HYDROFRACKING: AN UNDERWRITING PERSPECTIVE
NJ CPCU I-DAY
OCTOBER 17, 2014

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Agenda

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The Basics – A Short Overview

Exposures

Claim Scenarios

Underwriting/Coverage Considerations

Takeaways

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Hydrofracking Basics

What They're Saying?

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Willis May, 2012	• Certain U.S. insurers are now including exclusions for fracking activities in their policies, in light of pricing difficulties.
Millimen July 2012	• Analyzed various disaster scenarios - concluded that a fracking-related accident would far exceed liability limits. Urged regulators to require sufficient insurance/other resources in place to respond to claims.
Advisen July 2012	• Major U.S. insurer won't cover fracking. Personal and commercial policies "not designed to cover" risks arising from the drilling process.
Market	• Insureds want higher limits and more coverage – sometimes negotiated in connection with a larger SIR or higher premiums

Market Consensus:
Standard Polices are not designed to cover Hydrofracking
Specialty Coverage is needed.

What They're Saying?

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Global Reach…

...Local Impact ??

Reports from Germany : Concern that Fracking could ruin the German Beer industry

Wikimedia; Bavarian Oktoberfest

Hydrofracking 101

Not New:

- March 17, 1949 - First commercial frack in Velma, OK (Standard Oil)
- 2.5 million frack performed since 1949
- 60% of wells drilled today are fracked
- As of 2010 Fracking credited with increasing U.S. recoverable reserves:
  - Natural Gas by 90 %
  - Oil by 30%

Photo:Credit: Michael Jagger [CC-BY-SA-2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

Why Hydrofrack?

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Perceived Benefits of Hydrofracking

Cost Effectiveness

- Makes shale rock treatment less costly
- Gas exploration made financially viable

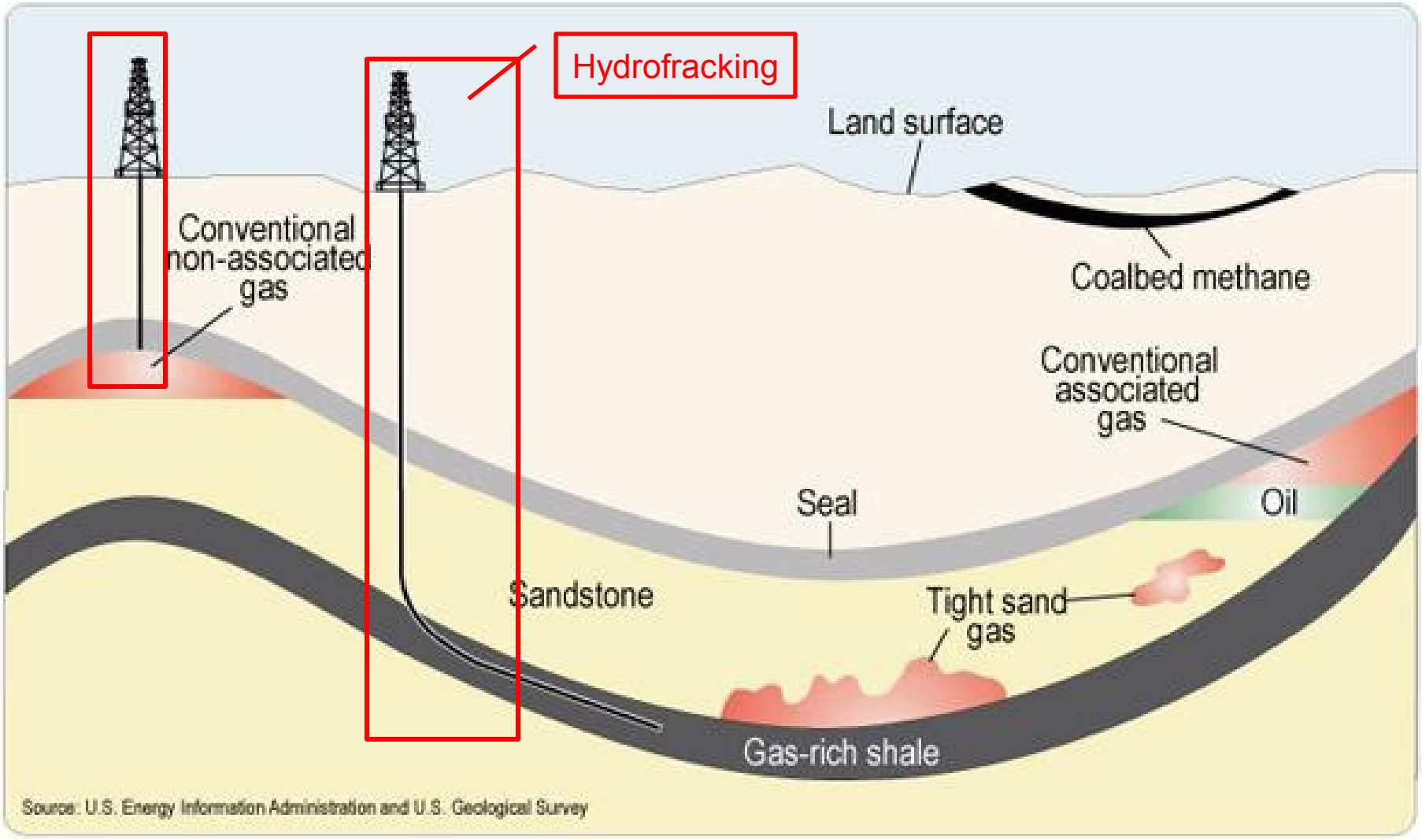
Global / Political

- Lessens dependence on foreign oil (supply & price volatility)
- U.S. as a price-setter and exporter

U.S Society/Economy

- Long-term source of energy supply
- Job creation
- Smaller carbon footprint (use is more climate change friendly – but water pollution exposure needs to be managed)

Process…..
Compared to Conventional Gas Drilling



Process …..
Drill Site

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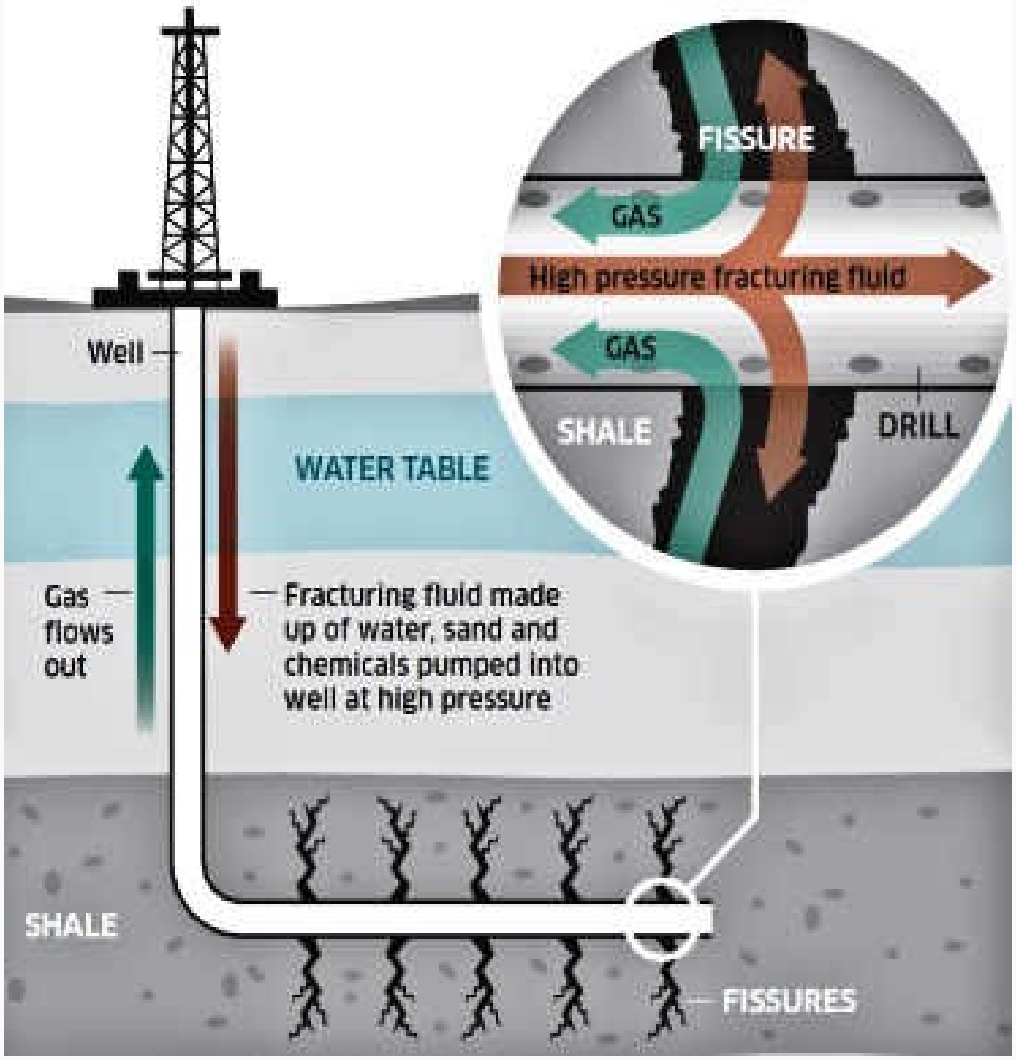
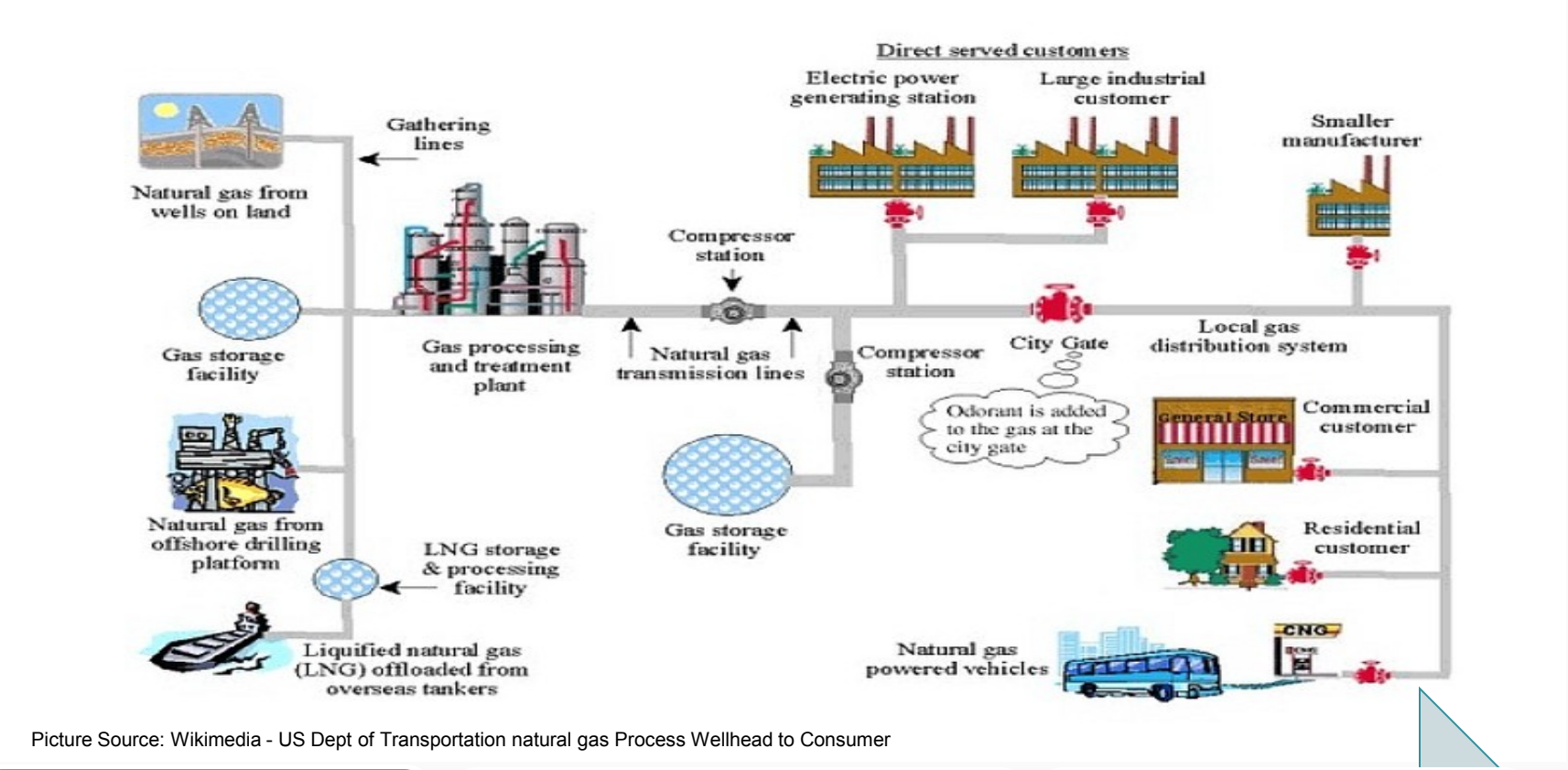
Hydraulic - A gas well is treated with large amounts of extremely pressurized water (up to 5mm gallons per well) mixed with sand (up to 4 million pounds per well) and chemicals (some of which are toxic)

Fracturing – Water injected at significant depths to fracture (create fissures in) the shale rock and extract natural gas ….. .....20%- 80% of the water stays in the ground; the remainder need to either be disposed of or is reused



blogs.cas.suffolk.edu

The Overall Process…..Supply Chain



Picture Source: Wikimedia - US Dept of Transportation natural gas Process Wellhead to Consumer

Up Stream

(Find/Extract Raw Gas, NGLs, Crude Oil)

Midstream

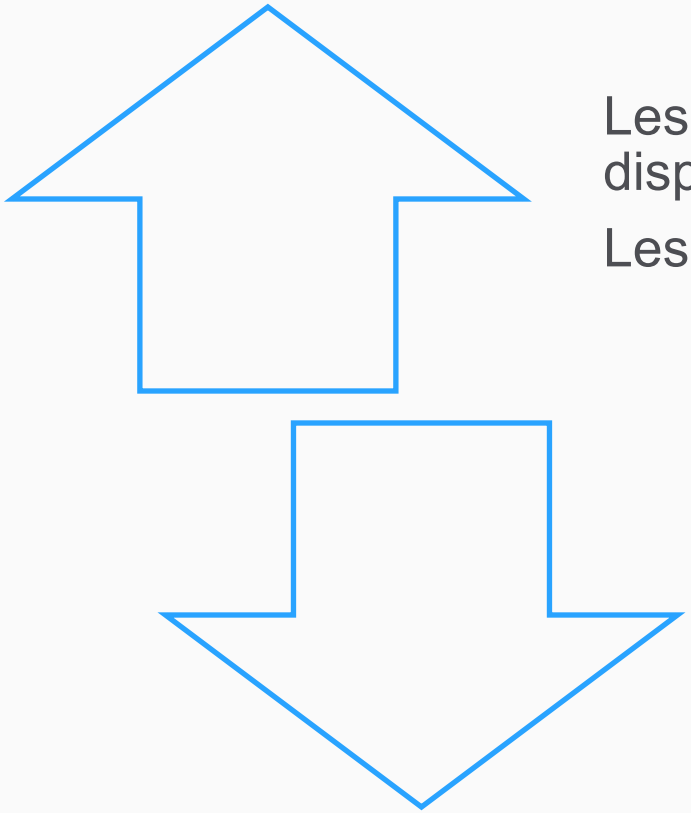
(Collect/Deliver on-spec Gas to Downstream), Fractionate and Sell Liquids – e.g., ethane, propane)

Downstream

(Storage and Delivery to End Users)

Process
….Propane Gel Alternative?

Propane Gel Fracking Introduced and being Tested ……..
…..Results not formally confirmed



Less Water, Chemicals used, waste to dispose;

Less Road Traffic

Highly Flammable;

Test Results not Conclusive

Where's the Shale Resource….

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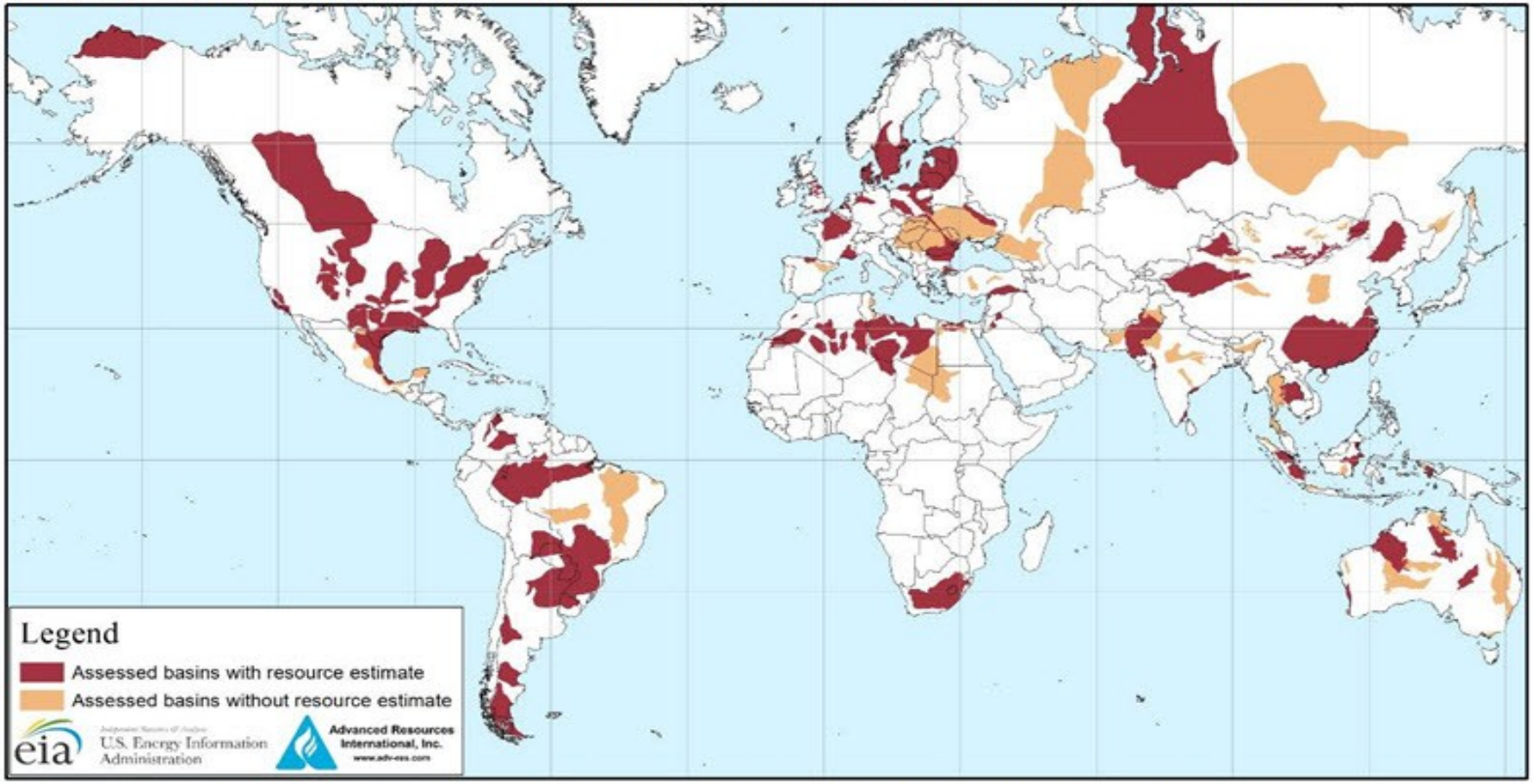
Global Perspective

Figure 1. Map of basins with assessed shale oil and shale gas formations, as of May 2013



Source: United States basins from U.S. Energy Information Administration and United States Geological Survey; other basins from ARI based on data from various published studies.

Shale Resources Globally (2013)

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Top 10 countries with technically recoverable shale resources

Recoverable Shale Oil Resources

Rank	Country	Shale oil (billion barrels)	
1	Russia	75	
2	U.S.[1]	58	(48)
3	China	32	
4	Argentina	27	
5	Libya	26	
6	Australia	18	
7	Venezuela	13	
8	Mexico	13	
9	Pakistan	9	
10	Canada	9	
	World Total	**345**	**(335)**

[1] EIA estimates used for ranking order. ARI estimates in parentheses.

