



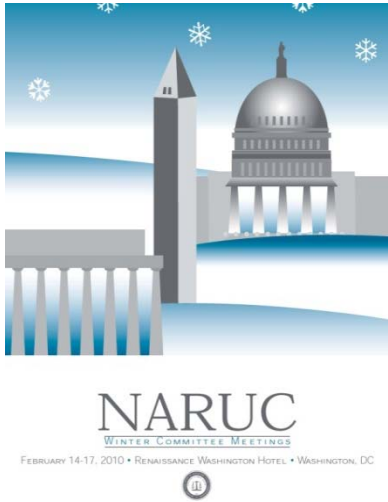
Hydraulic Fracturing

(A Proven Well Completion
Technology for Shale Gas)

Commissioner Bob Anthony
Oklahoma Corporation Commission

Winter NARUC
WASHINGTON, DC

February 16, 2016



2010 Winter NARUC Hydraulic Fracturing Panel

Hydraulic Fracturing - How to balance the need for new gas supplies with environmental uncertainties

Hydraulic fracturing releases natural gas by injecting highly pressurized water mixed with some sand and a small amount of chemicals through a deep well, lined with steel pipe and sealed with cement, into the ground to break shale rocks and release natural gas.

By enabling access to previously untapped shale basins, hydraulic fracturing has been projected to increase the nation's gas supply by over 35%. Yet, uncertainty about potentially adverse environmental impacts, including concerns about drinking and agricultural water contamination, have raised questions about potential unintended environmental consequences.

Moderator: ***Hon. Bob Anthony***-Chairman, Oklahoma Corporation Commission

Panelists:

Hon. Barry Smitherman-Chairman, Public Utility Commission of Texas

Steve Heare-Dir, Drinking Water Protection Division, Office of Groundwater & Drinking Water, US EPA

Bill Kappel, Hydrologist, Section Chief, US Geological Survey, Water Science Center, Ithaca, NY

Michael Bahorich -Executive Vice President and Technology Officer, Apache Corporation

Nancy Johnson-Dir, Environmental Science and Policy Analysis, DOE Office of Oil and Natural Gas

EPA Official: State Regulators Doing Fine On Hydrofracking

February 15, 2010, Dow Jones, Ian Talley

WASHINGTON (Dow Jones)--State regulators are doing a good job overseeing a key natural gas production technique called hydrofracking and there's no evidence the process causes water contamination, a senior federal environment official said Monday.

Environmentalists and some lawmakers are pressing to give the Environmental Protection Agency federal oversight of the process, concerned that the drilling technique is contaminating water suppliers.

State regulators and the natural gas industry have been fighting against federal regulation, saying it could prevent or delay development of trillions of cubic feet of new resources.

The process, which injects water, sand and a small amount of chemicals into natural gas reservoirs under high pressure, has opened new deposits to development, dramatically expanding estimates for domestic production.

"I have no information that states aren't doing a good job already," **Steve Heare, director of EPA's Drinking Water Protection Division** said on the sidelines of a state regulators conference here. He also said despite claims by environmental organizations, he hadn't seen any documented cases that the hydro-fracking process was contaminating water supplies.

In its 2011 budget, the EPA is seeking to spend \$4 million to study the environmental impacts of the process.

Bill Kappel, a U.S. Geological Survey official, said contamination of water supplies is more likely to happen as companies process the waste water from hydrofracking. In some instances, municipal water systems that treat the water have reported higher levels of heavy metals and radioactivity.

"Treatment of the [waste] water hasn't caught up with the hydro-fracking technology," Kappel said.

But both re-injection of that waste water and water treatment at the surface is already regulated by the federal government under the Safe Drinking Water and Clean Water Acts.

Although legislation in the House and Senate to bring greater federal oversight of the hydro-fracking process hasn't gained momentum, Heare said even if such proposals are approved, it wouldn't likely have a dramatic affect on regulation. States would still have the right under the Safe Drinking Water Act to use their own regulatory standards.

The National Association of Regulatory Utility Commissioners has pushed to maintain state's primacy in oversight of oil and gas activities.

Contrary to some press reports, Heare also noted that the EPA wasn't conducting any current investigations linking hydrofracking to water contaminations.

Companies such as Range Resources Corp. (RRC), EOG Resources Inc. (EOG), Devon Energy Corp. (DVN), Royal Dutch Shell PLC (RDSA) and Chesapeake Energy Corp. (CHK) say the process is multiplying their reserves. For example, the Marcellus deposit that lies under Pennsylvania, Virginia, Ohio and New York is estimated to hold more than 500 trillion cubic feet, compared to total conventional natural-gas resource estimates in the U.S. of around 378 trillion cubic feet, according to the U.S. Geological Survey.

http://online.wsj.com/article/BT-CO-201002150706628.html?mod=WSJ_latestheadlines

“Reservoir Stimulation” using Hydraulic Fracturing

What is Hydraulic Fracturing ?

- A method for creating a conductive fracture or crack in a subsurface formation to provide an easier path for fluids to flow to the well bore from the extremities of the well's drainage area

Why Frac ?

