# Highlights of US Government Research on Hydraulic Fracking


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Conference on Environment & Energy:

Comparison of US and EU Policies

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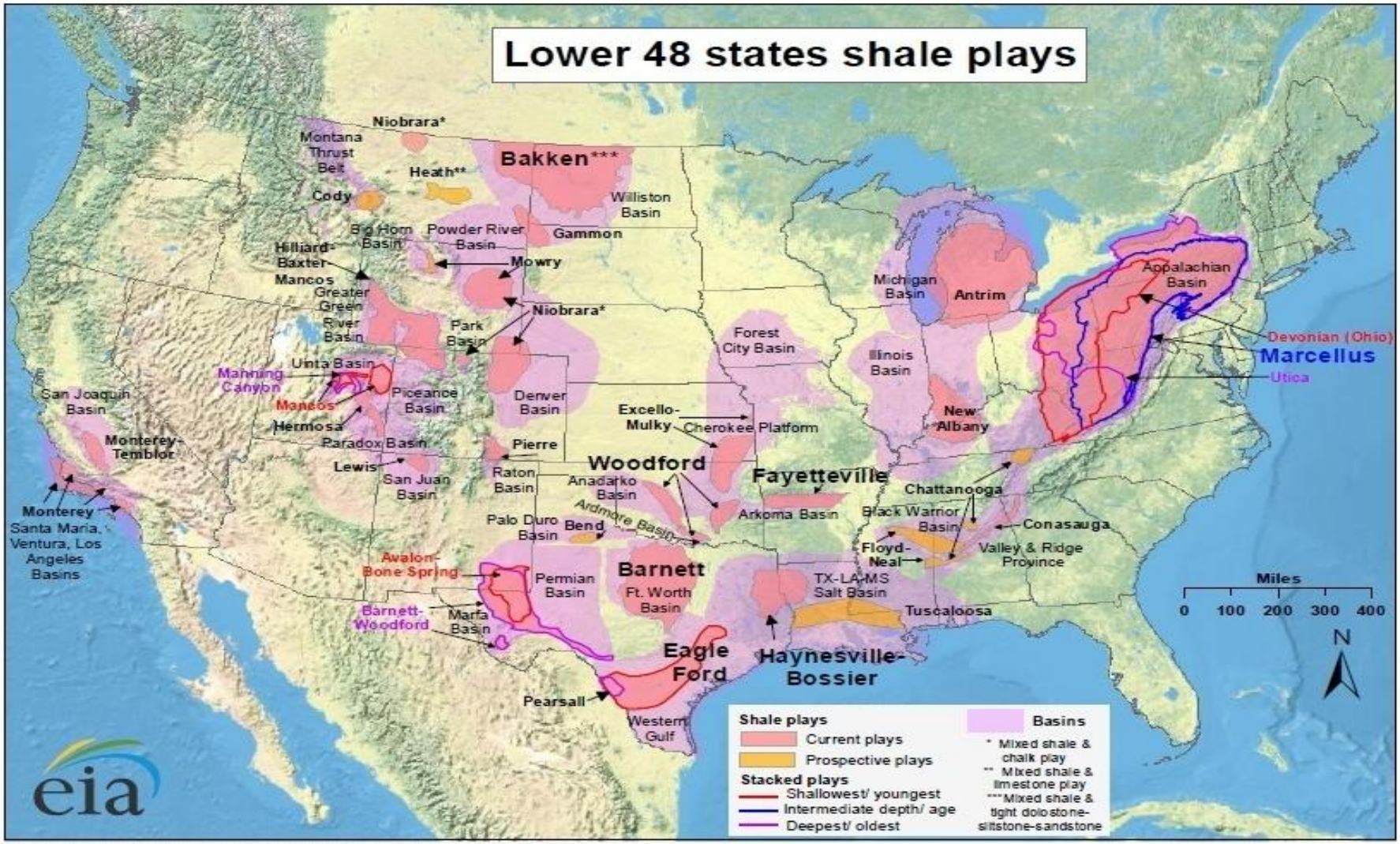
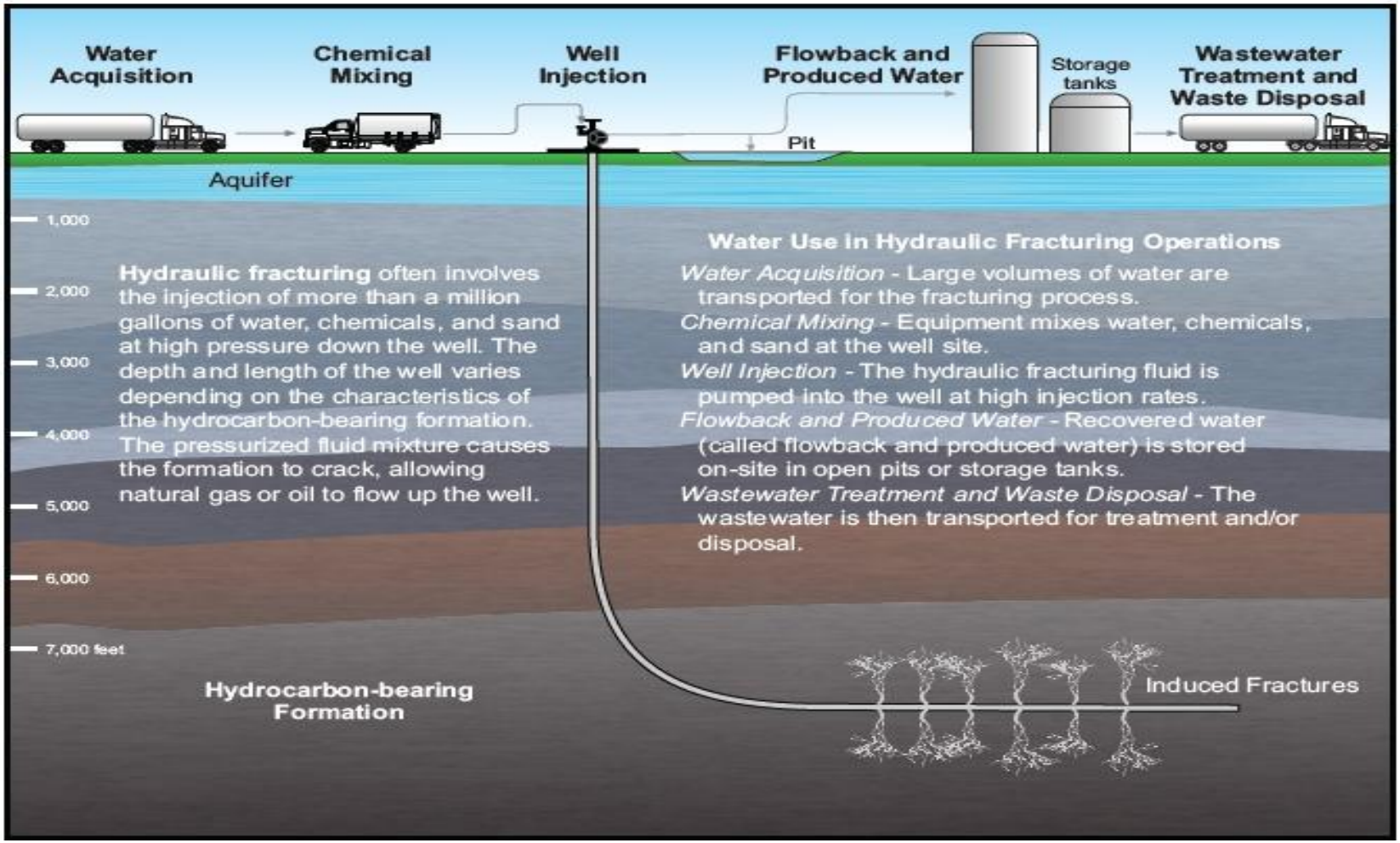
# Overview

