

Hydraulic Fracturing Study

Consultation with Environmental Organizations

| | |
|-------------|--|
| 2:00 – 2:15 | Greetings & Roll Call Tracy Mehan, Facilitator Ann Codrington, Office of Ground Water and Drinking Water |
| 2:15 – 2:45 | EPA Preliminary Plans for Study Jeanne Briskin and Dr. Robert Puls, Office of Research and Development |
| 2:45 – 3:00 | Stakeholder Process Jill Dean, Office of Ground Water and Drinking Water |
| 3:00 – 4:00 | Discussion |

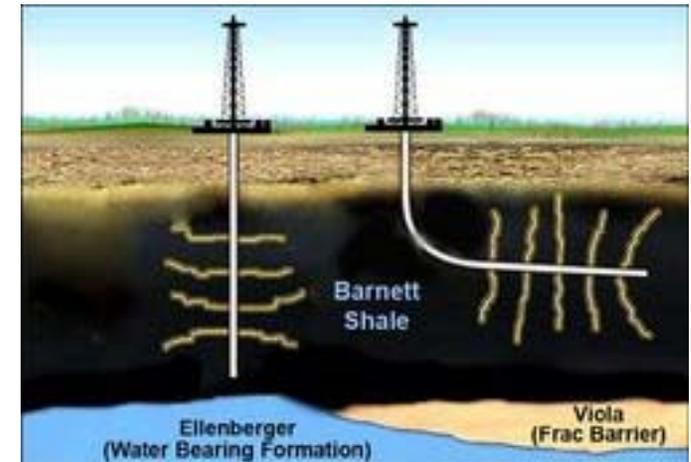
Potential Relationships Between Hydraulic Fracturing and Drinking Water Resources

*Outreach to Environmental Groups on Study Design and
Stakeholder Involvement*



Major Topics to be Discussed

- Provide overview of context for study and approach for developing study design
- Describe potential components of study
- Identify types of data and information that stakeholders can provide
- Provide summary of April 2010 Science Advisory Board (SAB) Consultation
 - Scope of Study
 - Research Focus and Prioritization
 - Stakeholder Process
- Describe Stakeholder Process
- Solicit input/feedback from participants through discussion session

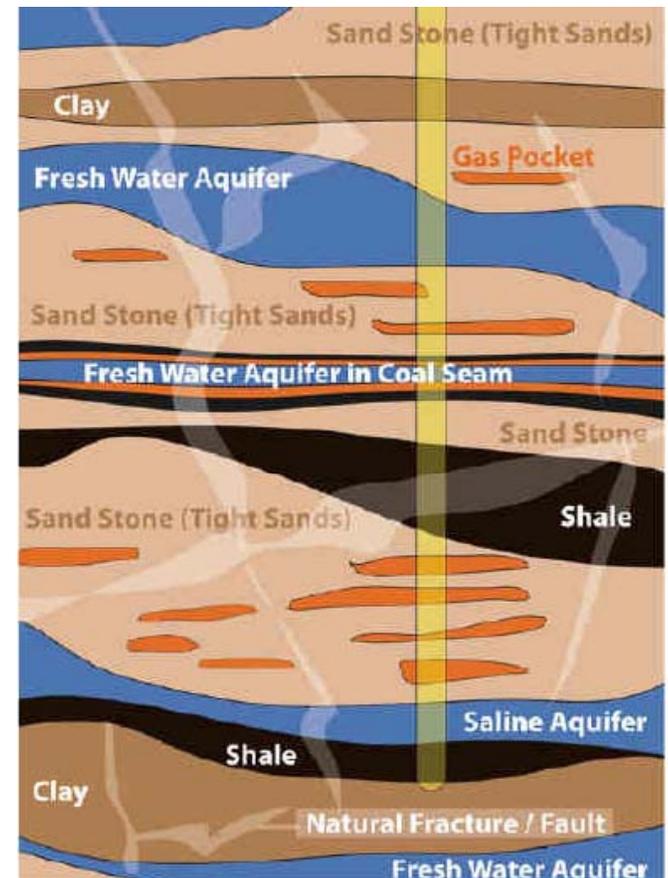


Directive to EPA from the FY10 Appropriation Conference Committee

“The conferees urge the Agency to carry out a study on the relationship between hydraulic fracturing and drinking water, using a credible approach that relies on the best available science, as well as independent sources of information. The conferees expect the study to be conducted through a transparent, peer-reviewed process that will ensure the validity and accuracy of the data. The Agency shall consult with other Federal agencies as well as appropriate State and interstate regulatory agencies in carrying out the study, which should be prepared in accordance with the Agency's quality assurance principles.”

Why is Hydraulic Fracturing a Concern Now?

