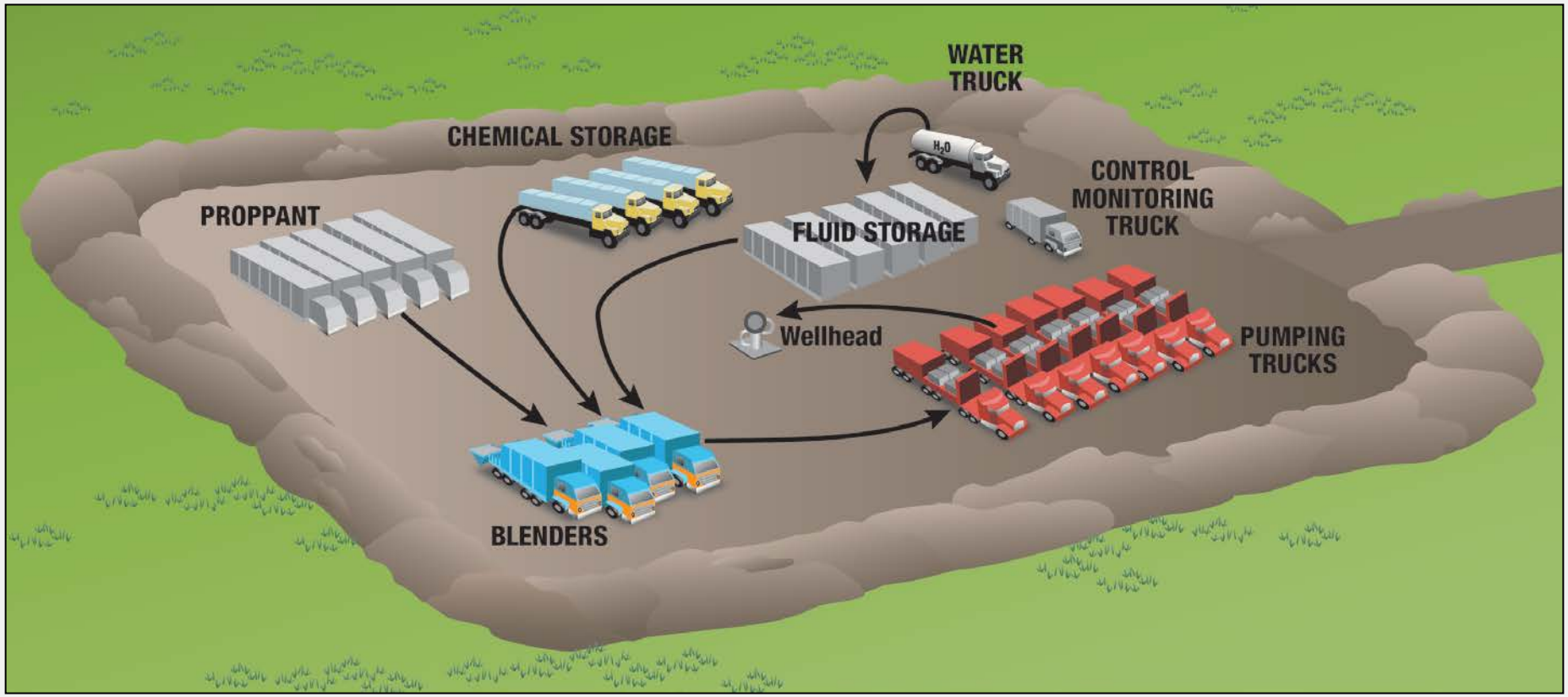
EPA
United States
Environmental Protection
Agency

Chemical Mixing

Jeanne Briskin

Chemical Mixing



What are the possible impacts of surface spills on or near well pads of hydraulic fracturing fluids on drinking water resources?

