce frack time and water consumption, yet increase production
- Insurers should be mindful that new drilling technologies are causing the fracking risk to be constantly evolving. Keeping up with this rapid rate of change is one of our biggest challenges.

Dallas - Fort Worth Airport: What a Gas

- Very busy super hub
- 30 square miles with 53 well pads
- Almost complete coverage under the eventually airport anticipated
- This scenario is repeated at other 'non energy' locations (school districts, landowners, etc.) >> what is happening at our 'non energy' insured locations?

Multiple Collection Pipes at Bottom of Single Well

Drilling pads allow widespread underground development by concentrating wellheads at the surface



The Four Risk Groups

Water

- Unique to fracking are the risks associated with the transport, storage and use of significant amounts of water. Each fracking project may use 2-4 million gallons of water

Risks:

- Limited water supply – impact on other groundwater users
- Change in water table – impact on shallow aquifers
- Storage of fracking cocktail at the drilling location (usually housed in “frack tanks” or purpose built ponds) presents both short- and long-term risks e.g., storm event causing overflow and gradual seepage

The Four Risk Groups (cont'd)

Casing

- Breach of vertical casing may cause release (which can be gradual or sudden in nature) impacting shallow aquifers
  - And there are numerous casings:
    conductor casing → surface casing → intermediate casing….

- Operators should take measures before, during and after operations by monitoring nearby groundwater wells for exposure to fracking fluid and methane before, during and after drilling

The Four Risk Groups (cont'd)

Blowout

- This includes the loss of well during drilling operations, as well as loss of flow back water from production site
- The risk concerns impact to surrounding areas: farms, homesteads, waterways….
- If drilling site is located near a (sub)urban area, it may impact more directly the local community and business

The Four Risk Groups (cont'd)

Fracking Fluid ("Cocktail")

- Made up of:
  - 99% water highly concentrated in saline;
  - 0.5% sand (including silica sand), which acts as a proppant to crack shale and release natural gas. Up to 4 million pounds of sand can be used in drilling operations
    - Exposure to silica sand can occur during any part of the operation when sand dust laden with silica becomes airborne
  - 0.5% other chemicals, which companies are not legally obligated to disclose pursuant to the Halliburton Loophole in 2005 Energy Bill
  - Significant amount of fracking fluid is never recovered

Earthquake Risk: Issues & Allegations

- There is concern that both hydrofracking & deep well injection are causing earthquakes (seismic activity that has already occurred and been detected + potential for these activities to facilitate future seismic activity).

- Companies involved in these activities may be subject to claims, lawsuits, and complaints that these activities cause property damage and/or bodily injury

- This issue is not just related to fracking but also other parts of the energy industry where high pressure fluids are pumped into the ground

