Assessing the Perceived and Real Environmental Consequences of Shale Gas Development

Report on an Initiative of the Energy Institute
The University of Texas at Austin

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Why Shale Gas?

- Shale gas increasingly important as energy source worldwide – now 1/3 of gas resource in U.S.
- Concerns about environmental effects must be addressed with effective, fact-based regulations and controls.
- Some of the claims about shale gas development effects may be overstated or not based on good science.

Shale Gas: The Changing Picture

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- Current resource estimate: 862 Tcf
- Doubled from 2010 to 2011
- Annual production 4.8 TCF in 2010
- Increased 5-fold from 2006 to 2010
- Currently 23% of natural gas production
- Expected to increase to 46% by 2035
- By almost any measure a “game changer”

Shale Gas Occurrences in the U.S.

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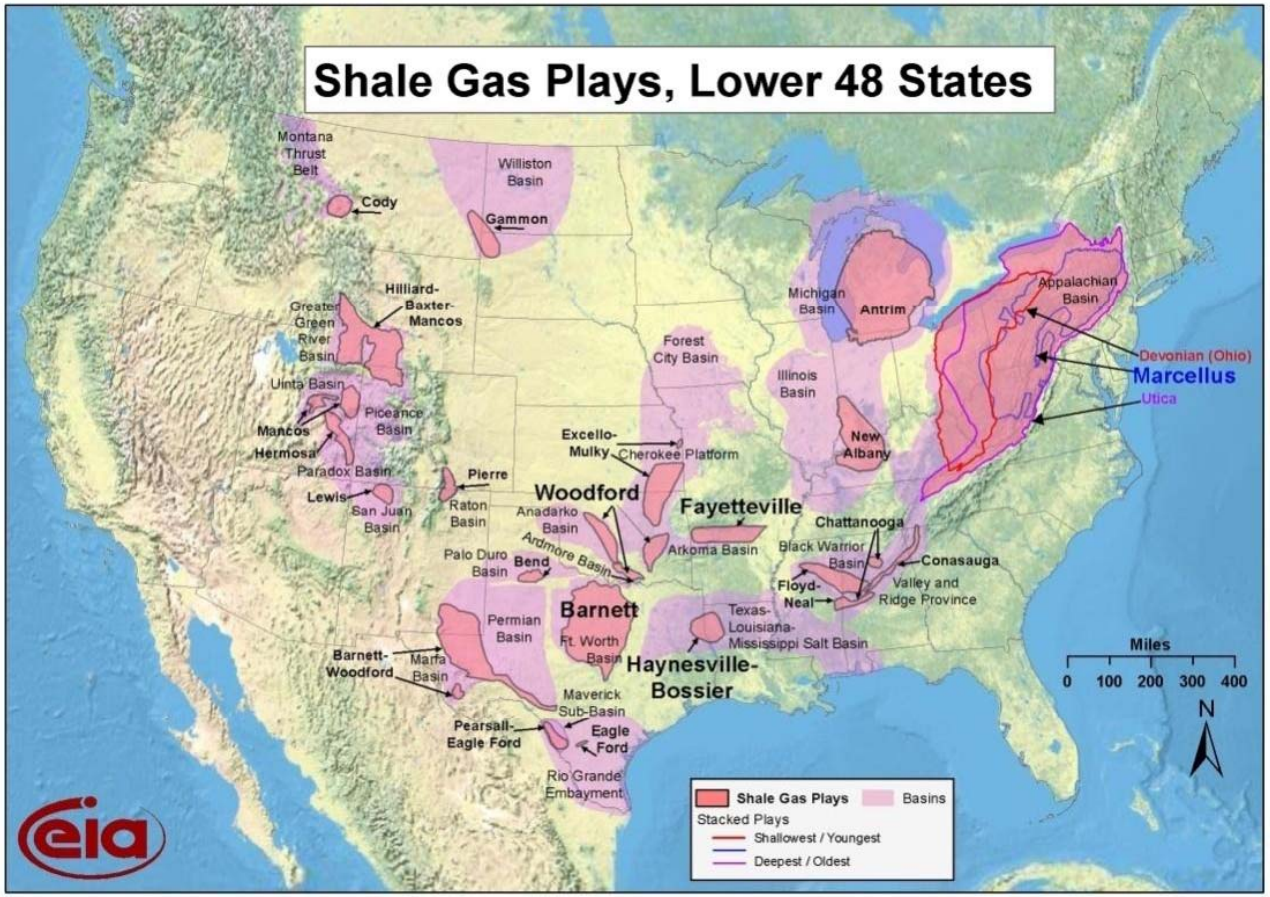