- Overview of Unconventional Oil and Gas (UOG) Development, including Hydraulic Fracturing
- Potential Public Health Issues
- US Government Activities
  - Executive Order 13605
  - Interagency Task Force
  - Multi-Agency Collaboration on Unconventional Oil and Gas Research
  - Department of Interior (DOI)
  - Department of Energy (DOE)
  - Environmental Protection Agency (EPA)
  - Health and Human Services (HHS)
  - National Science Foundation (NSF)
- Summary




Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

# Hydraulic Fracturing Process



# Public Health Questions

- What are the potential human health impacts involved in unconventional gas activities?
- What are the potential likelihoods and consequences of these impacts?
- Are there ways to minimize or mitigate these potential impacts?

# Executive Order 13605, April 2012

**Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources**

*"In 2011, natural gas provided 25 percent of the energy consumed in the United States. Its production creates jobs and provides economic benefits to the entire domestic production supply chain…it is vital that we take full advantage of our natural gas resources, while giving American families and communities confidence that natural and cultural resources, air and water quality, and public health and safety will not be compromised."*

*-- President Obama*

# Executive Order 13605, April 2012

**Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources**

Interagency working group, chaired by the Director of the Domestic Policy Council, with Deputy-level representatives from:

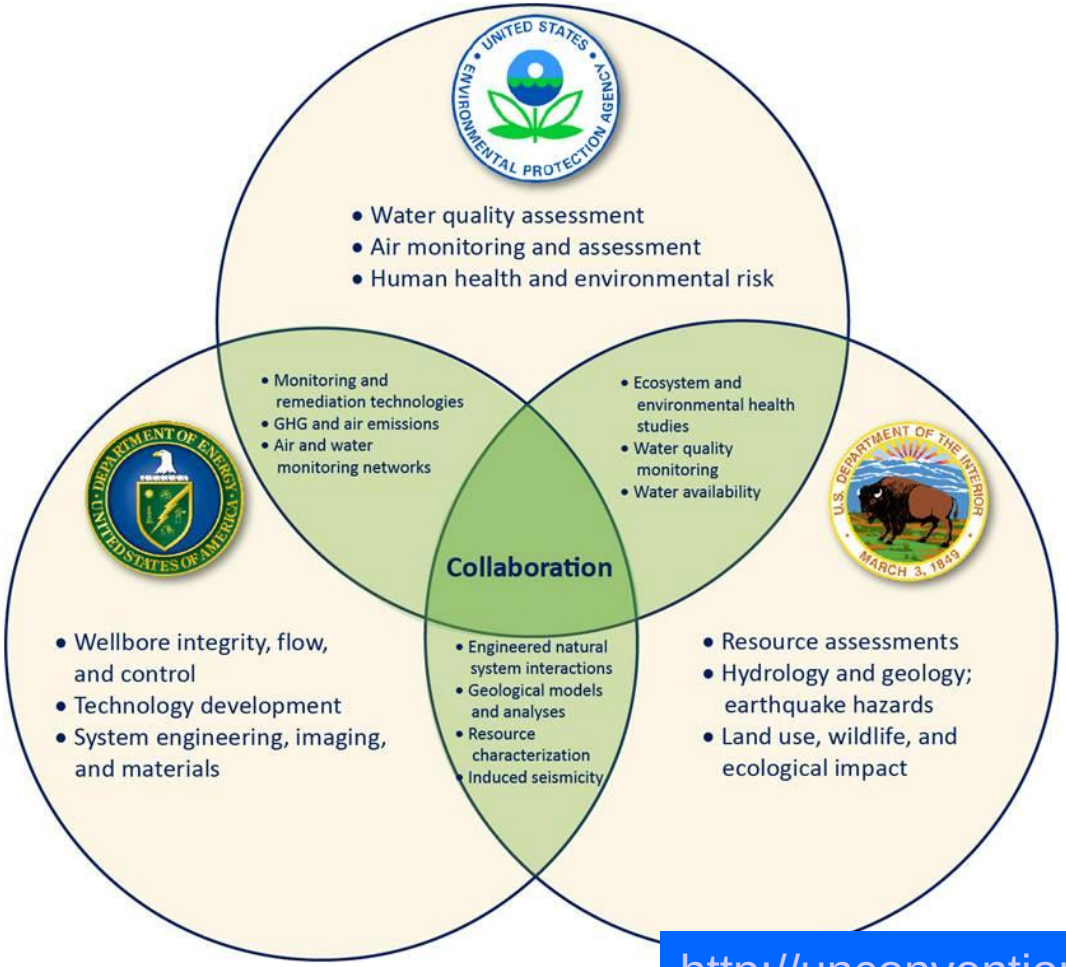
- Department of Defense
- Department of Interior
- Department of Agriculture
- Department of Commerce
- Department of Health and Human Services
- Department of Transportation
- Department of Energy
- Department of Homeland Security
- Environmental Protection Agency
- Council on Environmental Quality
- Office of Science and Technology Policy
- Office of Management and Budget
- National Economic Council