Recoverable Shale Gas Resources

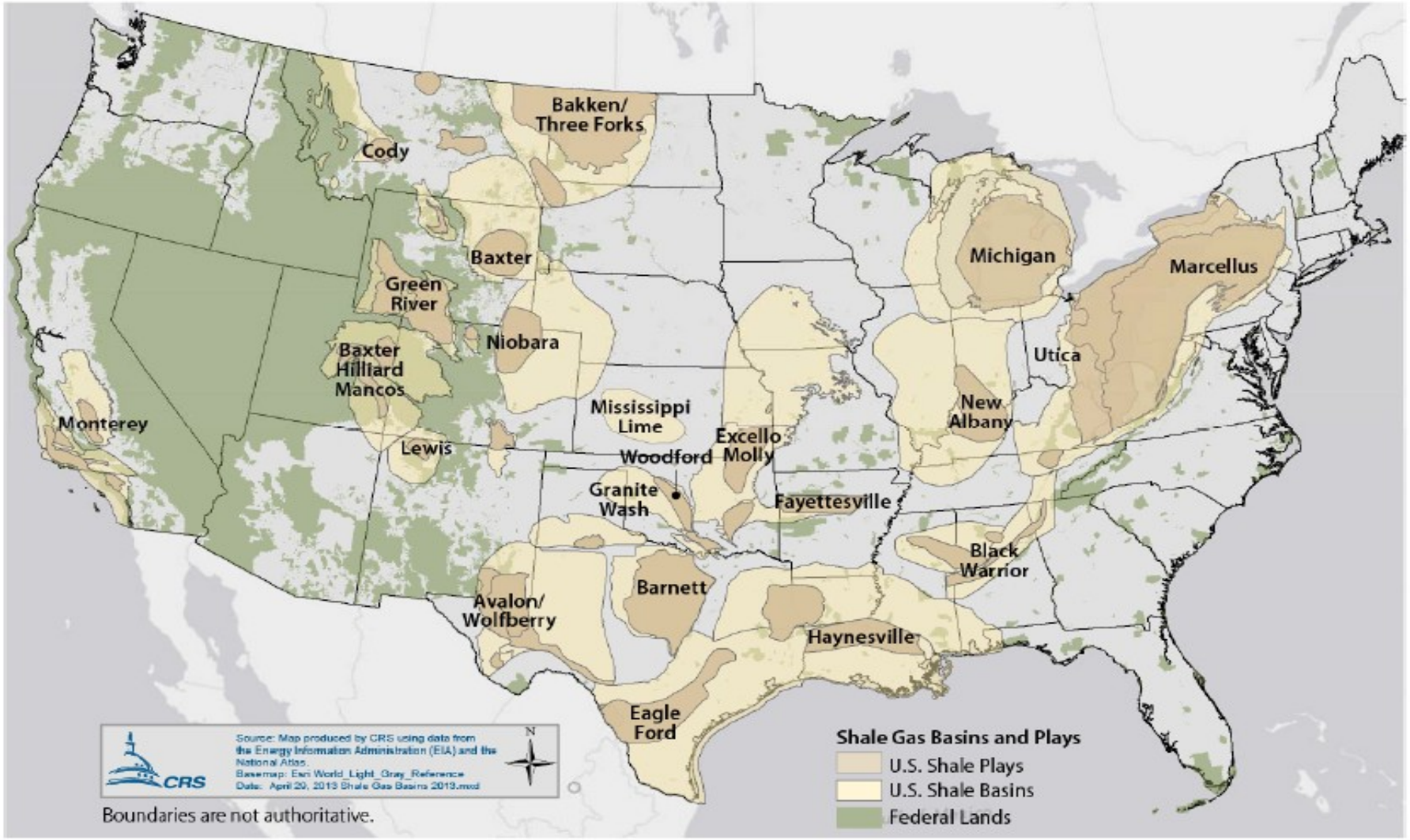
Rank	Country	Shale gas (trillion cubic feet)	
1	China	1,115	
2	Argentina	802	
3	Algeria	707	
4	U.S.[1]	665	(1,161)
5	Canada	573	
6	Mexico	545	
7	Australia	437	
8	South Africa	390	
9	Russia	285	
10	Brazil	245	
	World Total	**7,299**	**(7,795)**

[1] EIA estimates used for ranking order. ARI estimates in parentheses.

Energy Information Administration/Advanced Resources International 2013 Global Energy Resources Study

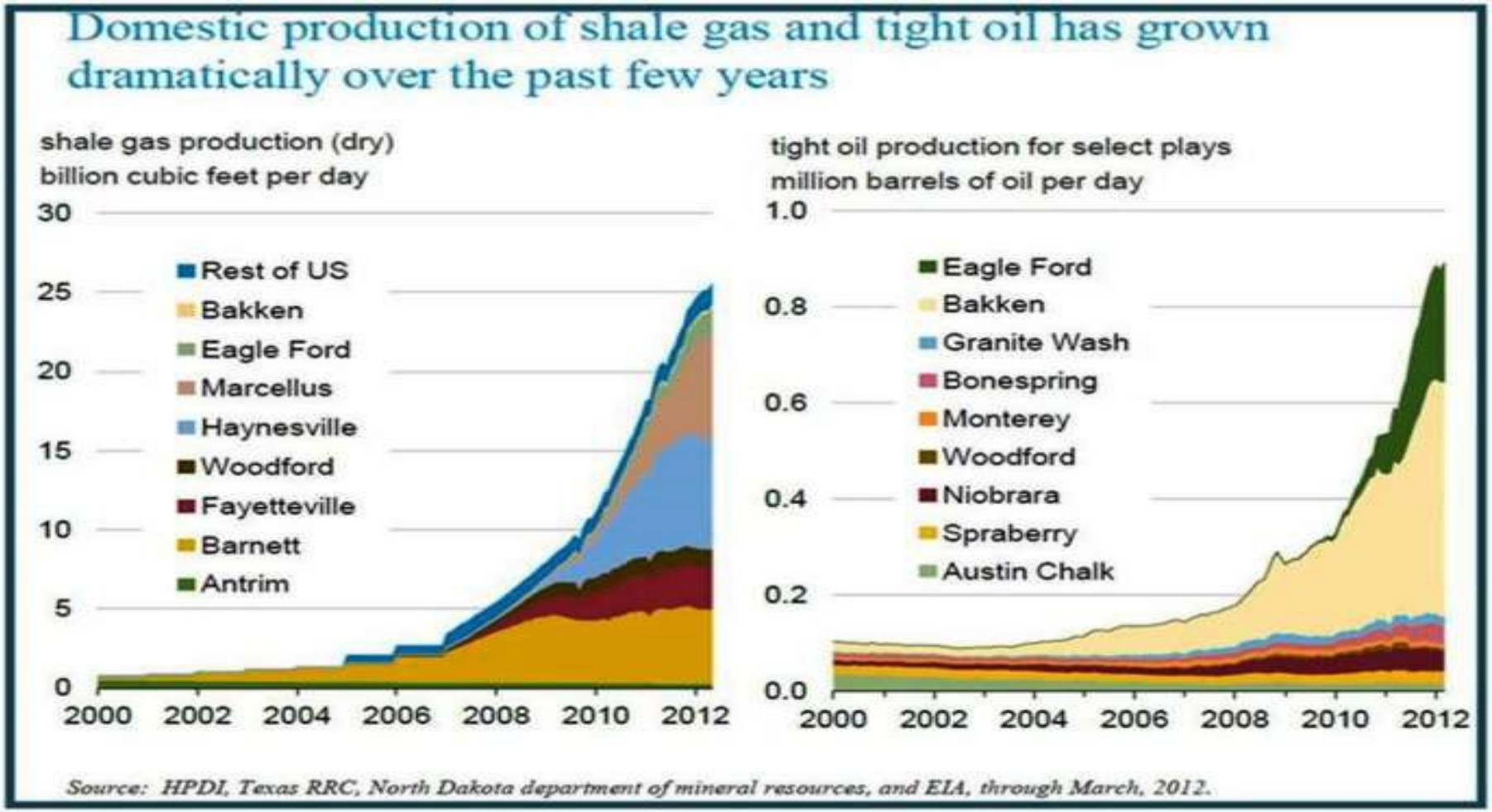
Where's the Shale Resource….

Unconventional Shale Plays in the Lower 48 States



Source: CRS, compiled from U.S. Energy Information Administration sources.

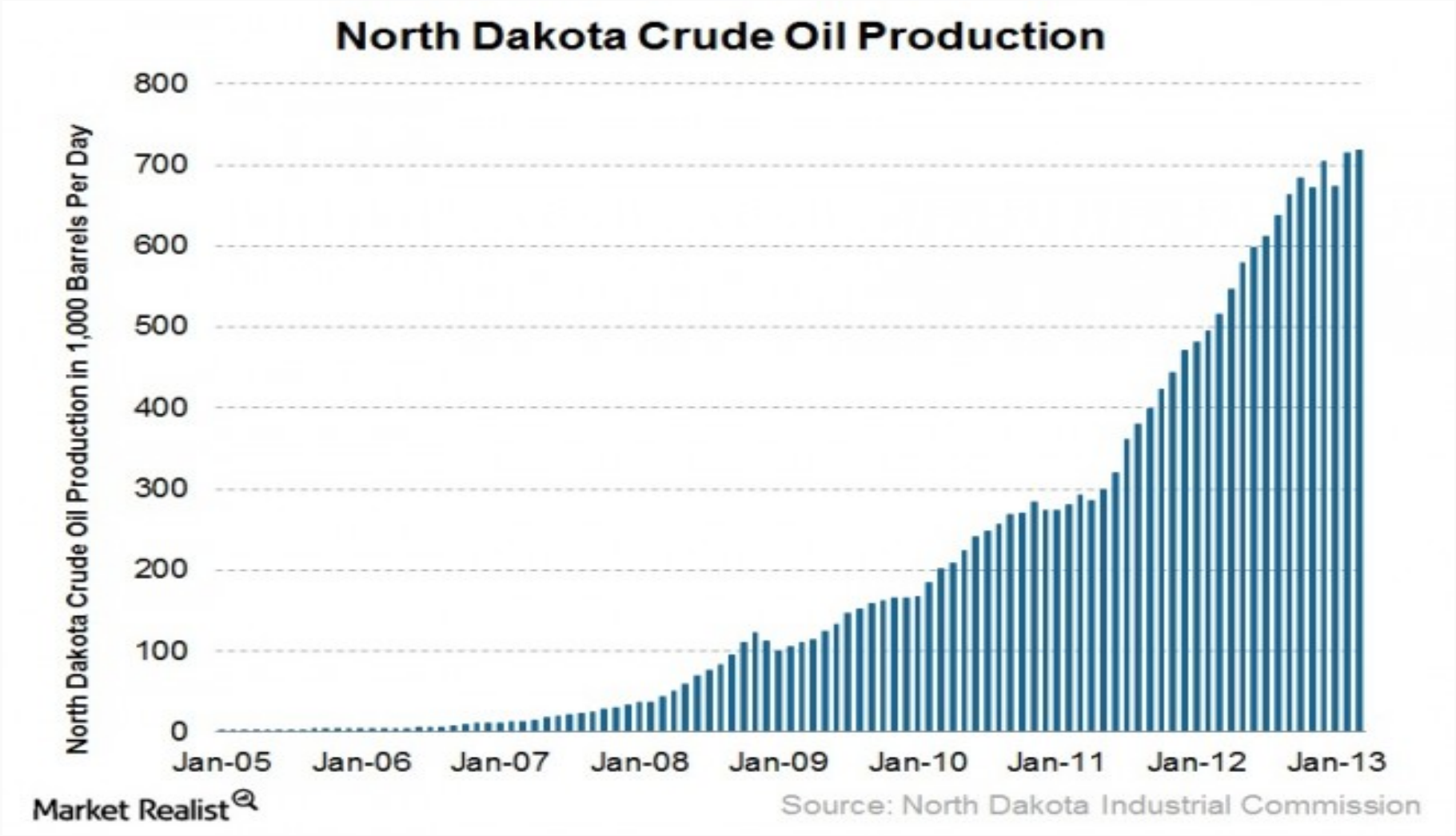
Where's the Shale Resource….



Texas Natural Oil / Gas Barrels Per day (Time 9/25/13)

- 2008 = 710,480
- 2013 = 903,494

Where's the Shale Resource….



Where's the Gas….
Marcellus Shale Gas Reserve

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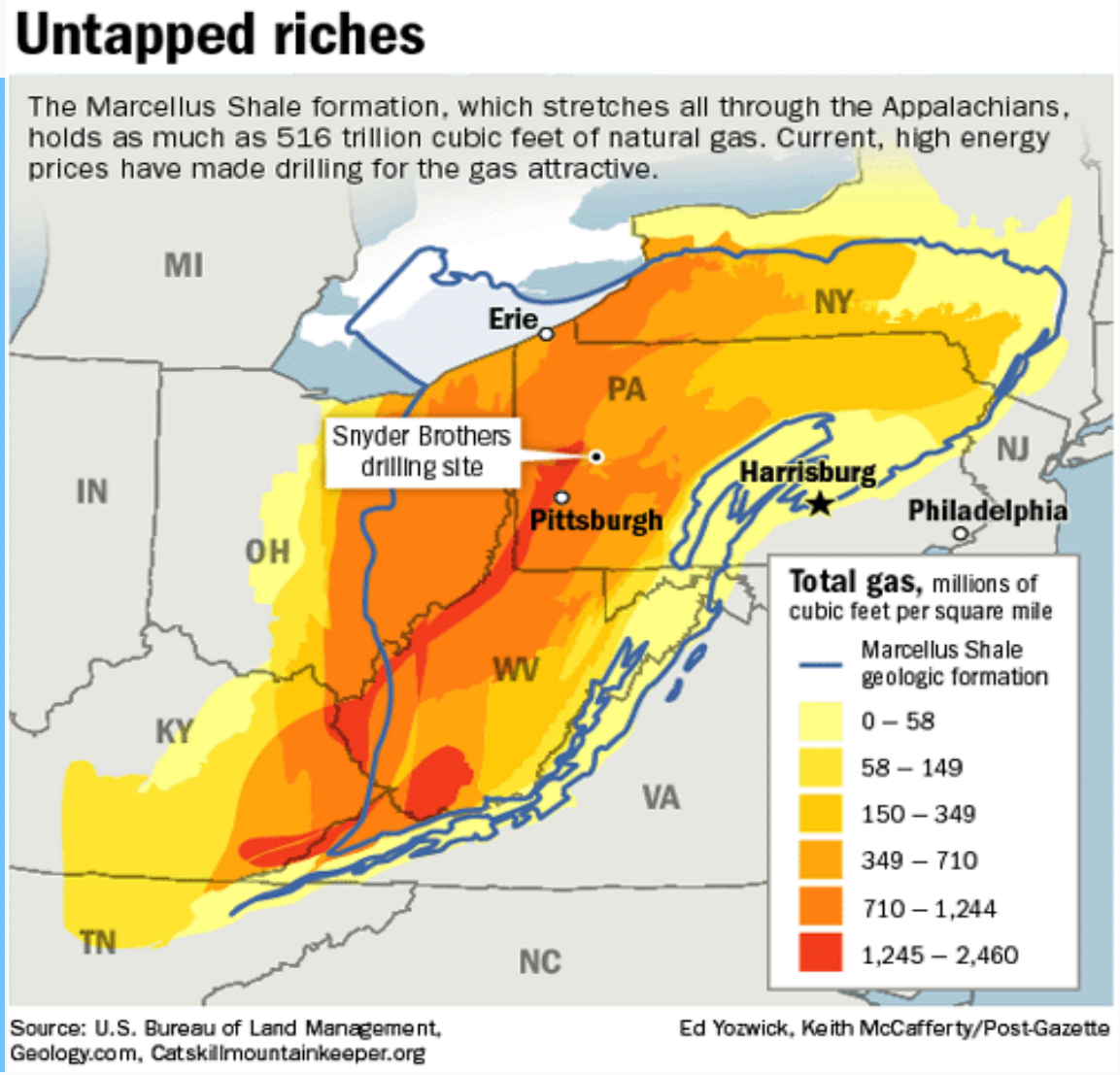
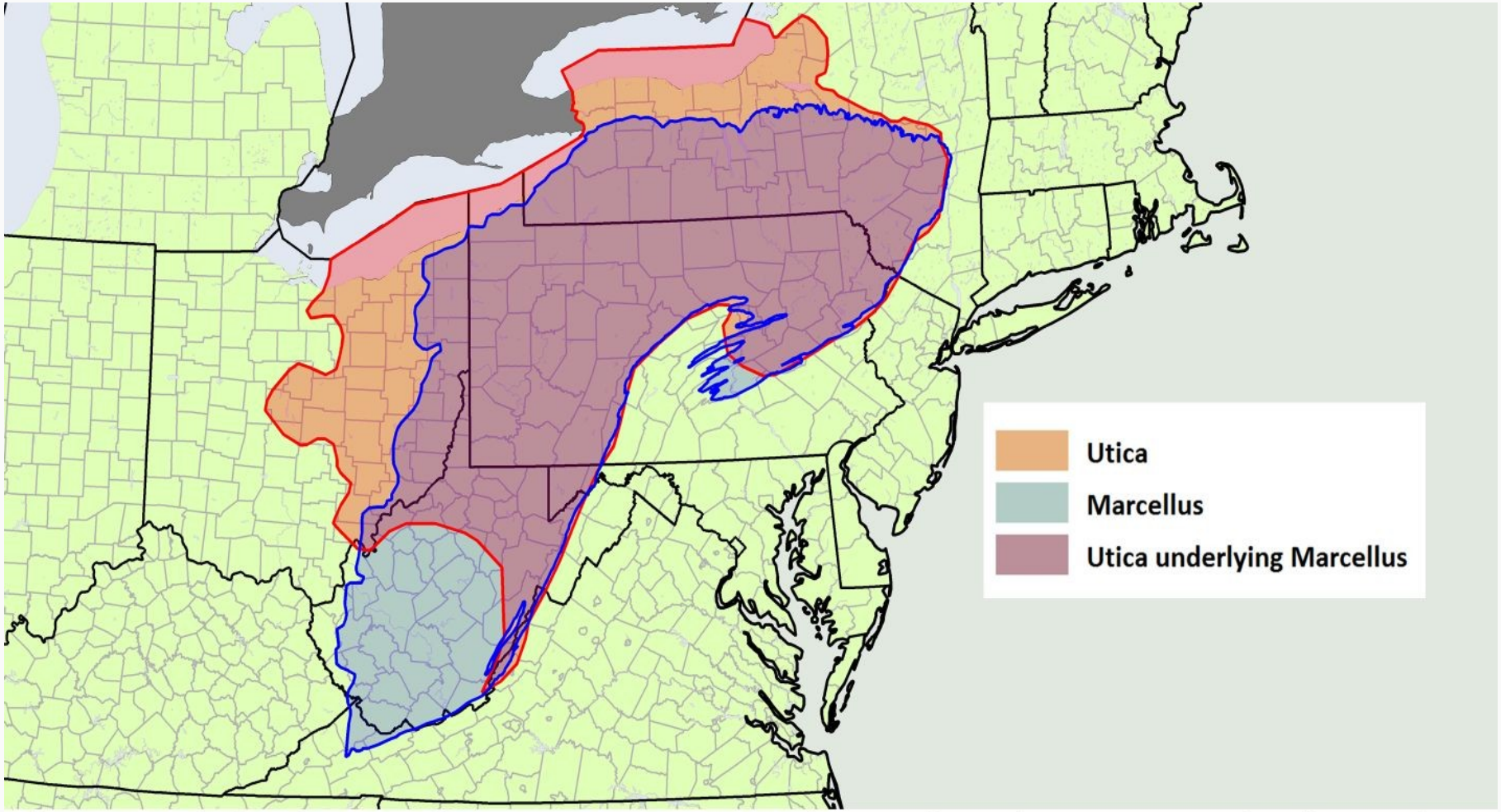
Marcellus/Utica Shale Gas Play, Appalachian Basin

2014:

- 14B CU Ft per day
- 18% of US Natural Gas Production



Where's the Gas….
Utica Shale Gas Reserve



The Utica underlies the Marcellus in many areas, coming closer to the surface in eastern Ohio. (Source for Marcellus and Utica outlines: Energy Information Administration.)

Where's the Gas…
…the US by the Numbers

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U.S. Shale Gas Unproved Discovered Technically Recoverable Resources

Summary

Play	Technically Recoverable Resource		Area (sq. miles)		Average EUR	
	Gas (Tcf)	Oil (BBO)	Leased	Unleased	Gas (Bcf/ well)	Oil (MBO/ well)
Marcellus	410.34	…	10,622	84,271	1.18	…
Big Sandy	7.40	…	8,675	1,994	0.33	…
Low Thermal Maturity	13.53	…	45,844		0.30	…
Greater Siltstone	8.46	…	22,914		0.19	…
New Albany	10.95	…	1,600	41,900	1.10	…
Antrim	19.93	…	12,000		0.28	…
Cincinnati Arch*	1.44	…	NA		0.12	…
Total Northeast	**472.05**	**…**	**101,655**	**128,272**	**0.74**	**…**
Haynesville	74.71	…	3,574	5,426	3.57	…
Eagle Ford	20.81	…	1,090		5.00	…
Floyd-Neal & Conasauga	4.37	…	2,429		0.90	…
Total Gulf Coast	**99.99**	**…**	**7,093**	**5,426**	**2.99**	**…**
Fayetteville	31.96	…	9,000		2.07	…
Woodford	22.21	…	4,700		2.98	…
Cana Woodford	5.72	…	688		5.20	…
Total Mid-Continent	**59.88**	**…**	**14,388**		**2.45**	**…**
Barnett	43.38	…	4,075	2,383	1.42	…
Barnett Woodford	32.15	…	2,691		3.07	…
Total Southwest	**75.52**	**…**	**6,766**	**2,383**	**1.85**	**…**
Hilliard-Baxter-Mancos	3.77	…	16,416		0.18	…
Lewis	11.63	…	7,506		1.30	…
Williston-Shallow Niobraran*	6.61	…	NA		0.45	…
Mancos	21.02	…	6,589		1.00	…
Total Rocky Mountain	**43.03**	…	**30,511**		**0.69**	…
Total Lower 48 U.S.	**750.38**	**…**	**160,413**	**136,081**	**1.02**	**…**

US Energy Information Administration July, 2011 Study: Review of Emerging Resources US Shale Gas and Shale Oil Plays

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Hydrofracking Exposures

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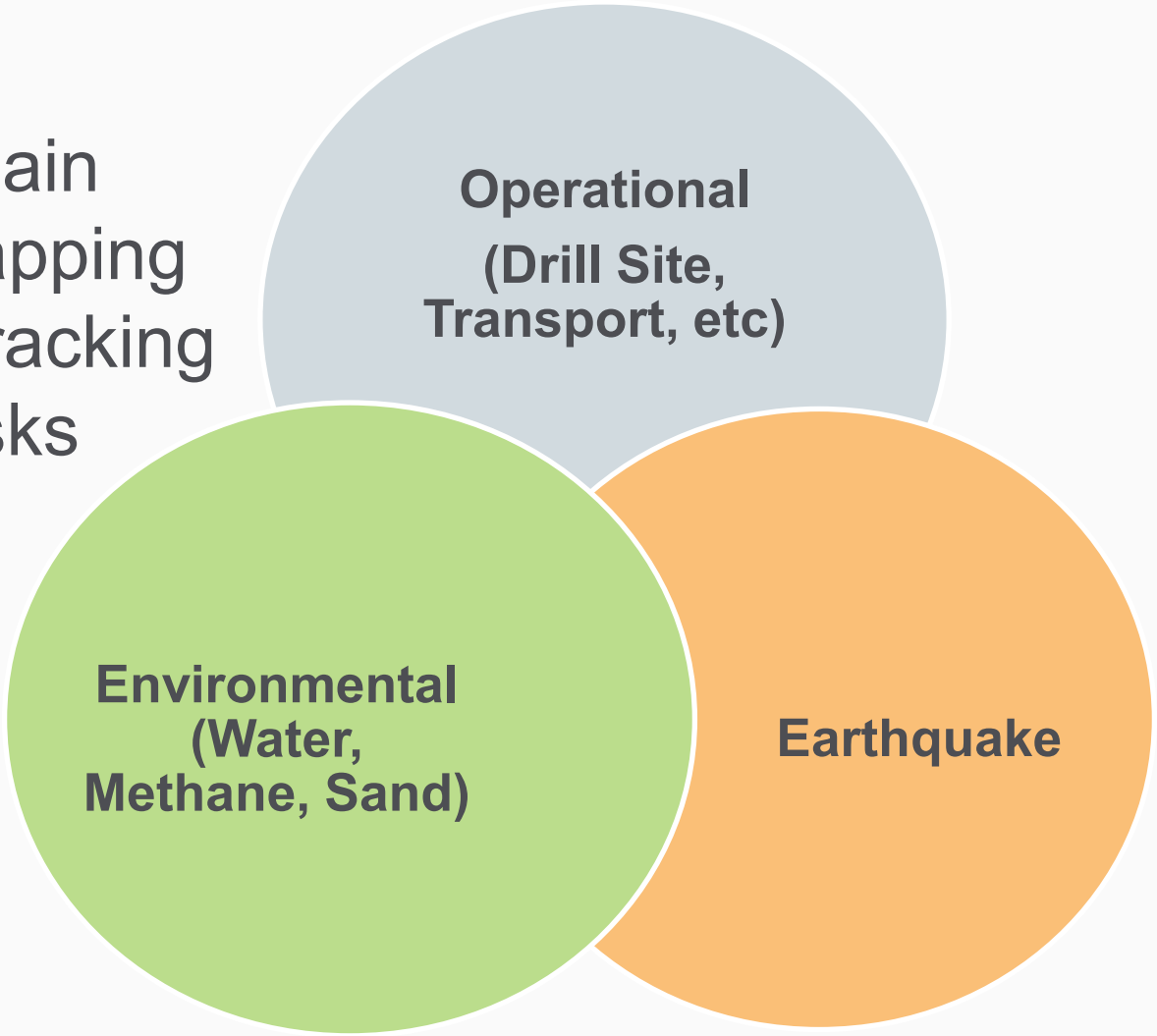
3 Main Overlapping Hydrofracking Risks



Exposures
First Party

Typical of Traditional Drilling Operations

Blowout/Earthquake

- ❑ Damage to on-site Property /Business Interruption
- ❑ Damage to on-site Equipment / Business Interruption
- ❑ Operators Extra Expense/Business Interruption
  - Regain Control of the Well
  - Re-drilling
  - Lost Revenue
  - Extra Expenses for crew and Equipment

Exposures
Third Party

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Potential Loss Scenarios
Land Leasing, Energy Industry, Well Operators, Contractors, Gov't./Municipal, etc.