Research Projects

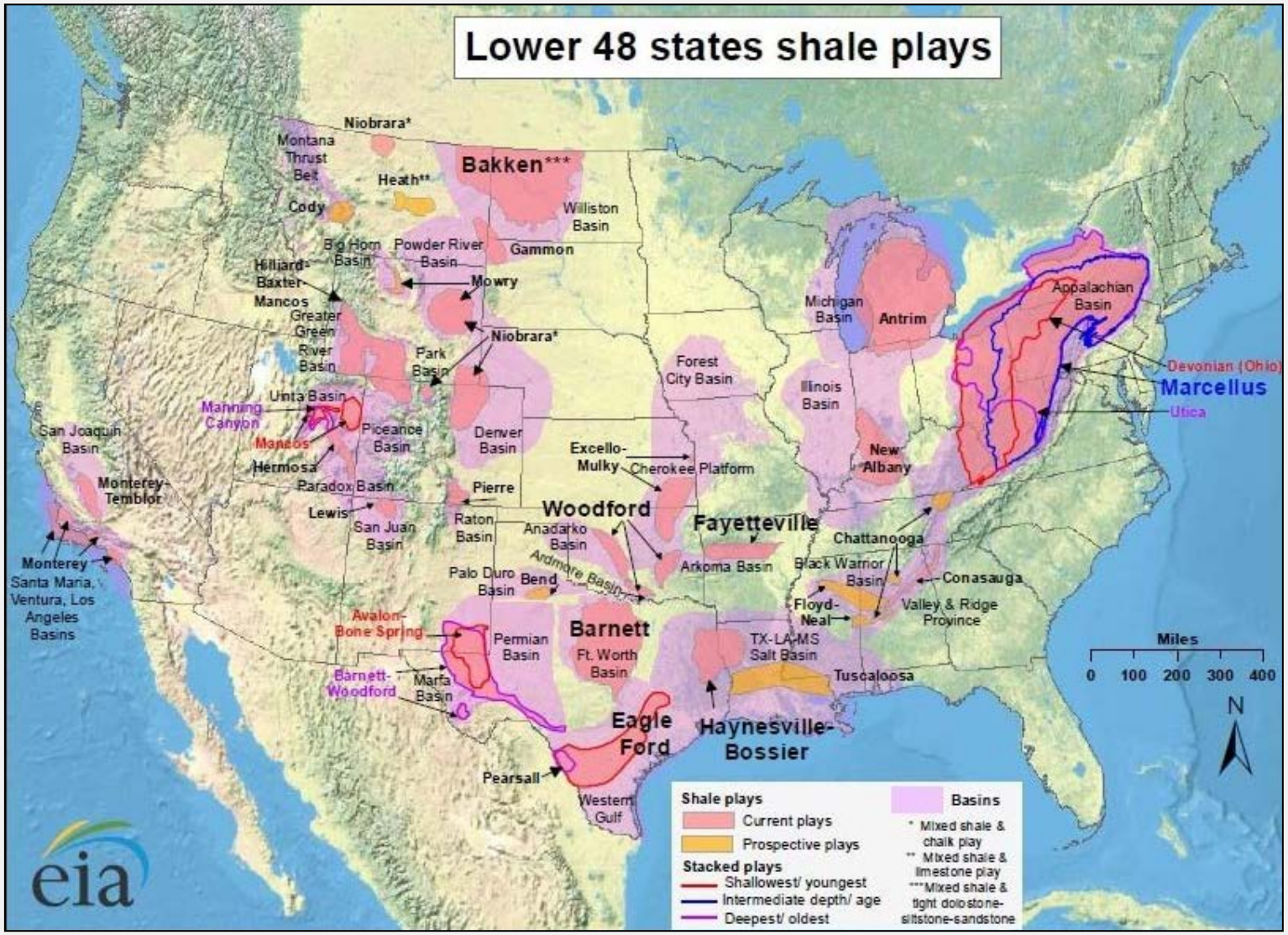
- **Chemicals used in hydraulic fracturing fluids**
  - Literature Review
  - **Service Company Analysis**
  - **FracFocus Analysis**
  - **Well File Review**

- **Frequency, severity and causes of hydraulic fracturing-related spills**
  - Spills Database Analysis
  - Service Company Analysis
  - Well File Review

Charge Question #4

Given the data sets available, what information on **fluid composition**, factors affecting composition, and/or **trends in composition** of hydraulic fracturing fluids may be most useful for identifying potential impacts to drinking water resources across the United States?