Source: Energy Information Administration based on data from various published studies.
Updated: March 10, 2010

Source: U.S. EPA Draft Plan

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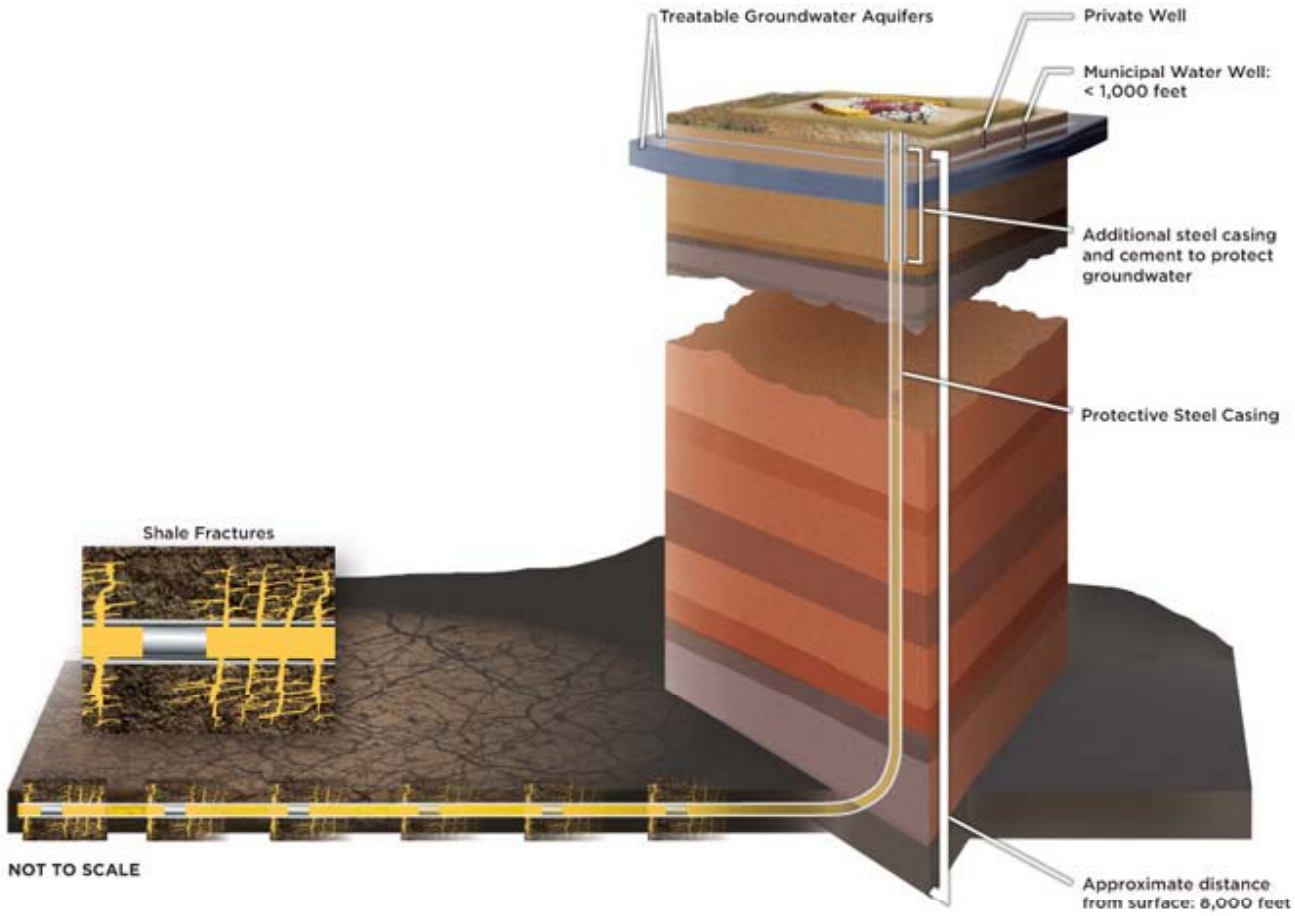
Shale Gas Operations



