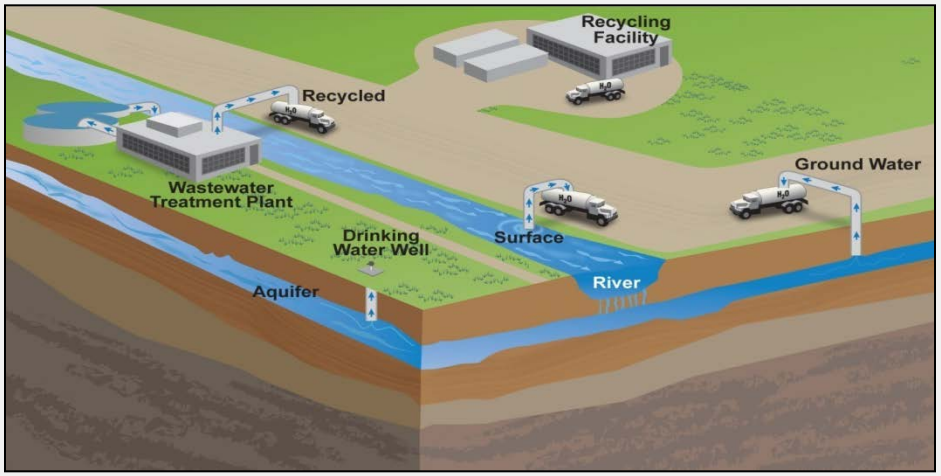
Water Acquisition: Analysis of Existing Data

Technical Workshop Series:
Water Acquisition Modeling: Assessing Impacts Through Modeling and Other Means



Andrew J. R. Gillespie
EPA-Arlington, VA • June 4, 2013

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

Assess whether hydraulic fracturing may impact drinking water resources

Identify driving factors that may affect the severity and frequency of any impacts

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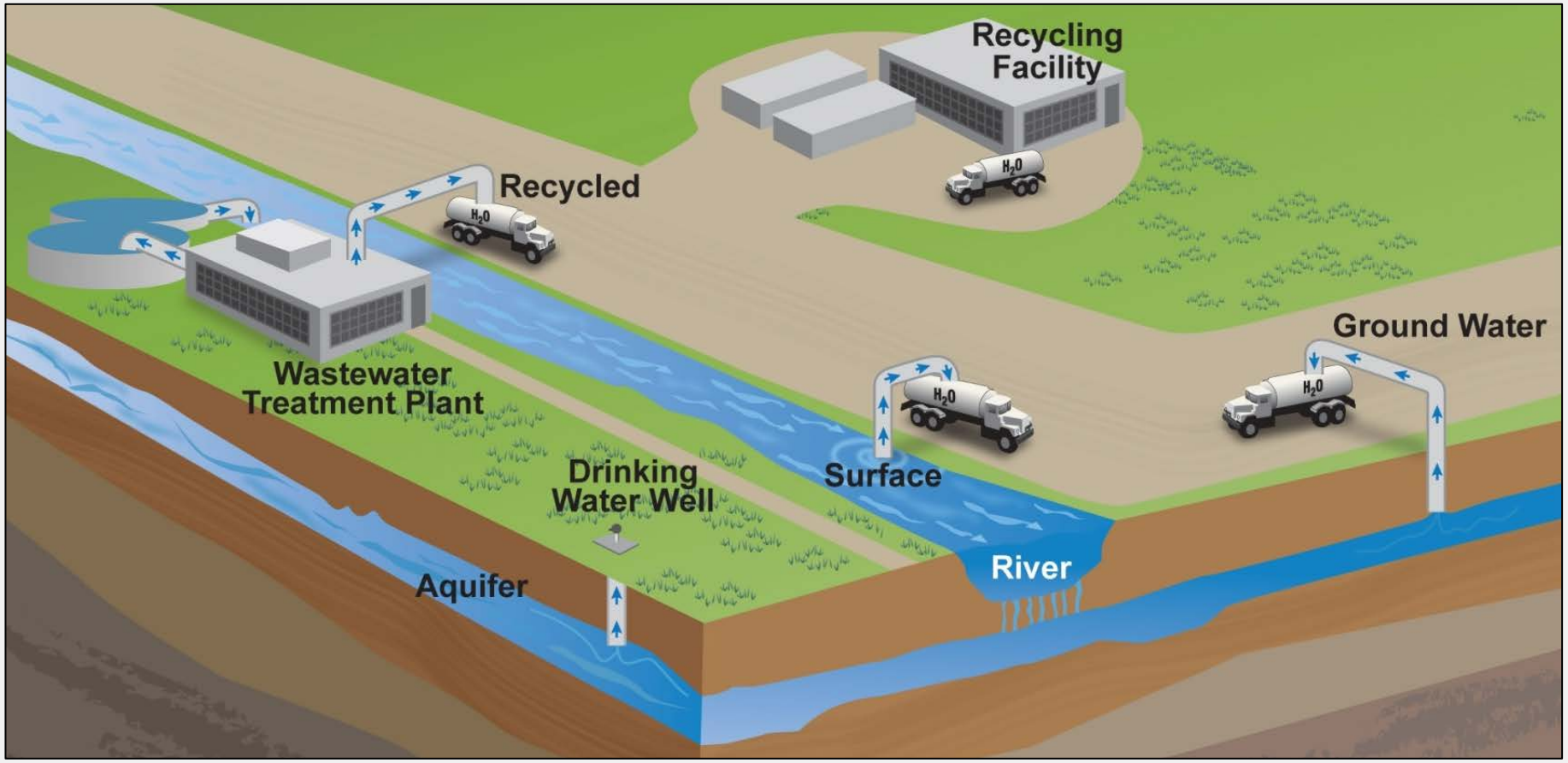
Water Acquisition