General Liability

- Bodily Injury/Property Damage
- injunctive relief (loss of value)
- Private nuisance w/o BI stemming from odors or noise
- Attractive Nuisances with Bodily Injury
- Breach of contract, misrepresentation,
- Negligence, gross negligence, strict liability
- Violation of statues (federal or state)
- Medical monitoring
- Sediment and water run-off
- Trespass (Horizontal Drilling)

Products / Completed Operations

- Chemical manufacturers (e.g., mislabeling)
- Equipment manufacturers (e.g., testing equipment; well casing material, blenders, mixes, storage equipment)
- Cement work (e.g., well casing, pad footings)

Underwriting Implications
Exposures

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Potential Loss Scenarios
Land Leasing, Energy Industry, Well Operators, Contractors, Gov't./Municipal, etc.

Environmental	▪ Air pollution caused by drilling activities ▪ Ground and subsurface water ▪ Methane ▪ Wastewater treatment

Workers Compensation	▪ Contractors including all related activities
	  ▪ Blowouts
	  ▪ OD (Silica)
	  ▪ Trucking

Automobile	▪ Trucking Activities – Sand, water Chemical Hauling
D&O / Public Officials E&O	▪ Investor Class Actions ▪ Municipal Exposures

Operational - Drill Site

Operational Drill Site Size/Scope

Photo Credit: Doug Duncan, USGS

Drill Site Related Operations
Who's Exposed

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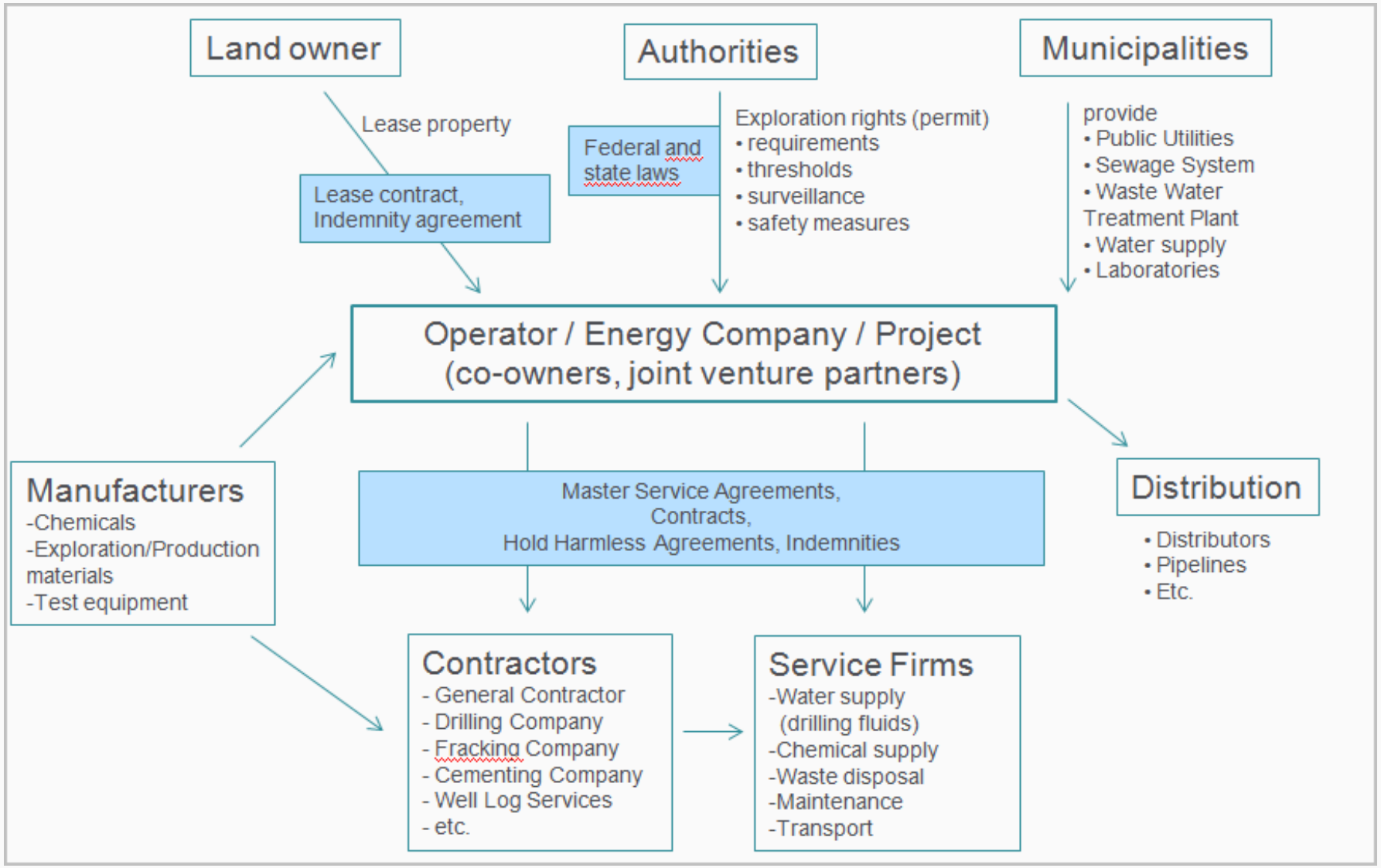

Drill Site Related Operations
How are they Exposed

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Primary Risks

- Energy/Exploration companies
- Engineers, Surveyors
- Service/construction contractors
- Drilling contractor
- Drilling Equipment Mfg.
- Trucking
- Pipeline, Storage, Refining

- Exploration and Distribution
- Own/build operate or maintain the well;
- provide equipment

Secondary Risks

- Municipalities
- Public utilities
- Water treatment plants
- Testing labs
- Testing equipment mfg.

- Public safety responsibilities

Tertiary Risks

- Landowner/Farmer Lessors
- Chemical mfg.

- Mostly contractual or vicarious liability

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Potential Drill Site Loss Scenarios – First and Third Party

- **Leaking Pipelines** – Gradual or Sudden Release of Pollutants
  - Air – Meathane, Silica (Sand), Vehicle emissions
  - Water – Chemicals
  - Noise and Light intruding on nearby populations
- **Gas Migration related fires, explosions…above or under ground**-
  - Storage of hazardous substances
  - Blow outs (Leroy Township, PA on 4/25/11)
- **Spills from Natural Events -** 2013 CO flooding toppled an Oil Holding Tank
- **Transport (Rail and Trucking) related Claims** - Spills and accidents involving vehicles and equipment used to transport people, equipment, chemicals, Recovered Resource, etc.

Picture Source: epa.org

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Major Risk: Post Drilling Transport of Recovered Oil and Gas

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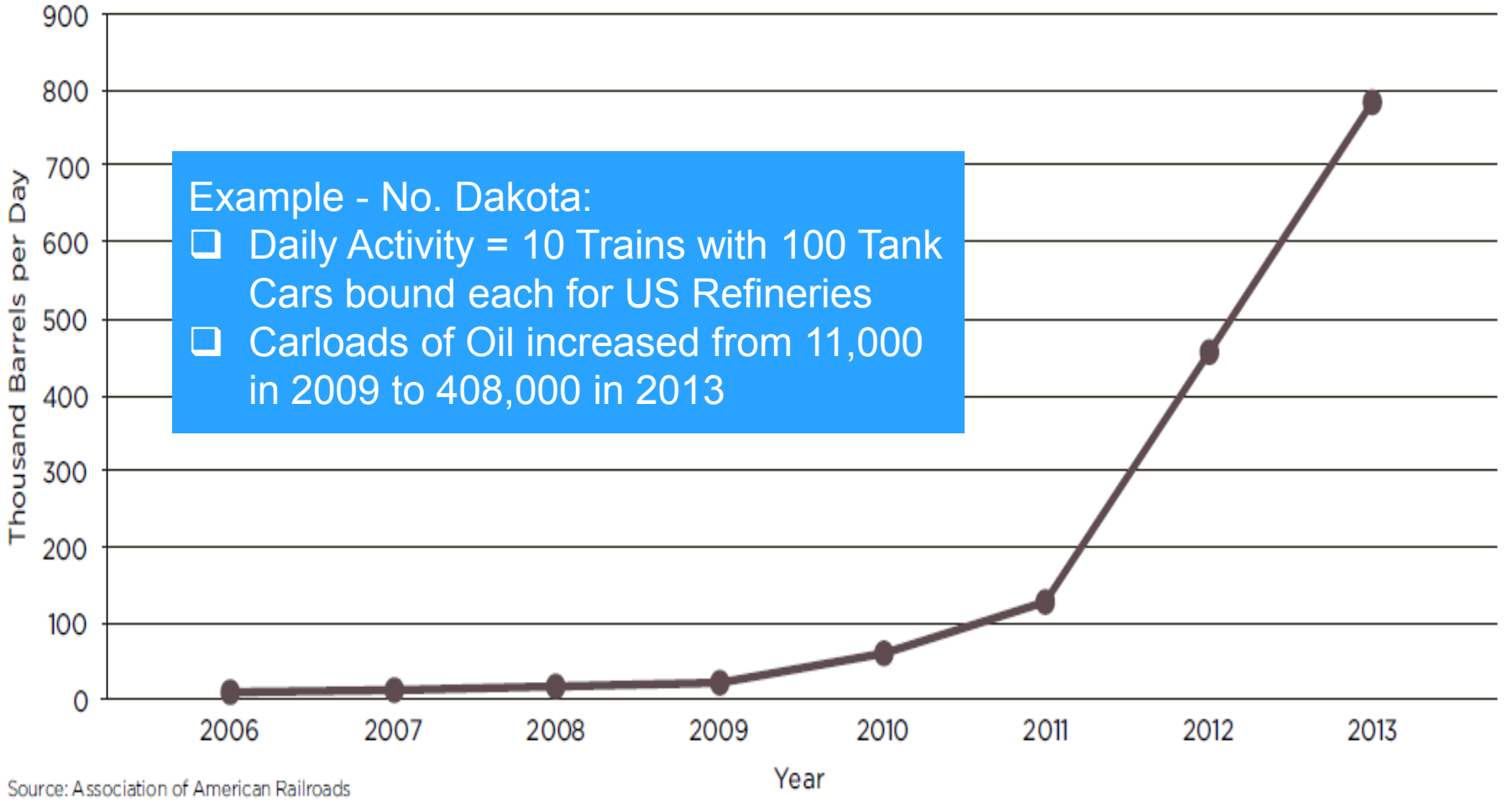
Major Risk: Post Drilling Transport of Recovered Oil and Gas



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Rail vs. Pipeline

- Expanding use of rail to transport oil may add additional stress for logistics operations
- Rail transport of Canadian crude oil is cost effective due to existing pipeline bottlenecks.
- Rail can rapidly enter markets - primary new infrastructure required is transloading terminals, which typically have short construction lead times of just 12-18 months.
- One unit train can carry nearly 70,000 bbl.

- Time Frame:
  - Rail shipments Alberta to the US Gulf Coast : ~ 8-10 days vs. ~ 40-50 days by pipeline.
- Cost Comparison Varies:
  - Distance/Destination (e.g., Bakken, ND to Gulf; Bakken, ND to Portland Maine, etc.
  - If Pipeline Infrastructure is in place, it could be less expensive in general.

Exposures
Site Operations: Rail

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Ten Major Accidents Involving Crude-by-Rail in US A and Canada, 2013-2014

Date	Location	Railroad	Crude Source	Fire?	Spill Volume (U.S. Gallons)	Type of Incident
Mar. 27, 2013	Parkers Prairie, Minnesota	Canadian Pacific	Canada, possibly tar sands	No	10,000-15,000	Derailment
Jul. 5, 2013	Lac-Mégantic, Quebec, Canada	Montreal, Maine & Atlantic Railway	Bakken, North Dakota	Yes	>26,500	Derailment
Oct. 19, 2013	Gainford, Alberta, Canada	Canadian National	Unknown	Yes	Unknown	Derailment
Nov. 8, 2013	Aliceville, Alabama	Genesee & Wyoming	Bakken, North Dakota	Yes	<748,400	Derailment
Dec. 30, 2013	Casselton, North Dakota	BNSF	Bakken, North Dakota	Yes	>400,000	Derailment
Jan. 7, 2014	Plaster Rock, New Brunswick, Canada	Canadian National	Unknown, Western Canada	Yes	Unknown	Derailment
Feb. 3, 2014	Wisconsin/Minnesota	Canadian Pacific	Unknown	No	<12,000	Leak from tank car over 70 miles of track
Feb. 13, 2014	Vandergrift, Pennsylvania	Norfolk Southern	Tar Sands Bitumen, Alberta, Canada	No	4,550	Derailment
Apr. 30, 2014	Lynchburg, Virginia	CSX	Bakken, North Dakota	Yes	<50,000	Derailment
May 9, 2014	LaSalle, Colorado	Union Pacific	Niobrara, Colorado	No	6,500	Derailment

Source: OCI Runaway Train Single reduce – May 2014

Lac Megantic/Canada 6 July 2013

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- 47 people killed.
- New Regulations on rail transport in Canada as a result.
- US and Canada plans to phase out older tank cars for newer stronger tank cars.

The Federal government will be involved in decontaminating the town after previously announcing an initial 60 million USD in emergency help.

Exposures
Site Operations: Trucking

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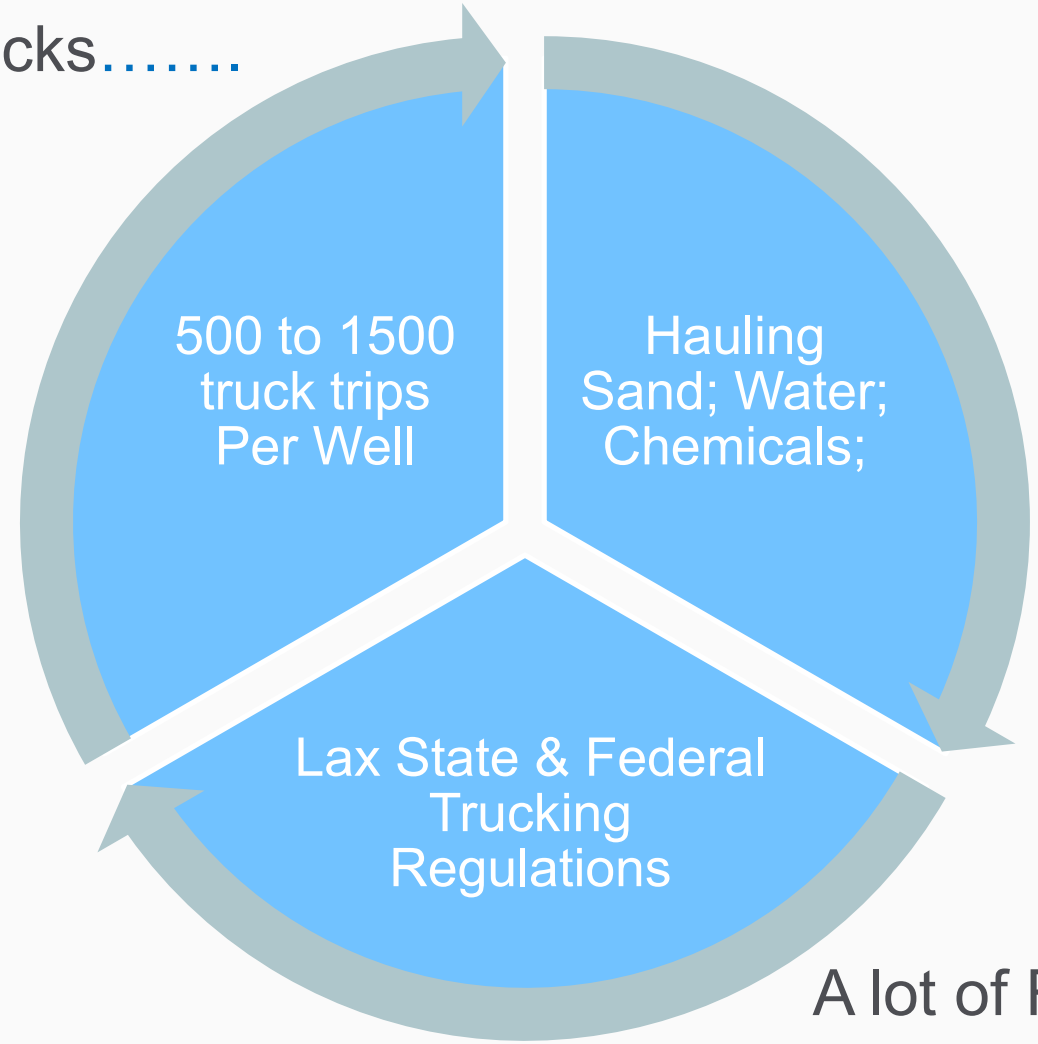
A lot of Trucks…….



