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

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Public Concerns

- **Ground and surface water contamination**
- Air pollution
- Ecosystem impacts
- Seismic risks
- Public safety
- Occupational risks

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

Purpose of EPA's Study

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

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

Study Plan Development

- Science Advisory Board recommendations
  - Scoping document review (April 2010)
  - Draft study plan review (March-May 2011)
  - Full committee review (July 5, 2011)
- Stakeholder input
- Literature review
- Internal EPA review
- External federal agency review

EPA's draft study plan focuses on the water cycle in hydraulic fracturing.

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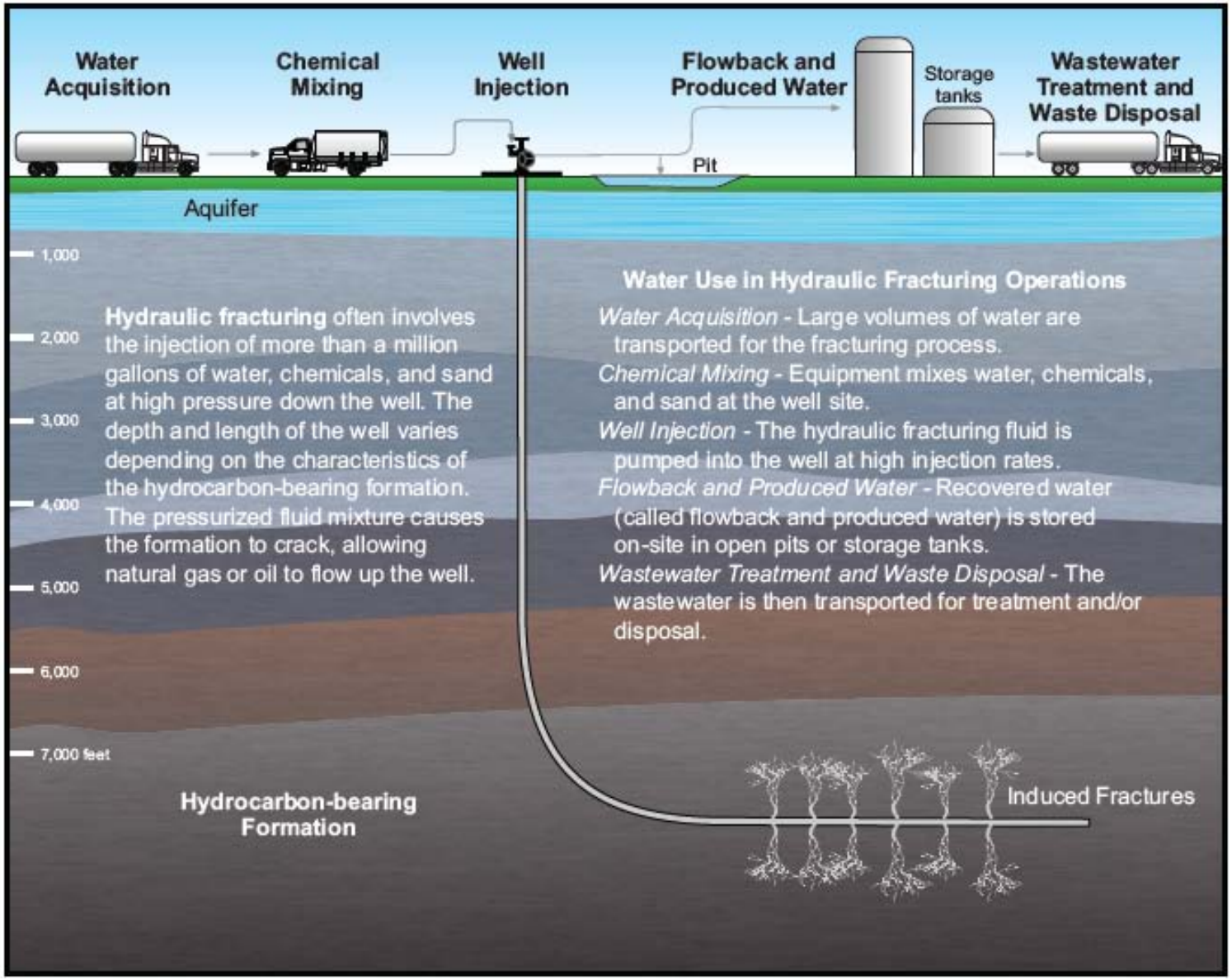
Hydraulic Fracturing



