Morgan Lewis

Hydraulic Fracturing and Wetlands Practical Considerations

Texas Wetlands Conference
January 9-10, 2014
Austin, Texas

Introduction

North American Shale Plays

Hydraulic Fracturing

Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
Updated: May 9, 2011

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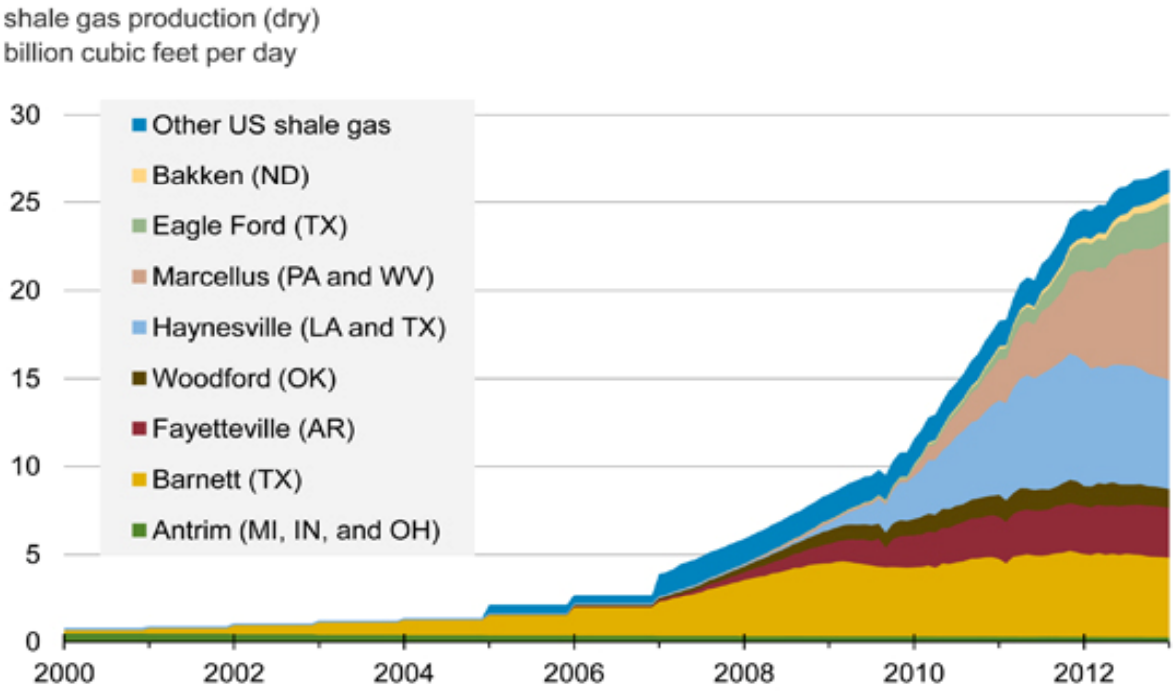
North American Shale Plays

Hydraulic Fracturing



Sources: LCI Energy Insight gross withdrawal estimates as of January 2013 and converted to dry production estimates with EIA-calculated average gross-to-dry shrinkage factors by state and/or shale play.