- Extraction of energy resources from shale is becoming more prevalent due to:
 - Advances in horizontal drilling technologies and new fluid formulations that improve economics
 - Access to different formations (e.g. shale)
 - “Unconventional” gas is perceived to represent a significant future domestic “clean” energy source
- Concerns about potential endangerment of water supplies
 - New and different geographic and geologic settings
 - Formations may contain metals, radionuclides, salts, or other constituents that may be mobilized and impact water quality
 - Environmental contaminants associated with hydraulic fracturing chemicals, wastes, and residuals may pose risks to public health, water resources, and the environment

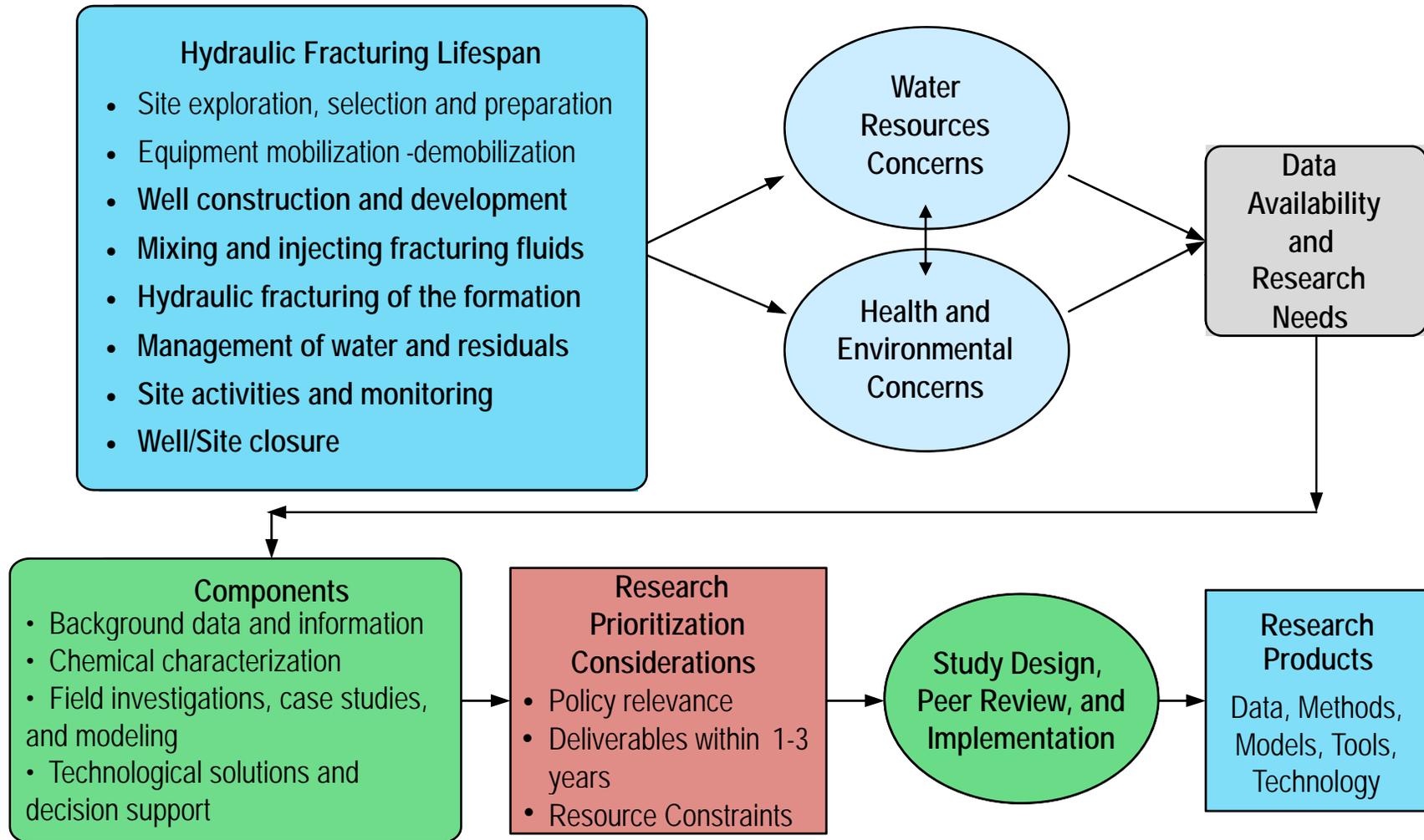


Role of Water in the Context of the Hydraulic Fracturing Lifespan

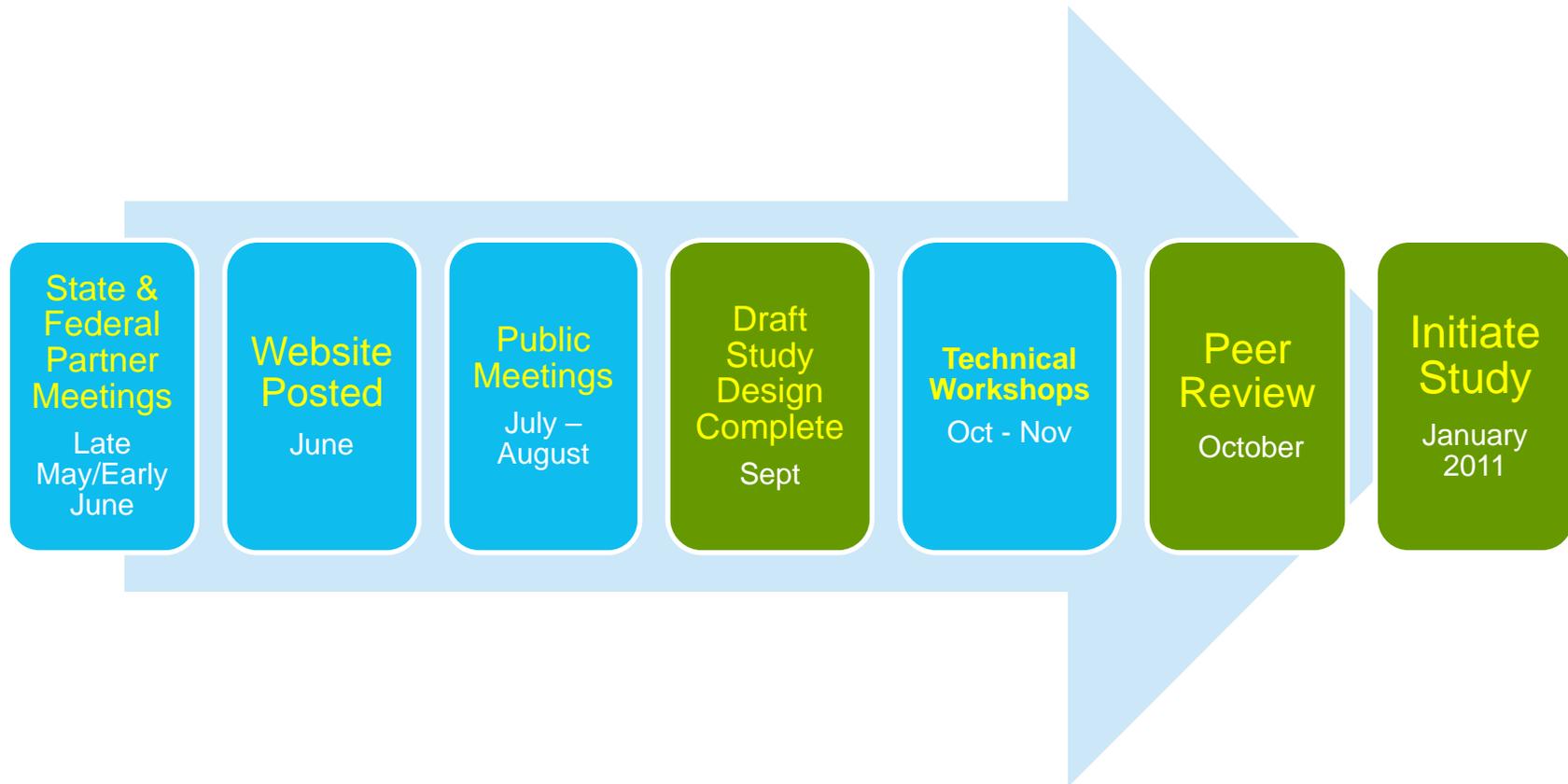
- Water associated with hydraulic fracturing is derived from local underground or surface sources, and it is either managed on-site or transported off-site for treatment and/or discharge
- Examples of water associated with the hydraulic fracturing lifespan include:
 - *Underground and surface sources of drinking water*
 - *Make-up water for mixing hydraulic fracturing fluids and proppants*
 - *Flow-back water, produced water, wastewater*
- Contaminants associated with flowback fluids and produced water may include:
 - *Hydraulic fracturing fluids, chemical degradation and transformation products*