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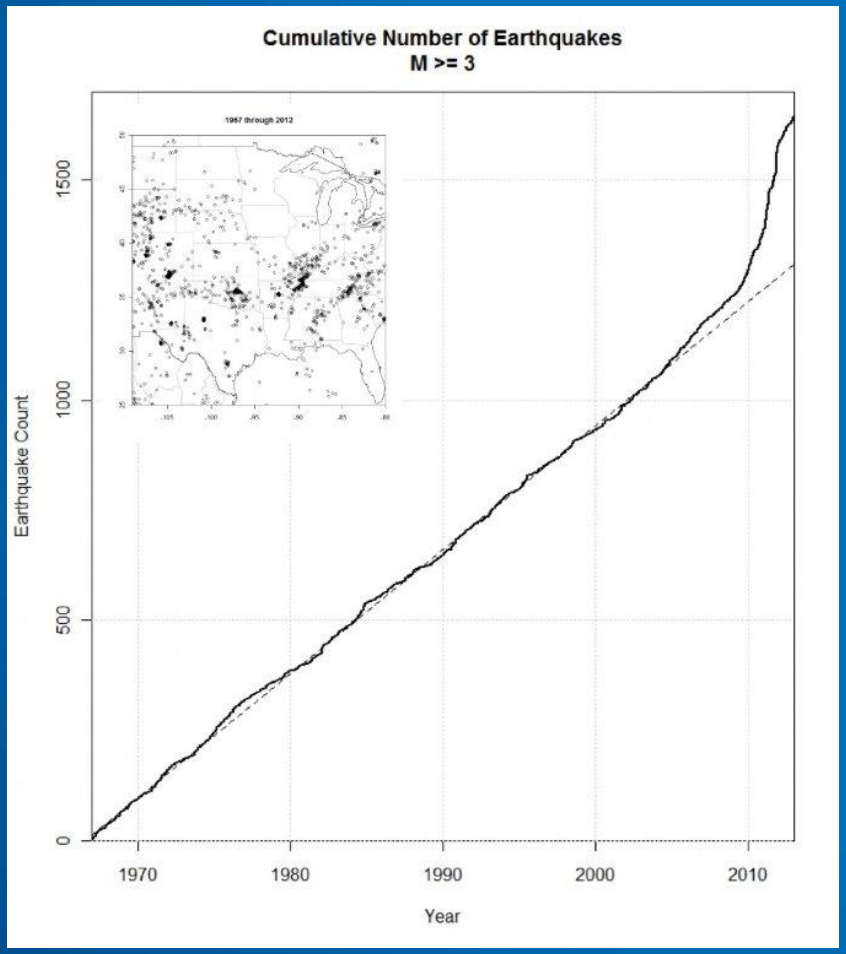
Seismic Activity: What The Numbers Say



Earthquake frequency had been consistent between 1967-2009, with dashed line in top right corresponding with the projected long-term rate

But suddenly spiked to 300+ over just 3 years (2010-2012)

Source: U.S. Geological Survey
http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/

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Seismic Activity: What The Numbers Say

- The US Geological Survey (USGS) says 567 earthquakes with magnitudes of 3.0 or greater were registered in OK in 2014, making it the most seismically active state in the nation, excluding Alaska and Hawaii.

- The 2014 total is five times greater than those recorded in OK in 2013.

- OH, CO and NM have also seen a rise in seismic activity that coincides with an uptick in activities associated with oil and gas extraction.

Seismic Activity: What The Science Says

- It has long been known that impoundment of reservoirs, geothermal development, withdrawal of fluids and gas and injection of fluids into underground formations are capable of inducing earthquakes. Microearthquakes (magnitude < 2) are routinely produced as part of the fracking process.

- Deep well injection (about 30,000 Class II wells in the US) is believed to be higher hazard than fracking from a seismic perspective.

- The most likely explanation is that the increase relates to the recent boom in fracking. That said, the long term impacts of both fracking and deep well injection on seismicity remain unclear. It is not clear what factors distinguish seismically active wells from the large majority of other wells with no associated seismicity.

Production Well Earthquakes?

- Recent scientific studies suggest that fracking activity may cause earthquakes in areas that previously had little or no seismic activity
- Although fracking wells cause minor seismic events, thus far they have been so small that they can only be detected via sensors on the surface
- No US study has conclusively determined that production well fracking leads directly to a seismic activity which is noticeable by humans at the surface
- Continue to monitor for developments

Photo source:
http://energy.gov/fe/mission

Earthquake Risk: Moratoriums

- Following earthquakes near wastewater disposal wells Arkansas and Ohio declared a moratorium on deep injection wells
- Oklahoma regulators adopted new data monitoring and reporting rules for injection wells in certain areas
- In 2014, regulators from Kansas, Texas, Oklahoma, and Ohio met for the first time to exchange information on man-made earthquakes. They seek to develop a set of common procedures to monitor earthquakes, investigate their cause, and draft rules and regulations to prevent them
- Public perception will likely continue to produce anxiety over these events
- More regulations and permit requirements likely going forward, with local and state variations