Shale Plays in the United States



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

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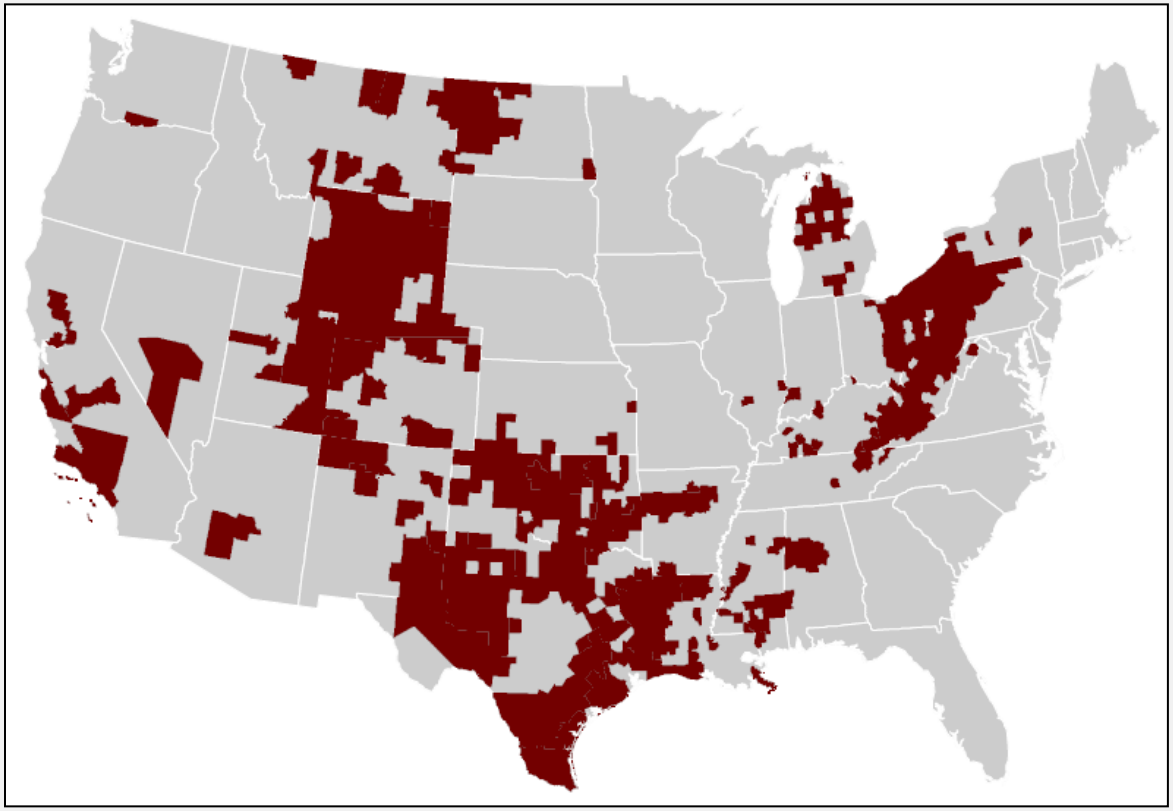
Service Company Analysis



Counties with Hydraulic Fracturing Activity as Reported by 9 Service Companies

- 9 hydraulic fracturing service companies provided nationwide data
  - Chemicals used in hydraulic fracturing fluids (2005 – 2010)
  - Sample formulations
- Some data claimed as confidential business information

FracFocus Analysis

Records obtained for wells hydraulically fractured from January 2011, through February 2013, include:

WELL DATA

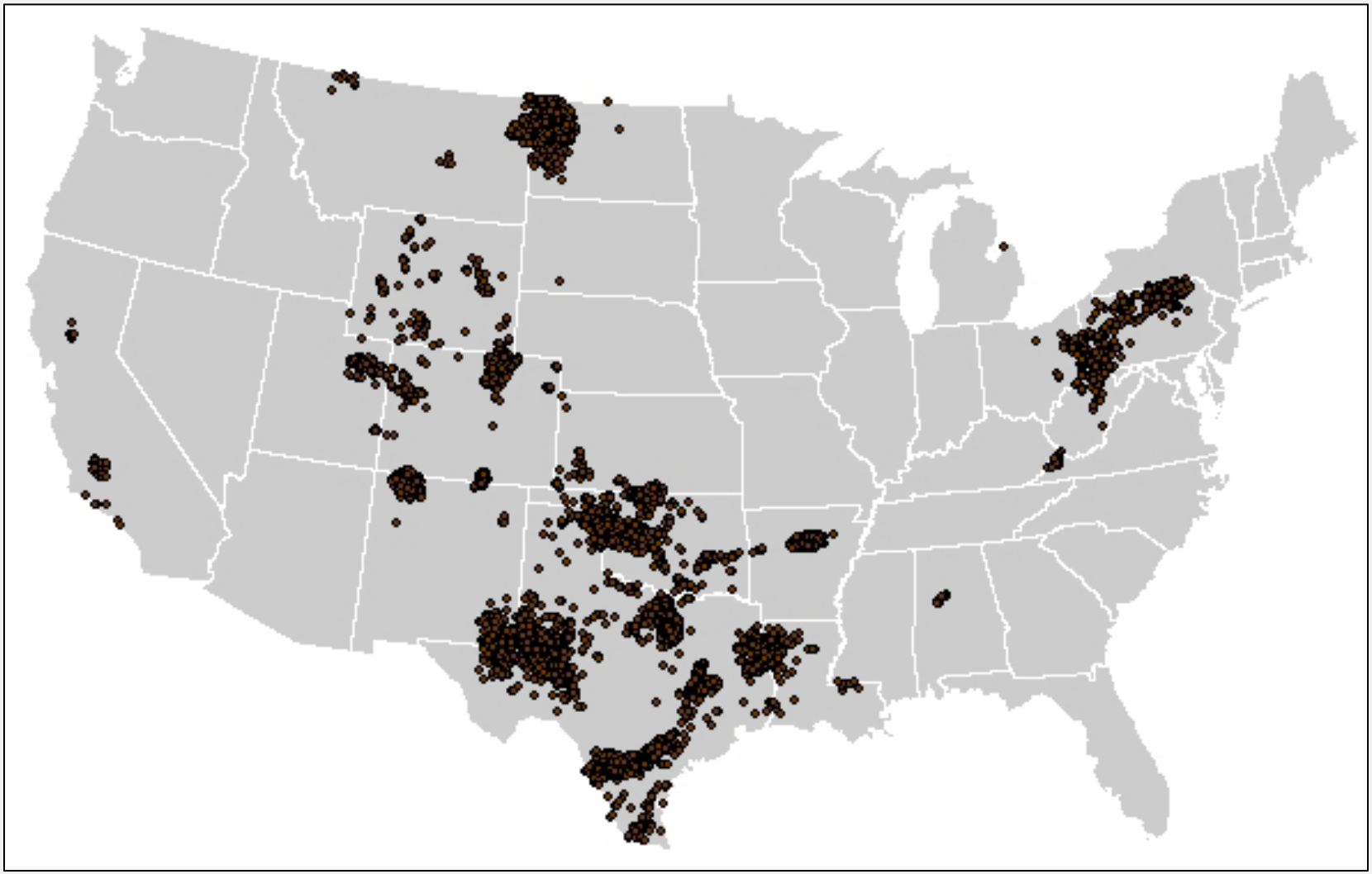
- Fracture date
- Location
  - State, county, longitude/latitude
- Production type
  - Oil or gas
- Depth
- Total fluid volume

FLUID COMPOSITION

- Additives
- Additive purpose
- Chemical ingredients
- Chemical Abstract Services Registration Number (CASRN)
- Maximum ingredient concentration in additive and in the hydraulic fracturing fluid

Chemicals claimed as "confidential business information" (CBI), "proprietary" or "trade secret" do not have to be reported in FracFocus

FracFocus Analysis



Wells Entered into FracFocus

(Wells fractured Jan, 2011 – Aug, 2012)

