WATER FACTS

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Hydraulic Fracturing Can Potentially Contaminate Drinking Water Sources

Communities across the country are concerned about the risks that oil and gas production using fracking poses to drinking water sources. Hydraulic fracturing, or fracking, is the practice of injecting water, chemicals, and proppant[1] at high pressure into a gas or oil well. The high-pressure injection fractures or re-fractures the rock, stimulating oil and gas production. But scientists and environmentalists are increasingly concerned about groundwater and surface water contamination that may be associated directly or indirectly with fracking. NRDC opposes expanded fracking until effective safeguards are in place. To protect drinking water sources from contamination, NRDC urges the use of key management practices to minimize the risks associated with fracking activities. This includes (1) federal regulation of all hydraulic fracturing under the Safe Drinking Water Act, (2) regulation of toxic oil and gas waste under federal and state hazardous waste laws, and (3) stronger standards and enforcement under the federal Clean Water Act and state laws.

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THREE RISKS TO DRINKING WATER THAT CAN OCCUR ON THE SURFACE

Depletion of water sources

Large volumes of water are required for fracking operations. Fresh water is taken from local surface or subsurface water bodies. In some areas, this may conflict directly with irrigation, drinking water, or aquatic ecosystem needs. Because water can be contaminated when it has been used for fracking, it cannot be returned to these water bodies without extensive treatment. Permanent loss of water from these fresh water sources can potentially have an adverse impact on water quality and availability, and aquatic species and habitat.[2]

Spills and leaks of fracking chemicals and fluids

Fluids, potentially hazardous chemicals and proppant used in the fracking process are stored on the surface in tanks or pits. If not stored properly, they can leak or spill. Fluids can be stored at a centralized facility near multiple wellpads and then be transported to the well location by trucks or by pipeline. This transit period is another opportunity for leaks and spills. Fracking fluid can also spill during the fracking process. Leaks on the surface from tanks, valves, pipes, etc. as a result of mechanical failure or operator error at any point during these processes have the potential to contaminate groundwater and surface water.[3]

Mismanagement of fracking waste

After fracking, some of the fracking fluid, often referred to as flowback, returns up the wellbore to the surface. In addition, naturally-occurring fluid is brought to the surface along with the produced oil or gas (referred to as "produced water.") This waste, consisting of both flowback and produced water, can be toxic, and the oil and gas industry generates hundreds of billions of gallons of it each year.[4] In addition to the chemicals that were initially injected, flowback and produced water may also contain hydrocarbons, heavy metals, salts,[5] and naturally occurring radioactive material (NORM). The wastewater is sometimes stored in surface pits. If the pits are inadequately regulated[6] or constructed, they run the risk of leaking or overflowing and can pollute groundwater and surface water.[7] The waste may also be disposed of on the surface, reused in another well, re-injected underground, or transported to a treatment facility. Each of these activities carries its own inherent risks, including spills, leaks, earthquakes (in the case of underground injection) and threats to groundwater and surface water.

FOUR RISKS TO DRINKING WATER THAT CAN OCCUR BELOW THE GROUND SURFACE

Well construction, cementing, and casing

An oil or gas well is constructed using layers of steel pipe, called casing, that are cemented, completely or partially, into the surrounding rock and to each other. Casing and cement isolate gas, oil, and fluids in the rock from groundwater resources. Improperly constructed and/or maintained oil or gas wells can act as migration pathways for oil, gas, formation water, drilling fluid, or fracking fluid to contaminate groundwater.[8]

Out-of-zone growth

When performing a frack job, out-of-zone fracture growth can occur, in which the fractures extend further than intended. The fracture can grow into other geologic formations[9] including groundwater aquifers, depending on how much separation there is between the producing formation and the aquifer.

Neighboring oil and gas wells

An oil or gas well that was improperly constructed or plugged can provide a migration pathway for frack fluid or other contaminants to reach groundwater. This can happen if the fractures emanating from one oil or gas well intersect with either: (a) a nearby improperly plugged or constructed oil or gas well; or (b) fractures emanating from a nearby improperly plugged or constructed wellbore.

Natural fracture networks

Some geologic formations are extensively naturally faulted and fractured. In such formations, induced fractures may link up to these natural fracture networks. Over years or decades, natural fractures and faults may provide migration pathways for gas and fluids to groundwater.[10] Fractures and faults may also cause complications in well drilling, construction, and completion. This can result in well integrity problems,[11] which can also lead to water contamination.

BEST PRACTICES FOR AVOIDING DRINKING WATER CONTAMINATION RELATED TO HYDRAULIC FRACTURING

There are dozens of measures that oil and gas producers can adopt to reduce the risks fracking poses to sources of clean water. Below is a summary of key recommendations, but there are many more[12] detailed techniques that are essential to protect public health and the environment. Properly managing environmental risk reduces the costs associated with remedial action and is necessary to maintain public trust.[13] Furthermore, many of these practices are already currently in use or documented as best practices by the industry itself, but they are not used uniformly.