Earthquake Risk: Lawsuits

- Oklahoma's highest court is about to make a decision that could really shake up the way fracking companies do business in the state.
- In the coming months, Oklahoma's Supreme Court will decide whether two oil companies should be held financially responsible for injuries suffered by a woman during a 2011 earthquake thought to have been caused by drilling activity.
- If the woman's lawsuit is successful, it could set a legal precedent for future earthquake claims against oil and gas companies in Oklahoma.
- In 2013, Arkansas residents who claimed that wastewater disposal wells caused earthquakes which damaged their homes, reportedly settled their lawsuit with Chesapeake Energy and BHP Billiton for an undisclosed sum
- In 2014 14 families in Arkansas filed a lawsuit in connection with a series of earthquakes

Earthquake Risk: Loss Control and Risk Management

- There are currently no standard risk assessment methods for induced seismicity (unlike well established procedures for water and air monitoring)
- Key issues affecting seismic risk are subsurface pre pressure and net fluid balance (fluid introduced vs. fluid removed). To what extent is the drilling company/well owner monitoring these parameters? This includes both baseline prior to operations as well as during operations.
- Differentiate hazard (potential for induced seismicity) from risk (possible damage that may occur to adjacent property, with the caveat that seismic activity may spread many miles from the site)
- A 'traffic light' control system has been used to adjust operations based on monitoring data. Does the insured use any type of 'traffic light' system (may be required by operating permit)

Railroad Exposure

For a variety of reasons transport by rail has increased dramatically.

Several high profile rail accidents led to increased discussion and regulation regarding safety measures, including testing requirements and new rail cars.

Several recent derailments that involved new higher safety rail cars (and trains that were travelling below allowable speed limit) have renewed debate over the adequacy of rail regulations and procedures, including test of the oil before loaded into the rail car.

Rail traffic expected to continue growing so this debate needs to be closely followed.

Commercial Auto Exposure

Contractors with large fleets of vehicles

- hauling wastewater
- transporting staff and equipment
- roads often times not appropriate for this type and volume of traffic

Accidents due to drivers not being familiar with winter weather plus fatigue

Loss control activity being directed here

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Insurance Potentially Implicated

- Casualty- General Liability and Umbrella Insurance
- Environmental/Pollution Liability Insurance (EIL or PPL or ESL)
- Operator's Extra Expense ("Control of Well") Insurance
- Errors & Omissions Insurance (e.g., Architects & Engineers Coverage)
- D&O Insurance
- Business Interruption Insurance
- Homeowner's Insurance
- Agricultural Insurance
- Workers' Compensation Insurance
- Products Liability Insurance
- From an operator's perspective, policies mainly at play are GL, Environmental & OEE

Risk Allocation: Parties Implicated

Various parties involved in fracking operations:

- Site owner-operator
- Non-operating owners
- Contractor(s) building the infrastructure (roads, pads, ponds)
- Drilling contractors (supplies, rig and crew)
- Wireline operators
- Equipment suppliers
- Fracking operators (provide the chemicals, blend the cocktail)
- Transporters
- Storage facilities
- Recycling facilities

Risk Allocation... (cont'd)

- The operating agreement between the site owner-operator and the non-operating owner usually allocates the risk between those parties in accordance with their ownership interest

- Among the contractors, however, industry norm is to have "knock for knock" contractual arrangement

  - Under a "knock for knock" contract, each contractor is responsible for their own workers and equipment, and indemnifies the other parties, regardless of fault

Third Party Liability Claims

- Insurer's duty to defend policyholder under GL policies
  - If allegations fall within coverage, ultimate liability is irrelevant
    - Insurer must defend until liability is determined – even if allegations are meritless
    - But, there must be a potential for coverage under the policy terms
    - Some jurisdictions allow the duty to defend to be assessed using evidence extrinsic to the allegations of the underlying complaint
- Motion practice on duty to defend may tee-up coverage issues at the outset of coverage litigation