Source: Chesapeake Energy

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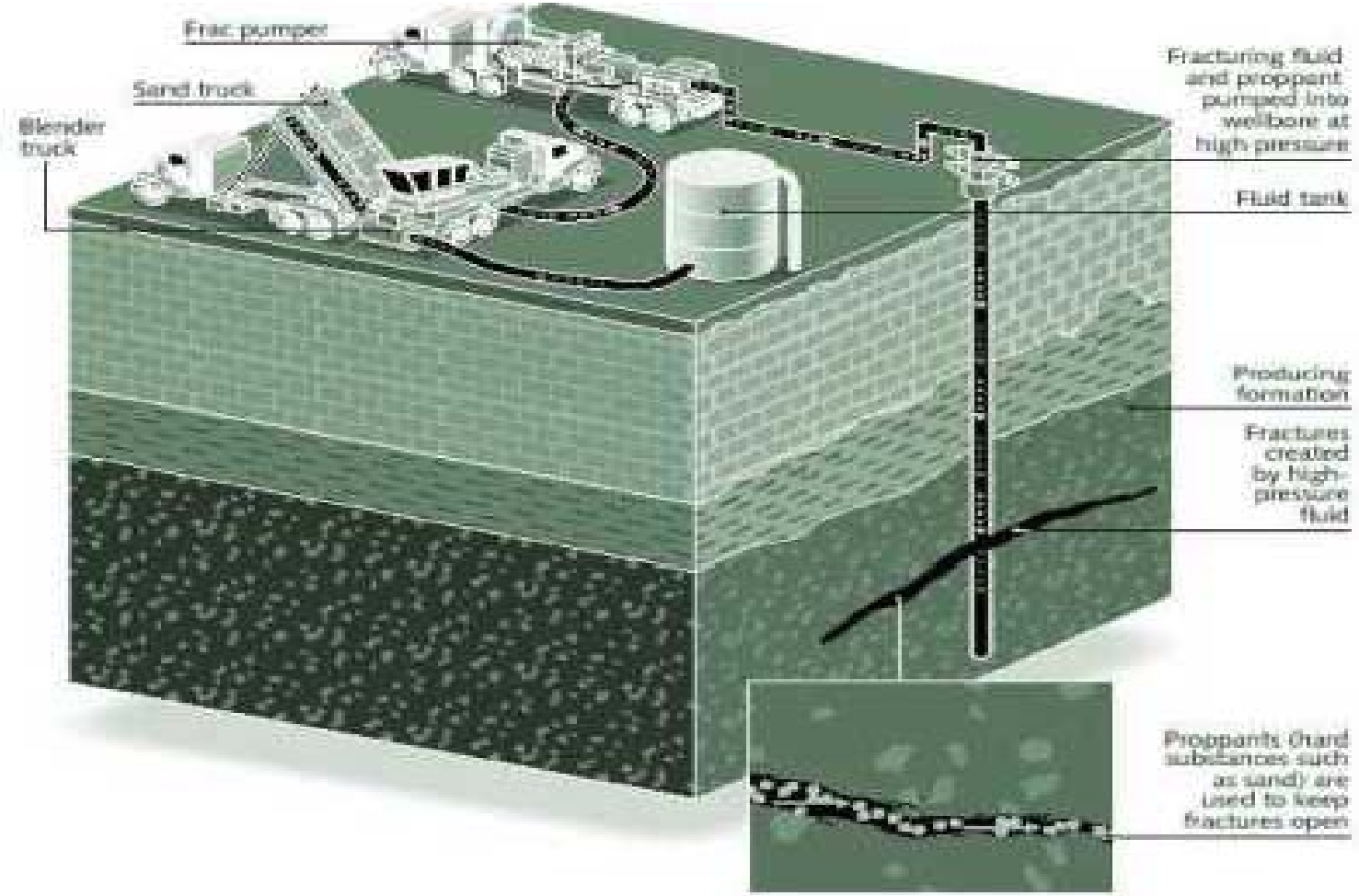
Hydraulic Fracturing