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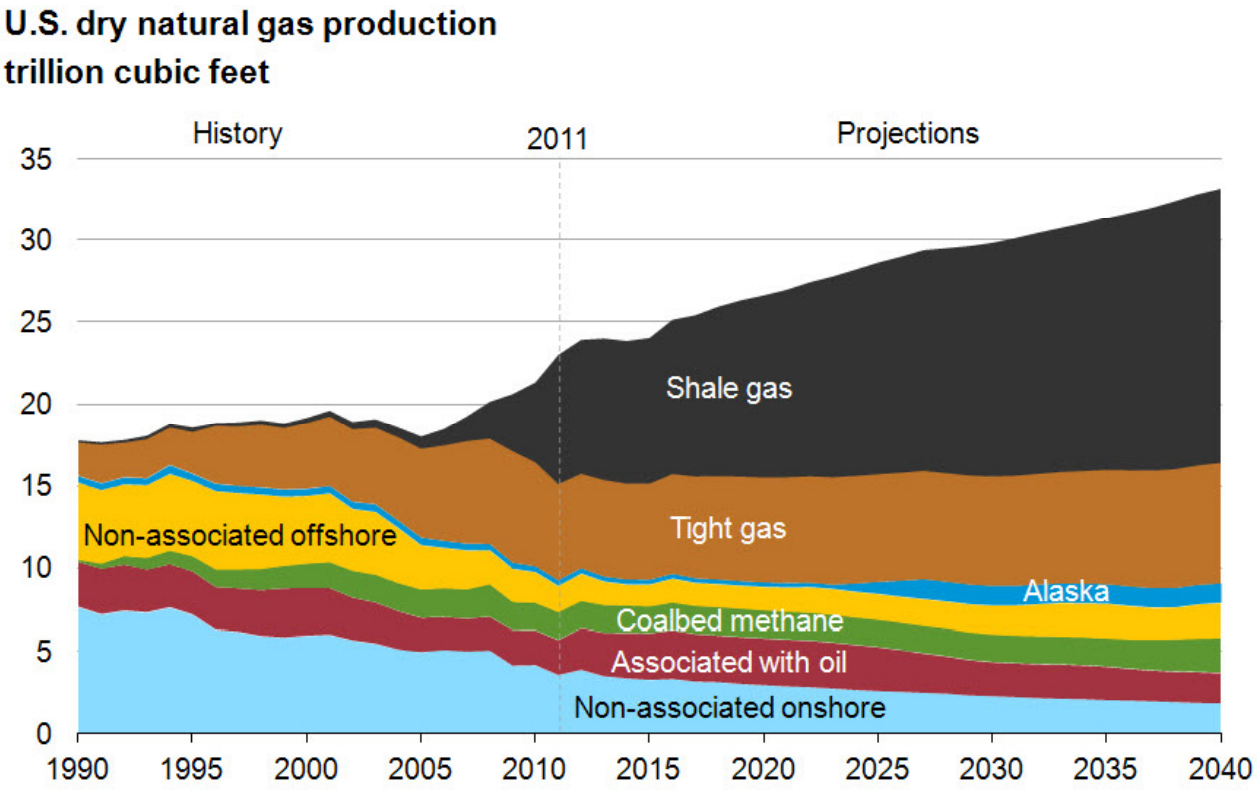
North American Shale Plays