Property Suits: Likely Causes of Action

Plaintiffs – Home, Property & Business Owners

- Trespass
- Negligence/Gross Negligence/Strict Liability
- Nuisance
- Fraud/Misrepresentation
- Air and Noise Pollution
- Strict Liability
- Breach of Contract
- Indemnity
- Medical Monitoring

Property Suits: Alleged Damages

Typical damages alleged:

- Air and Noise Pollution
- Well Contamination
- Seismic Activity / Sinkholes
- Diminution of Property Value
- Loss of Business Income
- Costs of Remediation/Monitoring

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Bodily Injury Suits: The New Toxic Tort

Causes of Action

- Violation of Federal Statutes (CWA, CAA, CERCLA,)
- Negligence, Trespass, Public/Private Nuisance
- Breach of Contract/Fraud
- Employer Liability
- Strict Liability

Damages Sought

- Typical Bodily Injury Damages
- Medical Monitoring
- Punitive Damages

Bodily Injury Suits: The New Toxic Tort

Employer Liability

- Employee exposure to contaminants
  - Failure to provide safe workplace
  - Failure to provide appropriate protective equipment
  - Failure to maintain safe levels of exposure
  - Failure to warn

- Silica Exposure?
  - NIOSH study
  - Latency issues

First Party Property Claims

Property Damage

- Well blow-outs
- Seismic activities beneath insured property: collapse, cracking, shifting, sink holes

Utility Service Interruption

- Provides coverage for losses that the policyholder incurs due to the interruption of utility services that result from physical damage to the property that supplies the utility
- For example, if hydraulic fracturing activities results in your business losing access to its water services, and your business then incurs losses because of interruption of service, you may have an insurable loss – i.e., a farm's inability to water its crops or provide water to its livestock

First Party Property Claims

Business Interruption

- Provides coverage for lost income due to suspension of business operations, often as a result from direct physical loss to insured property
- Generally, business interruption coverage requires property damage
  - Business Interruption coverage may turn on whether the policy requires property damage to insured property, like the insured's offices or factories
  - The majority of Time Element coverages, like Contingent Business Interruption (CBI) and Civil Authority coverage, do not require property damage to the insured's property

First Party Property Claims

Potential application of “Business Pursuits” exclusion

- Most homeowners insurance policies exclude coverage for liability relating to "business pursuits,“ barring coverage for any damage or liability “arising out of or in connection with the business pursuits of any insured.” Said “business” need not be owned or operated by the insured

- Although the law is not uniform, most jurisdictions generally define a business pursuit as a (i) continual or recurrent activity (ii) carried out for financial gain

First Party Property Claims

Business Pursuits Exclusion (cont'd)

- In most states, courts give a broad interpretation to "business pursuits," drawing in almost any activity that results in financial gain
- Few states have adopted a narrower interpretation of "business pursuits," limiting it to activities that are considered a "primary occupation" and not including those where profit is not the insured's primary motive (PA)
- GA, MS and NC: exclusion only applies to insured's principal business

Industry Developments: Best Practices

- Predrill baseline testing and ongoing monitoring of nearby drinking water
- Casing and cementing are key to protect groundwater and prevent gas leakage
- Protect the top portion of the well bore (surface and deeper) with multiple redundant layers of protective steel casing surrounded by cement + pressure testing
- Sufficient centralizers in the underground steel piping
- Subsurface safety shut-off valves for producing wells
- Thick industrial plastic liner (impermeable membranes) to prevent surface leaks at well pads

Industry Developments: Best Practices

- Transparency on what chemicals are being used in Fracking fluids and use safer alternatives where possible
- Store flow back wastewater in steel tanks (not earthen pits) and use closed loop systems (recycling)
- Air emissions monitoring and control (including noise)
- Real time seismic monitoring
- Management of NORM (naturally occurring radioactive matter)
- Roadways and transportation controls
- Repeat above steps for each re-fracking (not just initial fracking), especially pressure testing

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Future Technologies Intended to Make Hydrofracking Safer