- To stimulate oil and/or gas production to increase Net Present Value (NPV) of a well through:
 - ✓ • Accelerating income through increasing production rates
 - ✓ • Reducing well life operating expenses
 - ✓ • Increasing total cumulative production (reserves)

Source: “Hydraulic Fracturing”, Mohd Zaki bin Awang

Oklahoma

- 60 years of Hydraulic Fracturing (safer than nitroglycerin)
- 100,000 hydraulically fractured oil and gas wells
- No verified or documented instances of harm to groundwater from HF
- Cost per well: \$10,000 to \$2 million plus
- HF tailored to individual well characteristics

Gasland: Truth vs. Fiction

(<http://www.hbo.com/documentaries?cmpid=ABC449#/documentaries/gasland/index.html>)



Truth: The state agency that regulates natural gas drilling in Colorado found the flammable water was caused by naturally occurring methane gas, not Hydraulic Fracturing, according to the oil and gas industry-funded website energyindepth.org.

***Gasland:* Colorado Oil and Gas Conservation Commission (COGCC) Investigation Report**

(<http://cogcc.state.co.us/library/GASLAND%20DOC.pdf>)

- Issued 10/29/2010
- *“Finally, it should be understood that the COGCC Director, Dave Neslin, offered to speak with Gasland’s producer, Josh Fox, on camera during the filming of the movie. Because the issues are technical and complex and arouse concerns in many people, Director Neslin asked that he be allowed to review any material from the interview that would be included in the final film. Unfortunately, Mr. Fox declined. Such a discussion might have prevented the inaccuracies noted above.”*
- **None of the contamination situations described in the film were determined to have been caused by Hydraulic Fracturing.**
- All but one were determined to have been caused by naturally occurring biogenic methane deposits (e.g. coal beds)
- The exception was caused by improper cementing of surface casing. Enforcement Order 1V-276 was approved in 2004 and assessed a substantial fine against the operator.

www.earthjustice.org/ny

(Founded in 1971 as the Sierra Club Legal Defense Fund)



Water Usage

**EXHIBIT 37: ESTIMATED WATER NEEDS FOR DRILLING AND FRACTURING WELLS IN
SELECT SHALE GAS PLAYS**

Shale Gas Play	Volume of Drilling Water per well (gal)	Volume of Fracturing Water per well (gal)	Total Volumes of Water per well (gal)
Barnett Shale	400,000	2,300,000	2,700,000
Fayetteville Shale	60,000*	2,900,000	3,060,000
Haynesville Shale	1,000,000	2,700,000	3,700,000
Marcellus Shale	80,000*	3,800,000	3,880,000
<p>* Drilling performed with an air “mist” and/or water-based or oil-based muds for deep horizontal well completions. Note: These volumes are approximate and may vary substantially between wells. Source: “Modern Shale Gas, A Primer”, p. 64</p>			

Hydraulic Fracturing Installation



Source: Halliburton Presentation to OCC – March 2010



Flowback Water Sources for Recycling are Variable

Sample	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11
Specific Gravity	1.026	1.036	1.019	1.012	1.07	1.1	1.17	1.105	1.066	1.02	
pH	7.92	7.51	7.91	6.61	6.72	6.68	6.05	7.11	7.04	6.83	
Bicarbonate	1,010	717	1,190	259	183	193	76	366	366	839	94
Chloride	19,400	29,400	10,000	6,290	59,700	87,700	153,000	96,400	58,300	11,500	19,730
Sulfate	34	0	88	67	0	0	0	670	479	0	3,100
Calcium	630	1,058	294	476	7,283	10,210	20,100	4,131	2,573	282	451
Magnesium	199	265	145	49.6	599	840	1690	544	344	40.7	1,330
Barium	49.4	94.8	6.42	6.24	278	213	657	1.06	5.1	97.4	
Strontium	107	179	44.7	74.3	2,087	2,353	5,049	178	112	45.3	
Total Iron	4.73	25.7	8.03	14	27.4	2.89	67.6	26.4	33.8	63.4	0
Aluminum	0.17	0.21	0.91	0.38	0.18	0	0.1	0.17	0.78	1.12	
Silica	33.8		40.7							33.2	
Boron	28.2	27.1	26.7	8.82	45.1	73.1	80.4	94.5	65.7	4.79	4.5
Potassium	192	273	78.7	85.8	977	1,559	2,273	2,232	1,439	135	
Sodium	10,960	16,450	5,985	3,261	26,780	39,990	61,400	54,960	32,600	7,048	11,307
TDS	33,300	49,300	18,200	10,800	98,600	144,000	252,000	160,000	97,700	20,200	36,092
TSS	57	246	50	30	10	12	32	120	13,762	1,004	
TOC	89	64	133	180	218	70	143	266	235	344	
				fbw	fbw	pw	pw	pw	fbw		
Woodford			Marcellus				Bakken		Piceance	GOM Sea water	

Source: Halliburton Presentation to OCC – March 2010



Federal Regulation of the oil and gas industry includes:

- **MMS:** Minerals Management Service (outer continental shelf)
- **OSHA:** Occupational Safety and Health Administration
- **CWA:** Clean Water Act
- **SDWA:** Safe Drinking Water Act
- **CAA:** Clean Air Act
- **NEPA:** National Environmental Policy Act
- **ESA:** Endangered Species Act
- **CERCLA:** Comprehensive Environmental Response, Compensation, and Liability Act
- **SARA:** Superfund Amendments and Reauthorization Act

States and state agencies may adopt their own standards; however, these must be at least as protective as the federal standards they replace, and may even be more protective in order to address local conditions.

