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

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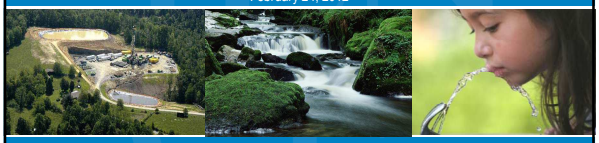

Office of Research and Development

Purpose of EPA's Study of Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

- 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

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EPA is committed to:

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

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Study Plan Development

- Extensive stakeholder input
- Federal agency review
- Science Advisory Board review
- Final study plan released November 3, 2011

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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

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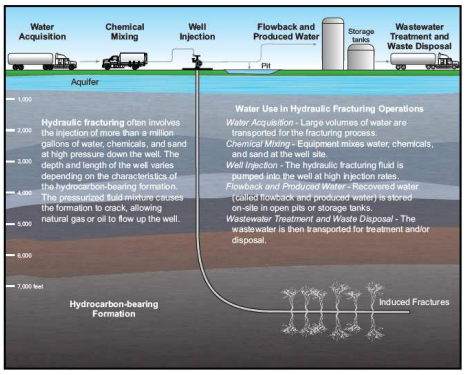
Water Cycle



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Research Approaches

- Gather and analyze existing data
- Case studies
- Scenario evaluations
- Laboratory studies
- Toxicity assessments

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Analysis of Existing Data

Data include:

- Well locations, construction practices, and water use
- Chemicals in HF fluids, flowback, and produced water
- Standard operating procedures
- Frequency, severity, and causes of spills
- Treatment and disposal practices

Data sources:

- Peer-reviewed literature
- State and federal agencies
- Information requests from industry

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Case Studies

- Retrospective case studies
  sites where hydraulic fracturing has already occurred
- Prospective case studies
  new sites - allow data collection of data prior to, during, and after hydraulic fracturing activities
- Site nomination through stakeholder outreach
- Site selection criteria included:
  - Applicability to and coverage of core research questions
  - Geologic, geographic, and hydrologic diversity
  - Potential human exposure
  - Ability to develop partnerships with stakeholders

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Case Study - Locations

Retrospective Case Studies

Bakken Shale – Killdeer, Dunn County, ND
Barnett Shale – Wise County, TX
Marcellus Shale – Bradford and Susquehanna Counties, PA
Marcellus Shale – Washington County, PA
Raton Basin – CO

Prospective Case Studies

Haynesville Shale – DeSoto Parish, LA
Marcellus Shale – Washington County, PA

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Scenarios Evaluations

- Explore potential cumulative impacts from **water withdrawals**
- Model various failure scenarios to determine conditions under which **subsurface contaminant migration** may occur
- Explore potential cumulative impacts from **surface water disposal** of treated HF wastewater

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Laboratory Studies

- Explore reactions between hydraulic fracturing fluids and shale
- Determine the effectiveness of HF wastewater treatment using conventional wastewater treatment technologies
- Assess potential for treated wastewater to impact drinking water resources
- Modify analytical methods, as necessary

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Toxicity Assessments

Focused on: Hydraulic fracturing fluids, wastewater, and naturally occurring substances in subsurface

- Summarize known chemical, physical, and toxicological properties
- Estimate chemical, physical, and toxicological properties using structure-activity relationships
- Screen chemicals for priority attention

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Reporting Results

- 2012
  - Analysis of existing data
  - Retrospective case studies
  - Scenario evaluations
  - Laboratory studies
- 2014
  - Analysis of existing data
  - Retrospective and prospective case studies
  - Scenario evaluations
  - Laboratory studies
  - Toxicity assessments

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(see Figures 10 & 11 and Appendix A for details)

Stakeholder Engagement

- EPA plans to provide quarterly updates on progress of research
- Additional suggestions?

EPA's *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*
http://www.epa.gov/hydraulicfracturing

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