

# Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Dr. Kevin Teichman  
March 7, 2011



# Purpose of the Study Plan

In its FY 2010 Appropriations Committee Conference Report, Congress directed EPA to study the relationship between hydraulic fracturing and drinking water, using:

- Best available **science**
- **Independent** sources of information
- **Transparent, peer-reviewed** process
- **Consultation** with others

# How Results May be Used

- Inform decision makers regarding the key factors that may drive potential impacts of hydraulic fracturing on drinking water resources
  - Industry
  - Local communities
  - State regulators
  - Tribes
  - Federal agencies

# Development of the Draft Study Plan

- SAB suggestions
- Stakeholder input
- Literature review
- Internal EPA review
- External federal agency review

*EPA's draft study plan focuses on the water cycle in hydraulic fracturing.*

# SAB Recommendations

## June 2010

- Use a lifecycle framework to identify important research questions
- Direct initial research to sources and pathways of potential impacts of hydraulic fracturing on water resources, especially drinking water
- Include 5-10 in-depth case studies at locations representing the full range of regional variability across the nation
- Engage stakeholders throughout the research process

# Past Stakeholder Input

- State and tribal consultations
  - Included interstate agencies (IOGCC, GWPC and others)
- Sector-specific meetings
  - Industry and non-governmental organizations
  - Federal agencies
- Informational public meetings
  - Held in Colorado, New York, Pennsylvania, Texas
  - Total attendance exceeded 3,500

# Current and Future Stakeholder Input

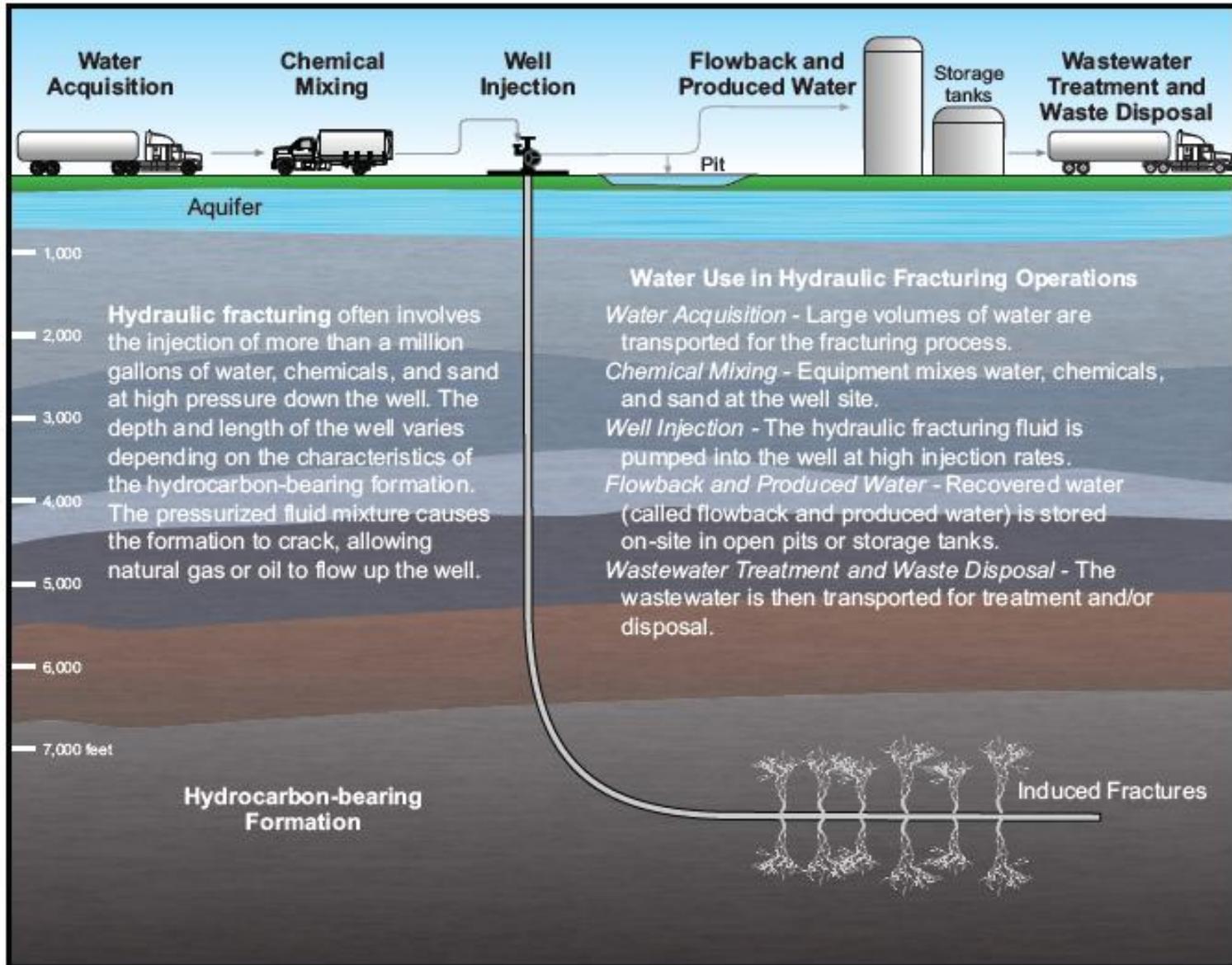
- Review of the draft study plan
  - Interagency comments
  - Comments from the SAB
  - Stakeholder comments received by the SAB
- Research implementation
  - Partner with industry, governmental and other stakeholders for case studies

# Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Jeanne Briskin  
March 7, 2011



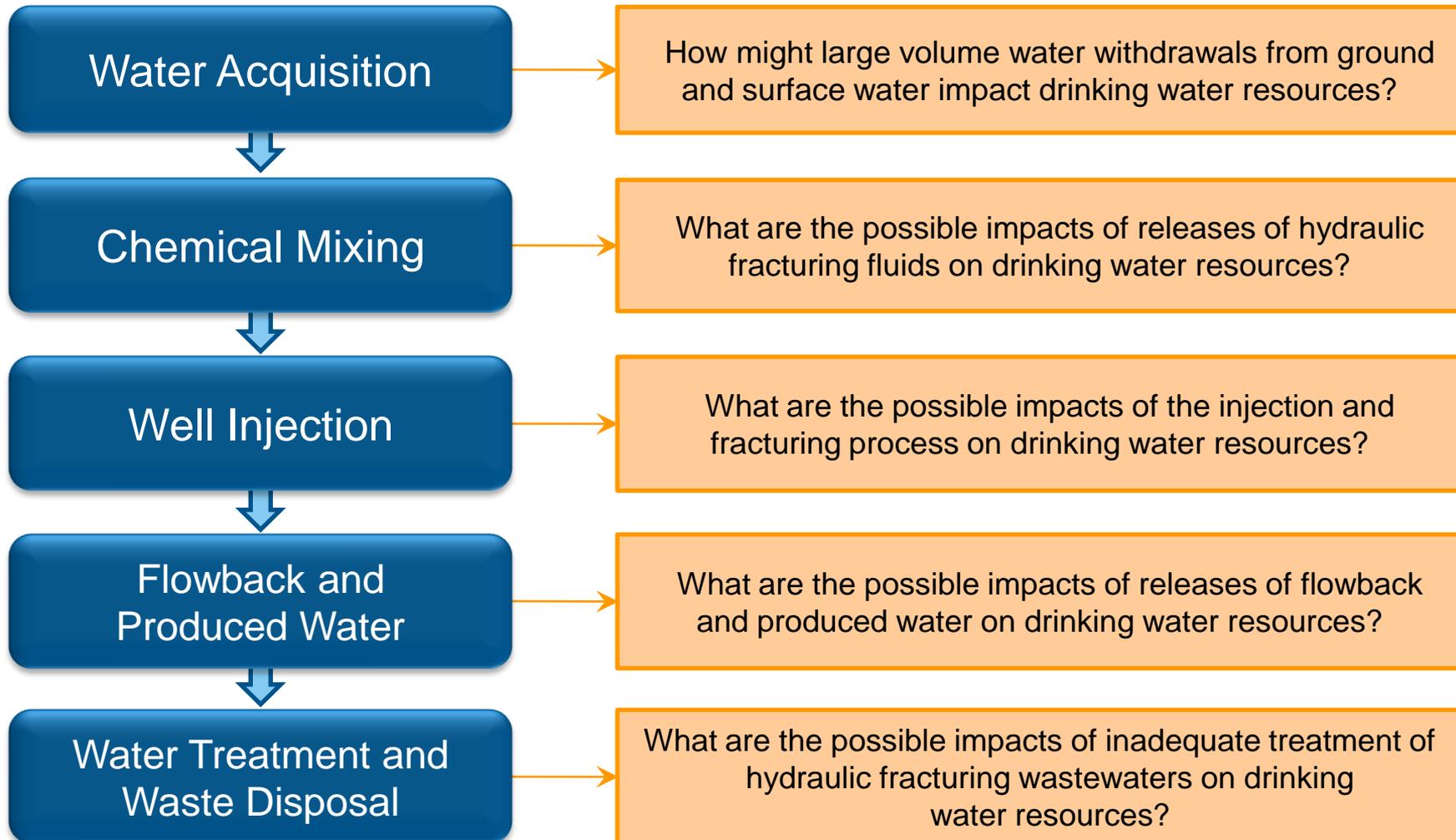
# Hydraulic Fracturing



# Research Questions

## Water Use in Hydraulic Fracturing Operations

## Fundamental Research Questions



# Purpose of EPA's Study

- To assess the potential impacts of hydraulic fracturing on drinking water resources
- To identify the driving factors that affect the severity and frequency of any impacts