Hydraulic Fracturing



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2013 Early Release*

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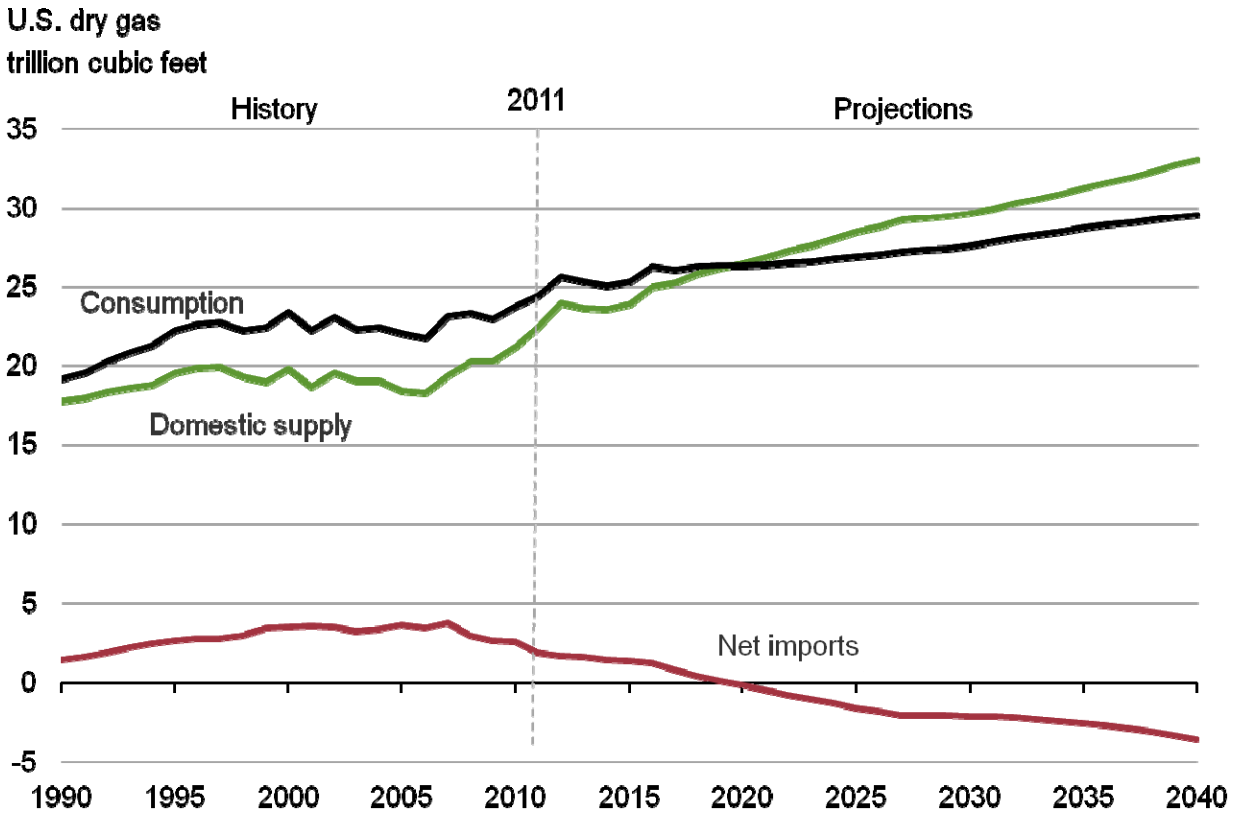

Source: EIA, Annual Energy Outlook 2013

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Hydraulic Fracturing

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North American Shale Plays

Hydraulic Fracturing

	Recoverable Shale Oil		Recoverable Shale Gas	
Rank	**Country**	**BBL**	**Country**	**TCF**
1	Russia	75	China	1115
2	United States	58	Argentina	802
3	China	32	Algeria	707
4	Argentina	27	United States	665
5	Libya	26	Canada	573
6	Australia	18	Mexico	545
7	Venezuela	13	Australia	437
8	Mexico	13	South Africa	390
9	Pakistan	9	Russia	285
10	Canada	9	Brazil	245
	World Total	**345**	**World Total**	**7299**