# Multi-Agency Collaboration on Unconventional Oil and Gas (UOG) Research

Department of Energy
Department of the Interior
Environmental Protection Agency

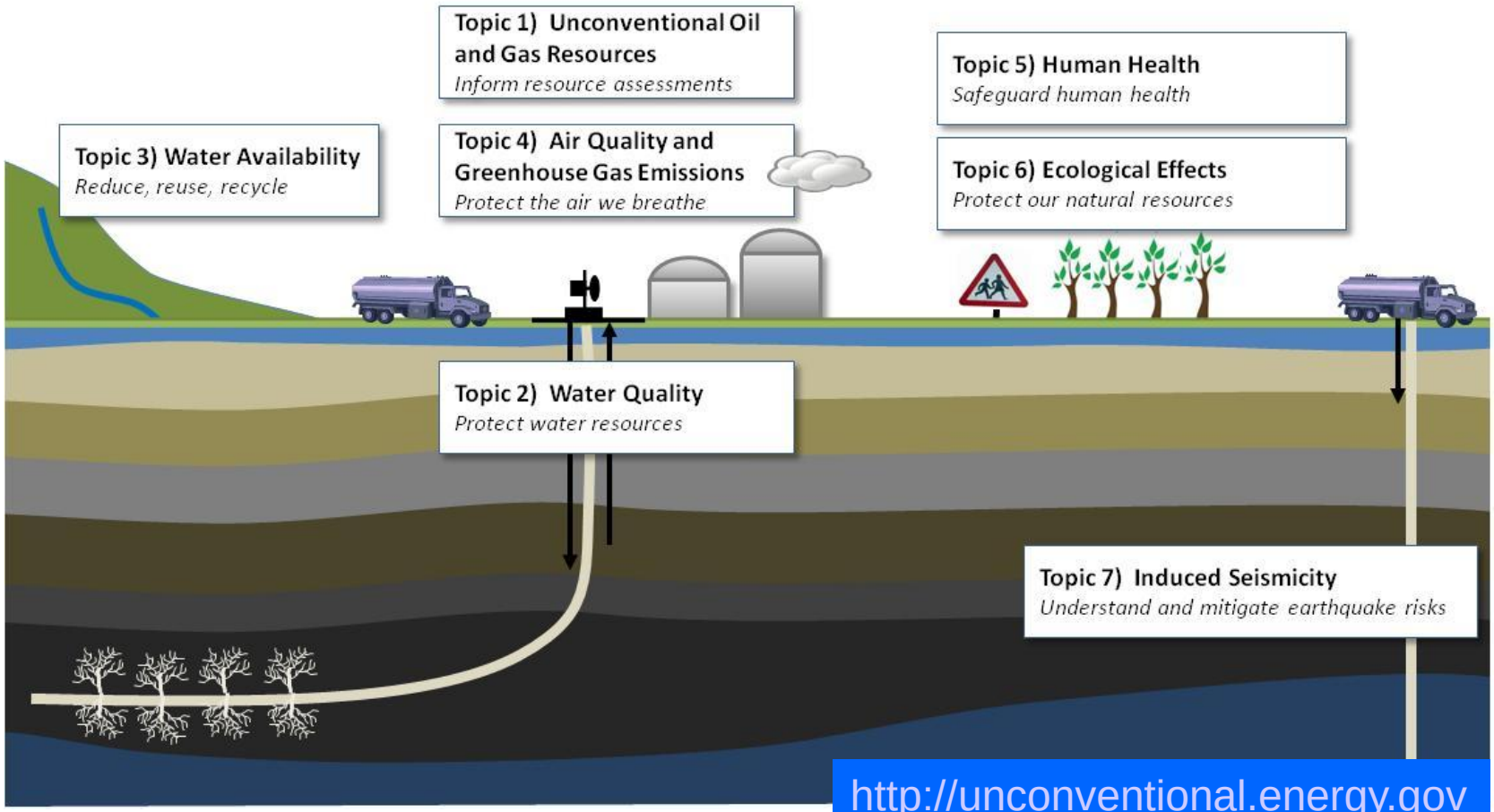
http://unconventional.energy.gov

# Agency Core Research Competencies




http://unconventional.energy.gov

# Multi-Agency Collaboration on Unconventional Oil and Gas (UOG) Research




http://unconventional.energy.gov

# Department of Interior

- U.S. Geological Survey
  - Characterize and assess undiscovered oil and gas resources
    - New assessments used to inform magnitude and location of potential future production.
  - Collect and provide baseline data on groundwater and surface water quality to assess UOG impacts.
    - Determine impacts of produced waters, flowback fluids, and hydraulic fracturing agents.
    - Develop geochemical methods and groundwater flow models to determine if hydrofracture fluids and other drilling materials are contaminating water supplies.
  - Conduct water budget analyses and water requirements
    - Understand how much water is required to produce UOG
    - Conceptual model of groundwater flow

# Department of Interior

- U.S. Geological Survey
  - Assess potential ecological impacts
    - How changes in land use, water quality, and water availability from hydraulically fractured oil and gas operations affect biological communities and specific species of management concern (including brook trout and freshwater mussels).
    - Technical reports and scientific literature that outline effects on terrestrial and aquatic species and create decision support systems to help avoid or minimize ecological impacts.
  - Induced seismicity studies
    - Assess potential for induced seismic activity resulting from UOG development.
    - Prepare probabilistic seismic hazard maps that reflect increased risk from fluid injection operations.

# Department of Energy (DOE)

R&D conducted by the National Energy Technology Laboratory (NETL) in partnership with the private sector and academia

| Resource Characterization |
|---|
| Estimate Technically Recoverable Resources |
| Scale/Timelines of Development |
| Subsurface Science |
| E&P Tech for Improved Efficiency |
| Long-Term Implications |

| Water Quality |
|---|
| Monitoring, Modeling, Diagnoses of Impacts |
| Wellbore Integrity/Technology |
| Reuse and Recycling |
| Life-Cycle Water Quality Modeling |
| Fate/Transport of Wastewater |

| Water Availability |
|---|
| Surface Water Baseline Monitoring |
| Inventory Withdrawals/Budgets/Case Studies |
| Predictive Tools |
| Less Water-Intensive HF Tech |