*The results of the study will inform decision makers at the local, state and federal level.*

# Qualitative Risk-Based Approach to Prioritize Research

- **Relevance:** Only work that may directly inform an assessment of the potential impacts of hydraulic fracturing on drinking water resources was considered.
- **Timing:** Work that needs to be completed before other work can be initiated received a higher priority.
- **Unique contribution:** Work already underway by others received a lower priority for investment by EPA.
- **Leverage:** Work that EPA can leverage with co-investigators received a higher priority.
- **Funding:** Work that is valuable but not affordable with the current budget was identified for consideration in later years.

# Research Budget

Fiscal Year			
	2010 (Enacted)	2011 (President's Request)	2012 (President's Request)
<b>Budget</b>	<b>\$1.9 M</b>	<b>\$4.4 M</b>	<b>\$6.1 M</b>

# Research Approach

- Literature reviews
- Data gathering and analysis
- Modeling
- Laboratory investigations
- Field investigations and case studies

# Research Summary

	2012 Report	2014 Report
<b>Water Acquisition</b>		
Water availability	✓	✓
Water quality	✓	✓
<b>Chemical Mixing</b>		
Fluid composition and toxicity	✓	✓
Factors that may influence contamination	✓	✓
Impacts of current practices		✓

# Research Summary (continued)

	2012 Report	2014 Report
<b>Well Injection</b>		
Well construction practices	✓	✓
Pre-existing pathways/features	✓	✓
Chemical/physical/biological processes		✓
Toxic effects of naturally occurring substances	✓	✓
<b>Flowback and Produced Water</b>		
Composition and variability		✓
Factors that may influence contamination	✓	✓
Impacts of current practices		✓
<b>Wastewater Treatment and Waste Disposal</b>		
Treatment and disposal methods	✓	✓

# Possible Uses of the Research Results

- Research will identify key drivers for impacts of hydraulic fracturing activities on drinking water resources
- Results may be used by:
  - Industry
  - Local, state, tribal and federal governments
  - Communities
  - Environmental groups

# Purpose of this Review

Provide an independent, peer-review of  
ORD's Draft Study Plan

- Areas of Review
  - Water Use in Hydraulic Fracturing
  - Research Questions
  - Research Approach
  - Proposed Research Activities
  - Research Outcomes

# SAB Charge Questions

## 1. Water Use in Hydraulic Fracturing

- Please comment on the appropriateness of this framework for the study plan.
- Within the context of the water lifecycle, does the study plan adequately identify and address the areas of concern?

## 2. Research Questions

- Has EPA identified the correct research questions to address whether or not hydraulic fracturing impacts drinking water resources, and if so, what those potential impacts may be?
- Please provide any recommendations for conducting the research outlined in this study plan, particularly with respect to the case studies.

## 3. Research Approach

- Have the necessary tools been identified?
- Please comment on any additional key literature that should be included to ensure a comprehensive understanding of the trends in hydraulic fracturing.

# Charge Questions *(continued)*

## 4. Proposed Research Activities

- Will the proposed research questions adequately answer the secondary research questions for each stage of the water lifecycle?
- Please provide any suggestions for additional research activities.

## 5. Research Outcomes

- If EPA conducts the proposed research, will we be able to:
  - Identify the key impacts, if any, of hydraulic fracturing on drinking water resources; and
  - Provide relevant information on the toxicity and possible exposure pathways of chemicals associated with hydraulic fracturing?

# Case Studies

Dr. Robert Puls  
March 7, 2011



# Purpose of Case Studies

- To evaluate potential impacts of hydraulic fracturing in different parts of the US
- Retrospective case studies
  - Investigate concerns regarding impacts on drinking water resources
  - Evaluate the extent to which any impacts may be associated with hydraulic fracturing
  - Identify the driving forces that contributed to impacts
- Prospective case studies
  - Understand potential impacts of hydraulic fracturing throughout the cycle
  - Establish baseline
  - Evaluate data available during and immediately after injection, including flowback and produced water quantity, flow rate and composition

# Case Study Identification and Selection

- Stakeholder suggestions
  - 4 public meetings
  - EPA website input
  - Webinars
  - Conferences (e.g., GWPC, IOGCC)
  - Face-to-face meetings with state agencies, affected homeowners and NGOs
  - EPA Regional Office input



*More than 40 locations for potential case studies have been brought to our attention.*