What are the possible impacts of large volume water withdrawals from ground and surface water on drinking water resources?

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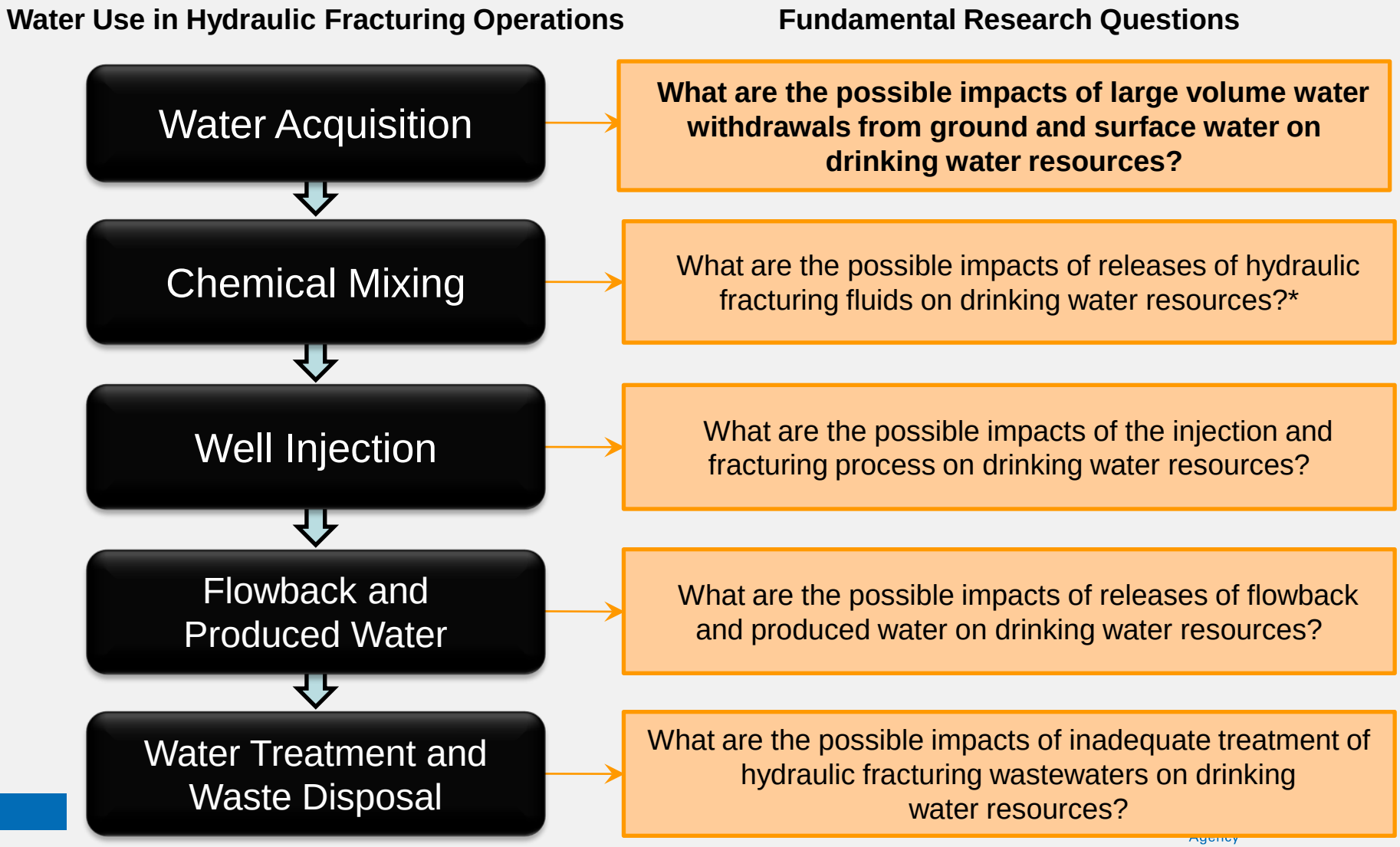
Hydraulic Fracturing Water Cycle