State Regulation is better than EPA Regulation

- Geology differs among/within states, not one size fits all
- Water availability is a local issue and is best allocated by state/local authorities
- Local knowledge of specific aquifers and producing gas formations
- States can adopt rules for specific geographic areas--field rules
- States can adopt, amend rules quickly to respond to changing circumstances, technology
- State Inspectors live in the area and can react more quickly
- Historically, EPA has focused on surface water, not groundwater
- EPA traditionally grants primacy for inspection/enforcement to states

NARUC Resolution Supporting State Regulation of Hydraulic Fracturing

WHEREAS, The National Association of Regulatory Utility Commissioners has observed with great concern the current debate in Congress over the appropriate method for regulating the use of hydraulic fracturing to complete oil and gas wells; *and*

WHEREAS, Hydraulic fracturing is a proven technology with a long history of environmentally safe use in the completion of oil and gas wells; *and*

WHEREAS, The oil and gas producing States regulate hydraulic fracturing as a component of their regulatory programs for the drilling, completion, operation, and plugging of oil and gas wells; *and*

WHEREAS, The reservoirs that produce oil and gas are highly variable geologically and separated geographically across the oil and gas producing States such that State regulatory agencies are best suited by local expertise and experience to effectively regulate hydraulic fracturing; *and*

WHEREAS, State regulatory agencies are the most appropriate regulatory bodies to provide oversight and protection of hydrologically and environmentally sensitive localities as they relate to hydraulic fracturing; *and*

WHEREAS, The regulation of hydraulic fracturing under the federal Safe Drinking Water Act would add burdensome and unnecessary regulatory requirements to the drilling and completion of oil and gas wells, thereby increasing costs of producing domestic natural gas resources without any ancillary benefit to public health, safety or the environment; *and*

WHEREAS, The increased cost of producing domestic natural gas resources will reduce domestic supplies of natural gas, increase utility prices, and other costs to consumers, reduce tax and royalty revenues for local, State, and federal governments; and increase the nation's dependence on foreign energy imports; *and*

WHEREAS, The Interstate Oil and Gas Compact Commission (IOGCC) conducted a survey of oil and gas producing States, which found that there were no known cases of ground water contamination associated with hydraulic fracturing, and set forth its opposition to federal regulation of hydraulic fracturing under the underground injection control program in Resolution 09.011, dated January 7, 2009, "Urging Congress Not to Remove Exemption of Hydraulic Fracturing from Provisions of the Safe Drinking Water Act;" *now, therefore be it*

RESOLVED, That the Board of Directors of the National Association of Regulatory Utility Commissioners, convened at its 2009 Summer Committee Meetings in Seattle, Washington, supports continued jurisdiction of the States to conserve and properly regulate oil and gas production in their unique geological and geographical circumstances.

Sponsored by the Committee on Gas, Adopted by the NARUC Board of Directors, July 22, 2009

Rick Simmers

Chief, Division of Oil & Gas Resources Management



Ohio Department of

NATURAL RESOURCES

What is 'Hydraulic Fracturing'?

“Hydraulic fracturing is an engineered, extensively monitored process in which fluids are pumped into rock at sufficient pressure to create and preserve fractures that are connected to a well bore.”