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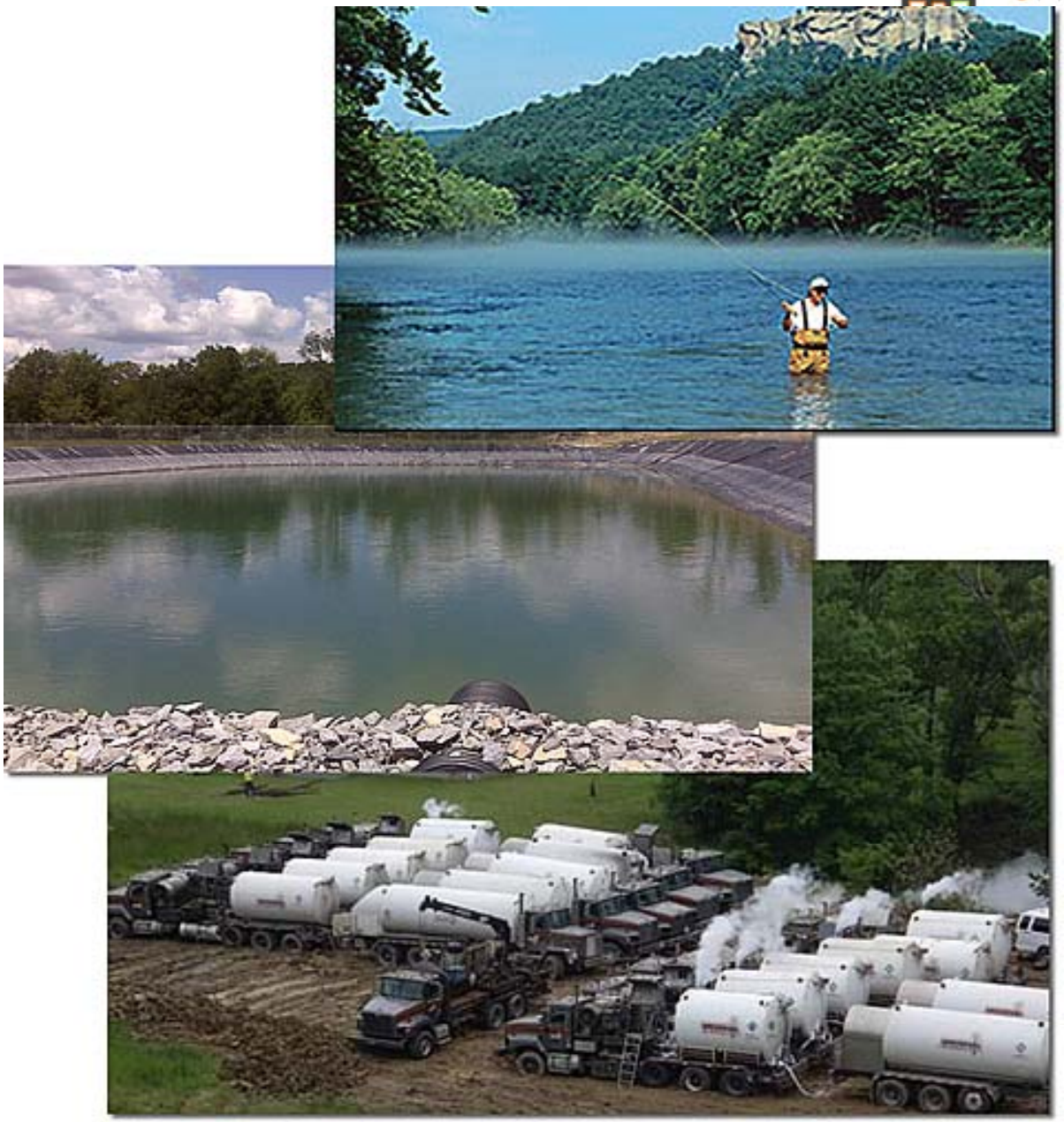