EPA HF Study – research questions

Water Acquisition

What are the possible impacts of large volume water withdrawals from ground and surface water on drinking water resources?

How much water is used in hydraulic fracturing operations, and what are the sources of this water?

How might water withdrawals affect short- and long-term water availability in an area with hydraulic fracturing activity?

What are the possible impacts of water withdrawals for HF operations on local water quality?

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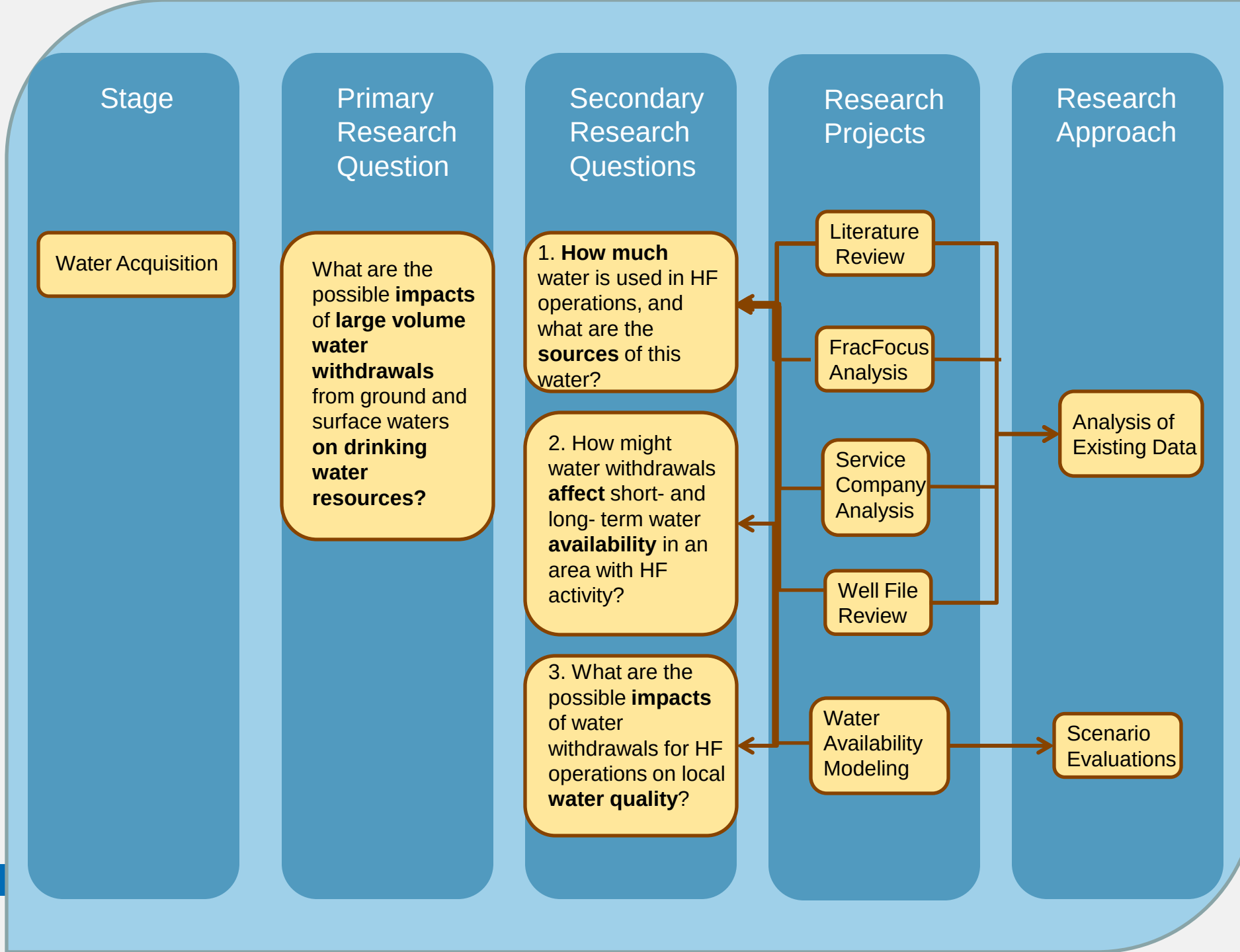
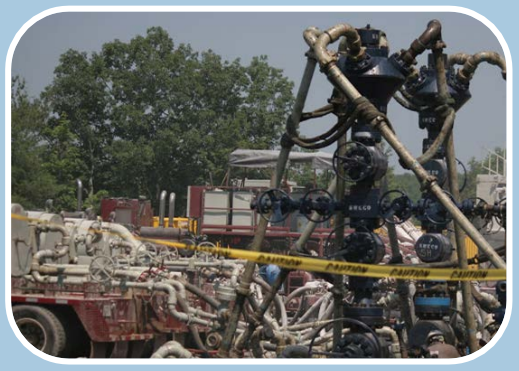