Source: ODNR Division of Oil & Gas Resources Management

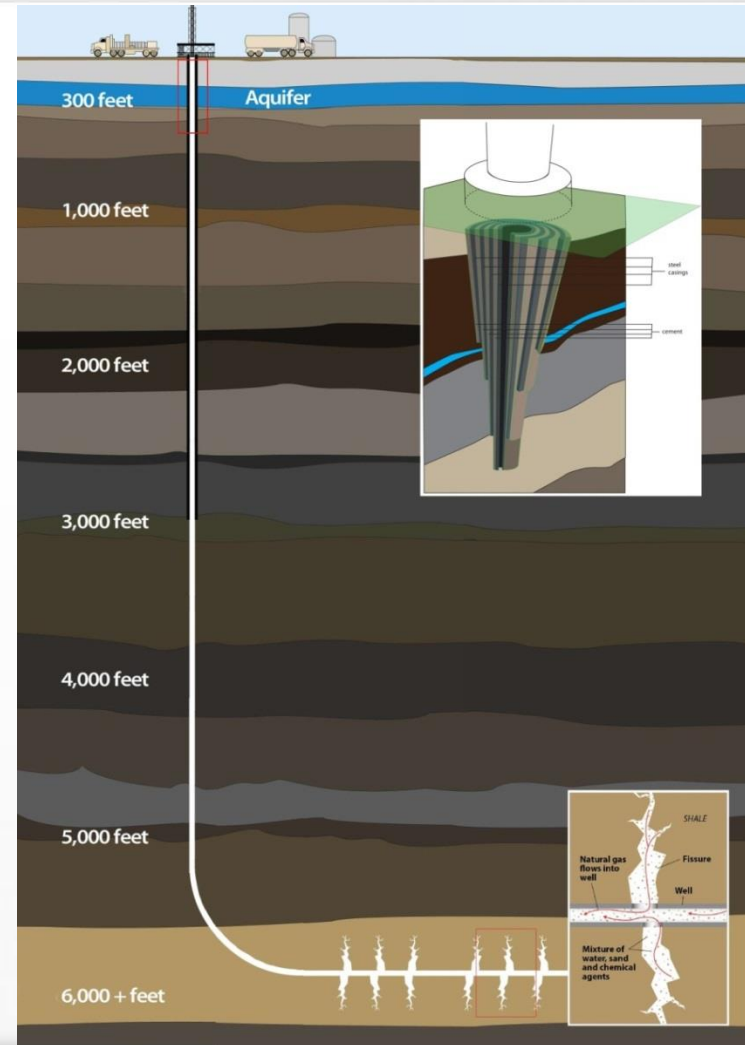


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NATURAL RESOURCES

Refinement of Horizontal Drilling Technologies

Horizontal drilling allows significant more contact between the wellbore and the target hydrocarbon-bearing formation

Today, more than 70% of all drilling rigs in the USA are drilling horizontally or directionally