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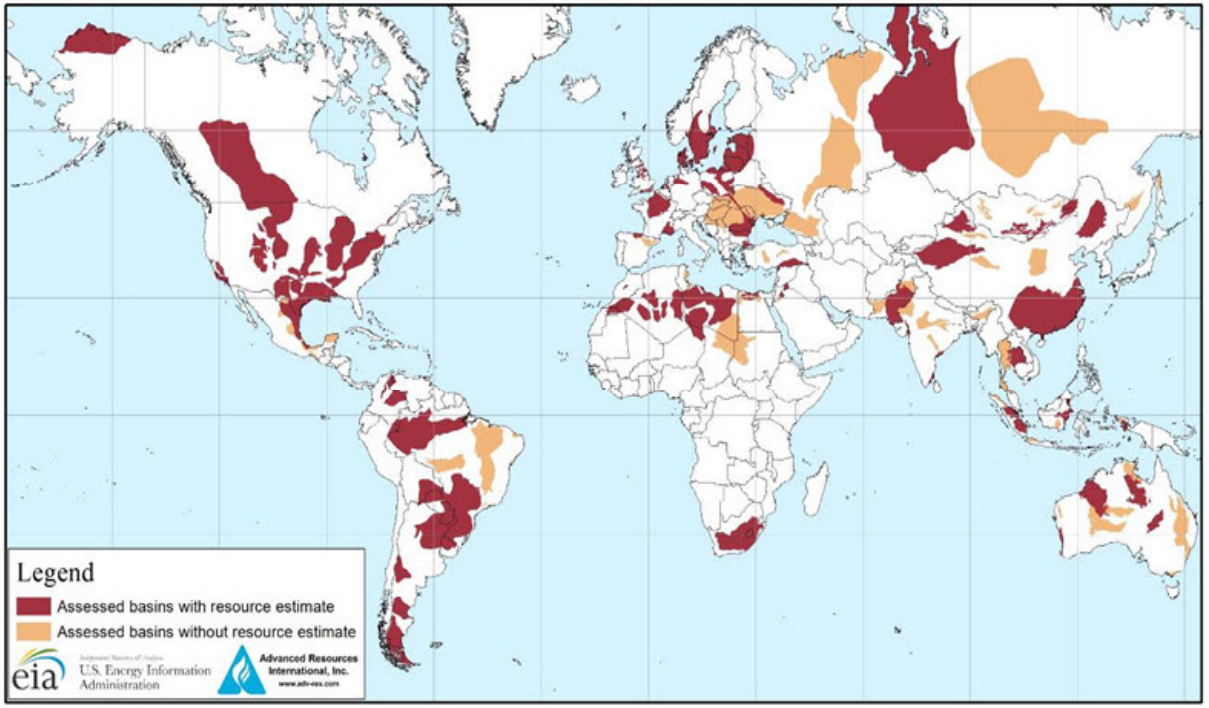
North American Shale Plays

Hydraulic Fracturing

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.

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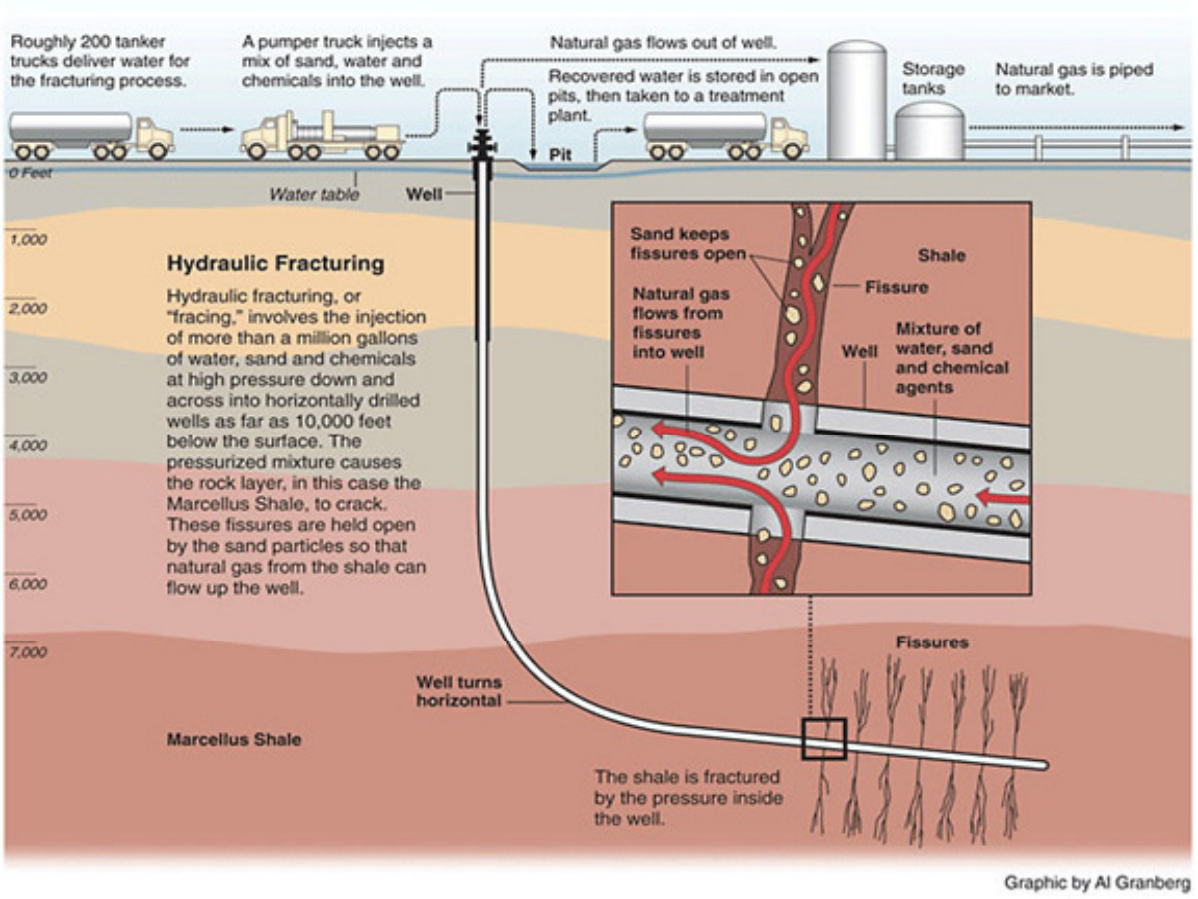