- Numerous new procedures, guidelines, organizations, etc. to foster collaboration with stakeholders and safer practices
  - More transparency regarding operations (especially fluid chemicals)
  - Use of 'greener' fracking fluids- substances with lower toxicity, even at high concentrations and/or prolonged exposure + chemical markers
  - Flow back wastewater recycling and treatment systems, as well as use of water not fit for drinking or agriculture usage (e.g., brine, coal mine stream runoff)
  - Possible water-free fracking (e.g., propane/other gases)
  - Nanotechnology proppants may replace sand and ceramics to reduce the amount of water and fracking chemical inputs, as well as increase oil & gas production outflow
  - Reduce methane gas well venting and flaring
- New techniques and products suggests that the fracking process will likely continue to evolve at a rapid pace

Insurance Market Response

- Increased scrutiny: what does this company do (especially contractors)?
- Higher hazard classes:
  - Oil & Gas Lease Operators and Non-Operators (SIC Code 1311)
  - Drilling Contractors (SIC 1381)
  - certain classes of oil and gas well servicing contractors included in SIC Code 1389: cementing, contractors, down hole testing and monitoring, pressure pumping, fluid trucking and disposal
  - shallow well drilling & fracking (for example, less than 2500 ft. deep)
- Reduce limit capacity for exposed risks
- Increased attention on aggregation and accumulation potential
- Limited time element or blended sudden & accidental pollution cover; general avoidance of gradual cover
- Some fracking exclusions for contractors who don't perform over/down the hole services but not practically feasible to exclude 'fracking' for drillers and operators

Insurance Market Response

- More collaboration with loss control & risk engineering
- Enhanced review of contractual liability
- Supplemental applications and questionnaires are more common
- Some avoidance of new and very small companies
- Concern regarding LLC and LP entities that may have short life span
- Naturally Occurring Radioactive Matter exclusions common
- Preference for defense inside the limit
- Limited underwriting authority for high hazard classes and certain policy terms and conditions
- Increased focus on specialty brokers for oil & gas business
- Develop specialized expertise or stay away

Where Do We Go From Here?

- How long will the current slow down in drilling activity last?
- However, production from investment in prior years is just now coming on line so exposure stays high
- How far will increased technological improvements and efficiencies take us?
- Can/will government regulation and monitoring keep up?
- Macro economic trends are a strong driving force

Where Do We Go From Here?

- Dual focus on both groundwater contamination as well as seismic risk >> expect additional claims and lawsuits on these topics and others >> to what extent will causation be established?
- Continued public and regulatory concern about railroad accidents
- Additional requirements at the local, state and federal level >> lack of consistent and uniform regulatory approach
- Will industry best practices actually emerge?

Where Do We Go From Here?

- Many unintended consequences and unusual linkages
- Very rapid pace of change >> a big challenge for insurance community
- What will be the impact on (re)insurance ??????????

Where Do We Go From Here?

Key Uncertainties:

- price levels >> what is the break even point and for how long can current price levels be sustained?
- regulatory and political decisions on stricter regulations, export trade and pipelines
- will public acceptance wane if accidents and seismic events continue?
- will current reserve estimates prove to be on target, too optimistic or increase even further?
- geopolitical tensions and their impact on energy production and trade
- development of other shale areas globally

Governmental and Industry Resources

Center for Sustainable Shale Development – performance standards, certification, and audits (http://www.sustainableshale.org)

FracFocus (http://www.fracfocusdata.org)

Energy in Depth (http://energyindepth.org)

Marcellus Center for Outreach and Research (http://marcellus.psu.edu)

Marcellus Shale Coalition (http://marcelluscoalition.org)

American Petroleum Institute (http://www.api.org)

Schlumberger Oilfield Glossary (http://www.glossary.oilfield.slb.com)

U.S. Energy Information Administration (http://www.eia.gov)

U.S. Energy Mapping System (http://www.eia.gov/state/maps.cfm?v=Petroleum)

Q&A

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