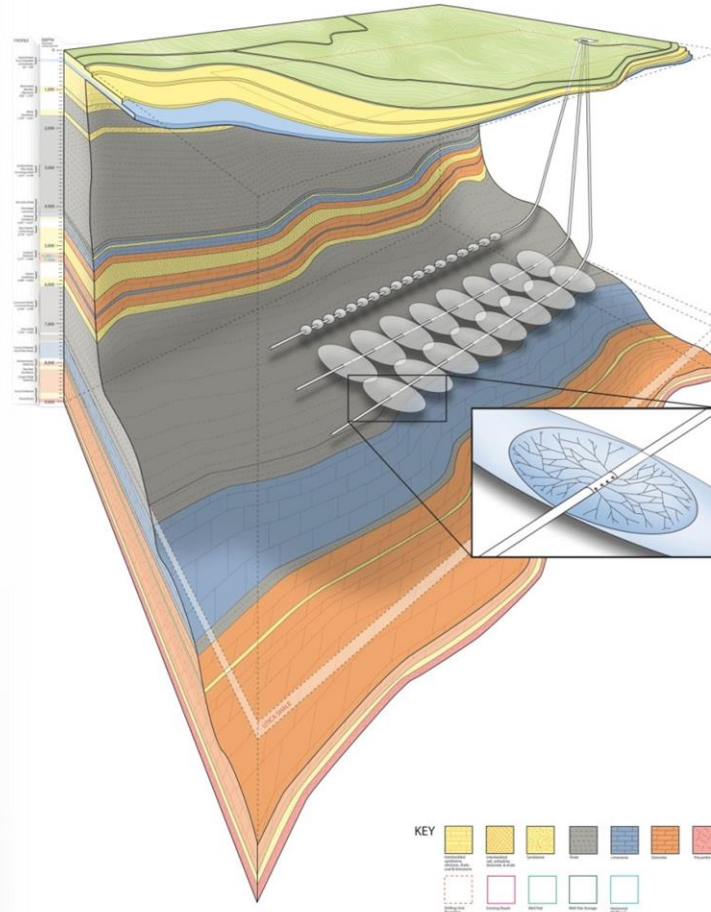


Source: ODNR Division of Oil & Gas Resources Management



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NATURAL RESOURCES

Multi-Staged Hydraulic Fracturing



Source: ODNR Division of Oil & Gas Resources Management



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NATURAL RESOURCES

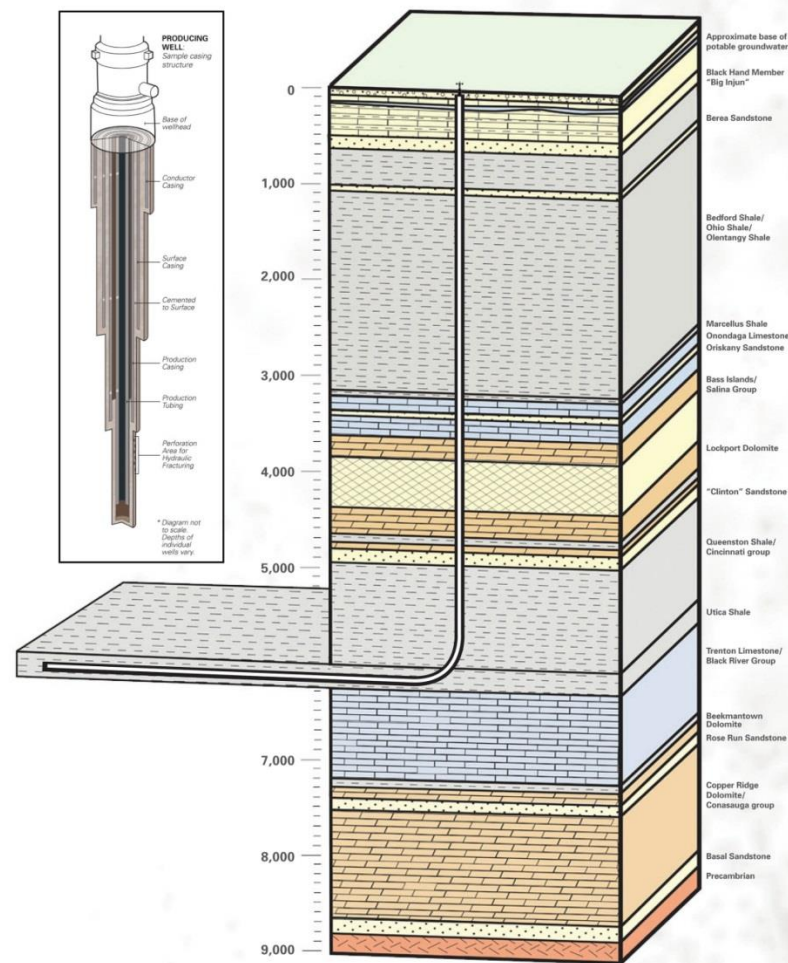
“Challenging” Positions

- Consumptive Water Use
- Chemical Disclosure
- Induced seismicity
- Waste management practices
- Appropriate regulatory framework
- Threat of drinking water contamination



Safeguards

- Design controls
- Geologic controls
- Physical barriers
- Well construction barriers
- Monitoring controls
- Regulatory controls



Source: ODNR Division of Oil & Gas Resources Management



Regulatory Constraints

- Notifications
- Well construction
- Wellbore integrity monitoring
- Pre-drill water sampling
- Chemical disclosure
 - Additive by trade name and CAS no.
 - Additive purpose and concentration
 - Material Safety Data Sheets (MSDS)