 - *Materials in the subsurface that are mobilized by the injected fluids and brought to the surface during energy resource extraction*
 - *Constituents such as metals, radionuclides, and organics that may precipitate or volatilize through water and wastewater management*



Approach for Developing EPA Study Plan



2010 Timeline



Initial study results are expected to be published by late 2012.

Potential Elements of the Study

- Compilation and analysis of background data and information
- Characterization of chemical constituents relevant to hydraulic fracturing
- Field investigations, case studies, and computational modeling
- Technological solutions for risk mitigation and decision support

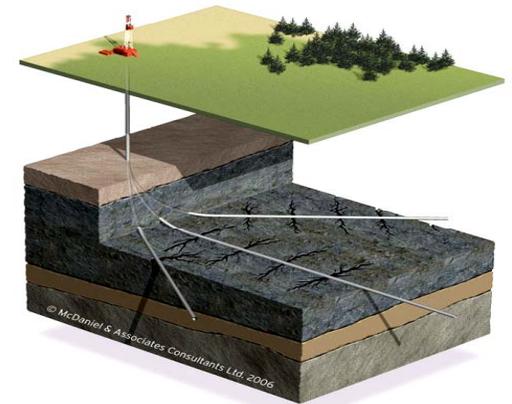
Hydraulic Fracturing Data and Information Needs

- **Types of data**

- Baseline data about site characteristics and surrounding area prior to drilling
- Validated and consistent data on chemicals, additives, and their concentrations
- Water quality data associated with flowback and produced waters
- Data on metals, radionuclides, and other constituents that are mobilized from the subsurface, wastewater, or residuals
- Data on well construction, well integrity
- Information on regulatory approaches and best management practices

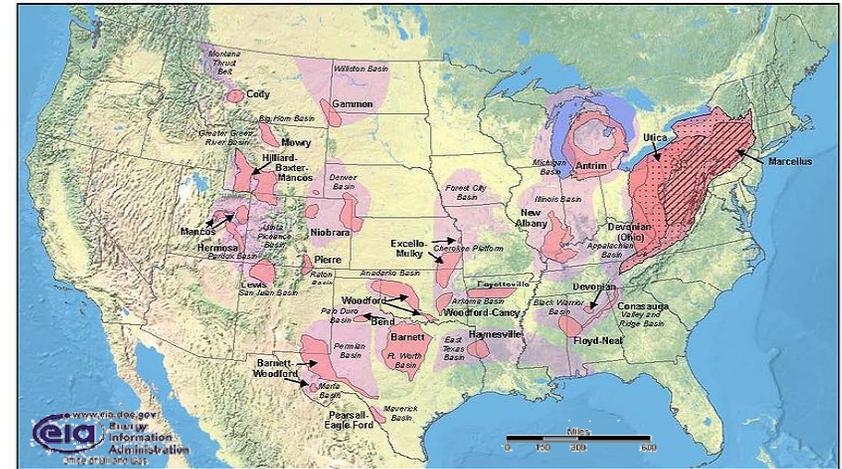
- **How the information may be used:**

- Qualitative evaluation of status of information
- Identify research and information gaps
- Inform study design and screen sites for case studies
- Identify regional and geographic variations
- Prioritize research