Auto Liability

Workers Compensation

A lot of Risk

Exposures
Site Operations: Truck Traffic

EPA

PA DEP

PA DEP

Virginia Department of Mines Minerals and Energy

Exposures
Site Operations: Trucking

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Some Numbers
Issues : Radioactive Exposure; Unstable Loads; Small Unstable Roads

- 1/3 of 648 deaths of oil field workers from 2003 - 2008 involved transportation related accidents……Across all industries figure is 1/5 of fatalities
- CDC: Fatalities among O&G workers rose 15 percent from 2003 to 2004.
- O&G industry
  - Fatality rates are 7 times national average across all industries
  - Exemption for total number of hours a driver can work per day.
    - Most commercial truckers - 14 hours/day down time; O&G drivers, down time not counted - can be 10 hours.
    - Commercial truckers - 34 hours off after working 60 hours over seven consecutive days; O&G workers need only take 24 hours off.
- 2009 - February 2012: 40 percent of O&G industry trucks inspected by PA State Police were taken out of service - not road worthy.
- Fracking a well requires between 500 to 1,500 truck trips.
- In the next decade in the US > 200,000 new wells drilled - 90% Fracked

May 14, 2012 - New York Times

Exposures
Site Operations: Trucks/Equipment …Fleet at the Ready

Picture Source: doe.org

Exposures
Site Operations: Trucks/Equipment ….Operating Mode

Picture Source: PA DEP

Exposures
Site Operations: Trucks/Equipment…..Water Storage

Picture Source: PA DEP

Exposures
Site Operations: Accumulation Risk

Picture Source: epa.org

Exposures
Site Operations: Trucks and more

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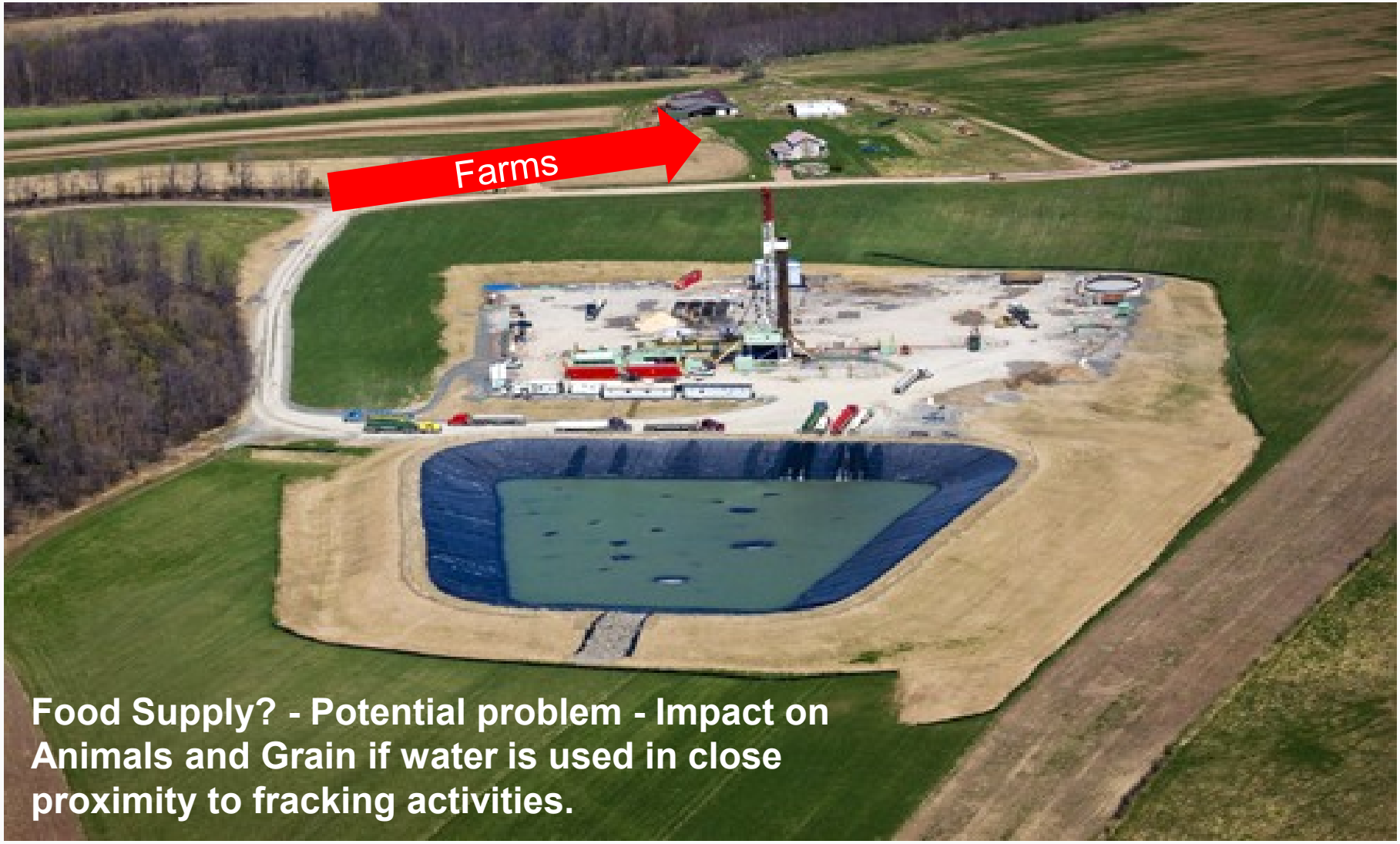
Well Pad Activity	Horizontal Well		Vertical Well	
	Heavy Truck	Light Truck	Heavy Truck	Light Truck
Drill pad construction	45	90	32	90
Rig mobilization	95	140	50	140
Drilling fluids	45		15	
Non-rig drilling equipment	45		10	
Drilling (rig crew, etc.)	50	140	30	70
Completion chemicals	20	326	10	72
Completion equipment	5		5	
Hydraulic fracturing equipment	175		75	
Hydraulic fracturing water hauling	500		90	
Hydraulic fracturing sand	23		5	
Produced water disposal	100		42	
Final pad prep	45	50	34	50
Miscellaneous	-	85	0	85
Total one-way, loaded trips per well	1,148	831	398	507
Total Vehicle Trips Per Well	**3,950**		**1,810**	

Source: ALL Consulting (2010) and Dutton and Blankenship (2010), as reported in NYSDEC (2011)

Exposures
Site Operations…Proximity to Populations

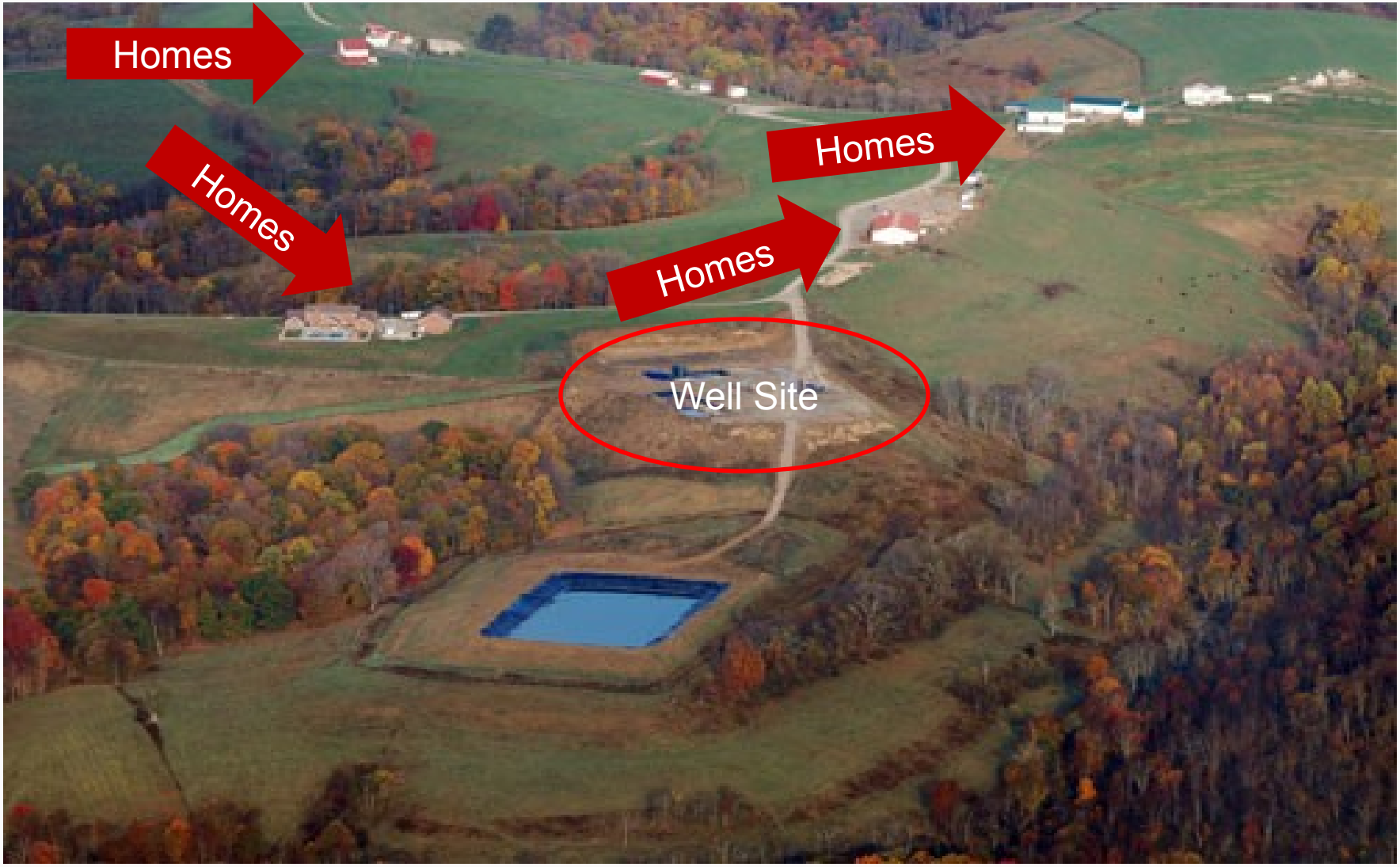
Picture Source: DOE

Exposures
Site Operations…Proximity to Populations



Picture Source: DOE

Exposures
Site Operations…Proximity to Populations



Picture Source: DOE

Exposures
Site Operations…Proximity to Populations

Photos of the fracking operation a few hundred feet from the Erie Elementary School and the Red Hawk Elementary School *taken with help from Erie Rising and are free for all publication courtesy of Lighthouse Solar.*

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Blowouts – Most common well control problem

- Uncontrolled release during drilling / production
- Results in escape of drilling fluid , chemicals, sand, gas and methane into the air, surface water or ground water
- Caused by unexpected high pressures or valve / mechanical failure
- Typically takes place at the wellhead
- Integrity of the casing and cementing of the well bore is critical

Source: Marcellus Drilling News

Exposures
Site Operations – Well Bore

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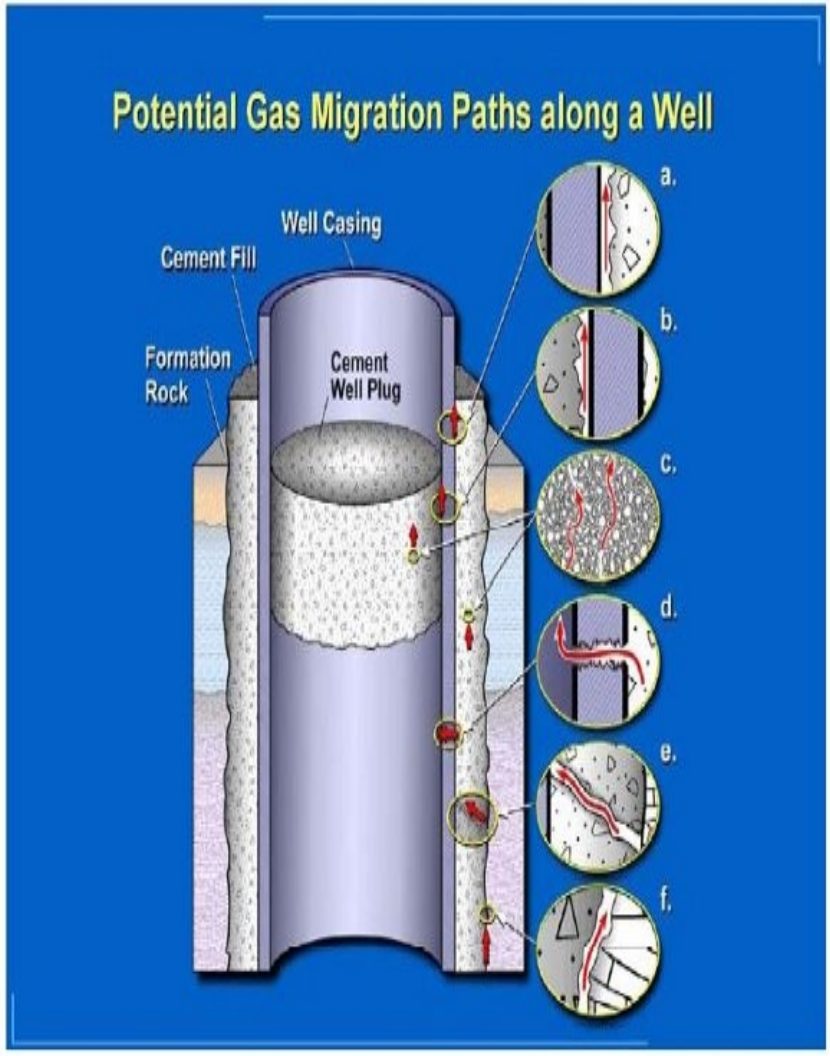
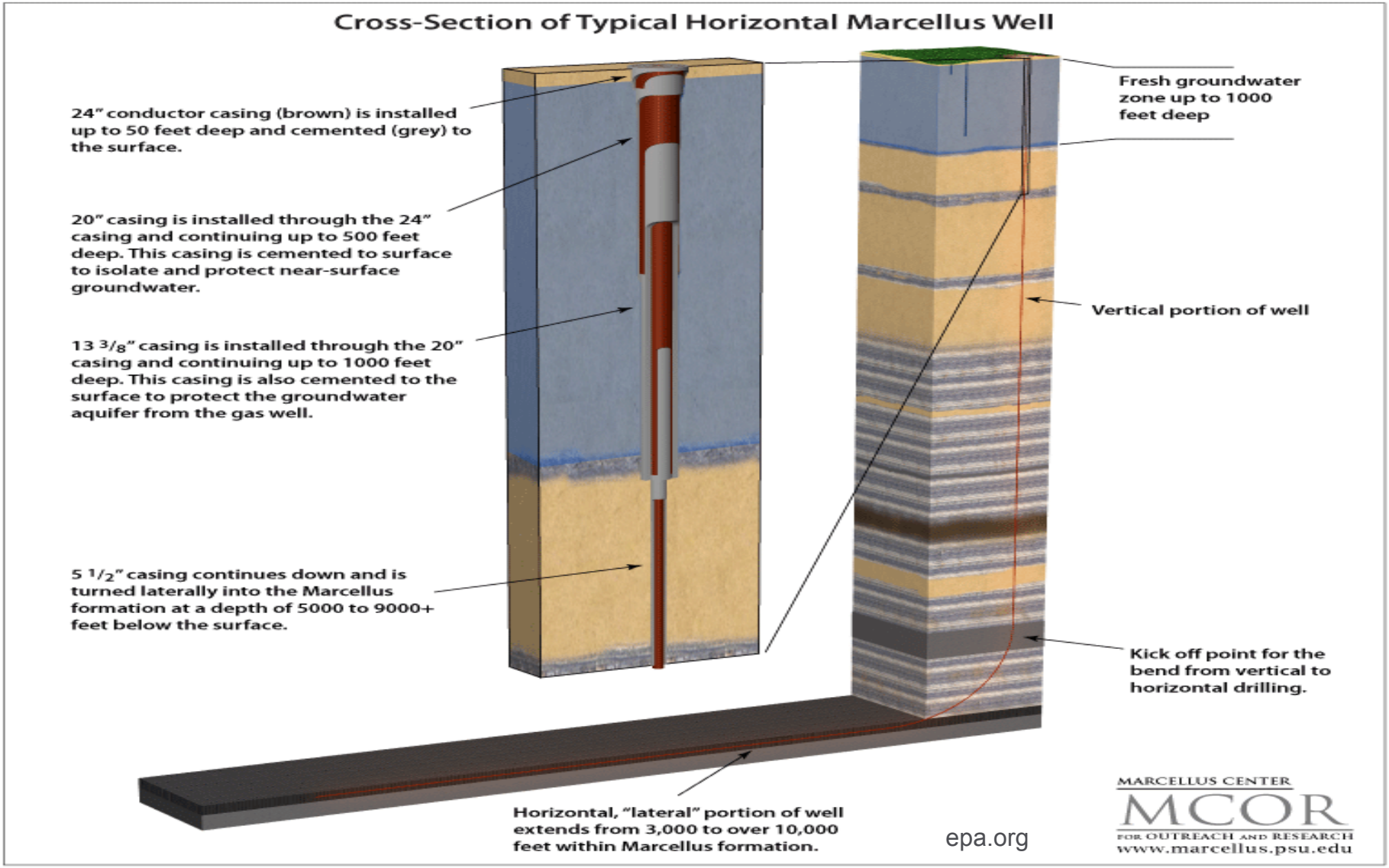
Products Completed Operations Liability: Wellbore Construction – Casing - Cementing

- Wellbore = hole in the ground
- Wellbore Casing – Multiple layers of Steel:
  - Seals off high pressure zones, controlling/preventing blowouts;
  - Prevents fluid loss into or contamination of production zones;
  - Provides a smooth internal bore for installing production equipment.
- Integrity is critical
- Cement (mixed with additives) that surrounds the Wellbore Casing – additional safeguard
- Continuous cement barrier from the surface to top of target zone



Source: Alberta Energy Utilities Board

Exposures
Site Operations – Well Bore



Leakage
Methane Gas / Water Contamination

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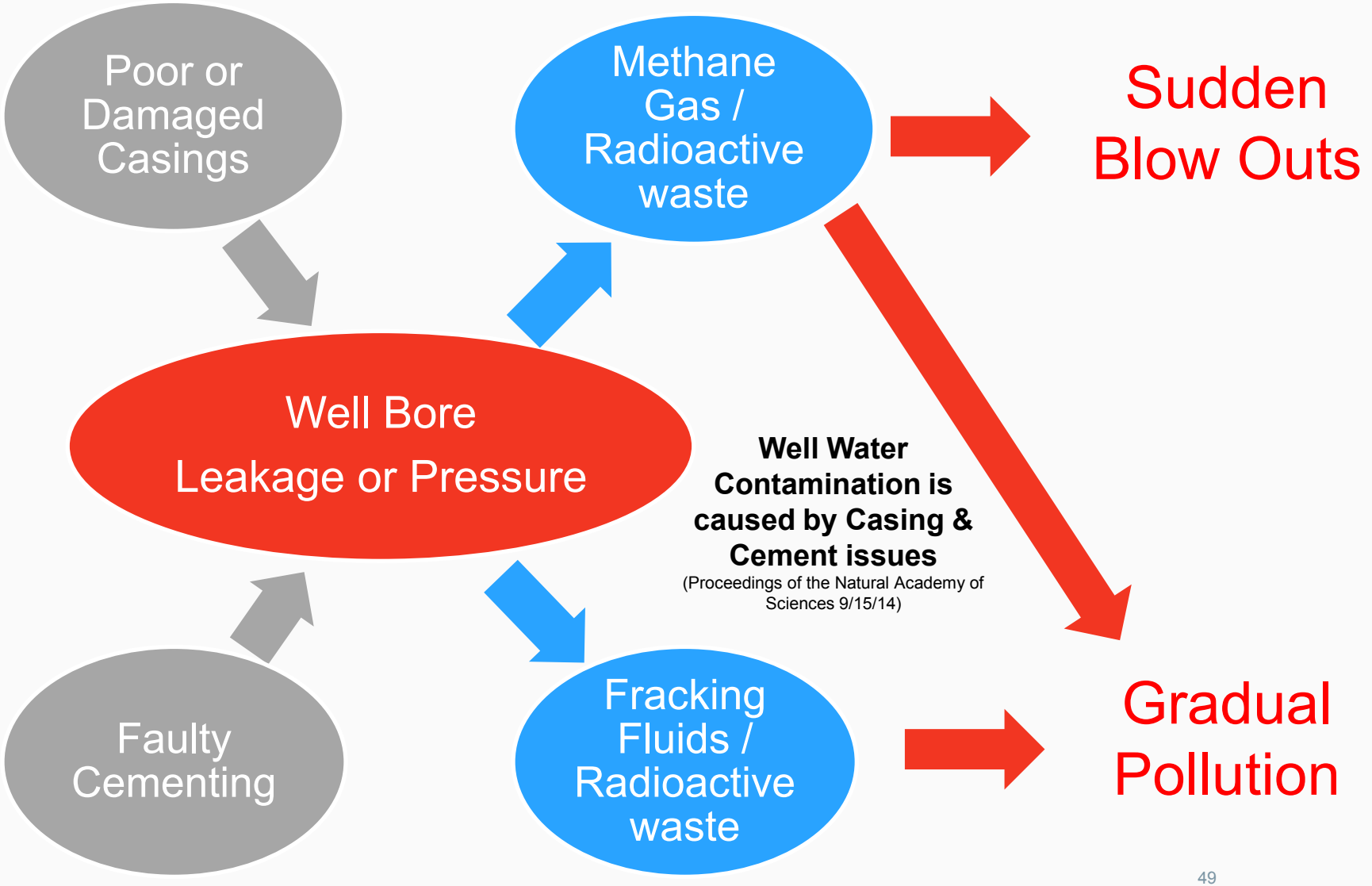


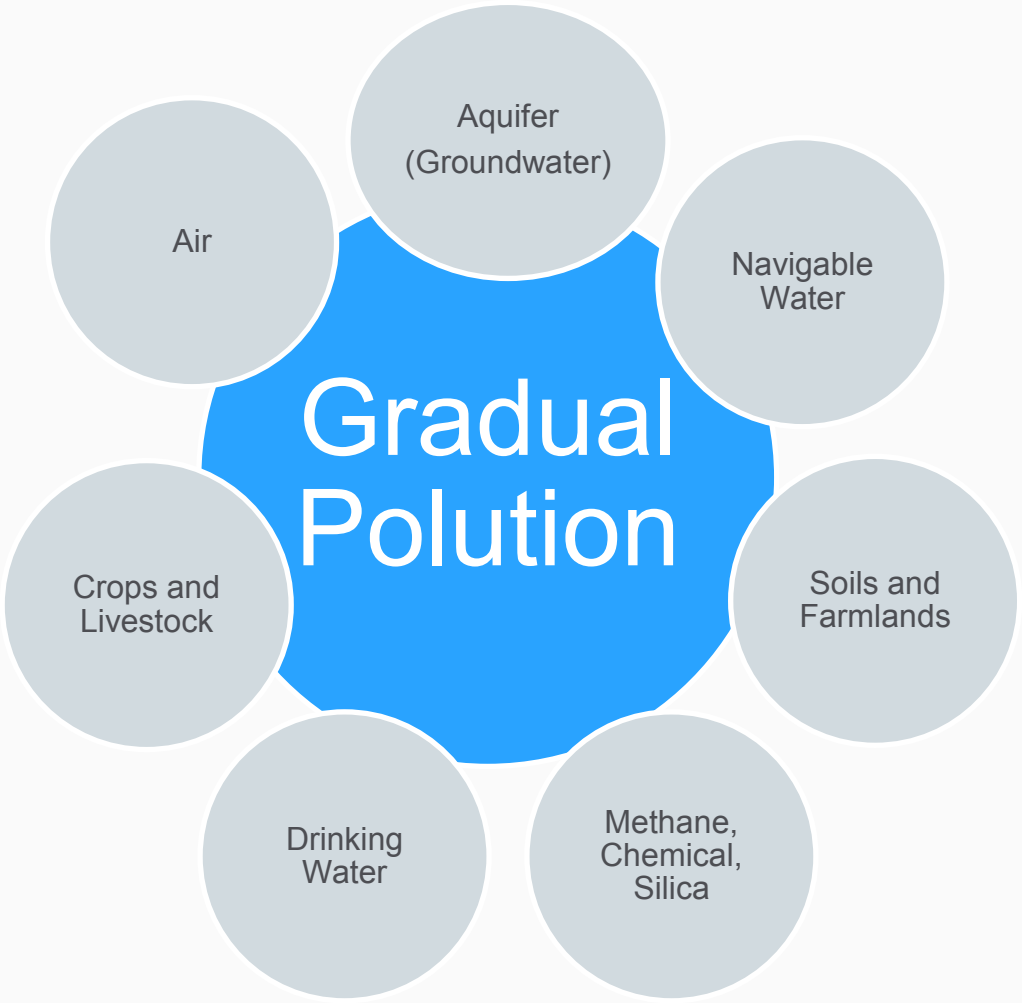
Exposures ……
……Environmental

Air Pollution - Operational Risk

- Silica (Sand); Methane; Radioactive Waste; Ground Level Ozone
- Noise Levels

Water/Methane Pollution –Systemic Risk

- Fracking water contains hazardous chemicals – Storage
- Up to 700 different chemicals have been used…some toxic
- Water treatment – water treatment plants fail to test and clean the water properly before releasing
- Groundwater pollution – methane or chemical infused wastewater can escape into the environment in several ways:
  - Failures in well casing allow water to leak into aquifers
  - Wastewater Leaks - Storage Pits (lining fails) or during Deep Injection