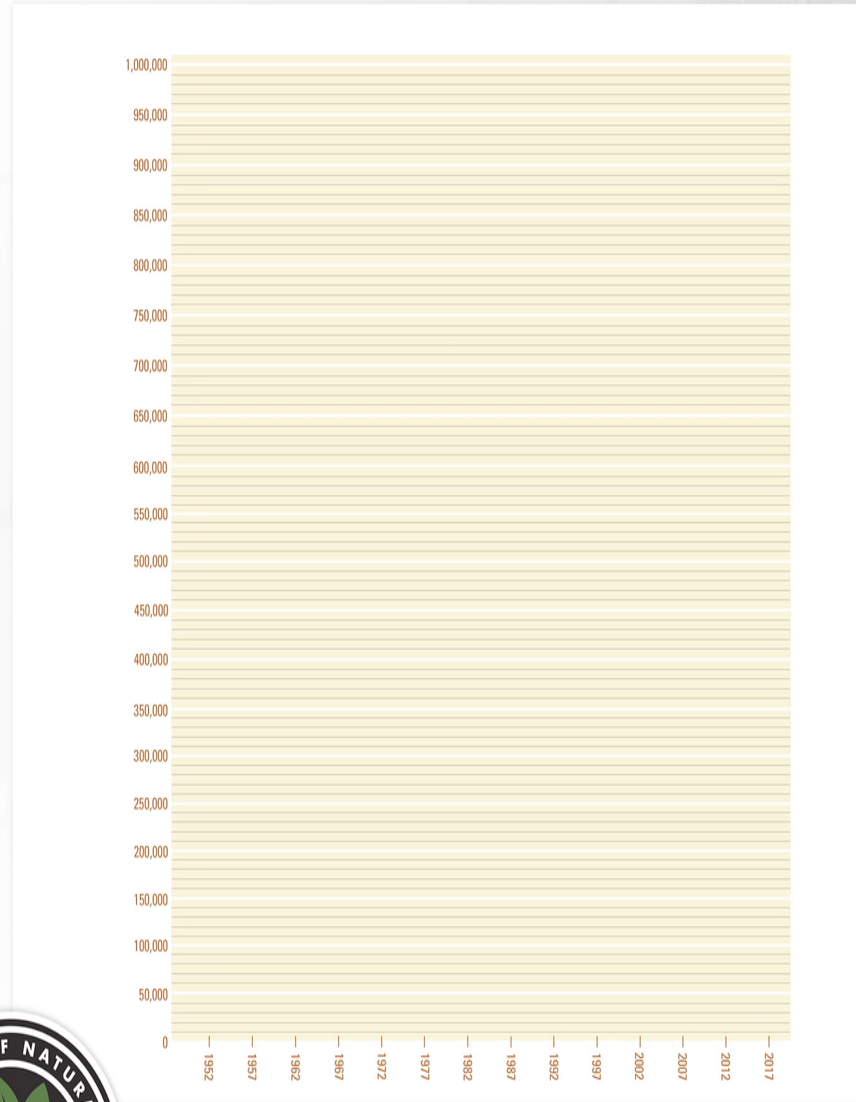
Regulatory Constraints

- Record submittal
 - Summary: Well completion report
 - Pump pressure and volume charts by stage
 - Job invoice
 - Fluid source
 - Total Volume
- Wastewater Management
 - Class II injection
 - Treat and recycle



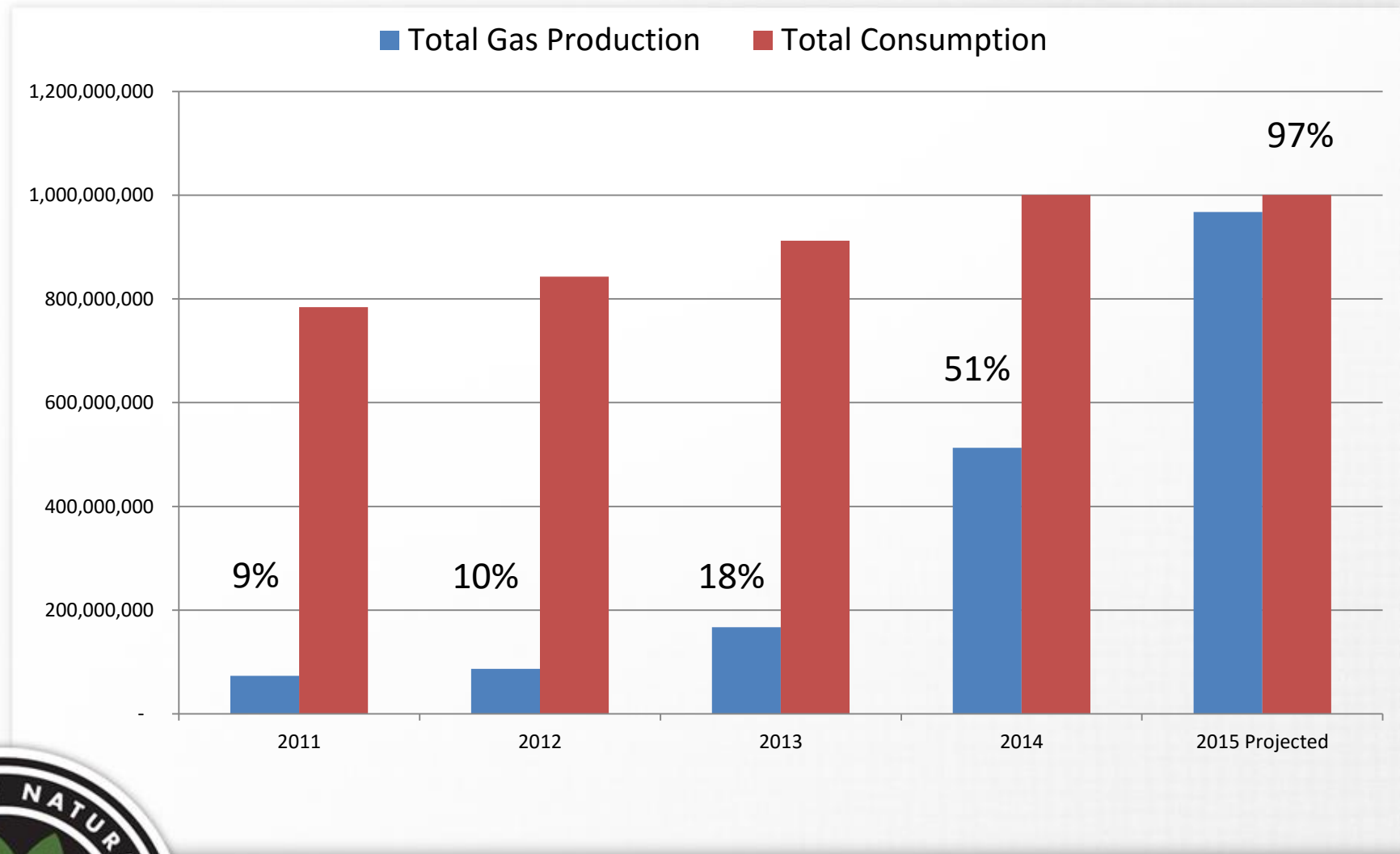
Historic Gas Production (1952-2015)

Total Amount of Gas Production (Mmcf)