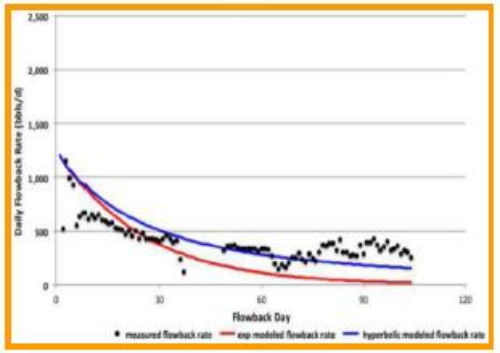
| Air Quality |
|---|
| Source Emission Measurements |
| Ambient Air Measurements |
| Current Controls Effectiveness |
| New Emission Mitigation |

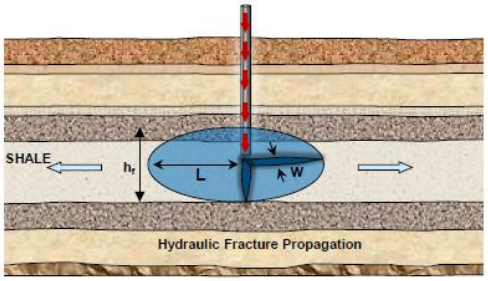
| Induced Seismicity |
|---|
| Monitoring at Select Sites |
| Models and Hazard Assessment |
| Predictive Models |

| Ecological Effects |
|---|
| Ecosystem Vulnerability Assessment |

# DOE: NETL Office of Research and Development

- Fugitive Air Emissions and GHG – Conduct air quality monitoring, leak detection, and point-source measurements, and perform Life Cycle Assessment.
- Water Management - Predict volume and composition of flowback water as a function of reservoir, stimulation, and fluid properties.
- Subsurface Migration of Gas and Fluids - Assess potential for gas and fluids to migrate along existing pathways to shallow systems
- Predicting Subsurface Phenomena – Estimate the extent of fracture development, fluid migration, and induced seismicity due to fracturing and waste injection

