Hydraulic Fracturing, Water Resources, and Human Health

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Some Public Concerns

• Drinking water contamination
• Water for hydraulic fracturing, 3-5M gallons per well
• Disposal of produced waters (salinity – 10-times sea water, bromide, arsenic, barium, radioactivity, hydrocarbon residuals)
• Earthquakes from hydraulic fracturing and disposal
• Air quality interactions
What are the possible water interactions?
What’s in Hydraulic Fracturing Fluids?

• 780 million gallons of products used from 2005-2009 (not including water).
• 2,500 hydraulic fracturing products containing 750 chemicals and other components
• Some harmless (salt, citric acid, coffee, walnut shells)
• Some not: benzene, napthalene, and diesel (carcinogens); toluene and hydrochloric acid (hazardous air pollutants); and many other chemicals, including 2-butoxyethanol, ethylene glycol, and lead.
A “No-Chemicals” Pledge

from Richard Moorman, Chief Executive
“Tamboran will not utilise any chemicals in its hydraulic fracturing process in Northern Ireland, and we will be bringing together the best technologies developed worldwide into this one project to ensure the safe and responsible development of a tremendous resource for Northern Ireland.”

Is this feasible, and can other companies follow suit?
What’s in Produced Waters?

- Salinity (Marcellus brine – 250,000 mg/L, 10-times seawater)
- High bromide; can enhance disinfection byproducts (e.g., carcinogens such as trihalomethanes) upon chlorination of downstream potable water;
- High concentrations of toxic elements (e.g., barium, arsenic, selenium, lead);
- High concentrations of natural radioactive materials; (5000 pCi/L, drinking water standard=5 pCi/L)
- Hydrocarbon residuals, oil, organics
Can produced water disposal cause long-term ecological effects and health risks?
Management of produced water

- Deep inject for underground disposal
- Spray on lands (some states permit this – bad idea)
- Haul to a municipal wastewater treatment plant (no!)
- Haul to a commercial wastewater treatment facility
- Reuse for a future fracturing job with or without treatment (kudos to industry here).
The effects of brine disposal: (preliminary results)

High salinity (bromide and trace metals) in the river water (up to 500m downstream)

Accumulation of radionuclides in river sediments (up to 300m downstream); implications for radium bioaccumulation.
What’s in Shallow Groundwater Naturally?
Occurrence of saline groundwater naturally enriched in Barium and other elements in shallow aquifers
No Evidence for Brines or Fracturing Fluids, but Methane Concentrations in Drinking Water Were Higher Near Gas Wells

Osborn et al. 2011  PNAS
Recommendation: Systematic Data and Disclosure

“The second need is for a public database of methane and ethane isotope values from each gas well. Requiring regular analyses of methane and ethane isotopes (13C and 2H), perhaps two times yearly, could also help researchers identify sources of stray gas.”

(Jackson et al. 2011 PNAS)
Recommenda7on: Initiate Medical Review of the Health Effects of Methane

Methane is not regulated as a contaminant in public water systems through the EPA’s National Primary Drinking Water Regulations. Historical concerns are for the extreme cases of explosion, flammability, and asphyxiation.

“We found no peer-reviewed research on its health effects at lower concentrations in water or air. Based on public concerns about the consequences of methane in drinking water, and the lack of peer-reviewed research on its health effects, we recommend that an independent medical review be initiated to evaluate the health effects of methane in drinking water and households.” (Jackson et al. 2011)
Emissions to the Atmosphere: Methane Leaks for the Boston Metroplex (with Boston Univ. and others)
One of the biggest public concerns is organics from fracturing fluids leaking into drinking water. Time and, likely, new test wells, will confirm (or refute) contamination documented by EPA.
Positive Developments on the Water Front

1) Recycling and reuse of water for fracking (industry initiative);

2) Greater disclosure of the chemicals in fracking fluids (voluntary – fracfocus.org; required - new state rules in WY, TX, and elsewhere). Transparency will lead to phase-outs of the most toxic chemicals;

3) Proposals to eliminate chemicals in fracturing fluids (e.g., Tamboran);

4) Green completions and elimination of open waste-water pits (e.g., enclosed tanks for handling waste).