Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Overview for Roundtable Meetings

U.S. Environmental Protection Agency
Office of Research and Development
November 2012
Webinar Outline

• Context for roundtable meetings
• Logistics and what to expect at the roundtable meetings
• Background and organization of EPA study
• Questions?
Technical Stakeholder Engagement for EPA’s Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Technical Roundtables

- November 14
  - Water Acquisition
  - Chemical Mixing

- November 15
  - Well Injection
  - Flowback & Produced Water

- November 16
  - Wastewater Treatment & Waste Disposal

Webinar: Week of December 17, 2012
- Release of 2012 Progress Report
- Report out on Technical Roundtables

Technical Workshops
- Discuss specific technical topics identified by Roundtables.
- Each Roundtable may identify 1-2 technical topics for further discussion.

SAB Meeting
- Public face-to-face meeting of the SAB Hydraulic Fracturing Advisory Panel.
- They will conduct a review of the 2012 Progress Report.
- March 2013

Technical Roundtables
- Reconvene in Summer/Fall of 2013. This provides continuity of stakeholder input.
- Present and discuss EPA’s scientific research approach and progress.

Report of Results

Peer Review Ongoing

* Estimated dates subject to change.
<table>
<thead>
<tr>
<th>EVENT</th>
<th>DATE</th>
<th>PURPOSE</th>
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<tbody>
<tr>
<td>Webinar</td>
<td>10/31</td>
<td>Introduce roundtable participants to the HF study and the roundtable meetings</td>
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<tr>
<td>Five Roundtables: each focusing on a stage of the water cycle</td>
<td>11/14 - 11/16</td>
<td>EPA to present information regarding the work underway on the HF water study. Seek a broad and balanced range of expertise and data from stakeholders Nominate topics for technical workshops</td>
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<tr>
<td>Technical Workshops</td>
<td>TBD</td>
<td>Technical experts from a cross-section of stakeholder groups discuss topics stemming from the roundtable discussions</td>
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<tr>
<td>Roundtable</td>
<td>Date and Time</td>
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<tr>
<td>Water Acquisition</td>
<td>Wednesday, November 14 8:00 am – 12:00 pm</td>
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<tr>
<td>Chemical Mixing</td>
<td>Wednesday, November 14 1:30 pm – 5:30 pm</td>
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<tr>
<td>Well Injection</td>
<td>Thursday, November 15 8:00 am – 12:00 pm</td>
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<tr>
<td>Flowback and Produced Water</td>
<td>Thursday, November 15 1:30 pm – 5:30 pm</td>
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</tr>
<tr>
<td>Wastewater Treatment</td>
<td>Friday, November 16 8:00 am – 1:00 pm</td>
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</table>
• EPA will present more detailed information regarding the work underway
• Discussion will help to ensure that EPA has access to a broad and balanced range of expertise and data
• Participants may nominate specific topics for technical workshops
During the Meeting

• Meeting is not a FACA
  – Primary purpose is exchange of information/facts
  – Seeking individual opinions, not consensus advice
  – No voting or recommendations from the group as a whole

• In-person meeting

• No substitutes
After the Meeting

- EPA will host a webinar for the public to inform them of the content and results of the roundtable meeting.
- Materials shared at the meeting will be posted on EPA’s website.
- EPA will identify and set up workshops on key topics.
Schedule

2012
- Stakeholder Roundtable Meeting
- Federal Register notice to solicit data and published papers
- Progress Report
- Stakeholder Webinars

2013
- Technical Workshops
- SAB review of Progress Report
- Follow up Stakeholder Roundtable meeting

2014
- Draft Report of Results
Information in Preparation for Roundtable Meetings
Water Cycle

Hydraulic fracturing often involves the injection of more than a million gallons of water, chemicals, and sand at high pressure down the well. The depth and length of the well varies depending on the characteristics of the hydrocarbon-bearing formation. The pressurized fluid mixture causes the formation to crack, allowing natural gas or oil to flow up the well.

Water Use in Hydraulic Fracturing Operations
- **Water Acquisition**: Large volumes of water are transported for the fracturing process.
- **Chemical Mixing**: Equipment mixes water, chemicals, and sand at the well site.
- **Well Injection**: The hydraulic fracturing fluid is pumped into the well at high injection rates.
- **Flowback and Produced Water**: Recovered water (called flowback and produced water) is stored on-site in open pits or storage tanks.
- **Wastewater Treatment and Waste Disposal**: The wastewater is then transported for treatment and/or disposal.
Research Questions

What are the potential impacts on drinking water resources of:

- Large volume water withdrawals from ground and surface water?
- Surface spills on or near well pads of hydraulic fracturing fluids?
- The injection and fracturing process?
- Surface spills on or near well pads of flowback and produced water?
- Inadequate treatment of hydraulic fracturing wastewaters?