Challenges of Shale Gas Development

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- Water Quality Impacts
- Water Consumption Impacts
- Seismic Events
- Air Quality Impacts
- Landscape Effects
  - Drill pads
  - Truck traffic
  - Production and transportation infrastructure

Life Cycle of Water in Hydraulic Fracturing

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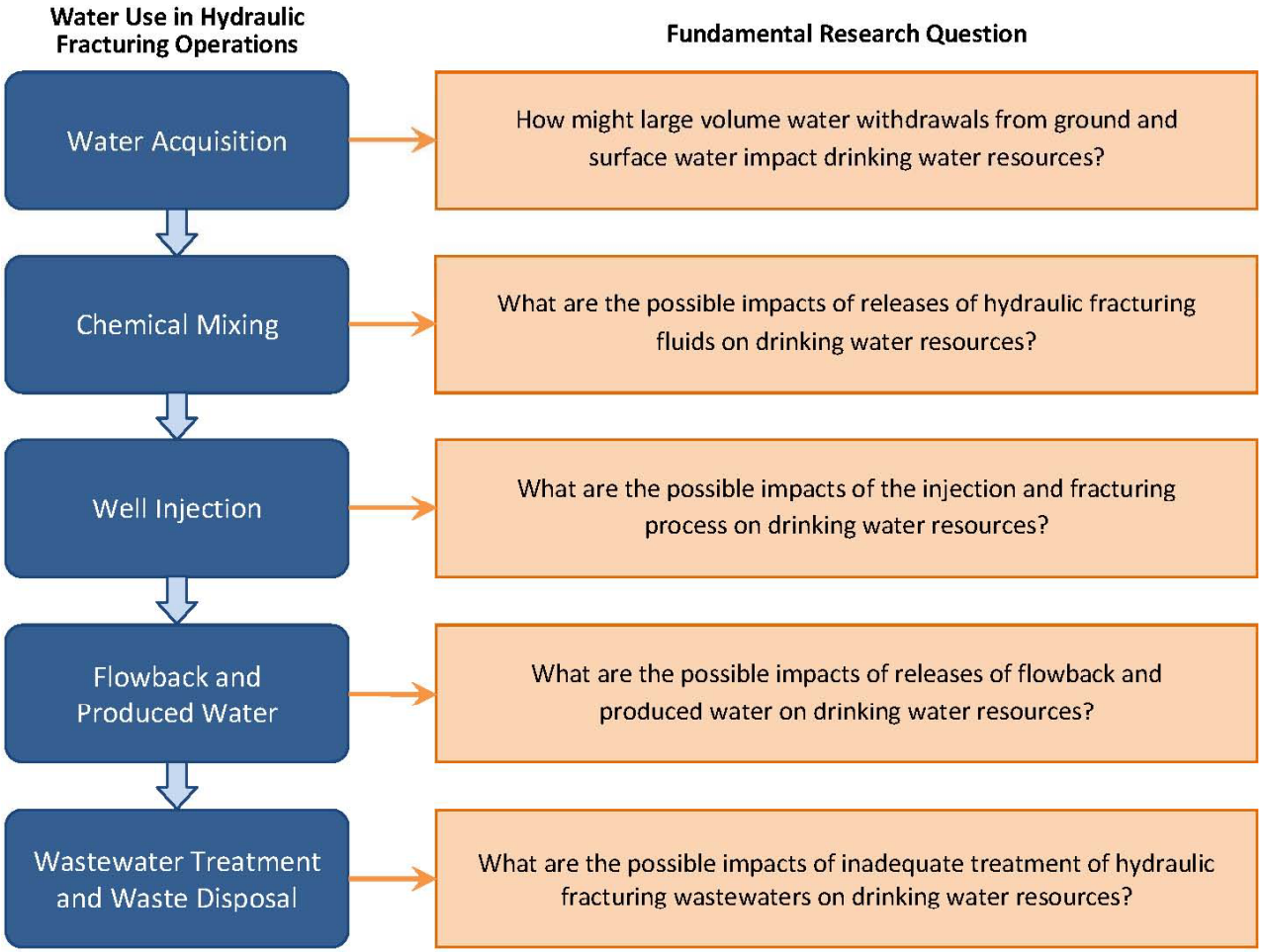

Source: U.S. EPA Draft Plan

Energy Institute Initiative Goals

- Achieve effective communication leading to fact-based regulation and public understanding
- Promote policies and regulations that are grounded in science
  - Provide products that effectively communicate with policy makers and regulators

How Was the Initiative Performed?