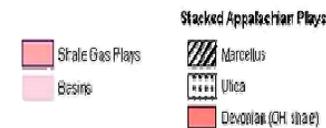


Approach for Data and Information Compilation and Analysis

- Identify, compile, and analyze published data
 - Published reports (e.g. EPA, DOE, USGS, GWPC, Industry, State Associations, Environmental Groups, Universities, etc.)
 - Peer-reviewed literature
- Develop process for collecting, compiling, and reporting data from stakeholders including Federal agencies, States, Interstate Agencies, Industry, NGOs, Citizens
 - Define categories of data and information
 - Develop quality assurance criteria
- Federal Register Notice during summer 2010 to request data
- Identify data and information gaps



United States Shale Gas Plays



Characterization of Chemical Constituents Relevant to Hydraulic Fracturing

- Objectives

- Characterize fracturing fluids and their degradation products to evaluate fate and transport properties and potential toxicity
- Determine the potential for metals, radionuclides, organic contaminants or gases to be mobilized from geologic formations
- Identify potential indicator/surrogate parameters that can be used to indicate exposure

- Approach

- Evaluate and troubleshoot existing analytical methods
- Identify matrix interferences
- Refine or modify analytical methods as needed
- Identify key biogeochemical processes that might impact the quality of drinking water supplies



Field Investigations, Case Studies, and Computational Modeling

- **Objective:**

- Collect data on how hydraulic fracturing potentially impacts water resources and associated health risks
- Collect data on water quality and availability
- Develop ground water and watershed models that can be validated and used to determine “area of review” and inform water resource management strategies

- **Approach**

- Field investigations and sample collection
 - Well Sampling and Analysis
 - Pre-injection, flowback fluids, produced water, wastewater discharges, surface water supplies
 - Process residuals
 - Other exposure pathways
- Data analysis and interpretation
- Modeling
- Risk assessment



Field Investigations

- **Objectives**

- Provide basis for developing assessment of hydraulic fracturing and water resources in different geographic and geologic settings
- Develop inputs for computational modeling, risk assessment, and decision-support tools
- Evaluate best management practices

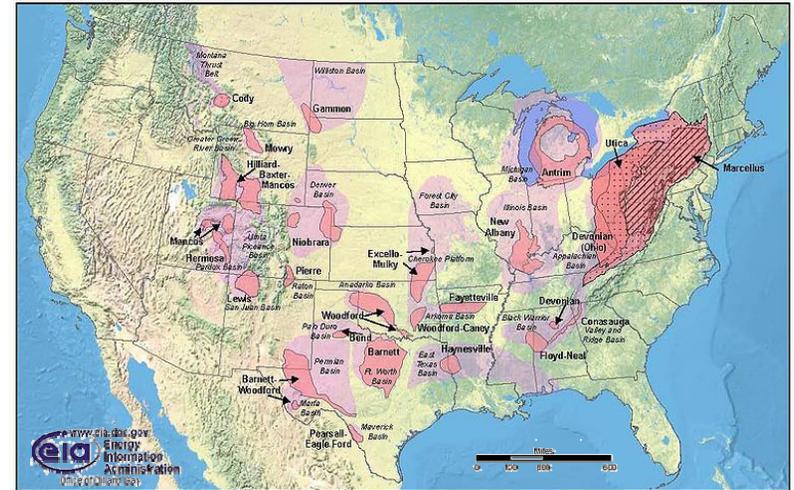
- **Approach**

- Develop criteria for nominating, screening, and prioritizing sites for field investigations
- Coordinate with stakeholders on identifying candidate sites for field investigations and case studies
- Compile background information and sampling program
- Develop detailed study plan and quality assurance
- Stage site activities to correspond to critical components of hydraulic fracturing lifespan and in coordination with other aspects of project including modeling
- Provide periodic progress updates

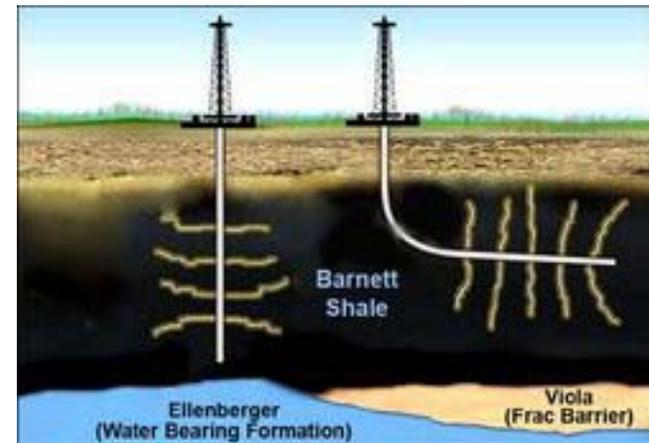


Potential Criteria for Site Selection

- **Screening Criteria**
 - Vulnerable surface or ground water resources
 - Proximity of population and drinking water supplies
 - Magnitude of activity (wells/acre)
 - Geologic conditions
 - Site history
- **Physical Considerations**
 - Site access for monitoring wells, surface water testing, and geophysical testing
 - Availability of support services
- **Other Considerations**
 - Stakeholder recommendations
 - Ability to leverage with other stakeholders (federal, state, interstate, industry, NGOs, citizens)