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Sand/Silica Exposure

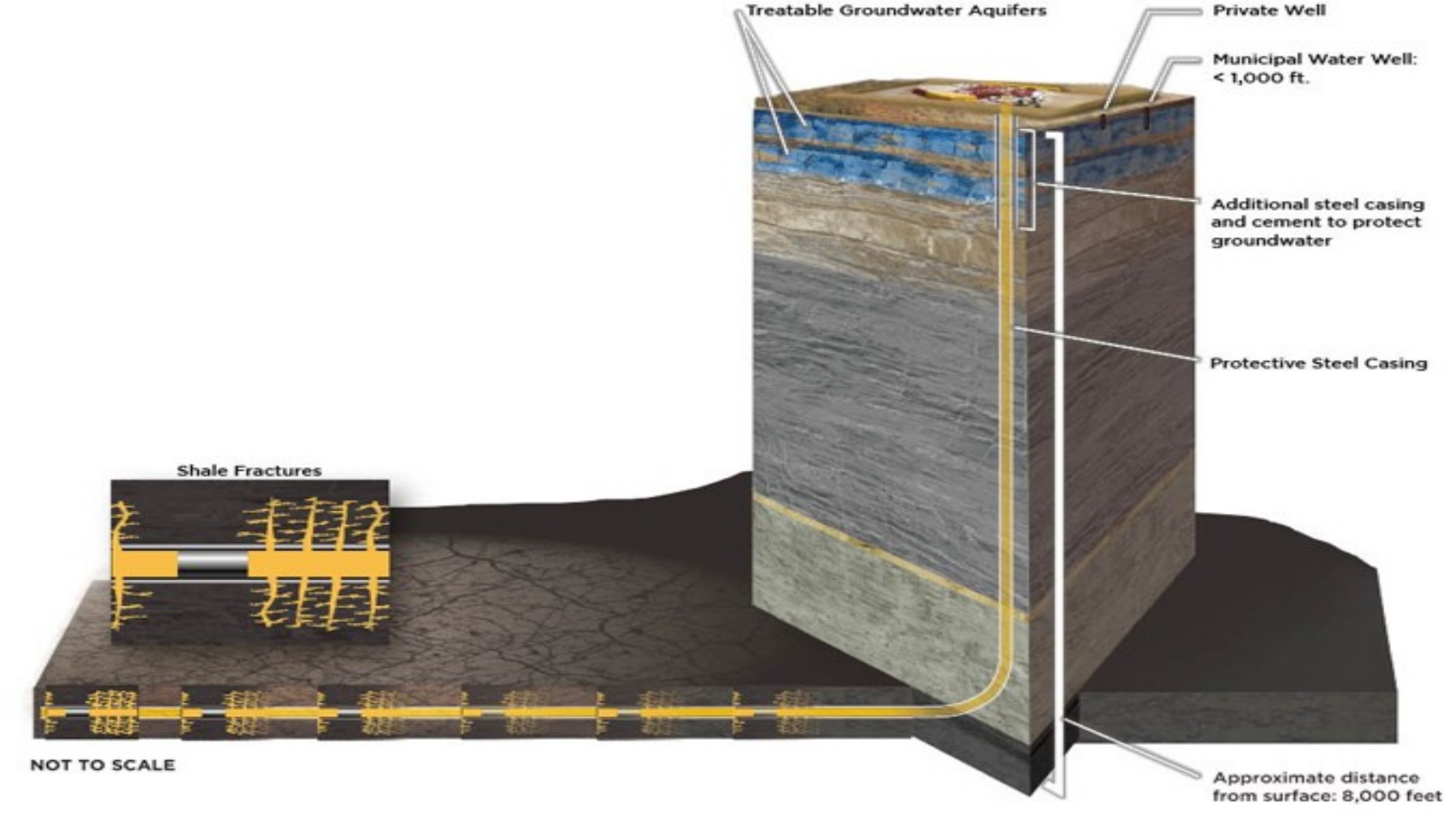

Photo Credit: NIOSH


Photo Credit: EPA

Workers and Residents

NIOSH Study: 79% of the air samples had greater levels of Silica dust than the maximum recommended and 31% had 10 times the recommended maximum

Exposures
Environmental Risk



Source: epa.org

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Fracking Pollution Management - Water/Air – Methane/Chemicals/Silica

Photos Source: USGS

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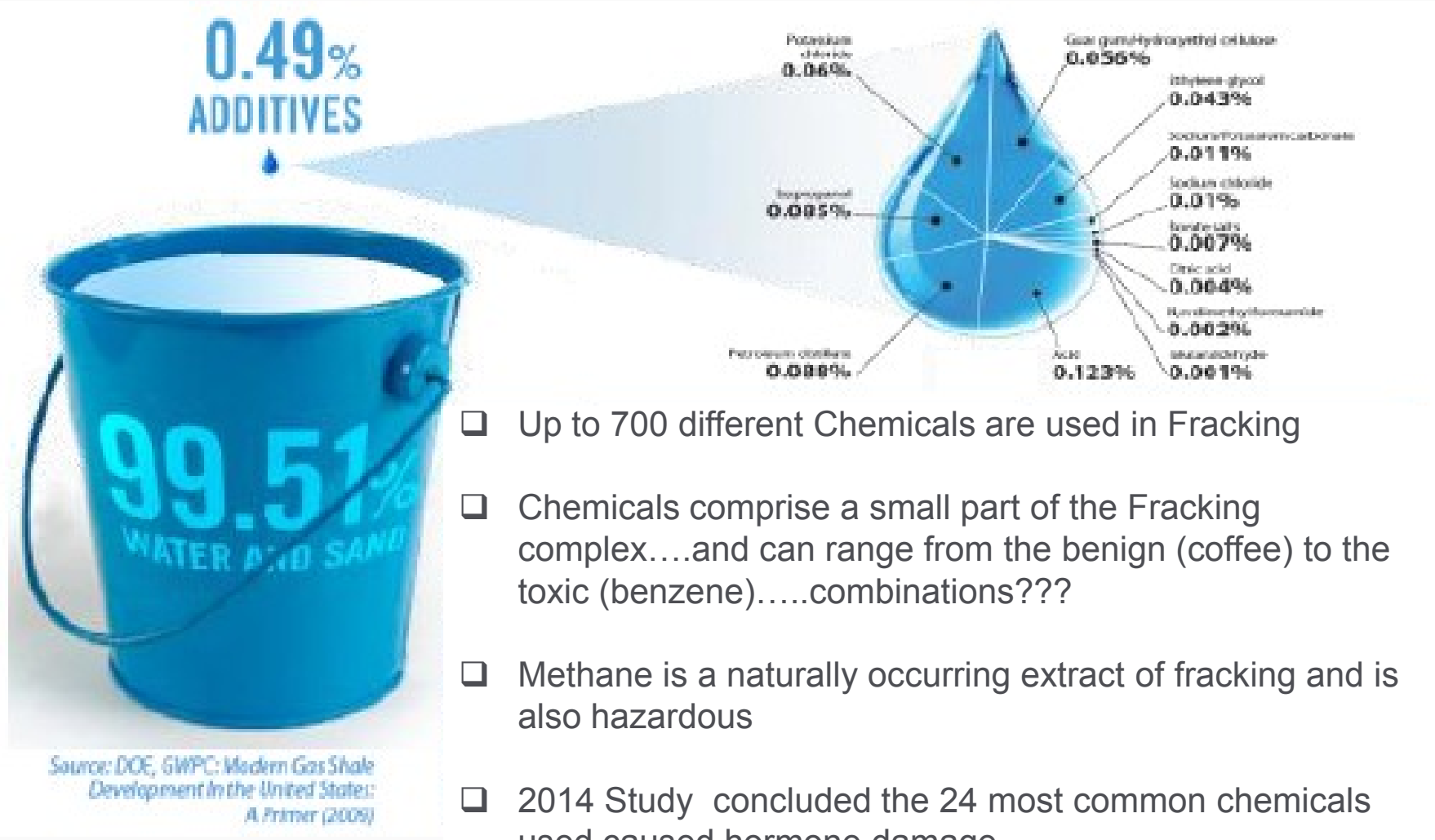
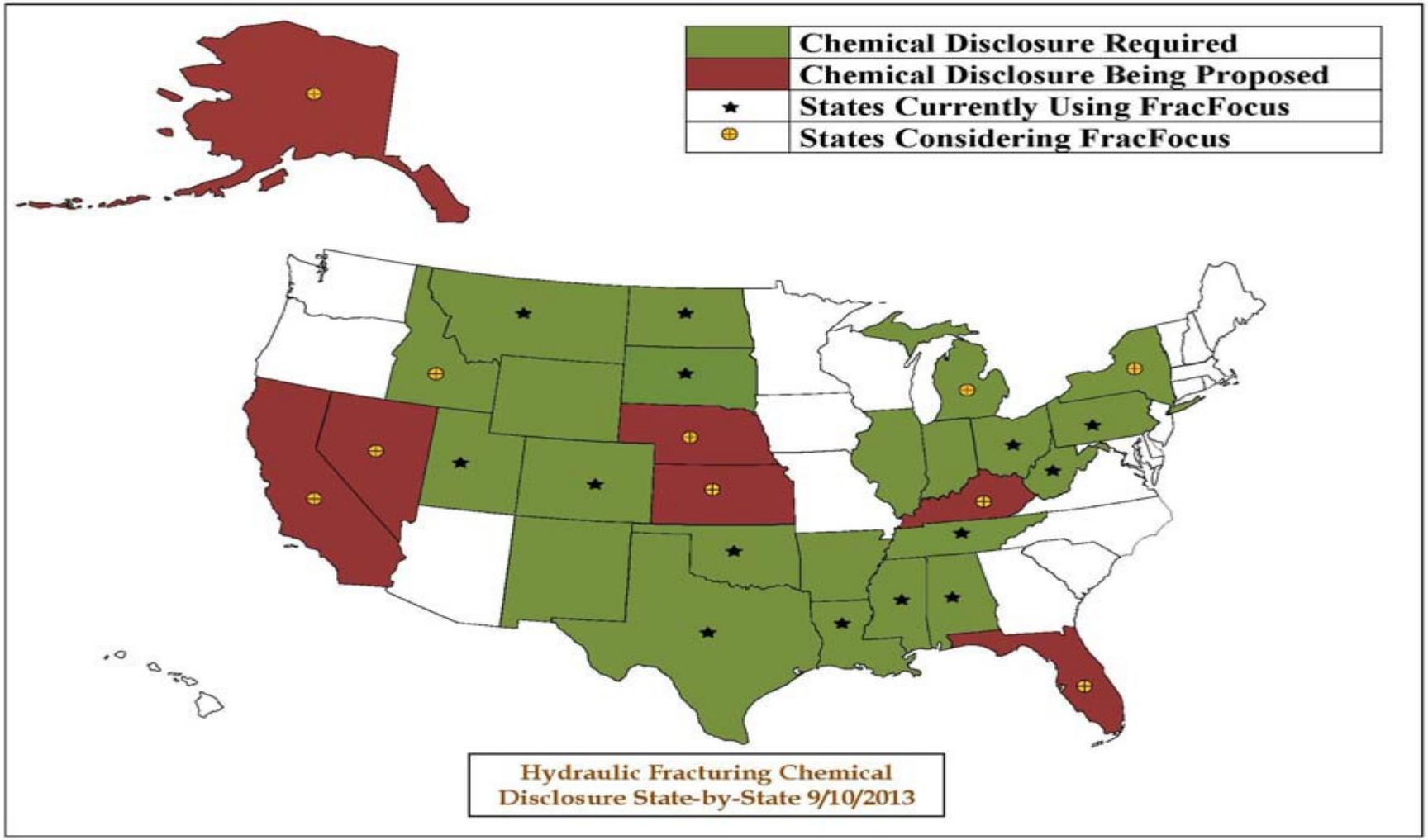
Fracking Cocktails - Composition



- Up to 700 different Chemicals are used in Fracking
- Chemicals comprise a small part of the Fracking complex….and can range from the benign (coffee) to the toxic (benzene)…..combinations???
- Methane is a naturally occurring extract of fracking and is also hazardous
- 2014 Study concluded the 24 most common chemicals used caused hormone damage.

Exposures ……
……Environmental : Chemical Disclosure



Source: Ground Water Protection Council, *Groundwater Communique, September 2013. An Overview of Unconventional Oil and Natural Gas: Resources and Federal Actions Congressional Research Service Report January 23, 2014*

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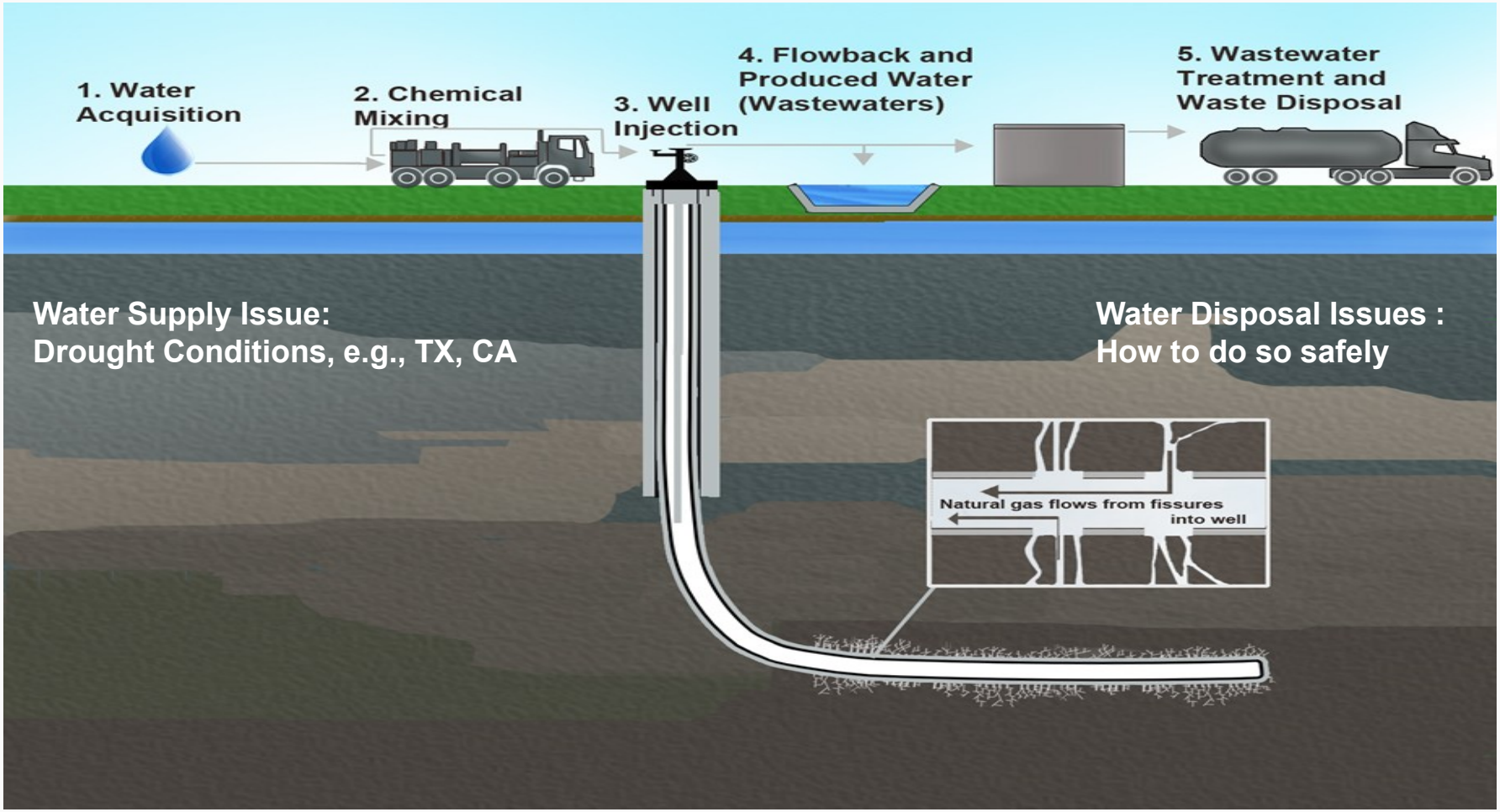
Water is Key
To Date 96Billion Gallons Used



Source: epa.org

Exposures ……
……Environmental

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Waste Water Options:

Source: DOE

Source: USGS

- ❑ Recycle/Re-use
- ❑ Dispose

Transport typically involved

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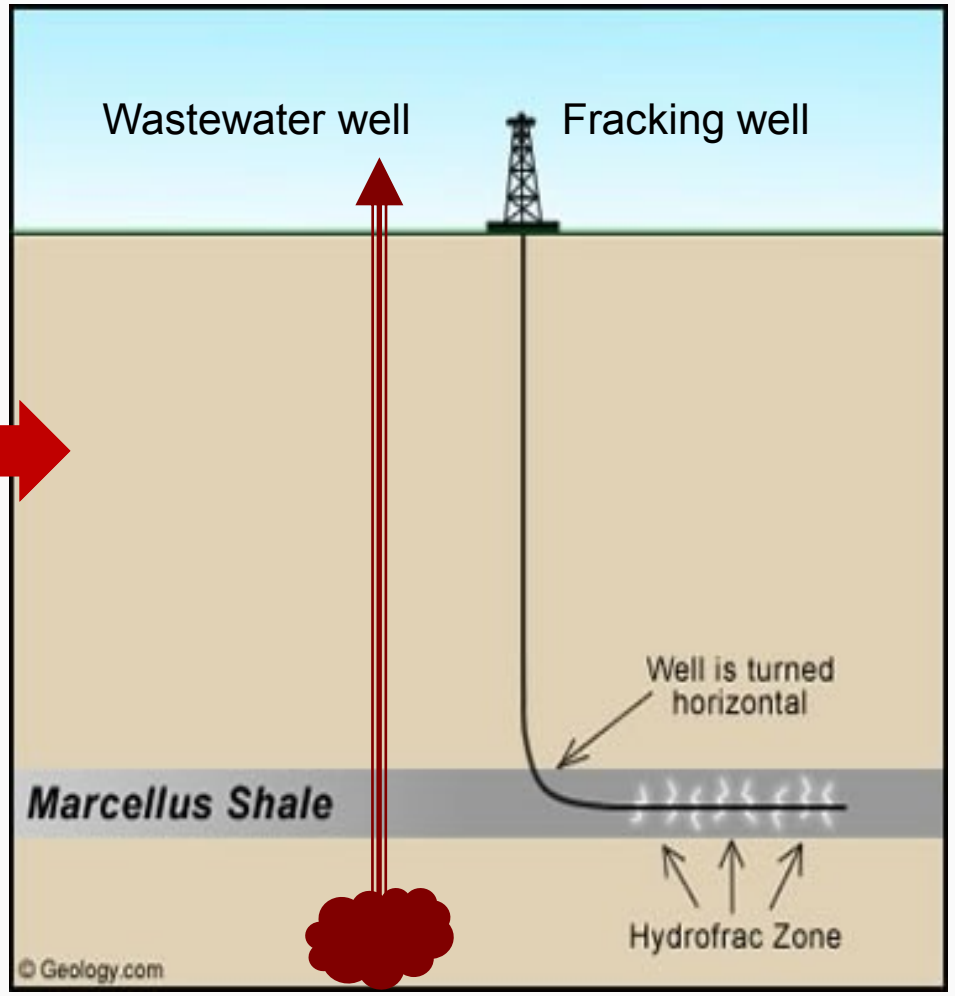
Does Hydrofracking cause Earthquakes?

No:

Wastewater Injection Wells……..
……greater issue than the Fracking Well itself…

……Deeper, Higher Pressure, Longer Duration

As of 2013 > 30,000 Deep Water Injection Wells nationwide



US Dept. of Interior/US Geological Survey

Exposures
Earthquake Risk

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US Dept. of Interior/US Geological Survey - Earthquake Examples (Largest recorded)

- Rangely, CO, injection experiments (M4.9, 1995), 1945-1995
- Rocky Mountain Arsenal (M5.3, 1967), fluid injection, 1962-1966
- Gazli, Uzbekistan, gas recovery (M7.2), 1976-1984
- Water Reservoirs: Lake Mead (M5), Koyna (M6.3), Oroville (6.1) Tadjikistan, Italy and many others
- Geysers Geothermal Field (M4.6), injection-enhanced production
- Dallas Airport (M3.3), fluid injection, 2008-2009
- Arkansas (M4.7), fluid injection, 2010-2011
- Youngstown, Ohio (M4.0), fluid injection, 2011
- **Prague, OK (M5.7), Waste Water Injection Well, 2011**
- Dallas/Ft Worth (M3.4) Waste Water Injection Well, 2012

Earthquake frequency in the central U.S. increased 50% in 2000, and then over seven-fold in 2008 and continues to increase

- Nationwide: 300 EQ > 3.0 from 2010-12
- OK EQ Activity (3.0 >): Up from 1 p/y (1976-07) to 44 p/y (2008-11), including over 200 in 2014 …(US Geological Survey/OK Geological Survey 2014 Rpt)

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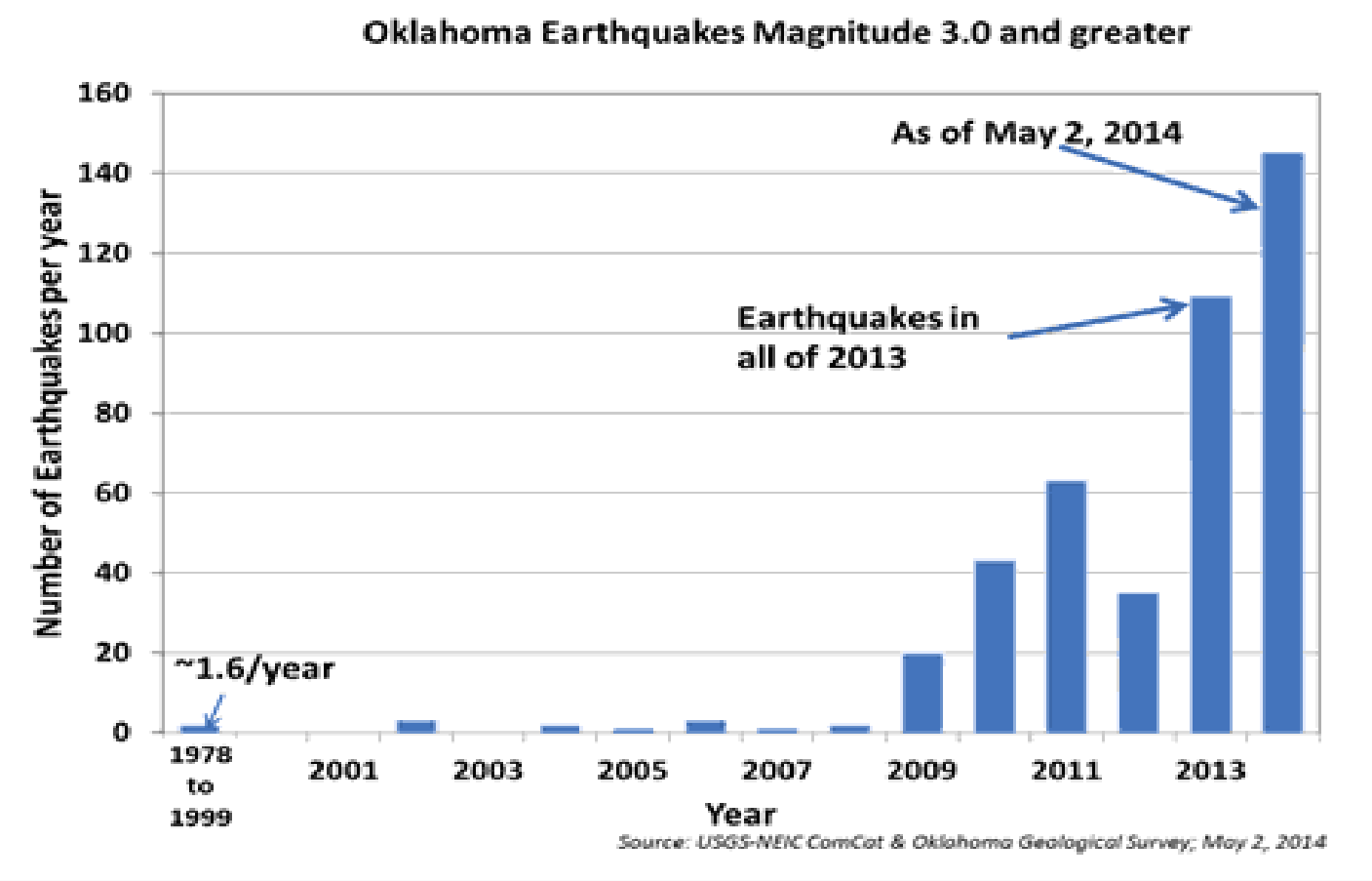
US Dept. of Interior/US Geological Survey – The Oklahoma Picture



Is Oklahoma Primed for a Big Quake ?