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1. Funding provided by Energy Institute
2. Engaged multi-disciplinary team members
3. Developed team member contributions – white papers. Outside review of papers.
4. Integrated individual contributions into a policy-maker-oriented final report and other products

The University of Texas at Austin: Campus-wide Participation

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- Jackson School of Geosciences
- UT Bureau of Economic Geology
- UT and Tulsa Schools of Law
- UT School of Communication
- Energy Institute
- Environmental Defense Fund

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Scope and Methods

1. Review claims in media
2. Evaluate claims and impacts geographically
3. Review technical literature on shale gas impacts
4. Review current regulations and records of violations
5. Three plays: Barnett, Haynesville, Marcellus

Initial Report; Addendums Anticipated

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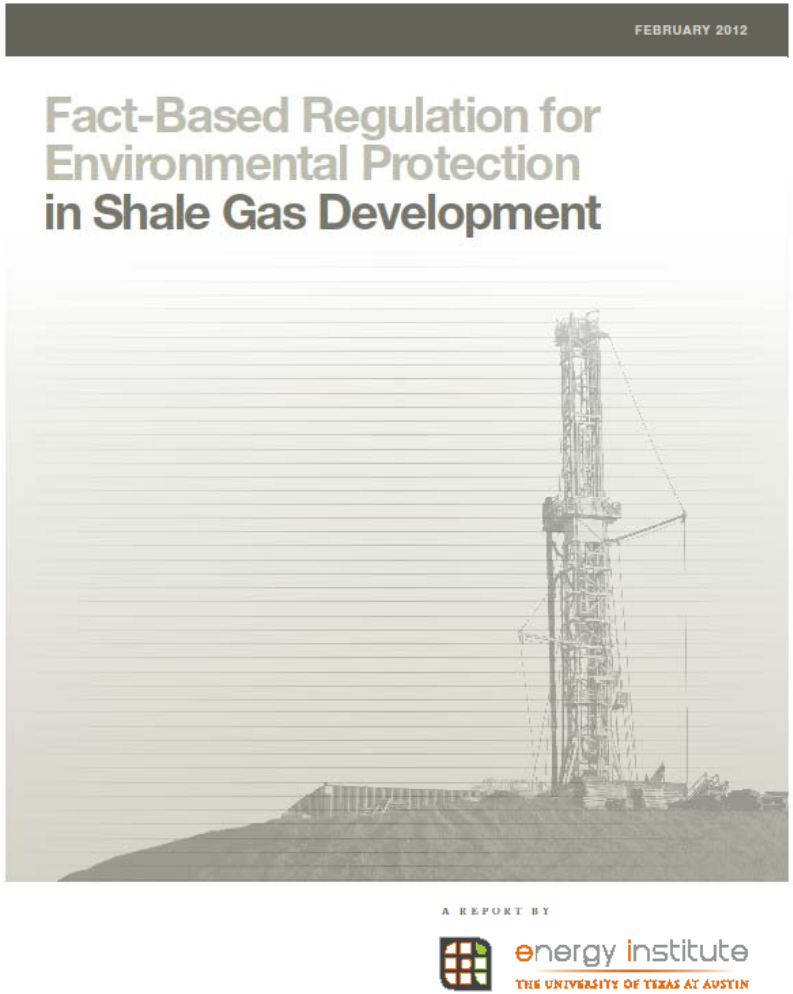
AAAS, Vancouver, February, 2012



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Assessment of Hydraulic Fracturing News: Coverage

- Newspapers
- Television
- Radio
- Online News

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Tone of Media Coverage

	Negative	Neutral	Positive
National Newspapers	64%	25%	12%
Local Newspapers	65%	23%	12%
National Television and Radio	64%	19%	18%
Local Television	70%	27%	3%
Online News	63%	30%	7%