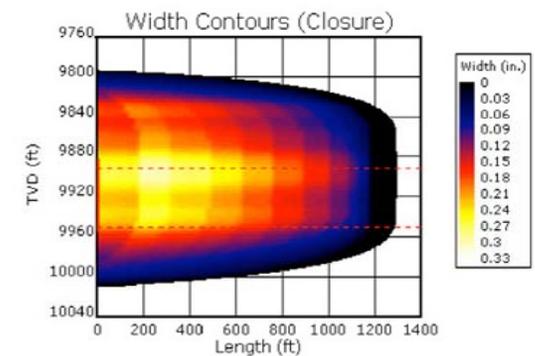
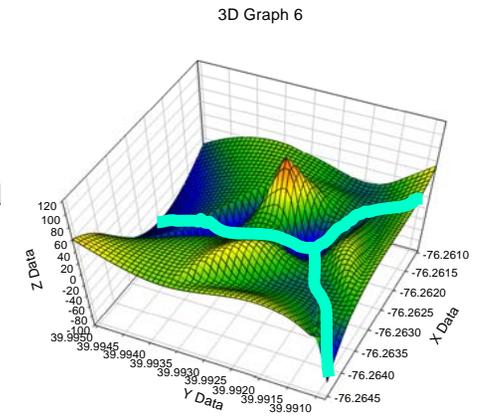


United States Shale Gas Plays



Potential Computational Modeling Activities

- Fate and transport studies of HF fluids
- Predict the likelihood of drinking water impacts based upon the available geologic, geochemical, geophysical, and hydrologic data
- Determine the zone of influence of HF fluids and area of review in the subsurface
- Evaluate vulnerability of drinking water supplies from abandoned wells
- Inform sampling and monitoring programs
- Apply watershed based models to evaluate impacts of water withdrawals and wastewater discharges on water quality and availability
- Develop decision-support tools to evaluate relationship of management practices to water quality and availability





Inform Technological Solutions for Risk Mitigation and Decision Support

- Monitoring strategies (short-term and long-term)
- Sustainable and reliable strategies for water management
 - Water use optimization (quality and quantity)
 - Identify/evaluate treatment technologies for flowback fluids ,produced waters, residuals, and other waste materials generated through HF
- Alternative chemicals/technologies that reduce environmental and health risks
 - Hydraulic fracturing chemicals
 - Alternative water sources and reuse
 - Drinking water source protection and monitoring
- Integrated data and information management including mapping to overlay HF activities with the locations of gas resources, drinking water resources, and other relevant site information

Science Advisory Board Consultation

- Public meeting held in Washington DC April 7-8 2010
- SAB provided with scoping materials and charge questions
- Charge questions
 1. Scope:
 - *What recommendations does the SAB Environmental Engineering Committee (EEC) have regarding the scope of the study?*
 2. Research questions and prioritization:
 - *What recommendations does the SAB EEC have regarding the research questions identified?*
 - *What process does the SAB EEC suggest for prioritizing research needs given the Congressional request and a desire by the Agency to complete initial research products by the end of calendar year 2012?*
 3. Stakeholders:
 - *What advice does the SAB EEC offer for designing a stakeholder process that provides for balanced input in developing a sound scientific approach for the overall research strategy?*
- **Stakeholder representation:** Other Federal agencies, States and State agencies, local governments, non-governmental organizations and associations, public interest groups, industries, industrial organizations and associations, and private citizens
- **Stakeholder Comments:** 64 written comments, 15 oral statements
- **For more information:** <http://www.epa.gov/sab>

Summary of Science Advisory Board Draft Response to Charge Questions (5-20-2010)

1. Scope:

- *Short-term research should be directed to study sources and pathways of potential impacts of hydraulic fracturing on water resources (quality and quantity), including surface waters, underground sources of drinking water, and potential sources of drinking water*
- *Use a lifecycle framework to identify the most important research questions and characterize fundamental physical and chemical processes below and above ground*
- *Focus on human health and environmental concerns specific to HF*

2. Research questions and prioritization:

- *Careful compilation and review of all available data and knowledge available in peer-reviewed literature, in industry, in professional and non-governmental organizations, and government agencies*
- *Use a case-study approach to facilitate exchange of information between resource development companies and citizen groups*
- *Prioritize research toward the reactions and transport of hydraulic fracturing fluids in complex subsurface environments including characteristics of the injected fluids, reactions occurring in the injected zone, and pathways for exposure*

Draft Overarching Research Questions Suggested by SAB EEC (5-20-2010)