Stage
Primary Research Question
Secondary Research Questions
Research Projects
Research Approach
Water Acquisition
What are the possible impacts of large volume water withdrawals from ground and surface waters on drinking water resources?
1. How much water is used in HF operations, and what are the sources of this water?
2. How might water withdrawals affect short- and long- term water availability in an area with HF activity?
3. What are the possible impacts of water withdrawals for HF operations on local water quality?
Literature Review
FracFocus Analysis
Service Company Analysis
Well File Review
Water Availability Modeling
Analysis of Existing Data
Scenario Evaluations

Consideration of Scale: National Estimates



1.5×10^{14} gallons

USGS estimated national water use in 2005

1.5×10^{12} gallons

USGS estimated national water use for Mining and Oil and Gas in 2005

~1% of total

$7\text{-}14 \times 10^{9}$ gallons

EPA estimate of water used for hydraulic fracturing in 2009-2010

<0.1% of total in 2005

Impacts of water withdrawals for hydraulic fracturing may not be visible at the national level

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Consideration of Scale: State Estimates

- Volume of water withdrawals may vary by state
- Potential impacts may depend on
  - Scale and distribution of hydraulic fracturing operations
  - Local geology
  - Local hydrology and water needs

	COLORADO	PENNSYLVANIA
Total number of wells drilled in 2010	2,753	1,386
Estimated water use per well in 2010 (million gallons)	1.7	5
Estimated total water use for hydraulic fracturing in 2010 (million gallons)	4,700	6,900
Compared to total state water use in 2005	0.09%	0.2%

Impacts of water withdrawals for hydraulic fracturing may not be visible at the state level

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Water Recycling/Reuse

- Anecdotal evidence of increasing recycling/reuse of produced and flowback water
- Comments from April Wastewater Workshop:
  - Dependent on local conditions: geologic and economic
  - Potential for cost savings
  - Possible reduced freshwater utilization