Water Acquisition

Chemical Mixing

Well Injection

Flowback and Produced Water

Water Treatment and Waste Disposal
Roundtable Meetings

- **Stages**: Water Cycle Stage
- **Primary Research Questions**: Primary Research Question
- **Secondary Research Questions**: Secondary Research Question 1, Secondary Research Question 2, Secondary Research Question 3
- **Research Projects**: Research Project 1, Research Project 2, Research Project 3, Research Project 4
- **Research Activities**: Research Approach 1, Research Approach 2

- **5 Stages**
- **5 Questions**
- **16 Questions**
- **22 Projects**
- **5 Activities**
What are the potential impacts of large volume water withdrawals from ground and surface waters on drinking water resources?
Water Acquisition

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

SECONDARY RESEARCH QUESTIONS

- 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 hydraulic fracturing operations on local water quality?

RESEARCH PROJECTS

- Literature Review
- Service Company Analysis
- Well File Review
- FracFocus Analysis
- Water Availability Modeling
- Analysis of Existing Data
- Laboratory Studies
- Toxicity Assessment
- Scenario Evaluations
- Case Studies
What are the possible impacts of surface spills on or near well pads of hydraulic fracturing fluids on drinking water resources?
Chemical Mixing

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

SECONDARY RESEARCH QUESTIONS

- What is currently known about the frequency, severity, and causes of spills of hydraulic fracturing fluids and additives?
- What are the identities and volumes of chemicals used in hydraulic fracturing fluids, and how might this composition vary at a given site and across the country?
- What are the chemical, physical, and toxicological properties of hydraulic fracturing chemical additives?
- If spills occur, how might hydraulic fracturing chemical additives contaminate drinking water resources?

RESEARCH PROJECTS

- Literature Review
- Spills Database Analysis
- Service Company Company Analysis
- Well File Review
- FracFocus Analysis
- Analytical Method Development
- Toxicity Assessment
- Retrospective Case Studies
Chemical Mixing

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

SECONDARY RESEARCH QUESTIONS

What is the composition of hydraulic fracturing fluids and wastewater?

What are the chemical, physical, and toxicological properties of these chemicals?

RESEARCH PROJECTS

- Literature Review
- Service Company Analysis
- Well File Review
- FracFocus Analysis
- Analytical Method Development
- Toxicity Assessment

Analysis of Existing Data
- Scenario Evaluations
- Case Studies

Laboratory Studies
Toxicity Assessment
Well Injection

What are the possible impacts of the injection and fracturing process on drinking water resources?
Well Injection

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

**SECONDARY RESEARCH QUESTIONS**

- What is currently known about the frequency, severity, and causes of spills of hydraulic fracturing fluids and additives?
- What are the identities and volumes of chemicals used in hydraulic fracturing fluids, and how might this composition vary at a given site and across the country?

**RESEARCH PROJECTS**

- Literature Review
- Service Company Analysis
- Well File Review
- Subsurface Migration Modeling
- Retrospective Case Studies

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Analysis of Existing Data  Laboratory Studies  Toxicity Assessment
Scenario Evaluations  Case Studies
What are the possible impacts of surface spills on or near well pads of flowback and produced water on drinking water resources?
What are the possible impacts of surface spills on or near well pads of hydraulic fracturing fluids on drinking water resources?

SECONDARY RESEARCH QUESTIONS

- What is currently known about the frequency, severity, and causes of spills of flowback and produced water?

- What is the composition of hydraulic fracturing wastewaters, and what factors might influence this composition?

- What are the chemical, physical, and toxicological properties of hydraulic fracturing wastewater constituents?

- If spills occur, how might hydraulic fracturing wastewaters contaminate drinking water resources?

RESEARCH PROJECTS

- Literature Review
- Spills Database Analysis
- Service Company Analysis
- Well File Review
- Analytical Method Development
- Toxicity Assessment
- Retrospective Case Studies
Flowback & Produced Water

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

SECONDARY RESEARCH QUESTIONS

- What is currently known about the frequency, severity, and causes of spills of hydraulic fracturing fluids and wastewater?
- If spills occur, how might hydraulic fracturing fluids and wastewater contaminate drinking water resources?

RESEARCH PROJECTS

- Literature Review
- Spills Database Analysis
- Service Company Analysis
- Well File Review
- Retrospective Case Studies

Analysis of Existing Data  Laboratory Studies  Toxicity Assessment
Scenario Evaluations  Case Studies
What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?
What are the possible impacts of surface spills on or near well pads of hydraulic fracturing fluids on drinking water resources?