- *What are the fundamental physical and chemical water-related processes for each phase of the hydraulic fracturing lifecycle (below ground and above ground in treatment processes and surface water)?*
- *What is the quality and quantity of injected fluids, flowback water and produced water that is co-mingled with the flowback water?*
- *How does the specific composition of TDS vary among flowback and produced waters?*
- *What do field case studies tell us about the effects of hydraulic fracturing on the reactions, fate, and transport of injected constituents, and the fate and transport of potential contaminants in particular regions and geologic regimes?*
- *What do field data convey about region-specific issues related to hydraulic fracturing and its environmental impacts?*
- *In what way does hydraulic fracturing, at one or multiple sites, alter existing surface subsurface flow paths?*
- *What are existing best management practices (BMPs) that affect quality and quantity of flowback and produced water?*
- *What are opportunities to develop technologies that could lead to green additives or improved approaches to managing process waters or waters impacted by hydraulic fracturing?*
- *What are the mass balances for water and constituents of concern at a hydraulic fracturing site?*



SAB Response to Charge Question 3: *Stakeholders*

- Engage stakeholders throughout the study
- Use best available social science for developing stakeholder engagement activities
- Engage with relevant states to inventory and conduct performance evaluations of the effectiveness of state regulatory, technological development and BMP activities

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Hydraulic Fracturing Study: Stakeholder Process

June 23, 2010

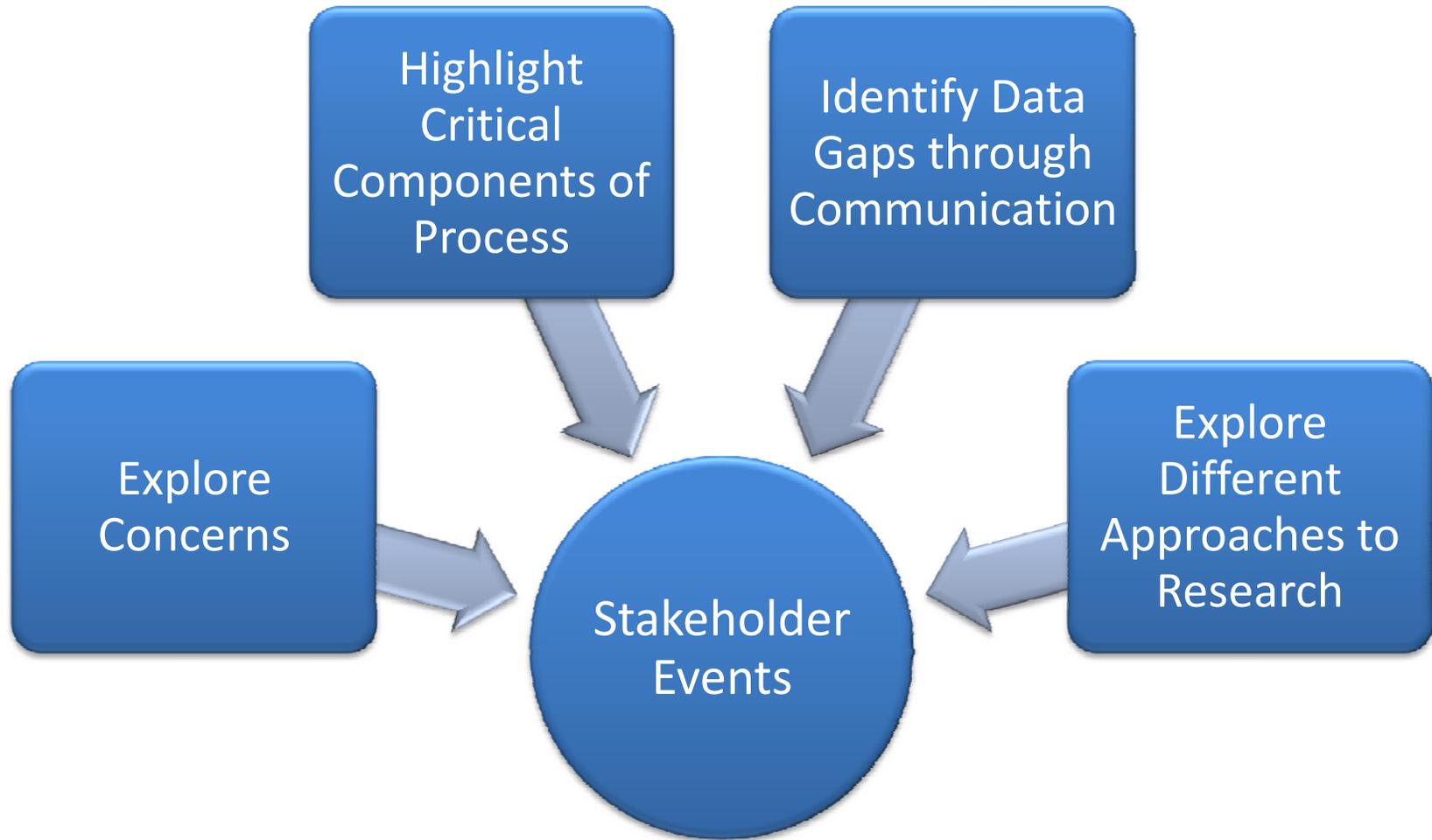
Consultation with Environmental Organizations

Jill Dean, EPA Office of Water

OUTLINE

- Purpose of stakeholder events
- Types of stakeholder events
- Collaboration
- Timeline

Purpose of Engaging the Public



Stakeholder Events

Facilitated Public Meetings

- July 8, Fort Worth, TX
- July 13, Denver, CO
- July 22, Canonsburg, PA
- Aug 12, Binghamton, NY

Sector-Specific Meetings

- June – July 2010
- Sectors: State & federal partners, industry, environmental groups, tribes