Graphic by Al Granberg

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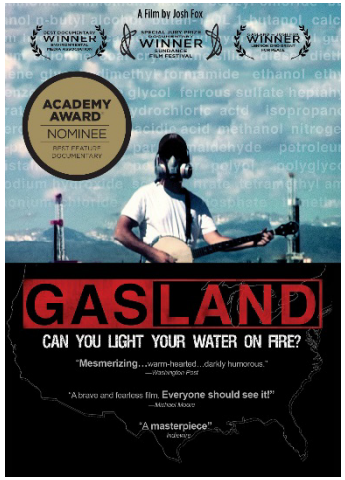

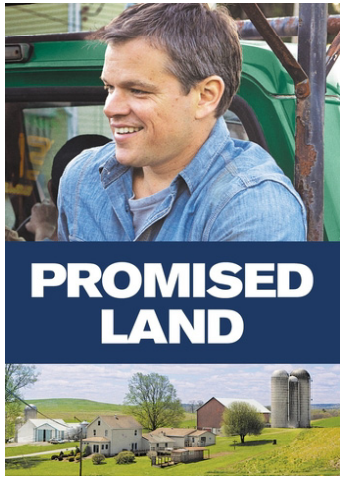

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Introduction

Evaluation

Seismic Testing, Geological Analysis, Well Data Evaluation

Drilling

Engineering, Cementing, Directional Drilling, Waste Management, Fluid Systems & Products

Completion

Perforation, Fracturing Stimulation, Tubing, Installation of Wellhead

Production

Extraction, Re-Fracturing

Environmental Management

Sources of Environmental Risk

Potential Consequences

Regional Considerations

Stakeholder Leadership

- Water
- Waste
- Permitting & Approvals
- Stage-Specific Issues
- Local Concerns
- Regional Considerations

Environmental Management

Sources of Environmental Risk

Potential Consequences

Regional Considerations

Stakeholder Leadership

- Health and Environment
- Relationships
  - Clients
  - Investors
  - Government
  - Public
- Financial Losses
- Legal Liabilities

Environmental Management

Sources of Environmental Risk

Potential Consequences

Regional Considerations

Stakeholder Leadership

- Natural Conditions
- History
- Demographics
- Economics
- Infrastructure
- Regulations
- Politics
- Public Perception