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NATURAL RESOURCES

Ohio Natural Gas Production and Consumption





North American Areas of Operation

RESERVES & PRODUCTION

2014 Reserves: 10,747 Bcfe

2014 Production: 768 Bcfe

2015 Estimated Production: 973-982 Bcfe



NORTHEAST APPALACHIA

2014 Reserves: 3,192 Bcf (30%)

2014 Production: 254 Bcf (33%)

Net Acres: 312,773 (Jan 2015)⁽¹⁾



SOUTHWEST APPALACHIA

2014 Reserves: 2,297 Bcfe (22%)

Dec 2014 Production: 370 Mmcfe/d

Net Acres: 443,376 (Jan 2015)⁽²⁾



FAYETTEVILLE SHALE

2014 Reserves: 5,069 Bcf (47%)

2014 Production: 494 Bcf (64%)

Net Acres: 888,161 (12/31/14)

NEW VENTURES



EXPLORATION

Sand Wash Basin – Approx. 376,000 net acres

Brown Dense – Approx. 304,000 net acres

New Brunswick – Approx. 2.5 million net acres

Other New Ventures – Approx. 982,000 net acres



⁽¹⁾ Includes approximately 46,700 net acres that were acquired as part of transaction closed in January 2015

⁽²⁾ Includes approximately 30,000 net acres that were acquired as part of transaction closed in January 2015

What is the Path to Sustainability?

- Maintaining our ability to operate
 - Working with Regulators at the State and Federal level
 - Understanding community values, knowledge, attributes and perceptions
 - Managing local impacts
 - Continued innovation which is nothing more than creativity in action
- It also means managing the current “hot button” issues
 - Water
 - Air
 - Community

Southwestern Energy

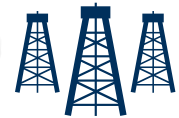
WATER



Model Regulatory Framework



AIR



Advancing Leak Detection Technology

LAND



Street Smart
Southwestern Energy



Stream Smart
Erosion Control Training

“In God We Trust, All Others Must Bring Data” - A Distribution Utility’s Perspective

Magnus Borg

Chief Information Officer

NiSource Inc.

February 16, 2016



Chief Information Officer (CIO) Magnus Borg



Magnus Borg is chief information officer for NiSource, Inc.

Borg assumed this role following the separation of Columbia Pipeline Group from NiSource during 2015. He brings extensive background in IT Strategy, innovation, project execution and management having led IT departments initiatives for several national and international corporations.

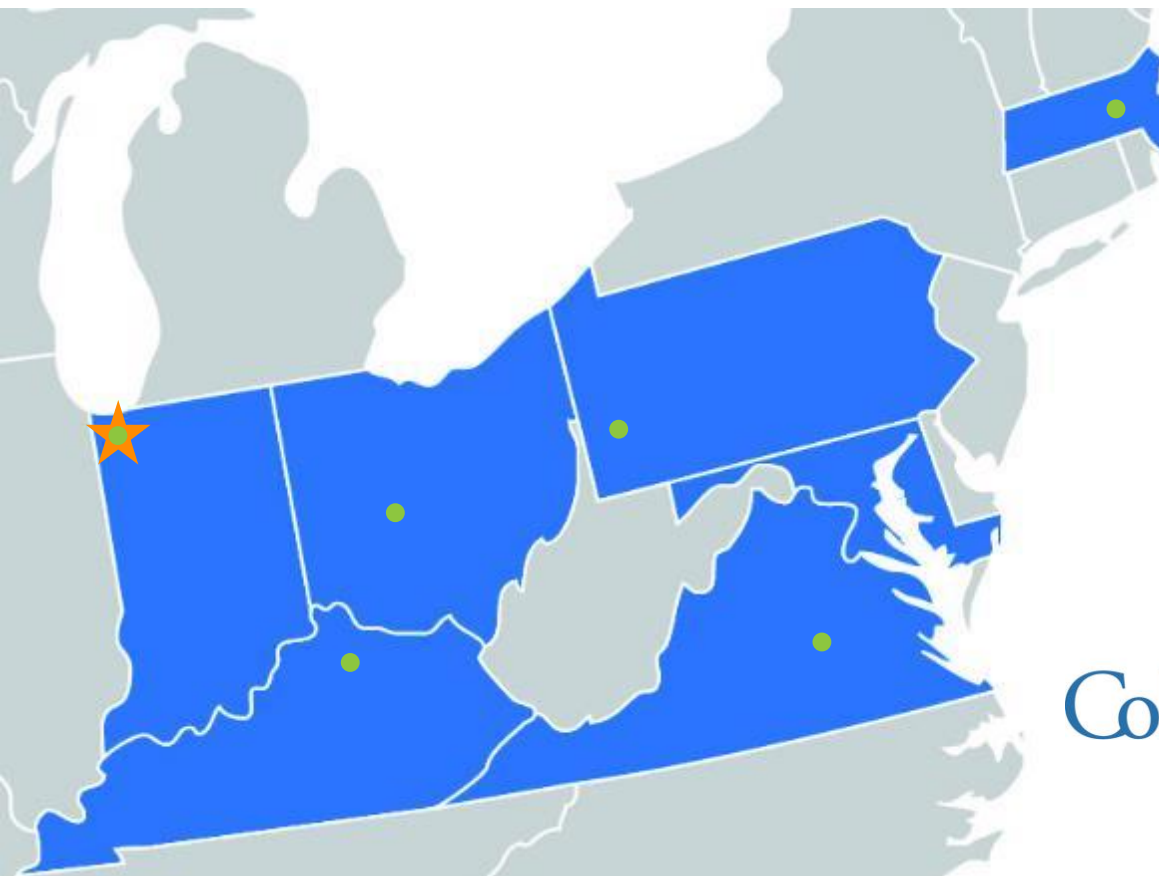
Prior to joining NiSource in July 2015, Borg was a senior advisor at PricewaterhouseCoopers LLP (PWC) where he focused on IT strategy, technology roadmaps and governance for various industries, including utilities. He has also held various leadership roles with Sigma-Aldrich Inc. (CIO); Safety-Kleen Inc. (CIO); Ericsson Inc. (senior vice president of new sales and CIO for North and South America); and Scandinaviska Enskilda Banken (General Manager), a global bank with headquarters in Sweden.