EPA Study: Literature review

- Identified available studies on volumes and sources of water used for hydraulic fracturing fluids in various plays
  - Peer-reviewed studies on: Barnett, Eagle Ford and Haynesville Shales
  - Limited peer-reviewed data from Bakken Shale
- Request for studies published in Federal Register notice
  - Submit through November 15, 2013

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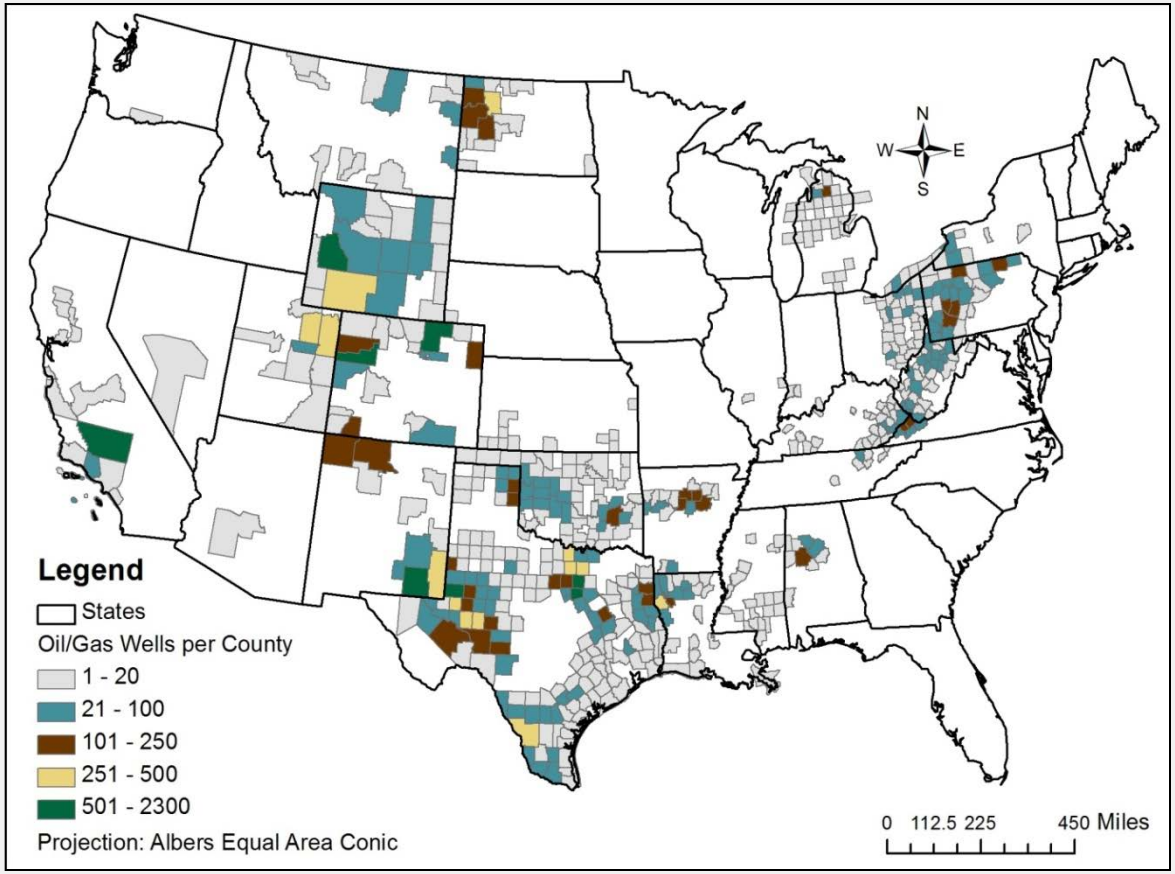
EPA Study: Service Company Analysis

Counties with Hydraulic Fracturing Activity (Sept. 2009 – Oct. 2010)



- Data provided by 9 hydraulic fracturing service companies
- Water volumes needed for hydraulic fracturing by play
  - Information not provided for other formations
- Water acquisition procedures and considerations
  - Standard operating procedures, water quality requirements, water source preferences decision processes