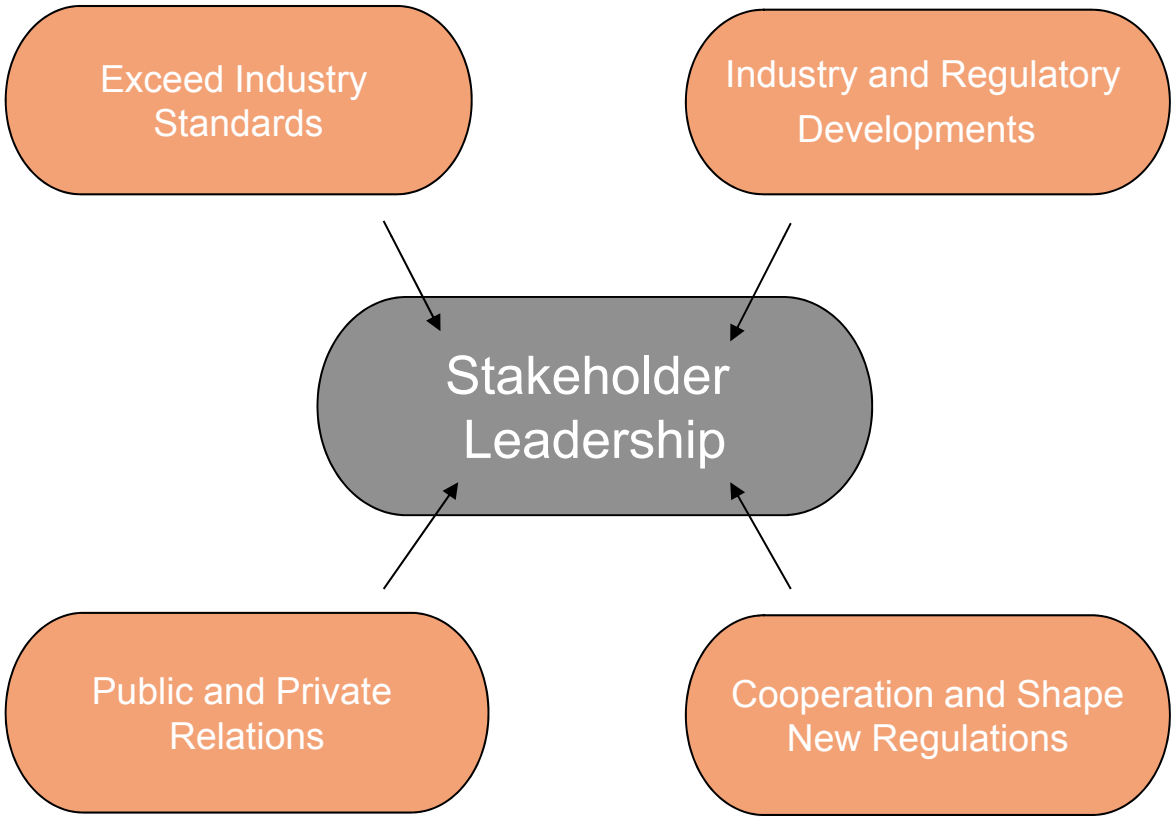
Environmental Management

Sources of Environmental Risk

Potential Consequences

Regional Considerations

Stakeholder Leadership



Sources of Environmental Risk

Evaluation

- **Water**
- Permitting & Approvals
- Project Siting

- Impact to Water Resources
  - Potential Pathway for Surface Contaminants to Contact Groundwater
  - Potential Pathway for Waters from Sub-Surface Formations to Commingle with Surface Waters
- Minimal Generation of Produced Water
- Nominal Water Consumption for Exploratory Operations

Sources of Environmental Risk

Evaluation

- Water
- **Permitting & Approvals**
- Project Siting

- Permit Process
  - Unpredictability and Inconsistency
  - Timing, Costs, and Public Participation
  - Conditions & Restrictions (e.g., Siting)
  - Third-Party Challenges
  - Enforcement
- Local Restrictions and Prohibitions
  - Variability of Local Ordinances
  - Variability of State Preemptive Power
- Political Influence on the Process