Borg is recognized for his knowledge in the areas of analysis, evaluation and negotiation. During his time in the IT industry (25+ years), Borg have managed IT strategy, organizational changes, new software/hardware platforms, Sarbanes-Oxley compliance, Security, vendor alignment and business process changes.

He has served as a member of the IT Advisory Board at Southern Methodist University in Dallas, Texas. He also served on the Verizon Advisory Board and Dell Advisory Board and chairman of CITA (International Motor Vehicle Inspection Committee) with consultancy status within the Economic and Social Council of the European Union.

Focused on Top-Tier Customer Satisfaction

An Industry-Leading Natural Gas and Electric Utility Company



- 7-State Footprint
- ~7,500 Employees
- ~3.5M Natural Gas Utility Customers
- ~500K Electric Utility Customers
- ~\$30B, 20+ Year Infrastructure Enhancement Plan
- Measure customer data in terabytes

Columbia Gas®

NIPSCO

One of the Nation's Largest Natural Gas Distribution Companies



Corporate Headquarters



State Utility Headquarters

Source

Cybersecurity Landscape

- **Types of Incidents for top 5 industries**

- Malicious code
- Sustained probe/scan
- Unauthorized access
- Suspicious activity
- Access or credential abuse
- Denial of service

Top 5 Industries	
1	Finance & Insurance
2	Information and Communication
3	Manufacturing
4	Retail & Wholesale
5	Energy & Utilities

- **Who are initiating the incidents?**

Outsiders – Organized crime, Nation states, Hacktivists

Malicious insiders – Employees with own motive

Unintended actors – Honest mistakes by employees

Unauthorized access incidents doubled from 2013 to 2014 accounting for 37% of the total Energy and Utilities edged out Health and Social Service for fifth place

Cybersecurity (examples)

Category	Key Activities
Strategy, Governance & Management	Identified roles and responsibilities Implemented Committees and Core Team Periodic read outs to a board
Security Training and Awareness	Purchased and distributed training modules Launched End User Awareness program Release of articles Periodic Phishing exercises and awareness assessments
Risk and Compliance	Alignment of a Framework (NIST etc.) Periodic IT Security Policy Updates
Incident and Crisis Management	Formalized incident & crisis management procedures File formal Cyber incident response plans Conducted annual table top and field exercises
Information & Privacy Protection	Process/procedure creation for data privacy & protection review Implementation of data loss prevention technology Update Contract to include Cybersecurity language
Identity & Access Management	Implemented multi-factor authentication solution for remote access Privileged Access Manager selection and implementation
Threat, Intelligence & Vulnerability Mgt	Internal and external penetration testing and possible remediated Selection of tool(s) for Access Control to block unauthorized devices Limit end user administrator rights to reduce spread of malware Implement internal penetration testing capability
Security Architecture and Services	Identified Security Event and Incident Management technology Physical security remediation at facilities Formalize application security standards

Cyber security as an holistic view

An Industry-Leading Natural Gas and Electric Utility Company

Balanced Strategic Priorities

- Enhance value to our customers and communities
- Build, maintain and operate a safe, reliable and efficient system
- Aligned, engaged employees, business partners and operations
- Financial discipline for our stakeholders



Delivering on Our Commitments

- Approximately \$1.4 billion in annual investments to systematically maintain reliability and further improve safety
- Elevating our customers' experience through new technology and system improvement
- Ongoing improvement of employee safety records and sustained solid employee engagement metrics
- Improving customer satisfaction ratings
- Sustainable earnings per share (non-GAAP) and dividend growth projected at 4-6% annually

2012 WORLD'S MOST
ETHICAL
COMPANIES
WWW.ETHISPHERE.COM

2013 WORLD'S MOST
ETHICAL
COMPANIES
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MEMBER OF
Dow Jones
Sustainability Indices
In Collaboration with RobecoSAM

2014 WORLD'S MOST
ETHICAL
COMPANIES™
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2015 WORLD'S MOST
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