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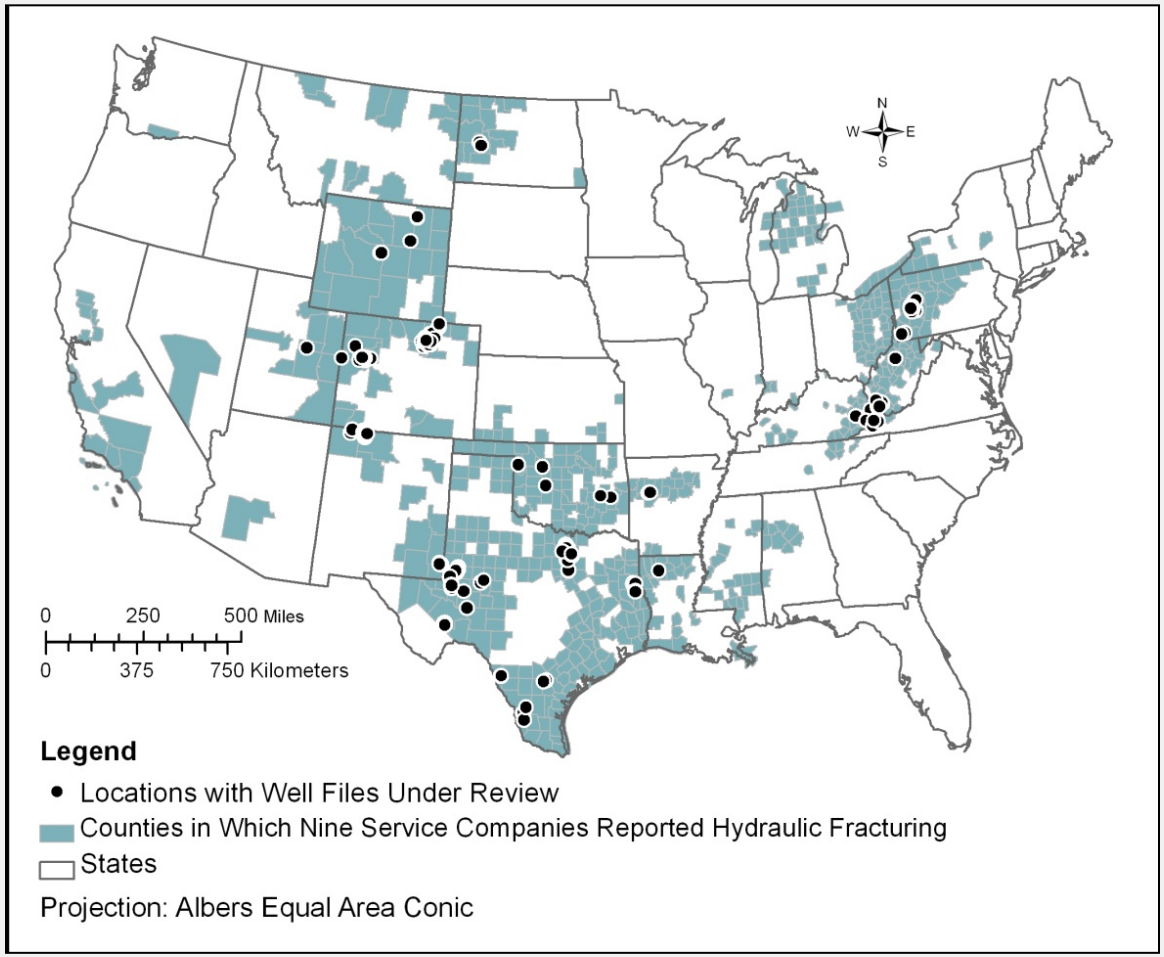
EPA Study: Well File Review

- 331 well files provided by 9 oil and gas operators from wells fractured between 2009 and 2010
- Information on:
  - Well construction
  - Hydraulic fracturing
  - Water management
- Volumes and sources of water used in hydraulic fracturing fluids