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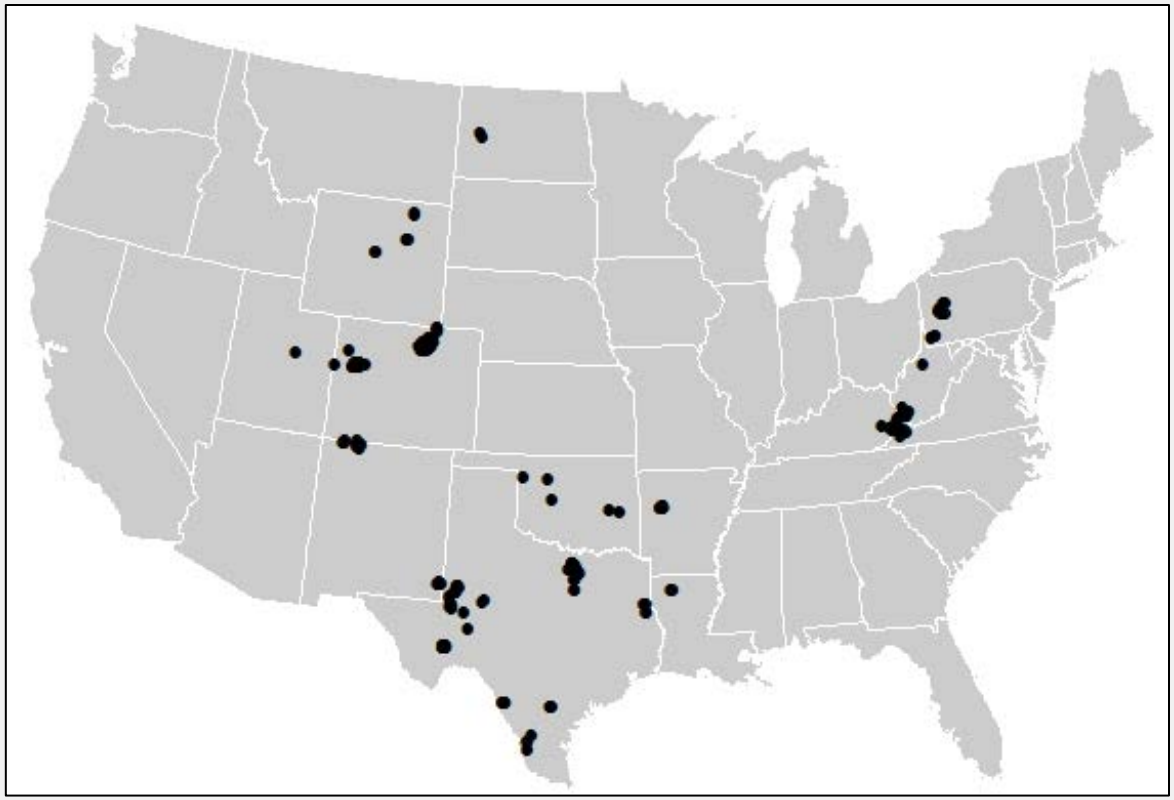
Well File Review



Locations of Wells Selected for Review

- Well files provided by 9 oil and gas operators
- Information on:
  - Well construction
  - Hydraulic fracturing
  - Water management
- Some data claimed as confidential business information

Data Comparison

	SERVICE COMPANY ANALYSIS	FRACFOCUS ANALYSIS	WELL FILE REVIEW
Timeframe	2005-2010	Jan. 2011 – Feb. 2013	Sept. 2009 – Oct. 2010
Well-specific data		X	X
Confidential business information	X		X
Decision criteria	X		
Trend analysis		X	

Charge Question #5

What key **historical changes** or **current trends**, if any, in hydraulic fracturing fluid composition should be considered as the EPA assesses the chemicals listed in Appendix A?

Technical Stakeholder Input*

- Large variety in fluid types, including:
  - Surfactant gels, energized or foam fluids, alcohol-based fluids, hydrocarbon-based fluids, liquid CO_2-based fluids
- Companies report that they are trying to use more environmentally friendly chemicals by removing or replacing harmful non-critical chemicals
- Recycling of flowback and produced water is increasing

*Technical Workshops 2011 & 2013

Charge Question #6

What criteria should be considered when identifying **indicator chemicals**, and why?

Indicators vs. Tracers

Indicator

- A chemical already present in hydraulic fracturing fluids or wastewater

Tracer

- A chemical added to hydraulic fracturing fluid in order to track fluid migration

Technical Stakeholder Input*

- Suggested indicators
  - Chloride
  - Potassium
  - Boron
  - Isotopic compositions of radium, strontium, water, methane
  - Chloride/bromide ratio
  - Total dissolved solids (TDS) and methane as “leading indicators”

*Technical Workshop 2011, Technical Roundtable 2012

Technical Stakeholder Input*

- Suggested Tier 1 parameters
  - TDS
  - Chloride
  - Potassium
- Suggested Tier 2 parameters
  - Total Kjeldahl nitrogen
  - Total organic carbon
  - Benzene, toluene, ethylbenzene, and xylene (BTEX) (in wet gas areas)

*Technical Workshop 2013

Charge Questions

4. Given the data sets available, what information on **fluid composition**, factors affecting composition, and/or **trends in composition** of hydraulic fracturing fluids may be most useful for identifying potential impacts to drinking water resources across the United States?

5. What key **historical changes** or **current trends**, if any, in hydraulic fracturing fluid composition should be considered as the EPA assesses the chemicals listed in Appendix A?

6. What criteria should be considered when identifying **indicator chemicals**, and why?