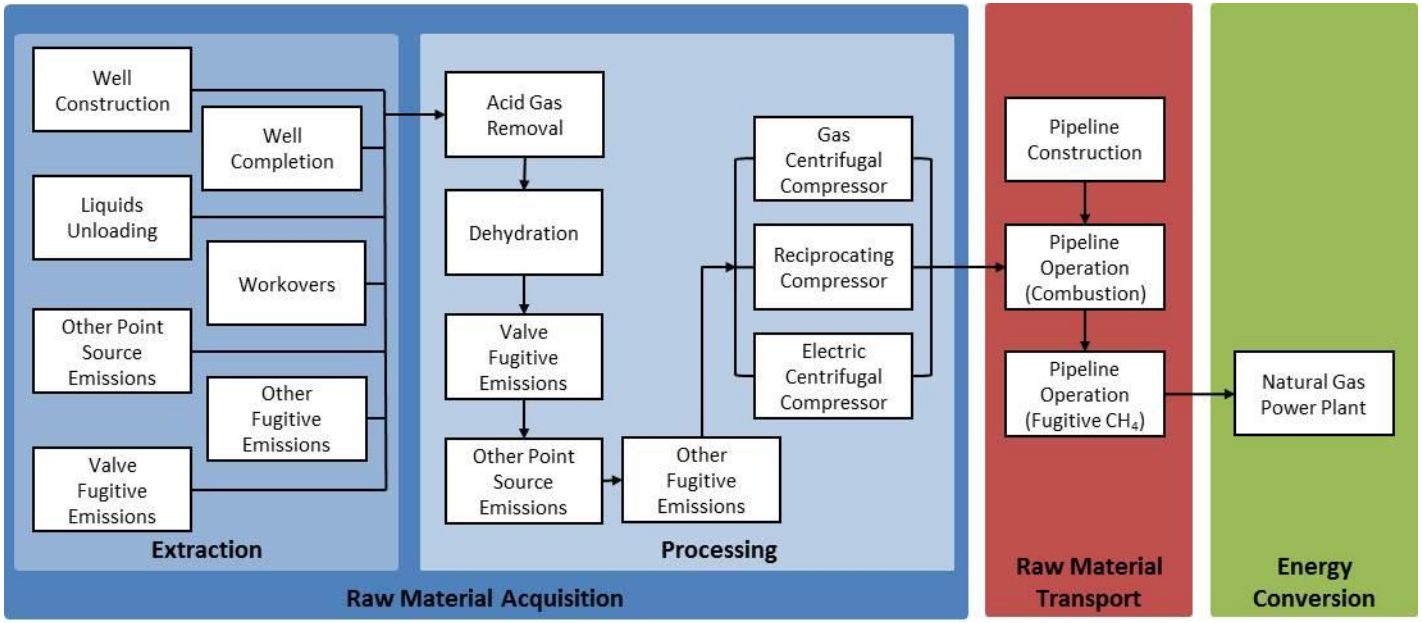



http://www.netl.doe.gov/about/index.html

# DOE: NETL Life Cycle Analysis Model

- The model is easily adaptable to advances in data associated with natural gas production and use.




| Onshore | Associated | Offshore | Tight | Barnett | Marcellus | CBM |
|---|---|---|---|---|---|---|
| • | • | • | • | • | • | • |

# Environmental Protection Agency (EPA)

**Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources**

www.epa.gov/hfstudy