Assessment of Public Perception

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- Online research method
- 1473 respondents
- 26 counties in Barnett Shale area
- About 75 questions
- Three areas surveyed
  - Attitude toward hydraulic fracturing
  - Knowledge of hydraulic fracturing
  - Media habits

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Public Perception Findings: Hydraulic Fracturing Attitudes

- Survey responses indicate that hydraulic fracturing is...
  - Valuable
  - Productive
  - Not foolish
  - Good
  - Beneficial
  - Positive
  - Somewhat helpful
  - Somewhat effective
  - Good for the economy
  - Important to the US economy
  - Important overall
- Responses also indicate that hydraulic fracturing is...
  - Bad for the environment
  - Unsafe

Shale Gas Development Cycle for Regulation

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1. Exploration/testing
2. Locating of well pad
3. Constructing well pad and facilities
4. Transporting equipment, fluids
5. Drilling and casing
6. Controlling air emissions
7. Withdrawing water
8. Fracturing the shale
9. Preventing spills
10. Testing and replacing water supplies
11. Storing waste
12. Disposing of waste
13. Remediating the site

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Regulation of Shale Gas Development: Coverage

- Federal and State Regulations addressed
- Full cycle of shale gas well construction included
- Sixteen states with current or pending shale gas production
- Most regulatory authority lies with states
- Majority of state regulations were written before shale gas development

Major Regulation Findings

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- Evaluation of state enforcement is hindered by several factors
  - Differing methods of recordkeeping for violations and enforcement actions
  - Variances in the completeness of records
  - Responsiveness of agencies to information requests.
- Capacity is variable, but most states have capacity to address a variety of complaints, inspection, and enforcement actions

Major Regulation Findings (continued)

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- Recent regulatory focus on three concerns
  - Proper casing of shale gas wells
  - Disclosure of content of fracturing solution
  - Proper management of flowback and produced water
- More consistency among states for similar regulatory requirements is needed
- Organizations are in place to enhance state O&G regulations (e.g., GWPC, STRONGER)

Major Regulation Findings (continued)

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- Regulations should address all stages of shale gas development
- Regulations need to focus on highest priority issues
  - Greater emphasis needed on surface events - less on hydraulic fracturing risks
- Surface effects easier to identify
  - Less likely to detect subsurface effects without sampling (not common)
  - More baseline information needed on surface-water and groundwater quality

Violations - General Observations

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- Many of the violations (58%) are procedural and:
  - represent no environmental effects, or
  - are minor with no environmental effects
  - represent minor effects, such as small releases
- Many of the effects noted occur in all types of oil and gas well development – not unique to shale gas
- Fractured wells may experience more incidents because of additional equipment on the site

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Violation Types

- In the areas studied there was no evidence of hydraulic fracturing itself causing contamination of groundwater
- Surface spills, improper disposal of oil and gas wastes, and problems with leaking pits or tanks
  - Relatively common violation
  - Can be prevented
- Upper wellbore issues – casing and cement problems – pose the greatest threat to groundwater

Major Environmental Findings

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- Methane reports in water wells from natural sources in many cases (e.g., Marcellus)
- Claims of well impacts often involve natural constituents (e.g., Fe, Mn)
- May be mobilized by vibrations, other energy from drilling (methane also)
- Subsurface blowouts may lead to house explosions in rare cases

Major Environmental Findings (continued)

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- Flowback water needs to be reused more to water quality reduce impacts and water demand
- Formation water produced with flowback has high TDS, etc. that are challenging for recycling
- Water requirements for HF are substantial (3 to 6 million gallons per well)
- Water consumption should be evaluated in comparison to other users and demands
- Consumption issues exacerbated by drought conditions in Texas

Health Impacts Perspective

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- To what degree do documented environmental violations impact health?
- What are the pathways for shale gas development related contaminants to result in human exposure?
- What are the quantity and quality of data available to substantiate health impact claims?
  - What are baseline conditions and pathways?

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Summary

- Interdisciplinary approach to fact-based regulation
- Findings indicate a “disconnect” in certain areas between science, actual violation types, and perceptions
- Many claims appear not to be based on science – greater emphasis needed on the facts for regulation
- Will be a supplement: air quality, seismic events