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Hydrofracking
Claim Scenarios

Claims

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Some Claims To Date….Pollution

Zimmerman v. Atlas Energy Washington Co., No. C-63-CV-200907564 (PA 2010)

- Tomato farmer (Heirloom Tomatoes)
- **Injunctive Relief Claim converted to Diminution of Property Value Claim**
- Claims: exposure to hazardous pollutants, loss of well water, loss of profits, loss of enjoyment of property due to **groundwater contamination**.
- Pollutants cited : acetone, benzene and other unidentified compounds

Fiorentino v. Cabot Oil & Gas No. 09-02284 (M.D. PA, 2010)

- Damages sought for **Toxic Tort, Strict Liability, Gross Negligence, Emotional Distress, Punitive Damages and the Establishment of Medical Monitoring Trust** Fund ……$4.1mm (Dimock , PA)
- Claim that Cabot released hazardous substances and failed to remedy **contaminated water**

PA Dept. of Environmental Protection v. Cabot Oil & Gas (Related to Fiorentino)

- Consent Order and Agreement
- Cabot agreed to address **Environmental violations** and "Pay Damages…." $120,000 in fines and other costs; $11.8mm for a new public water line.

Claims

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Some Claims To Date….Pollution, Administrative

Armstrong v. Chesapeake Appalachia, LLC (Pa. Ct. Com. Pl.)	▪ Caims : Methane, ethane and other pollutants discharged into the ground and aquifer near her residence, as well as groundwater well. ▪ Alleges damage/contamination caused by **negligent drilling techniques, negligent planning/design, ineffective/defective well casings and negligent training/supervision.** ▪ Causes of action: **strict liability for violation of the HSCA, negligence, private nuisance, trespass and medical monitoring costs** (among others). ▪ Seeks compensatory/punitive damages, remediation costs, injunctive relief. ▪ **2011 – Settled $900,000 State Penalty + undisclosed amount to Plaintiff**
Citizens for Pennsylvania's Future v. Ultra Resources, Inc., No. 4:11-cv-01360 (M.D.Pa.).	▪ Plaintiff is a statewide environmental and public health interest group . ▪ Contends that defendant has **violated the Federal Clean Air Act and other state statutes.** ▪ Seeks a declaration that defendant has violated the CAA and other statutes, **injunctive relief,** an order mandating compliance with the CAA, and **other civil fines/penalties.**
U.S. Energy Development Corp., File No. 11-57 (NYS DEC, 2012)	▪ New York State DEP filed an **administrative complaint** seeking an order requiring defendant to pay $187,500 for **water quality violations** associated with fracking activities in Pennsylvania that polluted an upstate stream in NY. ▪ Seeking the maximum penalty because of the company's failure to comply with two previous consent orders 2010.

Claims

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Some Claims To Date…….EQ, Pollution, Nuisance, etc.

Armstrong v. Chesapeake Operating / BHP Billiton Petroleum	▪ **2014 EQ Suit (in addition to 2011 Pollution Suit)** ▪ 14 Families in Arkansas claiming over 1,000 EK between 2010-11 including 30 >3.0 and two > 4.0
Mitchell v. Encana Oil and Gas (USA) No. 10-02555 (N.D. TX)	▪ Plaintiff property is next to drilling site ▪ Claims: **contaminated groundwater** preventing personal use and resulting in possible injury ▪ Causes of action: **Nuisance; Trespass; Negligence; Fraud; Strict Liability** ▪ Damages claimed: Loss of Use of Water; Property Diminution; Medical Monitoring……**Dismissed in 2011**
Lisa Parr, et al. v. Aruba Petroleum, No. CC-11-0165-E (Cty of Dallas, TX)	▪ Plaintiff property is next to drilling site ▪ Claims: **exposure to harmful impact** from all aspects of the drilling operation ▪ Causes of Action: **Negligence; Gross Negligence; Private Nuisance; Strict Liability;** ▪ Damages claimed: Bodily Injury (various forms); Death of Livestock; Emotional Distress; Loss of Earnings; Diminution of Property, etc. ▪ **2014 - Judgment for $2.9m in favor of Plaintiff**
Crowder v Chesapeake Operating	▪ Drill site 165 feet from plaintiffs property ▪ Cause of Action **: Private Nuisance** ▪ Plaintiffs asked for 108,000; were **awarded $20,000…Trend???**

Claims

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Some Claims To Date….Auto, Strict Liability Cause of Action

Udy v. Zia Transport, erstein Enterprises, and Standard E&S, LLC

- 2010 **Auto Accident** in NM – "Tired Driver"
- Tractor-Trailer tanker carrying water extracted from Texas wells collided with plaintiff's vehicle, killing him
- **Wrongful Dearth award of $58mm including $47mm in Punitive Damages assessed** against All defendants judged to be negligent
- **Under appeal**

Berish etal. v. Southwest Energy, No. 10-01981 (M.D. PA)

- Case brought by the defendant Southwest Energy to (in part) **dismiss a claim of Strict Liability**
- Federal District Court ruled against Southwest:

declining to find that hydrofracking is <u>not</u> "abnormally dangerous".

and

Allows (requires) the plaintiff to prove that hydrofracking <u>is</u> "abnormally dangerous"

Key

The issue of whether or not hydrofracking is "abnormally dangerous" and thus warrants strict liability treatment is still an open question.....For Now

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Warren Drilling Co. v. Ace American Ins. Co., et al., No. 2:12-cv-425 (S.D. Ohio 2012)

- Insured driller sued by property owners who lived near a fracking well.
- Plaintiffs alleged that fracking fluids and chemicals contaminated their water supply.
- Lawsuit settled $40K plus $155K in expenses), and insured brought suit seeking defense costs and indemnity under a CGL policy issued by ACE.
- Policy excludes coverage for BI/PD caused by pollutants, but insured argues that Energy Pollution Liability Extension (EPLE) and Underground Resources and Equipment Coverage (UREC) Ends. provide coverage.
- Issue: **Endorsements contain certain conditions precedent that bar coverage and are being adjudicate**d - EPLE endorsement reinstates pollution coverage that is “unexpected and unintended,” commenced “abruptly and instantaneously,” and was known by the insured within 30 days of the commencement of the discharge and reported to the insurer within 60 days of that time.
- **Parties Settled – Details Unknown**

Claims
Class Action Examples

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Tucker, et al. v. Southwestern Energy Co., No. 1:11-CV-00044 (E.D.Ark.)

- Plaintiffs alleged that as a result of fracking activities, their well water was contaminated with Alpha Methystyrene, a poisonous chemical and known component of fracking fluid.
- Asserted claims based upon **strict liability for ultra-hazardous activities, negligence and trespass, and alleged damages arising from bodily injury, property damage, and diminution in value of property, among others.**
- **Settled – amount not known, but plaintiffs were seeking millions in compensatory and punitive damages.**

Hearn, et al. v. BHP Billiton Petroleum (Arkansas) Inc., No. 4:11-cv-00474 (E.D.Ark.)

- Class Action - Residents allege that fracking activities have caused numerous earthquakes (over 599 alleged seismic events in the area).
- Activity allegedly abused by not only oil/gas operations, but also the drilling of injection wells used for disposal of fracking fluid.
- Causes of action: **nuisance (public/private), strict liability, negligence and trespass**. **Allege property damage, economic loss, business interruption (among others) and seek punitive damages/injunctive relief.**
- **Jury trial scheduled for late March 2014 - No Outcome known (Settled?)**

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Securities Class Action Suits/Disclosure Issues

- Recent uptick in class action lawsuits against large energy companies --- BP, Transocean, Massey Energy – **alleging that the companies misrepresented to investors the safety records or procedures related to fracking activities and accuracy of disclosures of gas reserve estimates.**

- **SEC** has expressed interest in having energy companies involved in fracking **disclose more information about the operational or financial risk**s.

- **New York AG** had subpoenaed certain energy companies (reportedly Cabot Oil and Gas, Range Resources and Goodrich Petroleum) **seeking information concerning whether accurate information was provided to investors about natural gas wells.**

Other Litigation of Note

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Norse Energy Corp v Towns of Dryden, Cooperstown and Middlefield, NY	▪ New York Supreme Court **Upholds Local Zoning Bans** on Hydrofracking Activities under Municipal Authority under Home Rule Law
EQ Litigation : Chesapeake Operating Corp.	▪ 14 families in Arkansas ▪ Waste Water Injections wells used in 2010 and 20111 cause over 1,000 EQ >1.0 includinbg 30 >3.0 and 2 >4.0

More Litigation to Come !!

Future Claims
A Sense of Direction

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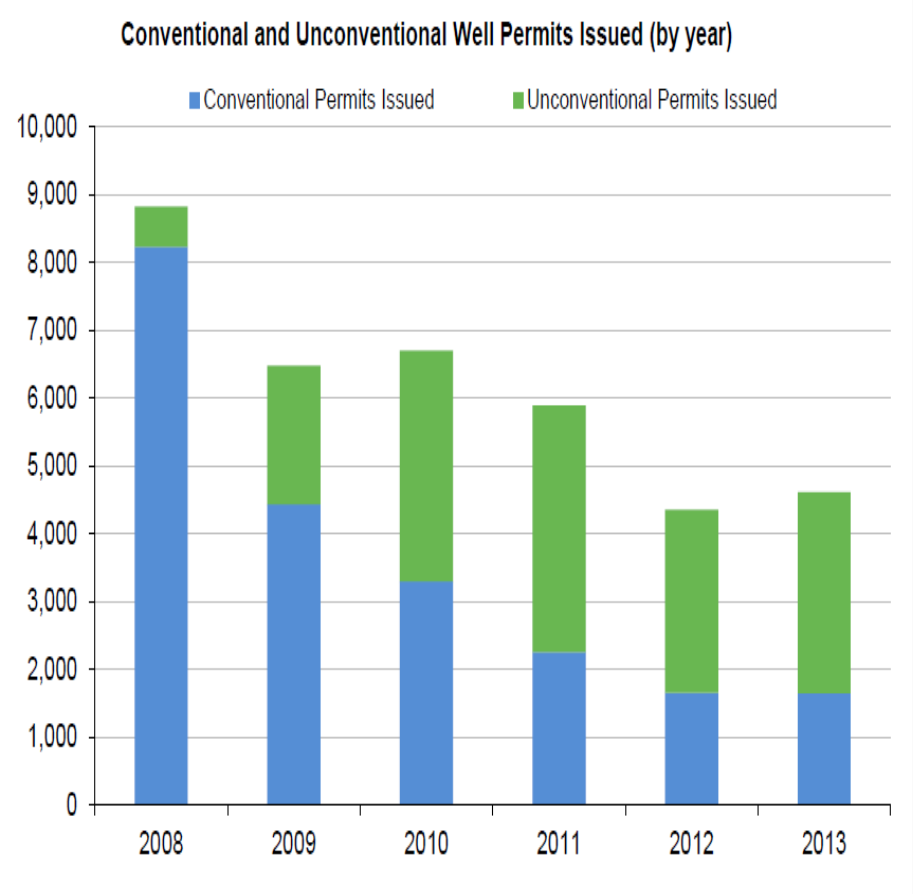
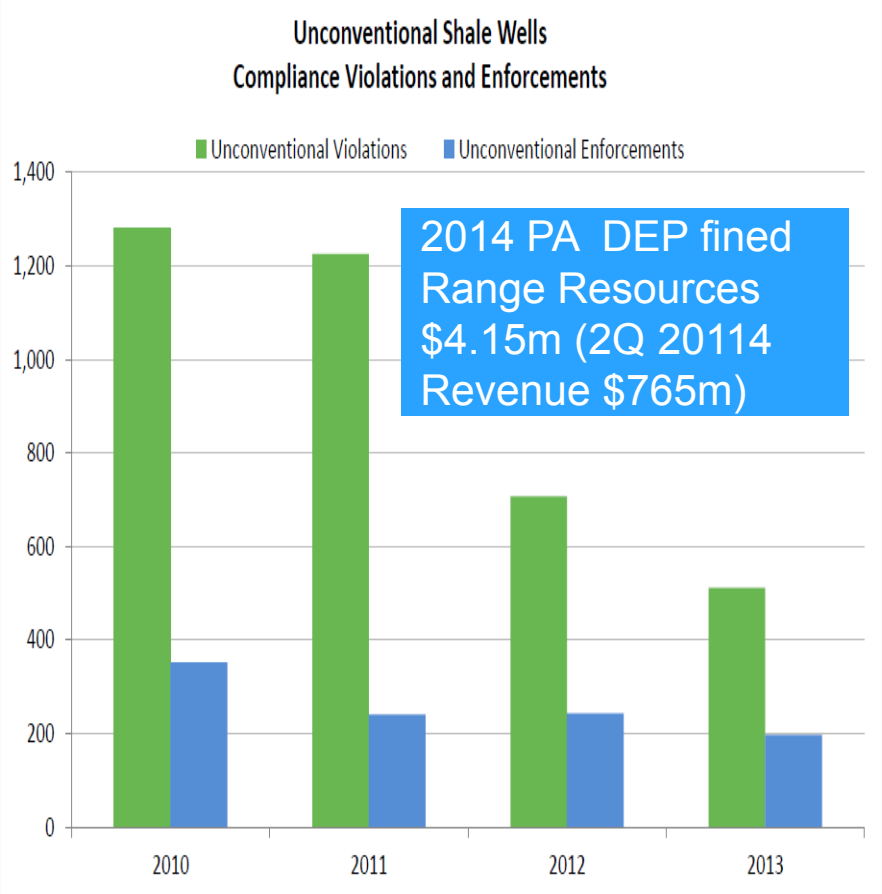
Marcellus Shale Example





Information : PA DEP 2013 Annual Report

Getting Better??.....

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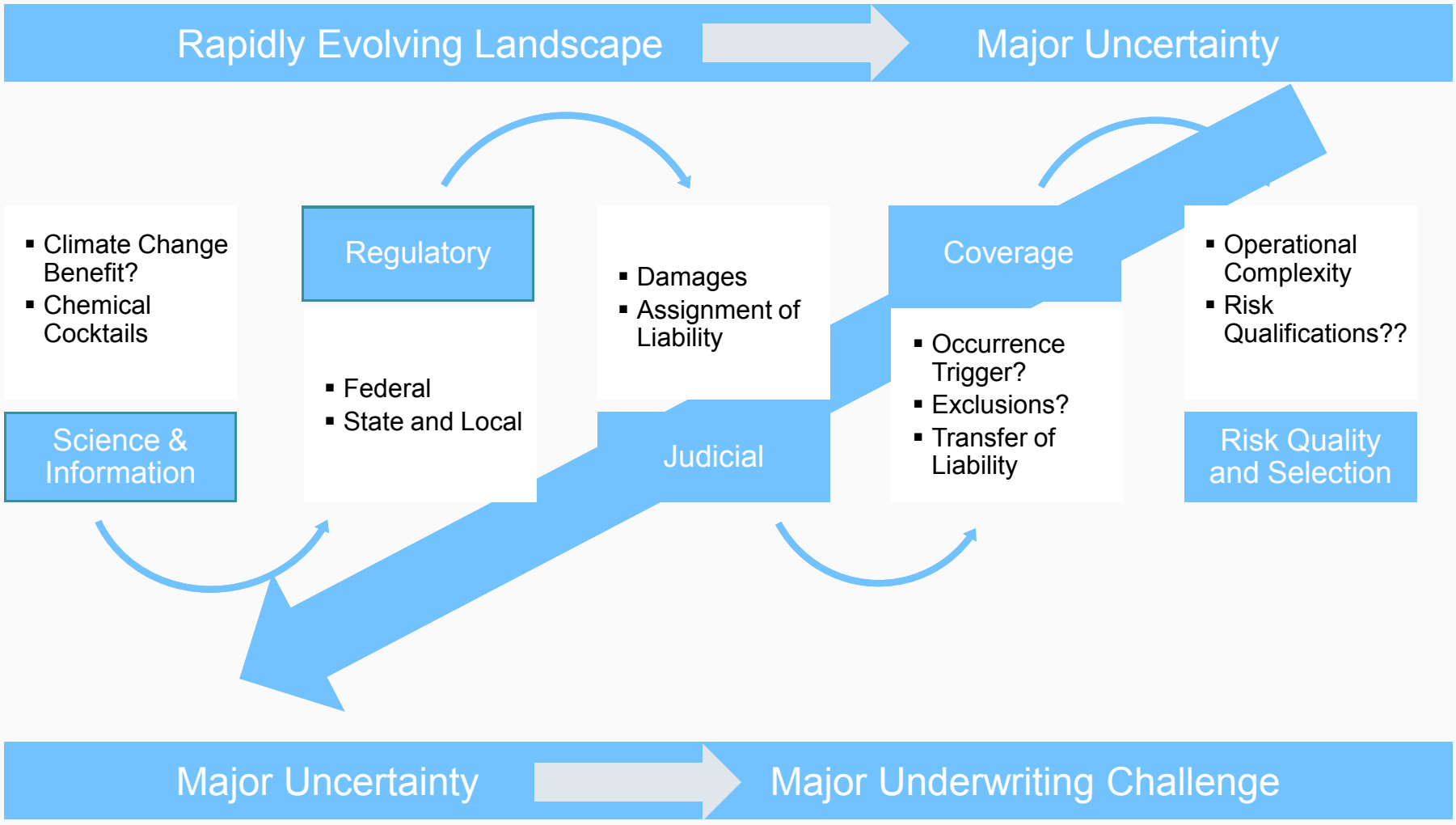
Hydrofracking Underwriting and Coverage Considerations

…….A Sample of Things to Think About

Underwriting Implications
Underwriting / Risk Management



Underwriting Considerations
Science and Technology

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Science and Technology

Fracking technique:

- Shale Gas v. Coal – conflicting studies?
- Seismic activity – does it or doesn't it?
- Water "testability" – can we test reliably?
- Water Disposal and Reusability

Many Questions…….Much still evolving

Chemical Cocktails

- What chemicals are used?
- What "new chemicals" are created by blending?
- Propane Gel?

Underwriting Considerations
Still Learning….Examples of Various Studies

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Ongoing Studies

- **Carnegie Mellon Study (11/12) :** 2011 Voluntary ban on disposing gas drilling wastewater in the Monongahela River may be diminishing levels of pollution linked to Fracking.
- **Univ. of Texas at Austin Study (1/13)** : Sharp increase in the amount of water used in Fracking in recent years but leveling off by 2020
- **PA Dept of Environmental Protection (1/13)** : Will study the levels of naturally occurring radioactivity in gas development by products….Concern is that formations like the Marcellous Shale contain naturally occurring radiation that is brought to the surface during fracking
- **NY Health Department Study (1/13)** : NY Times reported study completed in 2012 found that Fracking can be conducted safely (Report not formally released as of 2/13)….Formal state position not released yet.
- **MD State Panel (11/12**): Developing rules for Fracking in Western MD; may require a minimum of $5mm Pollution Liability Insurance and post a $5mm Performance Bond
- **EPA Hydrofracking Study -** As of 12/12 still working on it ….Focus is potential impact of Hydrofracking on drinking water

The Challenge: Clarify the Issues; Understand the Exposure Landscape

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Does Fracking Pollute Water: Mixed Messages….
Some Recent Examples

Yale University 2014

Random PA Survey: 492 People/180 Households with ground fed water

- Reports of **Upper Respiratory Symptoms**:
  - Living within I Kilometer (2/3 mile) of a Fracking well = 39%
  - Living more than 2 kilometers from a Fracking Well = 18%
- Reports of **Skin Irritation:**
  - Living within I Kilometer (2/3 mile) of a Fracking well = 13%
  - Living more than 2 kilometers from a Fracking Well = 3%

Associated Press 2014

Review reports of 4 states (PA, OH, TX, WV)

- **Hundreds of complains of water pollution**….
  ……**only a handful confirmed & small % of Wells**
  - PA - Since 2005 = 106 Confirmed out of 5,000 Wells Drilled
  - TX – Past 10 Years = No confirmed cases out of 62 Complaints
  - OH – 2010-13 = 6 Confirmed out of 190 Complaints
  - WV – past 4 Years = 4 Confirmed out of 122 Complaints

Public Perception ….May Impact Policy & Litigation in the Future

Underwriting Considerations
Science and Technology – Climate Change and Methane

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Climate Change….Is Shale Gas Better than Coal or Oil ????
More Mixed Messages…A Sampling

Cornell University 2011	❑ GHG Footprint of Shale Gas needs to include the Methane Impact of drilling not just post drilling use. ❑ 30% more methane released during Fracking than conventional gas drilling ❑ On a 20-year time horizon, the GHG footprint for shale gas is 43% higher than conventional gas, 50% greater than oil and 20% higher than coal for the same amount of energy produced by each of those other sources.
Carnegie Mellon 2011	❑ Shale Gas use resulted in 20-50% less GHG emissions than Coal.
PA DEP 2013	❑ 16 Month study of reported high methane levels in 3 homes found no connection with shale gas drilling activities nearby
EPA 2013	❑ Reported that private industry's pollution control efforts have cut methane emissions by an annual average of 41.6 million metric tons from 1990 to 2010, a 20 percent reduction from previous estimates.