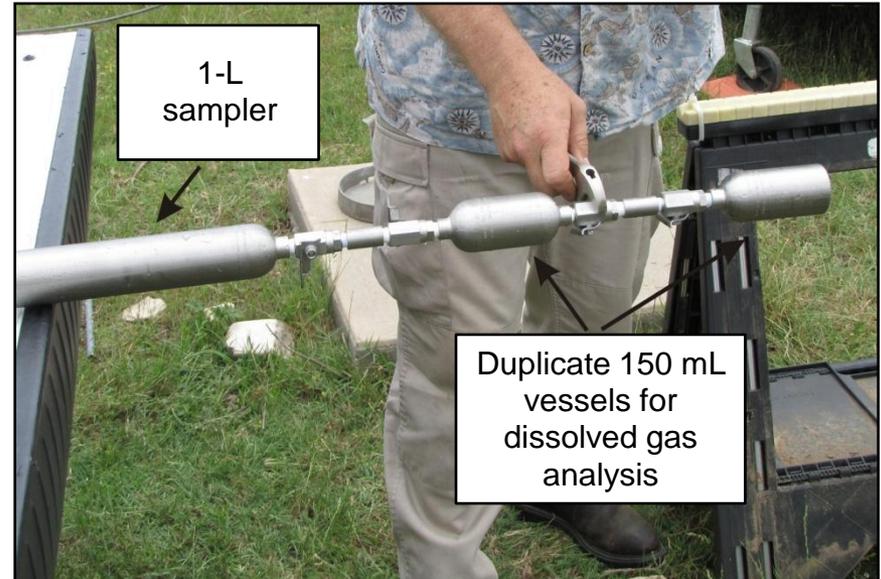
# Cases Studies: Nomination/Prioritization Criteria

- Geographic, land use variations
- Geologic diversity
- Proximity to populations potentially at risk
- Magnitude/Intensity of HF activity
- Impairment evidence (retrospective)
- Health and environmental concerns
- Available existing data
- Site access
- Potential to collaborate with others
- Ability to fill knowledge gap on HF and drinking water



# Retrospective Case Study Approach

- Evaluate existing data and information
- Conduct site visits
- Get stakeholder input and participation
- Conduct initial environmental sampling and testing
- Develop site conceptual models for fate and transport
- Collect additional samples (geoprobe, new wells), testing (geophysical) and more comprehensive analysis (including stable isotopic analyses)
- Perform modeling (hydrologic, geochemical)



# Prospective Case Study Approach

- Evaluate existing data and information
- Conduct site visits
- Get stakeholder input and participation
- Conduct baseline environmental sampling, testing
- Develop site conceptual models for potential exposure
- Conduct environmental sampling during/following pad and well construction, including well integrity testing
- Conduct environmental sampling during/following hydraulic fracturing operations
- Collect additional samples over time during resource production

# Retrospective Case Study Finalists

Location	Key Issues / Impacts
<p><b>Bakken Shale</b> <i>Killdeer and Dunn Co., ND</i></p>	<ul style="list-style-type: none"> <li>• Production well failure during horizontal fracturing</li> <li>• Potential contamination of USDW, adjoining streams, soils</li> </ul>
<p><b>Barnett Shale</b> <i>Wise and Denton Cos., TX</i></p>	<ul style="list-style-type: none"> <li>• Spills, impoundment leaks, degraded water quality in private wells</li> <li>• Potential contamination of USDW (private wells)</li> </ul>
<p><b>Marcellus Shale</b> <i>Bradford and Susquehanna Cos., PA</i></p>	<ul style="list-style-type: none"> <li>• Spills, leaks, methane in private wells</li> <li>• Potential contamination of USDW, streams, soils</li> </ul>
<p><b>Marcellus Shale</b> <i>Wetzel Co., WV, Green and Washington Cos., PA</i></p>	<ul style="list-style-type: none"> <li>• Impoundment leaks, spills</li> <li>• Potential contamination of USDW, streams, soils</li> </ul>
<p><b>Raton Basin (CBM)</b> <i>Las Animas Co., CO</i></p>	<ul style="list-style-type: none"> <li>• Degraded water quality in private wells</li> <li>• Potential contamination of USDW</li> </ul>

# Potential Prospective Case Study Sites

Shale Play	Location
Bakken Shale	Berthold Indian Reservation, ND
Barnett Shale	Flower Mound / Bartonville, TX
Marcellus Shale	Washington County, PA
Niobrara Shale	Laramie County, WY

# Potential Partners for Case Studies

- Federal partners
  - Department of Energy
  - U.S. Geological Survey
  - EPA Regional Offices
- State partners
  - State oil and gas commissions
  - State environmental agencies
  - Interstate agencies
- Local partners
  - Cities
  - Landowners and residents
- Industry
- Environmental groups