The study purpose is to:

- Assess whether hydraulic fracturing for oil and gas can impact drinking water resources
- Identify driving factors that affect the severity and frequency of any impacts

Study will focus on the water cycle in hydraulic fracturing and take the following research approaches:

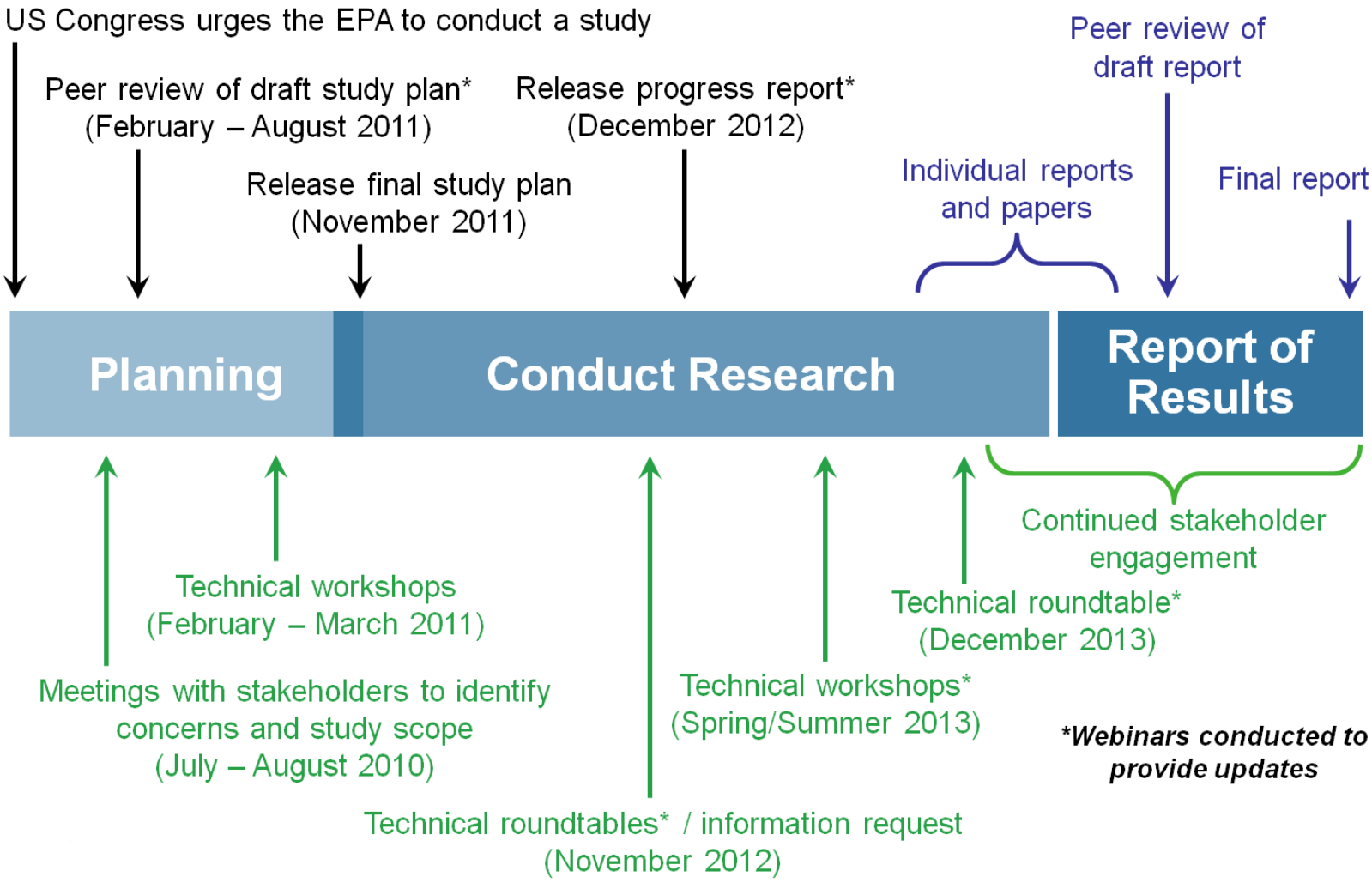
- Gather and analyze existing data
- Case studies
- Toxicity assessments
- Laboratory studies—water analyses
- Scenario evaluations (modeling)