Public Perception …….May Impact Policy & Litigation in the Future

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More on Methane

Cornell University 2014

June 2014 Proceedings of the national Academy of Sciences Report - Compared to older, conventional (vertical) wells, the newer, horizontal wells have twice the rate of methane leakage:

- 75,000 wells drilled since 2000 were reviewed
- Newer (post 2009) wells had a 2% rate ; Older wells had a 1% rate
- Newer conventional wells (vertical) had a 2% rate of leakage; newer horizontal wells had a rate of 6%
- Regardless of when drilled, horizontal wells reached a peak rate of 10% leakage.

The study has been called biased by the Energy Industry…but, if accurate…raises questions:

- **Is the horizontal aspect itself systemically that much more prone to leakage?**

or

- **Are the later wells simply being drilled with less diligence because of lack of oversight, expertise, or other reasons?**

Public Perception …….May Impact Policy & Litigation in the Future

Underwriting Considerations
Regulatory

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Federal

- CERCLA (Superfund) - Imposes Liability for the release of hazardous substances and provides response activities.
- Clean Air Act - Gives EPA jurisdiction over the reduction of contaminants in the air
- Clean Water Act - Gives the EPA jurisdiction over the discharge of pollutants into the water from the "point of discharge"
- Safe Drinking Water Act - Requires the EPA to set standards and oversee states, localities and water suppliers.
- Energy Policy Act of 2005 – Providing tax incentives & loan guarantees for various types of energy production……included the "Halliburton Loophole"
- FRAC Act of 2008/09/10/11/13- Aimed at repealing Halliburton Loophole
- US Dept. of Interior - In January 2013 announced it will require disclosure of Chemicals used in Fracking, control of Methane Emissions and strict management of wastewater for Fracking on on Public Lands
- Federal Railroad Administration i- A actively promoting the passage of Fracking Rail Safety legislation and enforcing current laws

The Challenge: Balance Energy Needs, Jobs/ Economics and Politics with Environmental Concerns

Underwriting Considerations
Regulatory

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State And Local

- NY, PA, MD & TX at the forefront (also AR, CO, NJ, WY)
- Initiatives vary– some include (Current or Proposed):
  - Ban or Moratorium (Pending a Study) - MD; NJ; NY
  - Chemical Disclosure laws (passed or proposed) - AR; CO, OH; MI; PA; WVA; WY
  - Operational Regulations –
    - Positing a bond to cover well closings (Delaware River Basin)
    - Monitoring level of fluid contamination (Ohio)
    - Presumption of liability (PA Oil and Gas Act)
    - Taxes initiatives (WVA passed a law imposing tax penalties for repairing land damaged by Hydrofracking activities)
- VT 2012 Legislation – Fracking & recept of Fracking Waste banned.
- WV 2014 Legislation - - Overturned limits of the amount of Fracking Waste can be accepted

The Challenge: Balance Energy Needs, Jobs/ Economics and Politics with Environmental

Underwriting Considerations
Regulatory

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State And Local

- PA 2012 legislation – Act 13:
  - Increased safety standards …
  - Required Operator "Impact Fee " to be paid (quasi tax)
  - Zoning Ban - Prohibitslocal municipalities from banning fracking
- PA Supreme Ct. 2014 – declared Zoning ban unconstitutional
- CT 2014 – DEEP (Dept of Energy and Environ. Protection) Law - Moratorium on accepting Fracking Waste until 2017 DEEP Study completed
- IL - HB 2615 introduced in 2013 - Broad Regulation of Hydrofracking activities
- NJ – S1041/A2108 – Banning Fracking Waste; Vetoed by Gov. in 2014 (even though Fracking itself is banned)
- NC - 2014 Energy Modernization Act – Lifted 2012 Ban on Fracking
- NY Sate Court of Appeals - 2014 - Ruled that individual towns can use Zoning Ordinances to ban Fracking
- CA 2014 State Senate - Rejected a bill that would ban Fracking

The Challenge: Balance Energy Needs, Jobs/ Economics and Politics with Environmental Concerns

Underwriting Considerations
Judicial

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Damages

Broad level:

- Bodily Injury
- Property Damage
- Personal Injury
- Environmental Damage (Cleanup)
- Operator Share Price (D&O)
- Public Officials (Municipalities)

Very Unsettled : Will vary Case by Case and Jurisdiction by Jurisdiction

Assignment of Liability

- Who will be liable?
- What will they be liable for?
- Strict liability?

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Potential Coverage Impacted

Standard Homeowners and Commercial Property	▪ Coverage not likely due to exclusions (e.g., pollution, animals, excavation, growing crops, etc.
Special Property (E&S or Inland Marine)	▪ Oil and gas drilling and service equipment – cover damage to equipment used in hydrofracking ▪ Business Interruption – cover loss of production due to damage to above ground property ▪ Operators Extra Expense (Cost of Well Control/Blow Out) – cover the cost of controlling an out of control well, cost of re-drilling a loss well, pollution liability and liability for damage to 3rd party equipment of property
CGL and Farmowners Liability	▪ Extent & nature of coverage - vary by jurisdiction and case fact patterns ▪ Pollution Exclusion will be tested…… Modified versions may apply
Miscellaneous	▪ Professional Liability – Engineers, seismic studies, etc ▪ Workers Compensation ▪ D&O and Public Officials
Environmental Liability	▪ Operators - Typically Claims Made ▪ Contractors – Claims Made or Occurrence ▪ May include time bound coverage

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The Environmental Impairment Liability Market

- Claims Made for the most part but some Contractors EIL may be Occurrence
- Demand is Up …but Supply is not Robust…especially in problem areas:
  - PA due to Population proximity;
  - LA due to legal climate
- Coverage Litigation just starting…
  - Pollution exclusions or application of coverage;
  - number of occurrences at sites with multiple wells;
  - allocation among various parties (Owners, Contractors, etc.)

EIL Coverage

Likely No Coverage | Possible or Limited Coverage | Likely or Conditional Coverage

	CGL	Property	D&O	Business Auto	Site EIL
Underground Storage Tanks					
Waste Disposal					
Material Transport					
Hostile Fire					
Business Interruption					
Fuel and Chemical Storage					
On-Site Clean –up & Remediation					
Waste Storage – On-site					
Prior Environmental Claims, Loss, Violations					

White and Williams, LLP

Underwriting Considerations
Coverage - CGL

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Occurrence Trigger

Possibilities:

- **Exposure** - Proximity to the well
- **Injury-in-fact** - The date the actual damage or injury takes place
- **Manifestation** - The date when the damage/injury becomes evident or is discovered
- **Continuous Injury Trigger** - Period from initial exposure to discovery

Very Unsettled : Will vary Case by Case and Jurisdiction by Jurisdiction

Exclusions / Limitations

Most Prominent Exclusions:/Provisions

- **Pollution**
  - Language – Total; Absolute; Named Peril / Time Element; Manuscript
  - Exceptions – S&A; Do all defendant “own, occupy or rent” the fracking location?
  - Application to Personal Injury – wringful eviction or invasion of privacy
- **Fortuity** – Are fracking losses “Expected /Intended”
- **Impaired Property** – Diminution of Property Value Claims

Underwriting Considerations
Coverage - CGL

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Damages

"Those sums….As Damages"
- Standard Coverage Language
- Intent: Limit coverage to Legal Liability for BI and PD

"All Sums"
- Alternate Coverage language
- Generally viewed as broader - May include fines , injunctive relief and other expenses not directly related to BI or PD

Emotional Distress / Medical Monitoring

"Mental Anguish" or "Emotional Distress"
- Included in Definition of "Bodily Injury" ??
- ISO definition Does Not…(but others might)

Personal Injury

"Wrongful entry, eviction or invasion of the right of privacy"
- Trespass, Public or Private Nuisance

Assignment of Liability

- **Who is Liable**
- **What are they Liable For?**
- **Strict Liability?**

Very Unsettled : Will vary Case by Case and Jurisdiction by Jurisdiction

Underwriting Considerations
Coverage – CGL

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Transfer of Liability

Contractual

Excluded, but 2 Exceptions:

- If Insured would have otherwise been liable Incidental Contracts
- local municipal ordinances that require the indemnification of the municipality

Additional Insured Coverage

- 'Sole negligence
- Completed Operations

Lone Pine Orders

Creates a hurdle for plaintiffs

Case Management Tool -

Requires Plaintiffs to substantiate

- Allegations of personal injury, property damage and
- Causation

Before proceeding with discovery

Mass Tort Impact

- Limits Plaintiff ability to use mass tort tactics as each claim must clear the hurdle

Very Unsettled : Will vary Case by Case and Jurisdiction by Jurisdiction

Underwriting Considerations
Coverage – CGL

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Underground Resources and Equipment Exclusion

Excludes Property Damage :

- Oil, Gas, Water or other Mineral substances still underground
- Any area through which exploration or production is carried on (Well, Hole; etc)
- Any Drilling or Service Machinery or Equipment located beneath ground (Casing, Pipe, Bit, Tool, etc.)

Excludes Bodily Injury or Property Damage :

- Remediation Cost/Expenses related to the above (e.g., Bringing damaged equipment to the surface)

Underground Resources and Equipment Coverage

Scheduled Coverage for Underground Equipment or Resources

- Aggregate PD Sublimit applies
- Excludes PD for Real Property in CCC
- Excludes BI and PD:
  - Well Control costs incurred
  - Damages Claimed by a Co-Owner

Very Unsettled : Will vary Case by Case and Jurisdiction by Jurisdiction

Underwriting Implications
Coverage….. Earthquake Exposures

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Standard Commercial & Personal Property Coverage

- Standard policies do not cover earthquake
- EQ coverage needs to be added by endorsement for an additional charge

Subrogation !!

(Even if Covered under Property Forms)

Developers/ Energy Cos./ Contractors……

……..could still be liable for damage!!

“Man Made” EQ?

Underwriting Implications
Coverage….. Operators Expense Coverage

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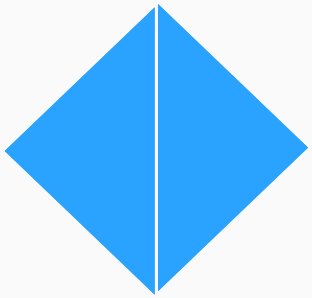
Operators Expense Coverage



Control of Well Cover

Blow Out

Regain Control of the Well
Re-drilling
Pollution
Third Party Damages

Underwriting Considerations

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Risk Appetite	▪ Exclude or cover and……. How best to do either ▪ Latent vs. acute (e.g., gradual pollution vs. blowouts) ▪ Type of Pollution Exclusion or Coverage Grant – Claims Made vs Occurrence – Absolute, Total or manuscript exclusion; Named peril and/or Time Bound coverage, etc. ▪ Sub-limits ▪ Transfer of liability (contractual, additional insured) – A key for subs and landowners
Loss Control	▪ Applicable regulatory requirements ▪ Insured experience, track record, financial strength ▪ Chemical cocktails – for primary & secondary operations - even if not required to be disclosed by the state, consider as a requirement for coverage
Pricing	▪ No credible experience – may be more severity than frequency driven ▪ Based on exposure and coverage…… focus on risk management and loss containment

Underwriting Considerations

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Risk Selection

Location

- Gas Reserves: where are they and what are they near???
- Legal jurisdiction
  - Applicable regulations (State and Federal) – Can vary widely
  - Coverage precedents (especially, coverage trigger, strict liability and pollution) – Can vary widely
- Proximity to other properties, populations or EQ faults
- Center for Energy Economics and Policy State Regulation Maps
  www.rff.org/shalemaps

Operations

- Nature of the insured's operations - Who do you insure…(Keep in mind primary, secondary, tertiary exposures)
- Experience , financial strength, Track Record aand qualifications – How well do they do it and is their experience relevant to hydrofracking operations.
- Loss Control/Risk Management
  - Applicable regulatory requirements
  - Chemical cocktails

Underwriting Considerations
Risk Quality/Selection

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Operational Complexity

- Many & varied aspects of hydrofracking-related activities
  - Drilling activities
  - Water : Treatment / Testing / Transportation / Disposal

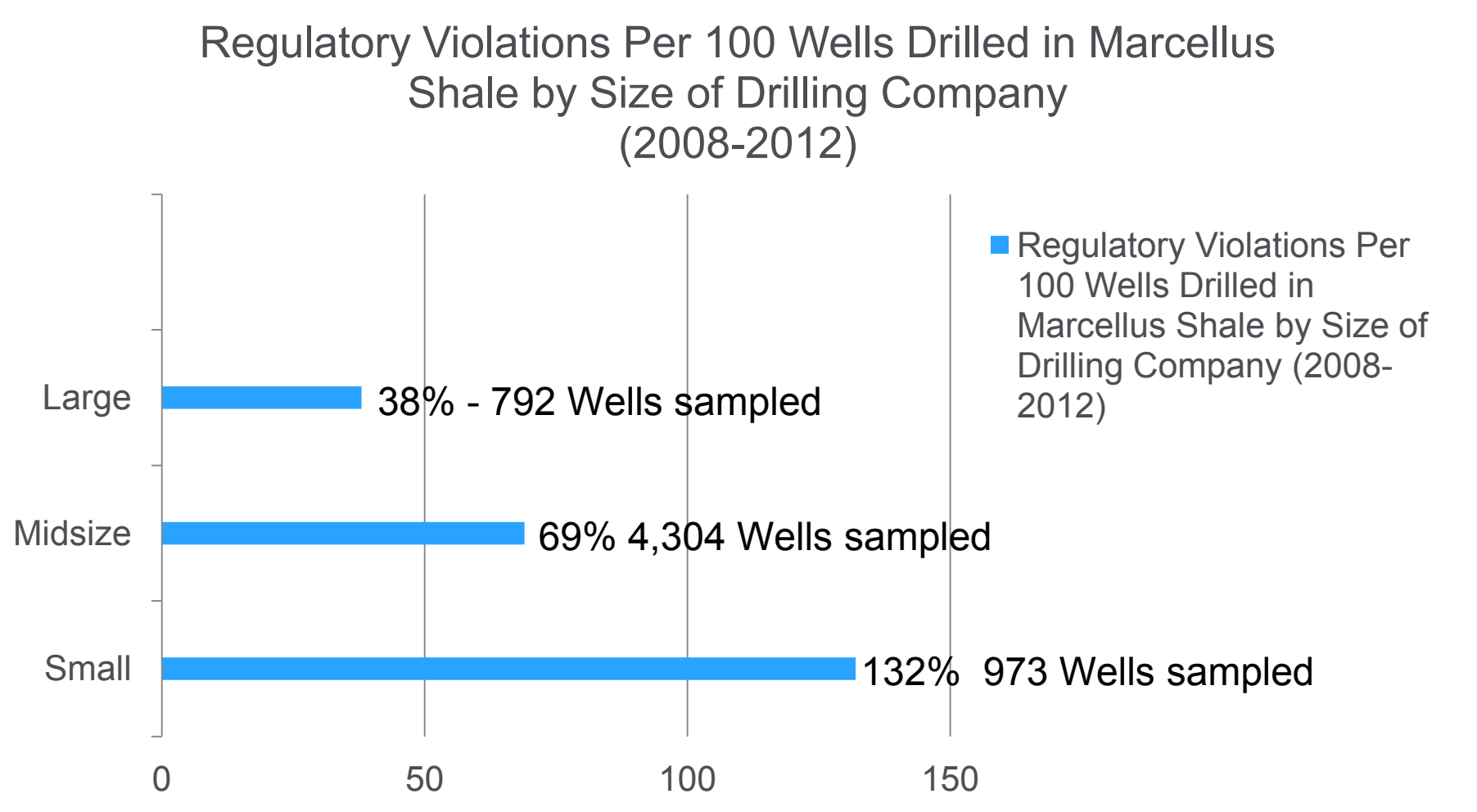
Nature of Operations……. Are there enough Qualified Practitioners?

Risk Qualifications

- Determining the good…. from the bad…… from the ugly?
- The weak economy may attract the marginally qualified contractors

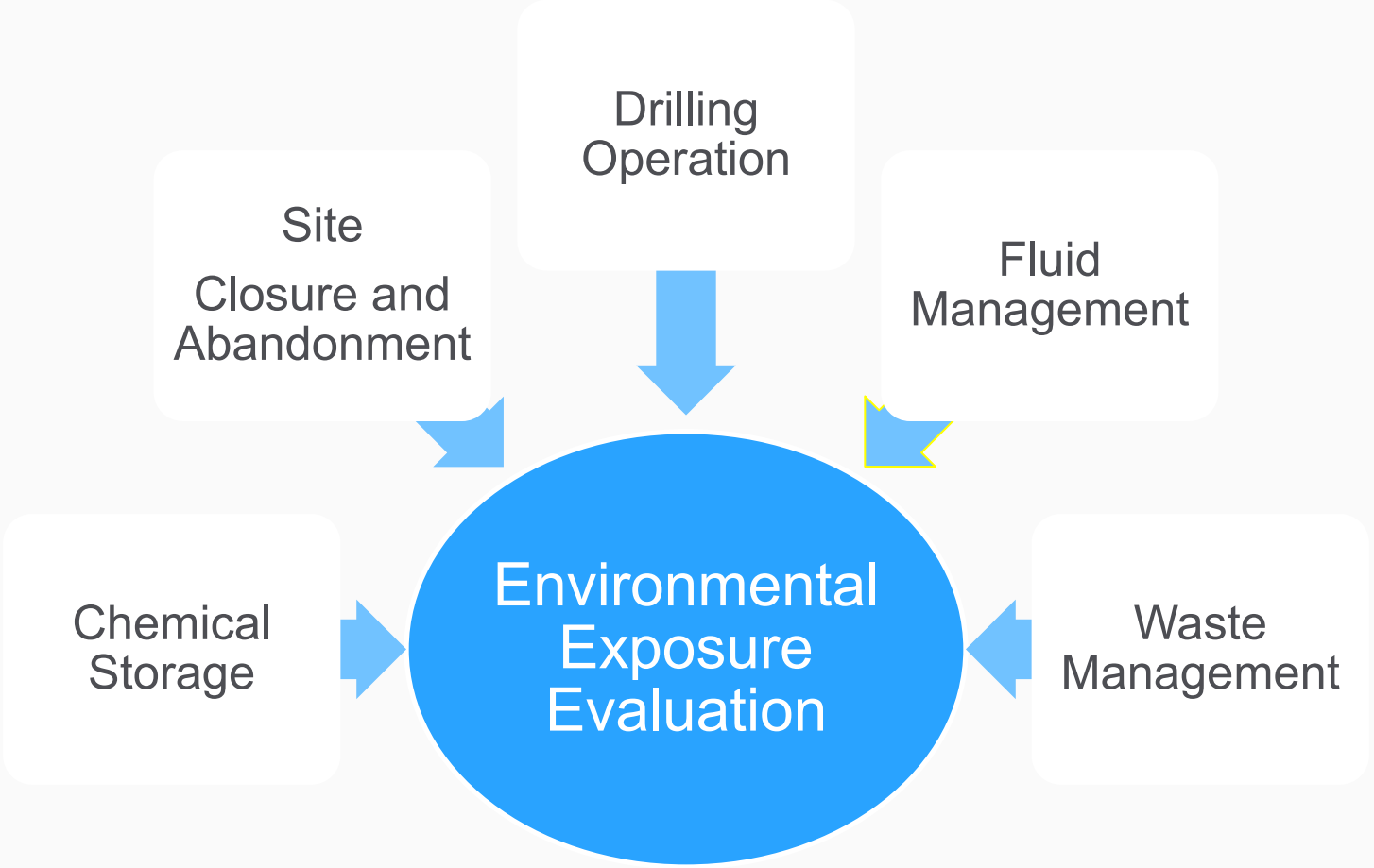
WSJ Report 4/1/13:
Bigger energy companies replacing smaller ones resulting in improved safety and environmental records

Underwriting Considerations
Size is Important



Source: PA Department of Environmental Protection/WSJ 4/1/13

Underwriting Considerations Environmental



Standard ISO Pollution Exclusions Should Apply…..
……Separate EIL Coverage Should Provide Coverage

Underwriting Implications
Underwriting / Risk Management

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Site Operational Risk Accumulation

- Property/Equipment Accumulation
- Casualty - Typical clash exposure
- Transfer of liability is key

Pollution – Latent Accumulation

- Exposure is significant - Air and Water
- Latency poses coverage challenges
- Standard CGL pollution exclusions should apply
- Safety Measures: e.g.,
  - Research to treat waste water is underway (SW Research Institute & Univ. of TX -"Bochar";
  - Use of vapor-recovery units and infrared monitors to detect methane leaks

Earthquake

- Hydrofracking activity, mostly waste water disposal injection wells carry a risk of inducing earthquakes.
- Earthquakes are not large enough to be a safety concern….for now, but frequency is a concern
- The rate of earthquakes in the U.S. midcontinent has increased in recent years, injection wells appear to be triggering earthquakes.
- Standard property coverage does not typically apply….will flow to Liability

Underwriting Implications - Underwriting / Risk Selection, Catastrophic Potential??