Technical Workshops

- October – November 2010
- Locations: To be determined
- Proposed topics: well mechanical integrity, fate & transport of fluids, monitoring

Facilitated Public Meetings

Public

Feedback on study scope, perspectives on risk, share data, identify data gaps

Meeting Activities

1. Brief presentations by EPA on
 - a. hydraulic fracturing background
 - b. draft study plan and scope
 - c. criteria for selecting case study locations
2. Oral comment period by public

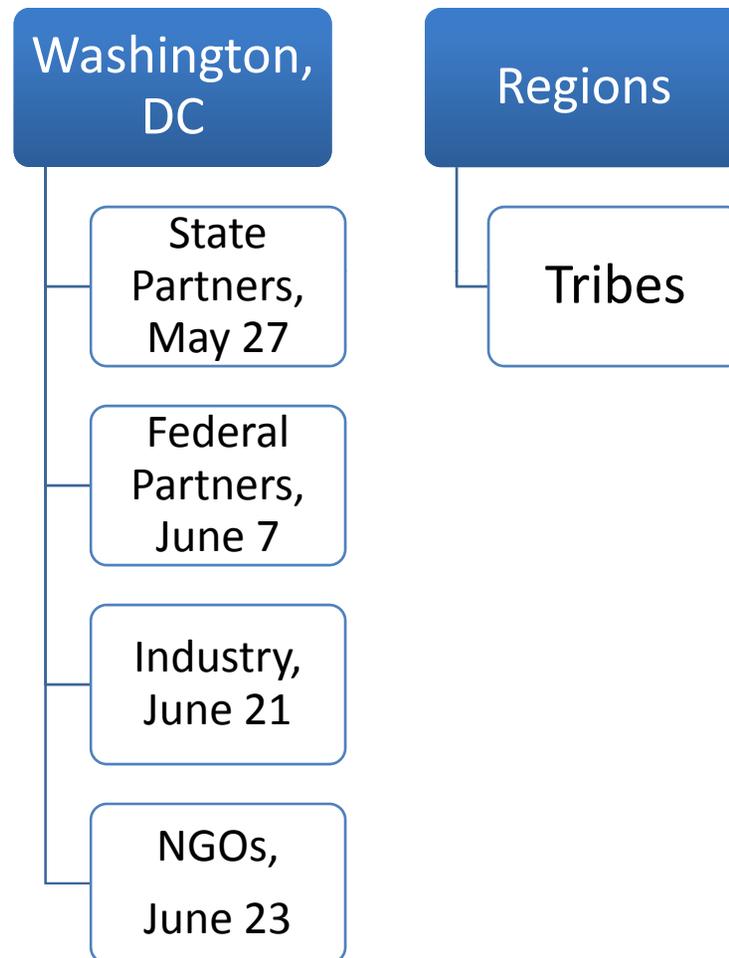
Share preliminary plans for study, HF background

EPA

Four hour public meetings from 6:00 – 10:00 pm (local time) in Fort Worth, Denver, Canonsburg.

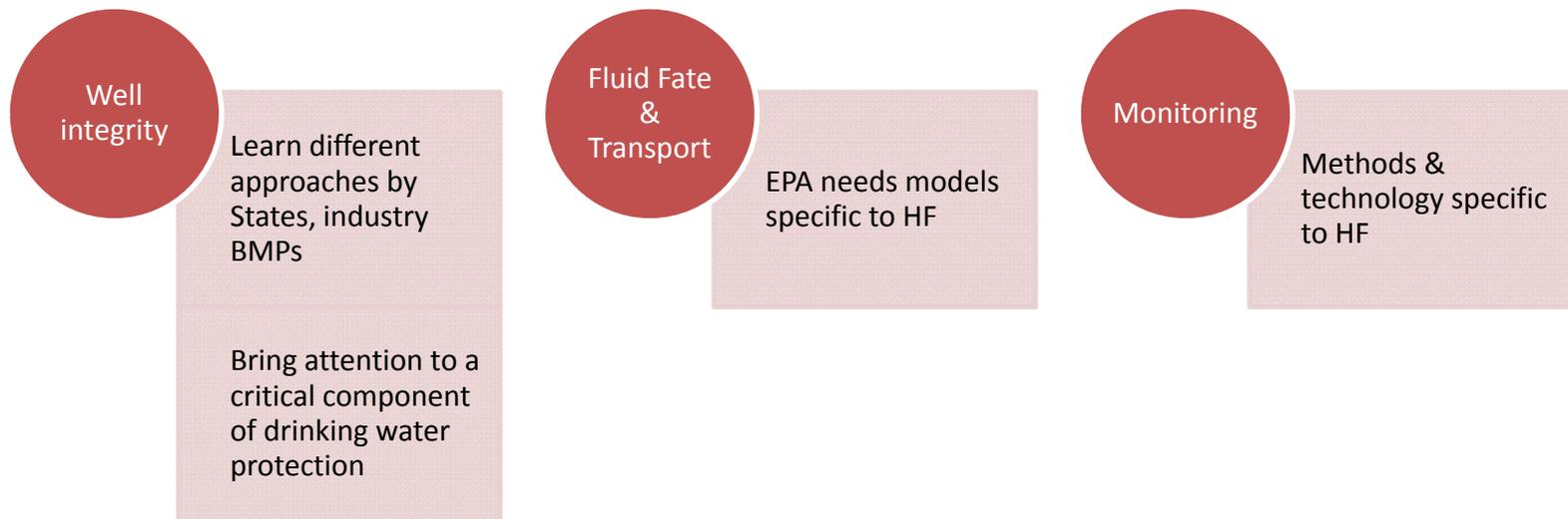
Three sessions in Binghamton from 8:00 am – 12:00 pm, 1:00 pm – 5:00 pm, and 6:00 pm – 10:00 pm local time.