# EPA: Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

**What are the potential impacts on drinking water resources of:**

| | |
|---|---|
| **Water Acquisition** | Large volume water withdrawals from ground and surface waters? |
| **Chemical Mixing** | Surface spills on or near well pads of hydraulic fracturing fluids? |
| **Well Injection** | The injection and fracturing process? |
| **Flowback and Produced Water** | Surface spills on or near well pads of flowback and produced water? |
| **Wastewater Treatment and Waste Disposal** | Inadequate treatment of hydraulic fracturing wastewaters? |

# EPA: Study Timeline



# Health and Human Services

- National Institute for Occupational Safety and Health (NIOSH)
  - Ongoing site industry hazard assessments for worker exposures, including silica and chemical exposures
  - Toxicological Effects of Silica and Diesel Exhaust Exposure
- Agency for Toxic Substance and Disease Registry (ATSDR)
  - Site-specific health assessment and exposure investigations in areas where natural gas extraction activities are occurring
    - Results given to residents and other federal agencies
- National Institute of Environmental Health Sciences (NIEHS)
  - Toxicity of Polycyclic Aromatic Compound Mixtures
  - Extramural funding including Environmental Health Science Core Centers and Community Outreach Engagement Cores

http://ceet.wpengine.com/target-communities/northeast-pennsylvania-communities-with-hydraulic-fracturing/

# National Science Foundation (NSF) Funded Projects

Routes to Sustainability for Natural Gas Development and Water and Air Resources in the Rocky Mountain Region:

http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1240584

RCN-SEES: The Marcellus Shale Research Network:

http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1140159

Standard Research Grant: The Marcellus Shale Gas Rush: A Study of Public, Private, and Academic Water Quality Monitoring Policies:

http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1126235

Collaborative Research: Modeling and Analysis of Fracture Network for Shale Gas Development and Its Environmental Impact:

http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1209124

# Summary

- Technology is now available that is capable of economically extracting energy resources that were not previously accessible.
- Federal agencies are working together on a wide variety of research projects with input from stakeholders to better assess the health and environmental impacts of the process.
- While well-coordinated, current research efforts are not yet fully comprehensive.
- If funded at the level of the President's FY 2015 budget, the Multi-Agency (DOE, DOI and EPA) research design would fill many gaps.

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# Thank you

Questions?