Sources of Environmental Risk

Evaluation

- Water
- Permitting & Approvals
- **Project Siting**

- Wide Range of State and Local Restrictions
  - Wetlands, Watersheds, Streams and Springs, Cultural and Historical Resources, Protected Habitats, H_2S Formations, Drinking Water Supplies, Public Resources (e.g., Parks, Wildlife Areas, Game Lands), Floodplains, Natural Resources (e.g., Coal Seams)
- Siting Restrictions Can Vary Significantly

	Setback – Buildings (ft.)	Setback – Water Sources (ft.)
Ohio	100 – 200	50
Pennsylvania	500	300 – 1000 (Depending on Type of Water Body)
North Dakota	500	Performance-Based Setback Restrictions
Colorado	500	Applicable Only for Designated Water Sources (Varies)

Sources of Environmental Risk

Drilling

- **Water**
- Waste
- Permitting & Approvals
- Protests / Activism

- Site and Access Road Preparation
  - Stormwater Flows, Wetlands / Stream / Protected Habitats
- Drilling Equipment Operation at Surface
  - Drilling Fluids and Cuttings
- Drilling of Vertical and Lateral Wellbore
  - Methane, Drilling Fluids and Cuttings, Saline Water Migration
- Casing and Cementing
  - Methane, Drilling Fluids and Cuttings, Saline Water Migration
- Venting / Flaring
  - Drilling Fluids and Cuttings
- Storage of Drilling Fluids
  - Drilling Fluids and Cuttings

Sources of Environmental Risk

Drilling

- Water
- **Waste**
- Protests / Activism
- Regional Considerations

- Characterization
  - Waste Designation Triggers Liability Concerns and Regulatory Obligations
- Categories
  - Flowback / Produced Water / Drilling Fluids
  - Radioactive Waste (TENORM)
- Management
  - Storage
  - Transport
  - Disposal

Sources of Environmental Risk

Drilling

- Water
- Waste
- **Protests / Activism**
- Regional Considerations

- Interference with Operations
- Publicity
- Impact to Reputation
- Impact to Community and Government Relations
- Legal Actions
- Political Impacts
  - Bans and Moratoria – (e.g., Ohio and Colorado)
  - Restrictive Local Ordinances – (e.g., Pennsylvania)

Sources of Environmental Risk

Drilling

- Water
- Waste
- Protests / Activism
- **Regional Considerations**

Marcellus Shale (PA)

- Pre-Drill Water Test Optional (Relevant for Liability)
- Cement Type Regulated
- Coordination between Oil and Gas and Coal Operations Regulated

Utica Shale (OH)

- Moratoria / Strict Ordinances
- Pre-Drill Water Test Required (Specified Distance)
- Cement Type Regulated

Bakken Shale (ND)

- Pre-Drill Water Test Required (Specified Distance)
- Cement Type Not Regulated

Niobrara Shale (CO)

- Moratoria / Strict Ordinances
- Pre-Drill Water Test Required
- Cement Type Not Regulated

Sources of Environmental Risk

Completion

- **Water**
- Permitting & Approvals
- Regional Considerations

- Use of Surface Water / Groundwater
  - Freshwater Withdrawals / Invasive Species
- Hydraulic Fracturing
  - Fracturing Fluids
- Introduction of Proppant
  - Fracturing Fluids / Proppants
- Flushing of the Wellbore
  - Fracturing Fluids / Proppants / Methane
- Flowback
  - Flowback / Produced Water / Hydrogen Sulfide
- Storage of Fracturing Fluids
  - Fracturing Fluids
- Stormwater Flows at the Site