SECONDARY RESEARCH QUESTIONS

- What are the common treatment and disposal methods for hydraulic fracturing wastewaters, and where are these methods practice?
- How effective are conventional POTWs and commercial treatment systems in removing organic and inorganic contaminants of concern in hydraulic fracturing wastewaters?
- What are the potential impacts from surface water disposal of treated hydraulic fracturing wastewater on drinking water treatment facilities?

RESEARCH PROJECTS

- Literature Review
- Well File Review
- FracFocus Analysis
- Surface Water Modeling
- Wastewater Treatability Studies
- Source Apportionment Studies
- Br-DBP Precursor Studies
Questions?
For More Information

www.epa.gov/hfstudy

Contact Lisa Matthews
Matthews.lisa@epa.gov
Background Information
Purpose of EPA’s Study

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

*EPA’s study plan focuses on the water cycle in hydraulic fracturing.*
EPA is committed to using:

✓ Best available science
✓ Transparent, peer-reviewed process
✓ Quality assurance principles
✓ Independent sources of information
✓ Consultation with others
Science Advisory Board Peer Review

- SAB found study plan to be “appropriate and comprehensive”
- Response to SAB recommendations:
  - Core research questions and general approach are unchanged
  - More focused research questions
  - More detail about how questions will be addressed
Overview of Research Projects

- Analysis of Existing Data
- Scenario Evaluations
- Laboratory Studies
- Toxicity Assessments
- Case Studies
# Analysis of Existing Data

<table>
<thead>
<tr>
<th>Project</th>
<th>Description</th>
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<tbody>
<tr>
<td>Literature Review</td>
<td>Review and assessment of existing papers and reports, focusing on peer-reviewed literature</td>
</tr>
<tr>
<td>Spills Database Analysis</td>
<td>Analysis of selected federal and state databases for information on spills of hydraulic fracturing fluids and wastewaters</td>
</tr>
<tr>
<td>Service Company Analysis</td>
<td>Analysis of data and information provided by nine hydraulic fracturing service companies in response to a September 2010 information request on hydraulic fracturing operations</td>
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<tr>
<td>Well File Review</td>
<td>Analysis of data and information provided by nine oil and gas operators in response to an August 2011 information request for 350 well files</td>
</tr>
<tr>
<td>FracFocus Analysis</td>
<td>Analysis of data compiled from FracFocus</td>
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## Scenario Evaluations

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<tr>
<th>Project</th>
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<tbody>
<tr>
<td>Subsurface Migration Modeling</td>
<td>Numerical modeling of five subsurface fluid migration scenarios that explore the potential for fluids to move from the fractured zone to drinking water aquifers</td>
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<tr>
<td>Surface Water Modeling</td>
<td>Modeling of concentrations of selected chemicals at public water supplies located downstream from wastewater treatment facilities discharging treated hydraulic fracturing wastewater to surface waters</td>
</tr>
<tr>
<td>Water Availability Modeling</td>
<td>Assessment and modeling of current and future scenarios exploring the impact of water usage for hydraulic fracturing on drinking water availability in the Upper Colorado River Basin and the Susquehanna River Basin</td>
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Laboratory Studies

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<tr>
<th>Project</th>
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<tbody>
<tr>
<td>Source Apportionment Studies</td>
<td>Identification and quantification of the source of high bromide and chloride concentrations at public water supply intakes downstream from wastewater treatment facilities</td>
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<tr>
<td>Wastewater Treatability Studies</td>
<td>Assessment of the efficacy of common wastewater treatment processes on removing selected chemicals found in hydraulic fracturing wastewater</td>
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<tr>
<td>Br-DBP Precursor Studies</td>
<td>Assessment of the ability of bromide and brominated compounds present in hydraulic fracturing wastewater to form brominated disinfection byproducts (Br-DBPs) during drinking water treatment processes</td>
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<tr>
<td>Analytical Method Development</td>
<td>Development of analytical methods for selected analytes found in hydraulic fracturing fluids or wastewater</td>
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# Toxicity Assessments

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<tr>
<th>Project</th>
<th>Description</th>
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<tbody>
<tr>
<td>Toxicity Assessment</td>
<td>Toxicity assessment of chemicals used in hydraulic fracturing fluids or found in hydraulic fracturing wastewater</td>
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# Case Studies

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<th>Project</th>
<th>Description</th>
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<tbody>
<tr>
<td>Prospective Studies</td>
<td>Investigation of potential impacts of hydraulic fracturing through collection of samples from a site before, during and after well pad construction and hydraulic fracturing</td>
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<tr>
<td>Retrospective Studies</td>
<td>Investigations of whether reported drinking water impacts may be associated with or caused by hydraulic fracturing activities</td>
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