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Some Broad Thoughts

Loss Potential Containment

- Property/Equipment Values
- Casualty Limits/Aggregate Limits
- One or a few policyholders
- Claims Made EIL – limited policy years…if coverage can be obtained (Some Contractors EIL May be Occurrence)

On the Other Hand……

Litigation / Judicial Risk is very High

- Coverage - Occurrence trigger, exclusions, etc
- Judicial/Regulatory Landscape evolving quickly
- Science and Technology
- Deep pocket potential
- Plaintiff bar gearing up

Market Posture Examples

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To Date: Cautious Market Response to Hydrofracking	
Property /IM	Typically excludes EQ unless endorsed otherwise – HO and Commercial Blow Out Exposure dominates
Auto Liability	Trucking exposure elevated
EIL	Carriers reluctant to cover in certaiun areas such as PA (near populated areas) or LA (legal Climate)….
General Liability ▪ Underground Resources & Equipment Exclusion	Pollution – standard exclusions should apply Excludes Property Damage: • Oil, gas, water or other mineral substances still underground • Any area through which exploration or production is carried on (well, hole; etc) • Any drilling or service machinery or equipment located beneath ground (casing, pipe, bit, tool, etc.) Excludes Bodily Injury or Property Damage: • Remediation cost/expenses related to the above (e.g., bringing damaged equipment to the surface)

▪ Underground Resources & Equipment Coverage	Scheduled Coverage for Underground Equipment or Resources
	• Aggregate PD sublimit applies
	• Excludes PD for real property in CCC
	• Excludes BI and PD:
	  • Well control costs incurred
	  • Damages claimed by a co-owner

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Takeways

Takeaways

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Will expand and add clarity….. ..possibly higher standards of care

Just starting to evolve on many fronts…beware of strict liability

Continued Growth	Federal & State Oversight	Chemical Disclosure	Case Law

Abundant supply
Improved technology

Will increase but, unlikely to be comprehensive

A lot of uncertainty……but there are opportunities
Need to be Proactive

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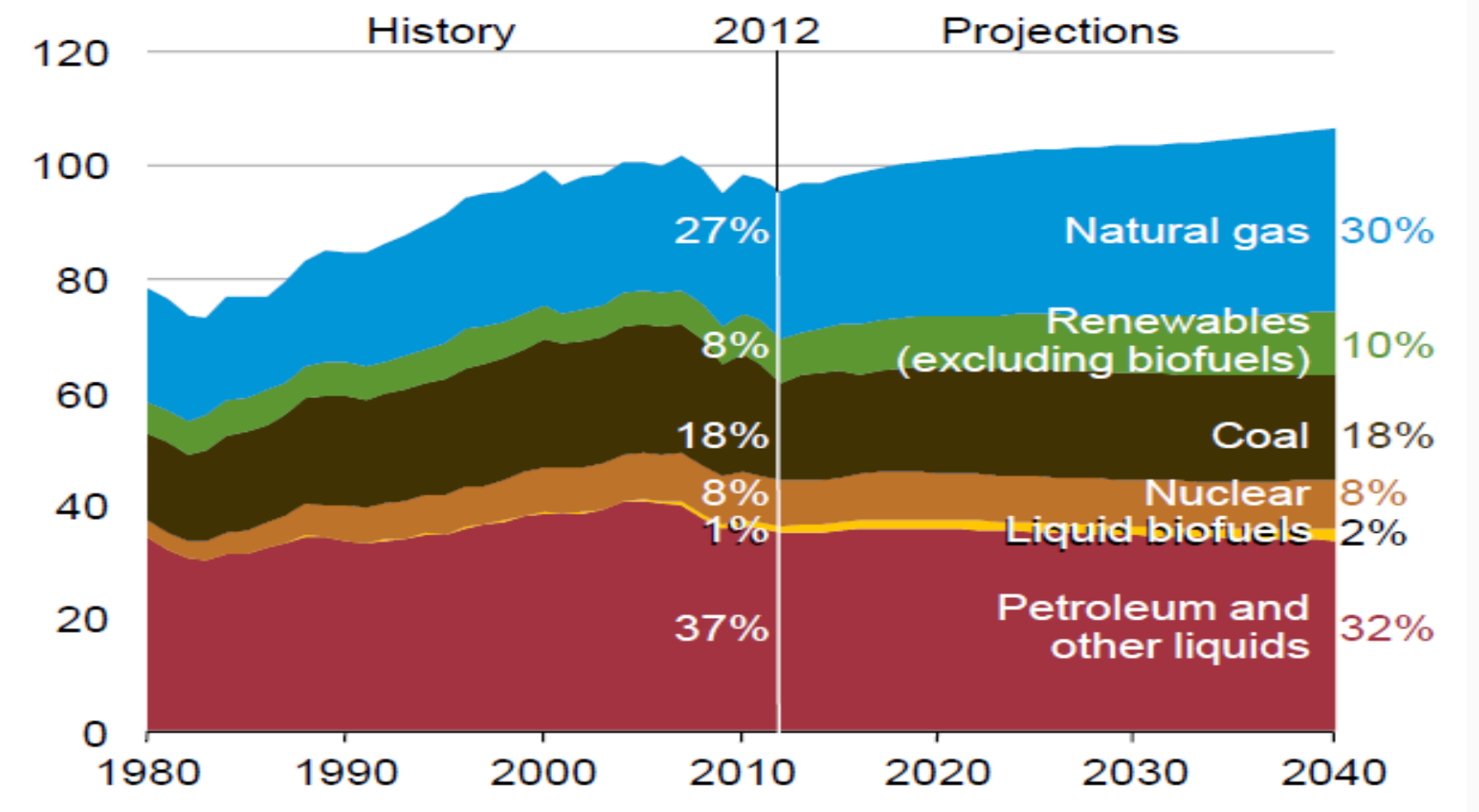
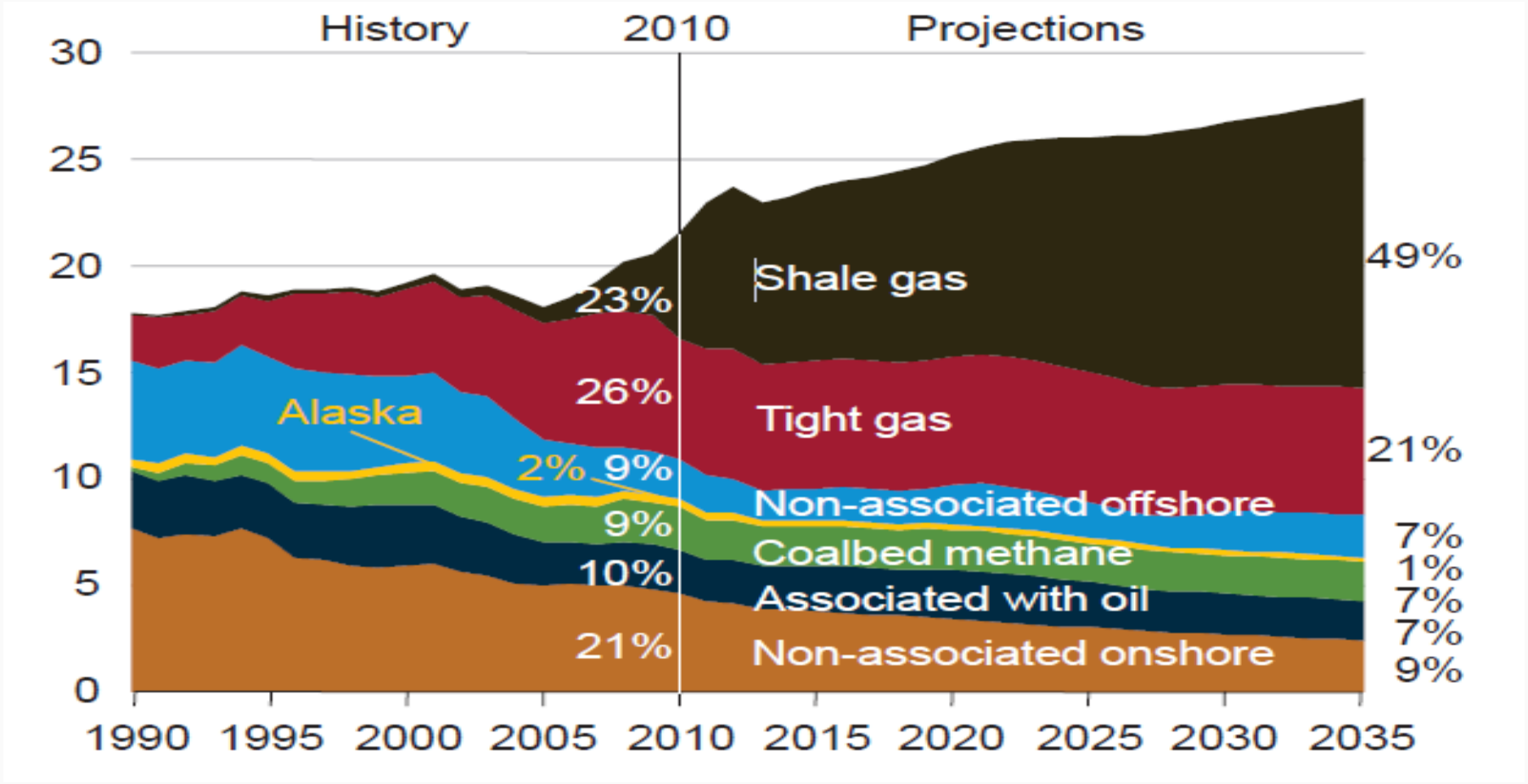
US Shale Gas Compared to Other Energy Sources



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2014 (AEO2014)*

Shale Gas Production Potential

U.S. Natural Gas Production, 1990-2035 (trillion cubic feet) @ 2014



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2014 (AEO2014)*

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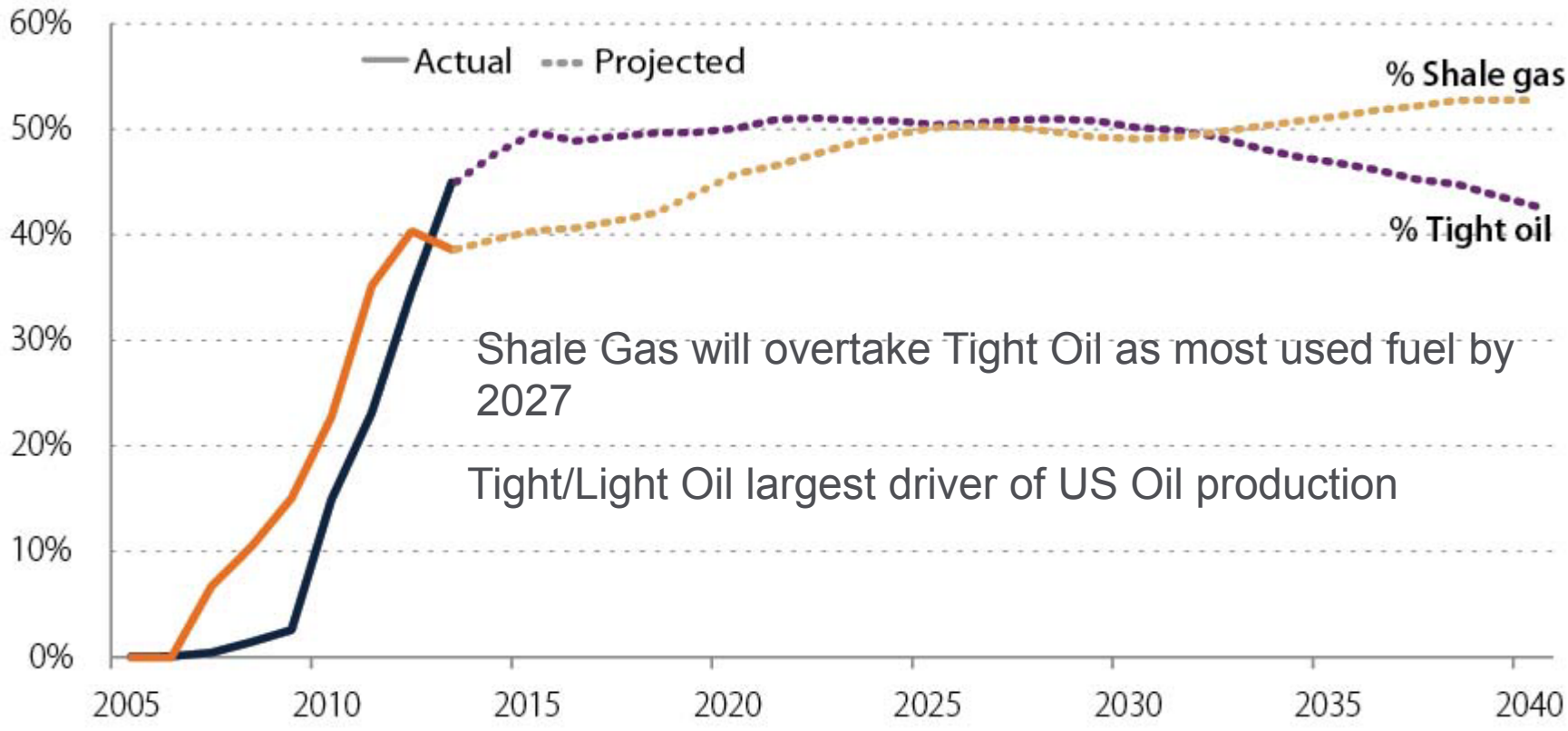
US Shale Gas and Tight Oil ….Here to Stay
Percentage of U.S. Oil and Natural Gas from Tight Oil and Shale Gas 2005-2040



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2014,* http://www.eia.gov/oiaf/aeo/ tablebrowser/ and other EIA data

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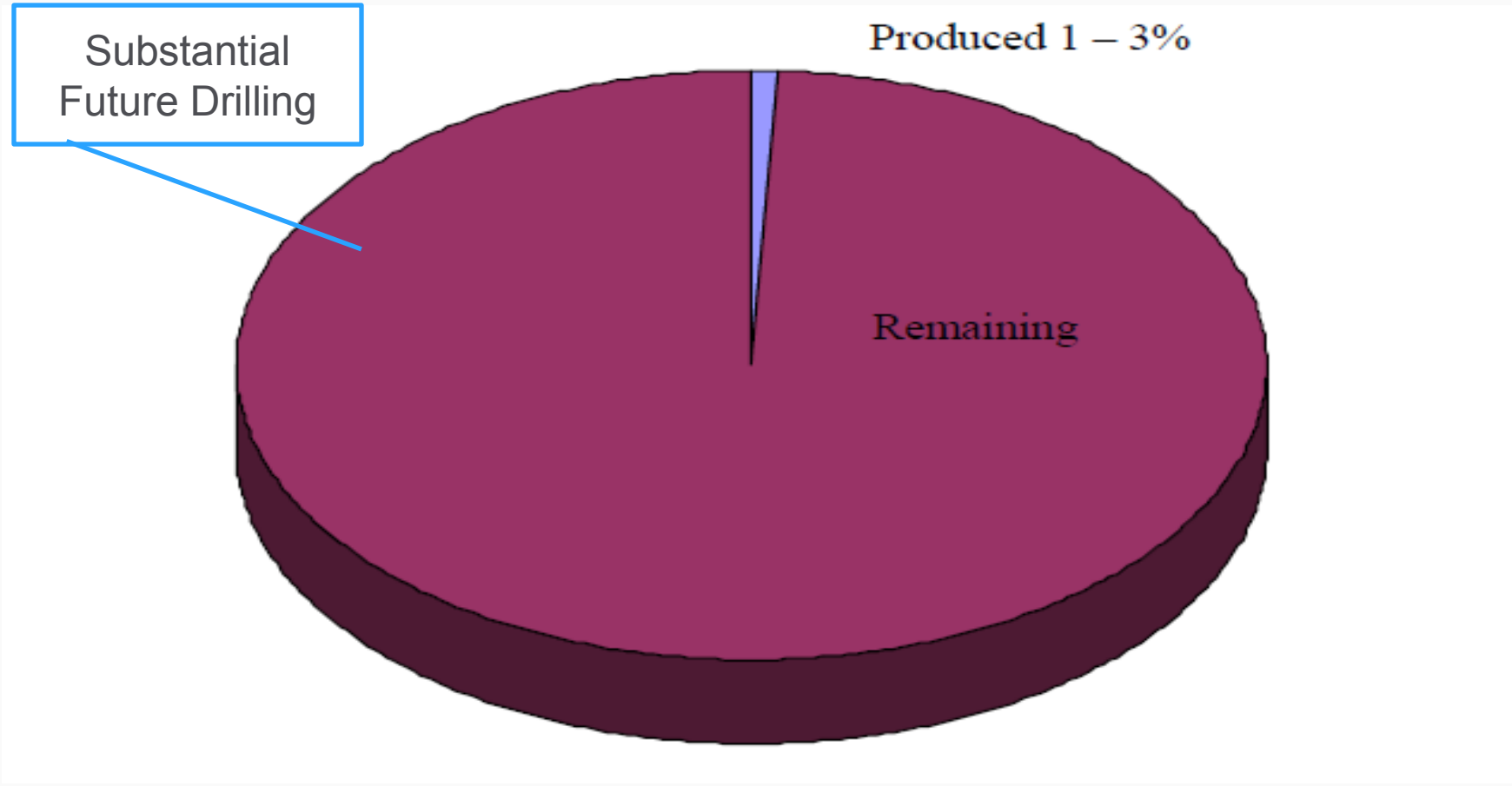
Shale Gas Technically Recoverable Resources and Cumulative Production (@ 2011)



US Energy Information Administration July, 2011 Study: Review of Emerging Resources US Shale Gas and Shale Oil Plays

Takeaways
From Here to There

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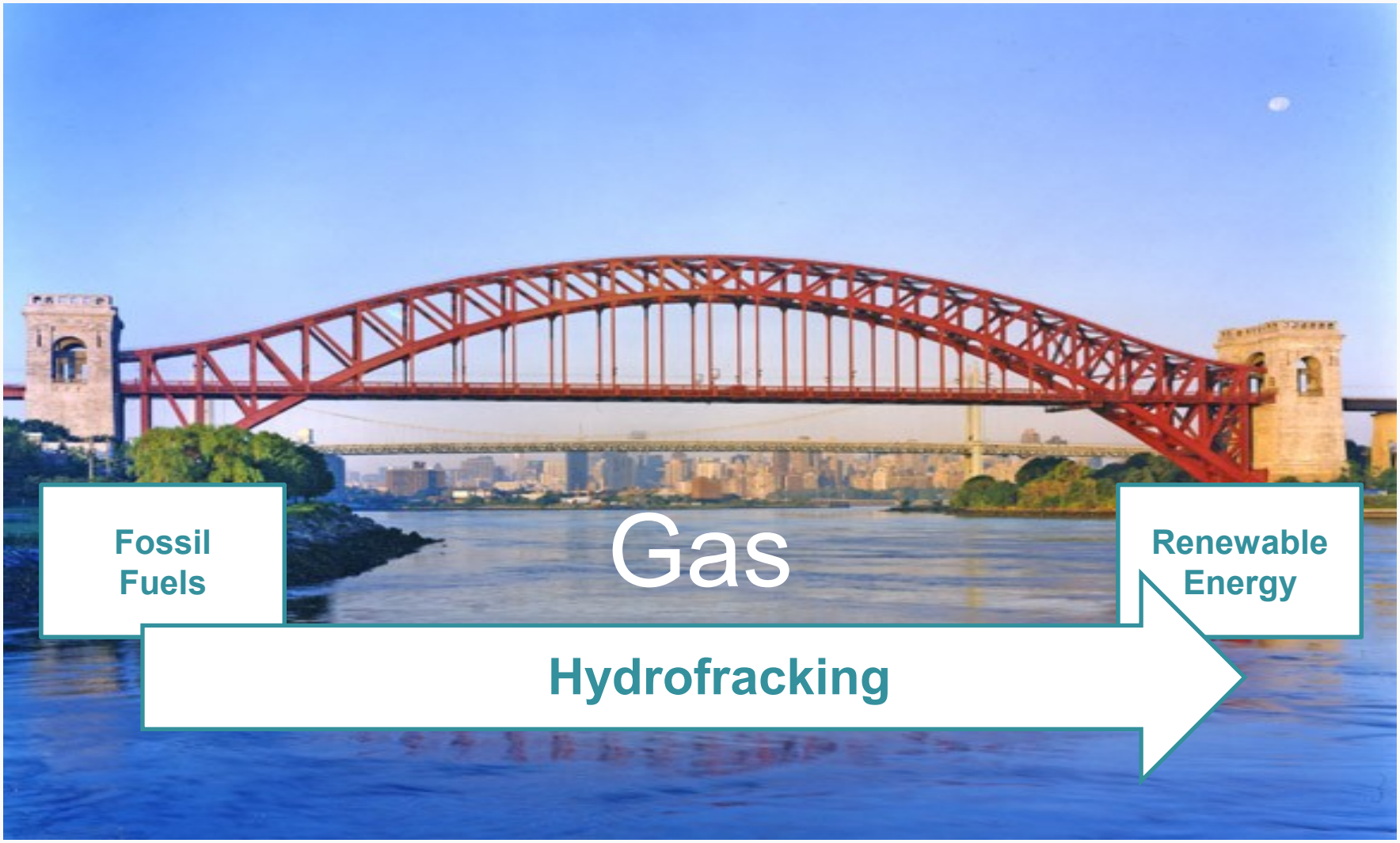

Takeaways
Summary

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Benefits

- Lower climate change footprint?
- High / volatile price of oil
- Technology more cost effective
- National security
- Abundant supply
- Jobs, jobs, jobs

Hyrdofracking

Potential environmental damage:
- Chemical “cocktails”
- Methane
- Ground water
- Waste water treatment

Risks

- Part of the long-term energy solution…….Not going away
- Benefits & rewards / challenges & risks……. Need to be fully understood / addressed
- Risk selection & loss control / exposure & coverage are the keys

Risks and Challenges …….But Also Opportunities
Need to be Proactive

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Opportunities

- Across the U.S., access to abundant oil & gas reserves is being enabled by hydraulic fracturing and other technologies in a cost effective manner ….
  …The US is now the world leader in oil and gas production.
- Well construction and sound engineering and operating practices are the keys to protecting the environment; equipment, properties, workers and 3rd parties
- Technological advancements are making positive impacts in reducing the industry's overall footprint
- With scientifically based and balanced regulations, shale can be developed in an environmentally sensitive and cost effective manner

But……Risks are Real and meaningful

Keys → Risk Management and Risk Selection

THANK YOU FOR YOUR ATTENTION
Q &A

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