Locations of Wells Selected for Review



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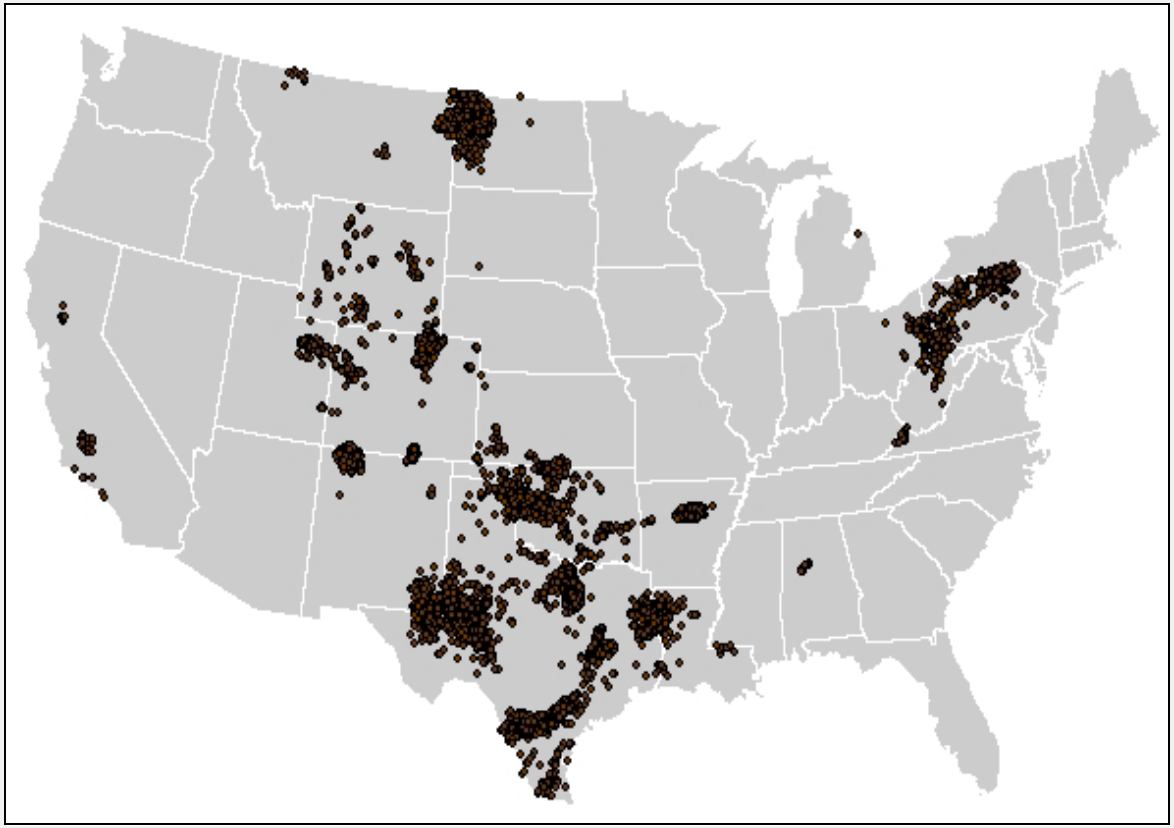
EPA Study: FracFocus Review

WELL DATA

- Fracture date
- Location
  - State, county, longitude/latitude
- Production type
  - Oil or gas
- Depth
- Water volumes used by type
  - Fresh water, produced water, brine, recycled water



Wells Entered into FracFocus
(> 30,000 Wells fractured
Jan. 1, 2011 – Aug. 29, 2012)

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Session 1 Presentations

- **Water Acquisition: Analysis of Existing Data** Andrew Gillespie, *US EPA*
- **Sources of Data for Quantifying Hydraulic Fracturing Water Use in Texas**

  J-P Nicot, *University of Texas at Austin*
- **Water Acquisition for Unconventional Natural Gas Development Within the Susquehanna River Basin**

  James Richenderfer, *Susquehanna River Basin Commission*
- **Recycling and Reuse of Produced Water to Reduce Freshwater Use in Hydraulic Fracturing Operations**

  Matthew Mantell, *Chesapeake Energy Corporation*

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Session 1
Discussion Questions

- What existing data could be used to better understand the effects of water acquisition on water availability?

- What are key attributes of a scientifically robust approach to measuring and monitoring hydraulic fracturing water use and disposition?

- What is the current industry practice with respect to recycling/reusing water for HF operations?

- What are the long-term, lifecycle implications and regional trends of recycling/reusing water in HF operations?

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