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

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Overview

• Introduction to Hydraulic Fracturing
• Purpose of the Study Plan
• Study Plan Development
• Study Plan
Hydraulic Fracturing

Hydraulic fracturing, or "fracing," involves the injection of more than a million gallons of water, sand and chemicals at high pressure down and across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes the rock layer, in this case the Marcellus Shale, to crack. These fissures are held open by the sand particles so that natural gas from the shale can flow up the well.

Graphic by Al Granberg / ProPublica
Hydraulic Fracturing

The combination of hydraulic fracturing and horizontal drilling has opened new areas for oil and gas development.
Stakeholder Concerns

- Ground and surface water contamination
- Air pollution
- Ecosystem impacts
- Seismic risks
- Public safety
- Occupational risks
- Economic impacts
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
Development of the Draft Study Plan

- Science Advisory Board suggestions
- Stakeholder input
- Literature review
- Internal EPA review
- External federal agency review
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.

**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
- Chemical Mixing
- Well Injection
- Flowback and Produced Water
- Water Treatment and Waste Disposal

Fundamental Research Questions

- How might large volume water withdrawals from ground and surface water impact drinking water resources?
- What are the possible impacts of releases of flowback and produced water on drinking water resources?
- What are the possible impacts of the injection and fracturing process on drinking water resources?
- What are the possible impacts of releases of hydraulic fracturing fluids on drinking water resources?
- What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?
Research Approach

- Analysis of existing data
- Laboratory-scale studies
- Scenario evaluations
- Case studies
  - Retrospective
  - Prospective
Water Acquisition

How might large volume water withdrawals from ground and surface water impact drinking water resources?

- What are the impacts on water availability?
- What are the impacts on water quality?
What are the possible impacts of releases of hydraulic fracturing fluids on drinking water resources?

• What is the composition of hydraulic fracturing fluids and what are the toxic effects of these constituents?

• What factors may influence the likelihood of contamination of drinking water resources?

• How effective are mitigation approaches in reducing impacts to drinking water resources?
Well Injection

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

- How effective are well construction and operation practices at containing fluids during and after fracturing?
- What are the potential impacts of pre-existing man-made or natural pathways/features on contaminant transport?
- What chemical/physical/biological processes could impact the fate and transport of substances in the subsurface?
- What are the toxic effects of naturally occurring substances?
Flowback and Produced Water

What are the possible impacts of releases of flowback and produced water on drinking water resources?

• What is the composition, quantity, and variability of flowback and produced water and what are the toxic effects of these constituents?

• What factors may influence the likelihood of contamination of drinking water resources?

• How effective are mitigation approaches in reducing impacts to drinking water resources?
Wastewater Treatment and Waste Disposal

What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?

• How effective are treatment and disposal methods?
## Retrospective Case Study Finalists

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<th>Formation</th>
<th>Location</th>
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<tbody>
<tr>
<td>Bakken Shale</td>
<td>Killdeer and Dunn County, ND</td>
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<tr>
<td>Barnett Shale</td>
<td>Wise and Denton Counties, TX</td>
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<tr>
<td>Marcellus Shale</td>
<td>Bradford and Susquehanna Counties, PA</td>
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<tr>
<td>Marcellus Shale</td>
<td>Wetzel County, WV, Green and Washington Counties, PA</td>
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<td>Raton Basin (CBM)</td>
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## Prospective Case Study Finalists

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Collaboration with Others

EPA will work with other federal agencies, states, and other organizations, such as:

- Department of Energy
- US Geological Survey

Examples of activities:

- Cooperate on research
- Evaluate data
Expected Results

EPA plans to synthesize the results of the research to assess:

- Whether hydraulic fracturing may impact drinking water resources, and if so, to what extent and under what conditions
- What are the driving factors for any potential impacts
• Analyze and map existing water quality and quantity data
• Compile a list of chemicals found in HF fluids, flowback and produced water
• Identify known toxicity of HF chemicals, other constituents associated with HF, and naturally occurring substances in wastewater
• Identify possible chemical indicators and analytical methods
• Review scientific literature on surface chemical spills
• Test well failure and existing subsurface pathway scenarios
• Assess existing data on treatment and/or disposal of HF wastewaters
• Identify HF chemical constituents that create disinfection byproducts
• Evaluate potential impacts of high chloride concentrations on drinking water utilities

• Results from retrospective case studies
2014 Report

- Assess impacts of cumulative water withdrawals
- Analyze well files
- Study reactions between HF fluids and target formations
- Develop additional analytical methods
- Predict the toxicity of unknown chemicals
- Develop provisional peer reviewed toxicity values (PPRTVs) for chemicals of concern
- Results from prospective case studies
Next Steps

- Complete Science Advisory Board review
- Research
- Publish an interim report of results in 2012
- Provide additional results in a 2014 report
A PDF of the study plan can be found at:
http://www.epa.gov/hydraulicfracturing

Find more information on the Science Advisory Board review of the draft study plan at:
http://yosemite.epa.gov/sab/SABPRODUCT.NSF/0/d3483ab445ae61418525775900603e79!OpenDocument&TableRow=2.0#2.