HF Water Cycle

Water Use in Hydraulic Fracturing Operations	Fundamental Research Questions
Water Acquisition	How might large volume water withdrawals from ground and surface water impact drinking water resources?
Chemical Mixing	What are the possible impacts of releases of hydraulic fracturing fluids on drinking water resources?
Well Injection	What are the possible impacts of the injection and fracturing process on drinking water resources?
Flowback and Produced Water	What are the possible impacts of releases of flowback and produced water on drinking water resources?
Water Treatment and Waste Disposal	What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?

Research Approaches

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

Analysis of Existing Data

Sources of Existing Data

- Peer-reviewed literature
- Federal agencies – USGS, DOE, ACE
- State regulatory agencies – OGCCs, DEPs, DEQs
- Industry – HF service companies
- Industry – Gas and oil well operating companies
- Other public sources

These data will be used to inform other research activities and to provide current information on hydraulic fracturing operations.

Case Studies

- Opportunity to evaluate hydraulic fracturing in different parts of the U.S.
- Retrospective and prospective
- Identification and selection
  - Stakeholder suggestions
    - 4 public meetings
    - EPA website input
    - Webinars
    - Conferences (e.g., GWPC, IOGCC)
    - Face-to-face meetings with state agencies, affected homeowners, and non-governmental organizations
    - EPA regional office input

More than 40 locations for potential case studies have been brought to our attention.

Case Studies Nomination/Prioritization Criteria

- Geographic, land use variations
- Geologic diversity
- Proximity to populations potentially at risk
- Magnitude/Intensity of HF activity
- Impairment evidence (retrospective)
- Health and environmental concerns
- Available existing data
- Site access
- Potential to collaborate with others
- Ability to fill knowledge gap on HF and drinking water

Case Study Locations

Prospective Case Studies

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

Retrospective Case Studies

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

Case studies will use existing data and will include environmental field sampling, modeling, and/or parallel laboratory investigations.

Scenario Evaluations

- Explore potential cumulative impacts from water withdrawals in a humid region and a semi-arid region
- Model various potential failure scenarios to determine the conditions under which subsurface contaminant migration may occur
  - Improper or inadequate well construction
  - Fractures reaching pre-existing wells or existing faults/fractures near the HF site
  - Fractures reaching ground water aquifers or permeable formations that communicate with ground water resources
  - Fracturing of multiple wells within the same area
- Explore potential cumulative impacts from surface water disposal of treated HF wastewater

Laboratory Studies

- Pilot-scale studies of HF wastewater treatability via conventional wastewater treatment technologies
- Explore reactions between HF fluid chemical additives and relevant environmental media (e.g., shale, soil)
- Modify existing analytical methods to support case study field monitoring activities

Laboratory studies will be targeted studies to investigate the ultimate fate and transport of chemical contaminants of concern.

Toxicological Assessments

- Assess toxicity using existing data on chemical, physical and toxicological properties

Examples of HF Fluid Additives	Examples of Naturally Occurring Substances
Hydrochloric acid	Brine
Polyacrylamide	Methane
Isopropanol	Hydrogen sulfide
Potassium chloride	Lead
Guar	Arsenic
Ethylene glycol	Radium
Glutaraldehyde	Polycyclic aromatic hydrocarbons

Where necessary, EPA may pursue additional toxicological studies (e.g., QSAR, ToxCast) to assess the toxicity associated with chemical contaminants of concern.

Timing

- 2011: Finalize study plan and conduct research
- 2012: Report of Results
  - Analysis of existing data
  - Retrospective case studies
  - Scenario evaluations
  - Laboratory studies
- 2014: Report of Results
  - Analysis of existing data
  - Retrospective and prospective case studies
  - Scenario evaluations
  - Laboratory studies
  - Toxicological studies