Sources of Environmental Risk

Completion

- Water
- **Permitting & Approvals**
- Regional Considerations

- Risks Similar to Drilling Risks
- Practical Considerations
  - Permitting Risks Can Influence the Ability to Coordinate and Plan Present and Future Operations
  - Permitting Decisions Based on Short-Term Needs May Hamper Future Operations and Invite Liability
    - *E.g., Agreeing with the Regulator a Permit is Required Limits Future Options for the Company and Industry*
  - Care Must be Taken in the Permitting Process to Avoid Unintended Consequences
    - *E.g., Agreeing a Substance is a Waste May Negatively Impact Public Relations Efforts as well as Pending Disputes / Negotiation with the Regulator*

Sources of Environmental Risk

Completion

- Water
- Permitting & Approvals
- **Regional Considerations**

Marcellus Shale (PA)	Utica Shale (OH)
- Hydraulic Fluid Disclosure Required - Fluid Storage Pits and Tanks Regulations in Rulemaking - Pit Liner Required	- Hydraulic Fluid Disclosure Required -Permit Required for All Fluid Storage Pits and Tanks - Pit Liner Requirements not Specified
Bakken Shale (ND)	**Eagle Ford Shale (TX)**
- Hydraulic Fluid Disclosure Required - Storage Tanks Required for Some Fluids (e.g., Saltwater) - Pit Liner Required	- Hydraulic Fluid Disclosure Required - Fluid Storage Pits and Tanks Permitted - Pit Liner Requirements Addressed in Permit

Sources of Environmental Risk

Production

- **Water**
- Permitting & Approvals

- Well Production
  - Flowback / Produced Water
- Condensate Tank, Dehydration Unit Operation
  - Condenser and Dehydration Additives
- Potential for Gas Migration
  - Faulty Casing / Cementing
  - Groundwater Contamination
  - Methane not Regulated under Safe Drinking Water Act

Sources of Environmental Risk

Production

- Water
- **Permitting & Approvals**

- Support Infrastructure Permits
  - Dehydration Units
  - Compressor Stations
  - Temporary Water Pipelines
  - Pipeline Systems
- Resource Coordination May Complicate Permitting
  - E.g., Pennsylvania Oil and Gas and Coal Coordination Requirements

Looking Ahead …

Closed Loop Systems

Water Reuse

Jurisdiction

- Case Study: Water Management
  - Exceed Standards
    - *Makes Good Business Sense*
    - *Allows for More Effective Water Reuse*
    - *Reduces Drilling Costs, Need for Storage Pits and Off-Site Disposal*
    - *Minimizes Risk of Releases*
  - Considerations
    - *Incorporated as Part of "No Spill" Strategies*
    - *Required Use of Closed Loop Systems*

Looking Ahead …

Closed Loop Systems

Water Reuse

Jurisdiction

- Case Study: Leadership via Wastewater Recycling
  - Exceed Standards
    - *Wastewater Reuse and Recycling Makes Good Business Sense*
    - *Driller X Develops Effective Recycling Infrastructure and Operations in Marcellus Shale*
  - Coordinate with Agencies
    - *PA DEP Proposes General Permit that Would Hinder Progress and Innovation for Wastewater Recycling*
    - *PA DEP instead Encourages Drillers to Recycle Mining Wastewater (Uncommon in Industry)*
  - Driller X Works Closely with PA DEP to Improve Regulation for Company and Industry
    - *Appeal → Negotiations → Economic Growth*
- Important Industry Development to Mitigate Impacts in Water Limited Regions

Looking Ahead …

Closed Loop Systems

Water Reuse

Jurisdiction

- Rulemaking to Clarify Waters and Wetlands Protected under the Clean Water Act
  - Attempt to Address Uncertainty Created by the Supreme Court Ruling in *Rapanos*
  - EPA Issued its Water Connectivity Study in Advance of Rulemaking
- Rulemaking Likely Will Expand Reach of the Clean Water Act
  - Increase Mitigation Costs to Compensate for Project Impacts
  - Impact Siting of Wells as a Result of the Regulatory Setbacks
  - Increase Exposure to Enforcement Actions by Expanded Scope of Jurisdiction

international presence

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