Sector-Specific Meetings



Technical Workshops

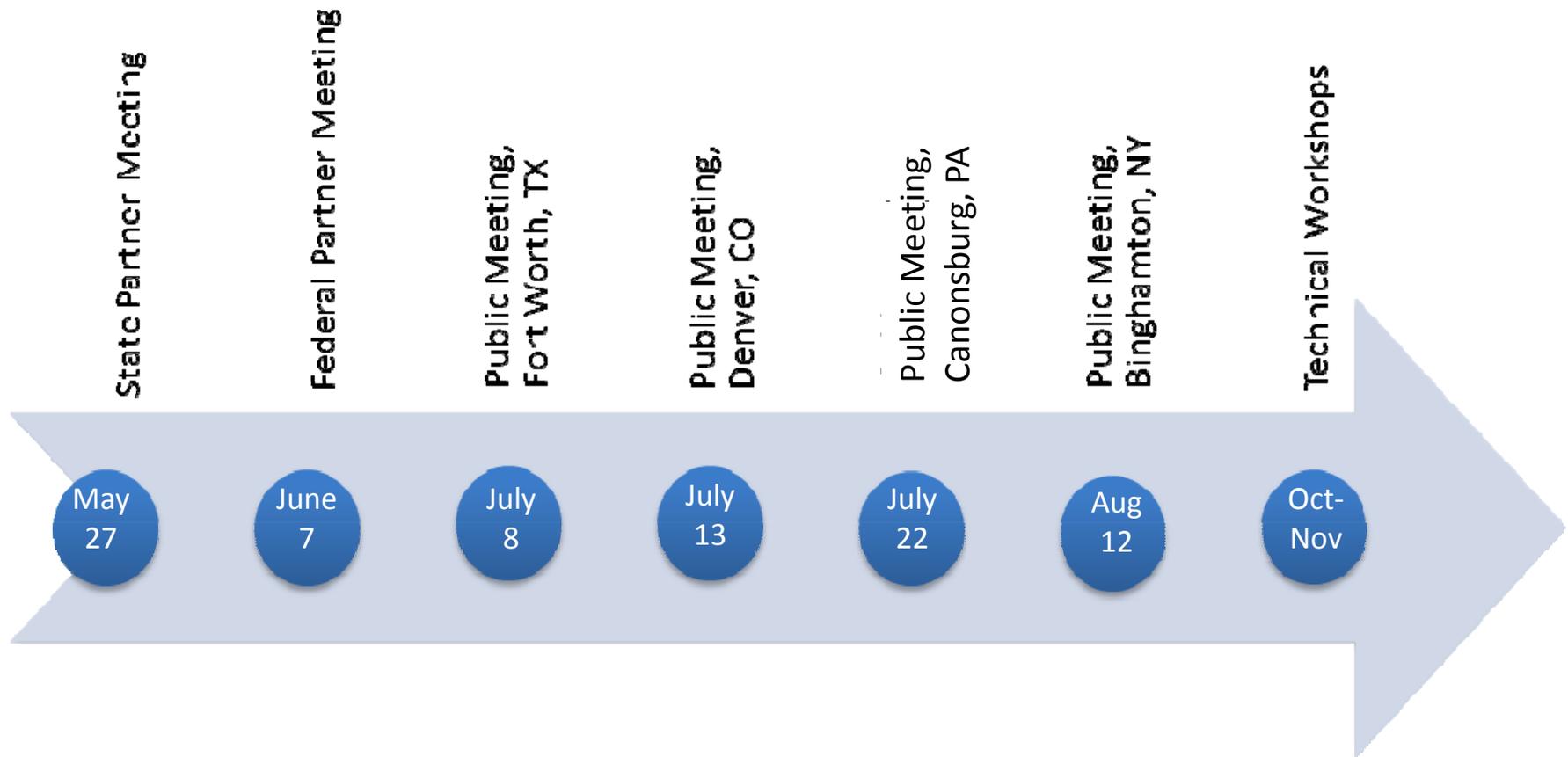
- Define the technical information EPA does not have to inform the study design, field investigations
- Who do we invite?
- Are these the right topics?



Opportunities for Collaboration

- Public meetings
- Written comments
- Data collection
- Technical workshops
- Case study location recommendations

2010 Stakeholder Process Timeline



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Discussion Topics

- **Components of study**
 - What are the highest priority and most critical outputs/outcomes that this study should seek to accomplish?
 - Are there issues that are not included that should be considered in the study design?
- **Availability of data and information**
 - What types of data and information are available?
 - Do you have suggestions on streamlining the data collection process?
- **Ongoing activities**
 - Can you provide information on other studies that may be relevant to this effort?
 - Are there ways that this study could complement/leverage current activities?



Discussion Topics (2)

- Case study concept
 - Do you have any feedback/suggestions on the case study approach?
 - Do you have suggestions on criteria that should be considered in selecting sites for the case studies?
- Other comments and suggestions?

For stakeholder questions, contact Jill Dean, dean.jill@epa.gov

For study-related questions, contact Jeanne Briskin, briskin.jeanne@epa.gov