Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources

Presentation by the U.S. Environmental Protection Agency Office of Research and Development

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HF Assessment
Objectives

• Assess the potential for hydraulic fracturing for oil and gas to change the quality or quantity of drinking water resources

• Identify factors affecting the frequency or severity of any potential changes
Draft HF Assessment Report

What it is:

• A state-of-the-science integration and synthesis of information concerning impacts on drinking water resources

• Based upon EPA research results, a robust literature review, and other information, including input from stakeholders

• Identifies potential mechanisms and addresses questions identified in the Study Plan and Progress Report

What it is not:

• Not a human health, exposure, or risk assessment

• Not site specific

• Does not identify or evaluate best management practices

• Not designed to inform specific policy decisions

• Does not identify or evaluate policy options
This Review

- EPA asked SAB to complete a technical review of the draft hydraulic fracturing drinking water assessment report

- The assessment includes:
  - Main report (Executive Summary and 10 chapters, 599 pages)
  - Appendices (10 appendices, 401 pages)
Hydraulic Fracturing Water Cycle: Follow the water

Chemical Mixing

Water Acquisition

Well Injection

Flowback and Produced Water

Wastewater Treatment and Waste Disposal
Water Acquisition: Sources and volume

- Sources of water used for HF include surface water, ground water, and reused wastewaters.
- Cumulative water use nationally for HF is at least 44 BG/year; Median water use for a well is approximately 1.5 MG.
- HF water use is small (usually <1%) compared with total water use and consumption at the national and state spatial scales.
- Potential for impacts on drinking water resources greatest in areas with high HF water use, low water availability and frequent drought.
Chemical Mixing: HF Chemical Additives

- Generally comprise <2% of injected fluid volumes
- Thousands of gallons are potentially stored on-site
- More than 1000 chemicals used as components of HF fluids
- No single chemical additive used at all well sites across the country
- Chemicals used at >65% of well sites include: methanol, hydrotreated light petroleum distillates, hydrochloric acid
Well Injection: Potential subsurface pathways

- Movement of gas or liquids from the wellbore into a drinking water resource
- Movement of gas or liquids from production zone through subsurface rock formations into a drinking water resource
Multiple barriers act together to prevent migration of gases and liquids.

- Inadequate construction, defects and degradation of casings or cement, or absence of redundancies can create pathways leading to contamination of drinking water resources.

- Specific rate of well failures unknown but thought to increase over time.
Subsurface Movement

- Physical separation between the production zone and drinking water resources can minimize impacts
- Deep HF operations are unlikely to create direct flow paths from fracture production zones to shallow drinking water resources
- In some cases, the production zone is co-located with drinking water resources
- Well-to-well communications are also pathways for fluid movement into drinking water resources
Flowback and produced water come out of the well when pressure of HF is released.

Amount of fracturing fluid returned to surface is generally 10% to 25% of injected fluid and varies widely.

Data on produced water composition limited.

High TDS present analytical challenges for characterizing chemical composition.
• Spills of HF fluids and produced waters have occurred; when spills occur, they can and have reached drinking water resources through multiple pathways
• Total number and frequency of spills due to HF activities unknown at the national level
• Most common causes of spills were equipment failure and human error
Hydraulic Fracturing Wastewater

- HF produces large volumes of wastewater
- Most HF wastewater is disposed of using underground injection control (UIC) wells, but practice varies geographically
- Wastewater reuse also varies geographically
- Other disposal options for HF wastewater:
  - Centralized wastewater treatment facilities (CWT)
  - Evaporation pits, land irrigation and road spreading
- Inadequately treated and discharged wastewater increases constituent concentrations in receiving waters
EPA created a database of 1,173 chemicals reportedly used in HF fluids or detected in FB/PW

- 147 have human oral toxicity reference values meeting criteria outlined in the assessment

Absence of toxicity reference values limits ability to conduct future site specific exposure/risk assessments

- Confidential Business Information limits complete characterization of chemical use in HF operations
Assessment Conclusions

- Assessment identifies existing and potential mechanisms and impacts to drinking water resources due to hydraulic fracturing activities.

- The number of documented impacts to drinking water resources is small relative to the number of fractured wells.

- Despite vulnerabilities, there is no evidence of widespread, systemic impacts on drinking water resources due to hydraulic fracturing activities.
Sources of Uncertainties

- The paucity of long-term systematic studies
- Insufficient pre- and post-fracturing data on the quality of drinking water resources
- The presence of other sources of contamination precluding a definitive link between hydraulic fracturing activities and a potential impact
- The inaccessibility of some information on hydraulic fracturing activities and potential impacts
Focus of Charge Questions

- Does the assessment accurately summarize available information?
- Are major findings clearly presented and supported by the data and information presented in the assessment?
- Are the uncertainties, assumptions and limitations clearly described?
- What additional information, background, or context should be added?