Detailed Site Characterization and Planning

- Geologic and hydrologic mapping and risk analysis to demonstrate geologic suitability and the presence of an appropriate confining zone to inhibit vertical migration of contaminants.
- Identification of existing wellbores, determination of the integrity of those wellbores (i.e. casing, cement, plugs, etc.), and mitigation where necessary.
- Estimation of full life-cycle fresh water use.[14]
- Estimation of full life-cycle wastewater volumes and assessment of the ability of the various disposal options to safely handle these volumes without adverse effects on the environment or human health.[15]
- Comprehensive assessment of potential impacts to water resources used to supply hydraulic fracturing base fluid.[16]
- Baseline water testing[17] and ongoing monitoring of potentially affected ground and surface waters.

Chemical Disclosure

- Public disclosure on a well-by-well basis of all chemicals planned for a fracking operation at least 30 days beforehand, and a report on chemicals actually used within 30 days following fracking.[18]

Proper Well Construction

- Best management practices for construction, cementing and casing of wells that undergo hydraulic fracturing.
- For example, ensure surface casing consists of only new pipe and will be set at least 100' below the deepest protected water and fully cemented in place to create an effective barrier.

Robust Operating & Monitoring Requirements

- Site-specific three-dimensional models of the subsurface geology to safely design and implement fracture treatments.
- Continuous monitoring of key performance indicators, such as pressures and injection rates, during hydraulic fracturing operations.[19]
- Appropriate use of techniques to measure actual fracture growth, such as microseismic monitoring.[20]

Proper Water Use & Wastewater Handling

- Restrictions on water withdrawals to levels that ensure protection of ecological function and waterbody health.
- Recycling or reuse of flowback and produced water in lieu of using freshwater[21] where appropriate.
- Use of closed tanks to collect flowback and produced water instead of pits.
- Routine and preventative maintenance to help prevent spills.
- Adequate buffer zones from potential sources of contamination for surface waters such as rivers, streams, and lakes, and for sensitive groundwater resources.
- Adequate treatment of waste water before discharge; no discharge to publicly owned treatment works; stricter requirements for siting, constructing, operating, monitoring, and closing disposal wells; and no road spreading of wastewater

Endnotes

1 Proppant consists of small particles of sand, or man-made materials such as coated sand or ceramic materials. The proppant holds open the fractures created by fracking treatments.

2 Soeder, D.J., and Kappel, W.M., 2009, Water Resources and Natural Gas Production from the Marcellus Shale: U.S. Geological Survey Fact Sheet 2009-3032, 6 p., available at: http://pubs.usgs.gov/fs/2009/3032/.

3 See, e.g., DEP Investigating Lycoming County Fracking Fluid Spill at XTO Energy Marcellus Well http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=15315&typeid=1.

4 U.S. Government Accountability Office, *Energy-Water Nexus: Information on the Quantity, Quality, and Management of Water Produced during Oil and Gas Production*, GAO-12-156 (Washington, D.C.: Jan 9, 2012).

5 Otton, J.K,, 2006, Environmental aspects of produced-water salt releases in onshore and estuarine petroleum-producing areas of the United States-a bibliography: U.S. Geological Survey Open-File report 2006-1154, 223p.

6 NRDC, "Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy," September 8, 2010, 18-23.

7 See, e.g., DEP Fines Atlas Resources for Drilling Wastewater Spill in Washington County http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=13595&typeid=1.

8 See, e.g. Consent Order and Agreement Between the Commonwealth of Pennsylvania, Department of Environmental Protection and Cabot Oil and Gas Corporation, November 4th, 2009, available at: https://www.epaosc.org/sites/7555/files/final_cabot_co-a%2011-04-09.pdf. McMahon, P.B., Thomas, J.C., and Hunt, A.G., 2011, Use of diverse geochemical data sets to determine sources and sinks of nitrate and methane in groundwater, Garfield County, Colorado, 2009: U.S. Geological Survey Scientific Investigations Report 2010–5215, 40 p.Ohio Department of Natural Resources, Division of Mineral Resources Management, "Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio" September 1, 2008.

9 SAFETY ADVISORY 2010-03, May 20, 2010: COMMUNICATION DURING FRACTURE STIMULATION hhttp://www.bcogc.ca/document.aspx?documentID=808&type=.pdf.

10 Myers, T., Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers. Ground Water. doi: 10.1111/j.1745-6584.2012.00933.x.

11 URS Corporation, 2006, Phase I hydrogeologic characterization of the Mamm Creek Field area in Garfield County: Prepared for the Board of County Commissioners, Garfield County, Colorado, 86 p.

12 See, e.g. http://docs.nrdc.org/energy/ene_12011201.asp; http://docs.nrdc.org/energy/ene_11120901.asp; http://docs.nrdc.org/energy/ene_12030701.asp; and Hammer, R. and J. VanBriesen, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater." Natural Resources Defense Council, May 2012.

13 U.S. Department of Energy, Secretary of Energy Advisory Board, Shale Gas Production Subcommittee 90-Day Report, August 18, 2011 (available at http://www.shalegas.energy.gov/resources/081811_90_day_report_final.pdf).

14 Recommended by the American Petroleum Institute in API Guidance Document HF2, First Edition, June 2010, *Water Management Associated with Hydraulic Fracturing.*

15 Id.

16 Id.

17 Id.

18 See, e.g. Wyoming Oil and Gas Conservation Commission rules, Chapter 3. Operational Rules, Drilling Rules, Section 45. Well Stimulation.

19 Hammer, R. and J. VanBriesen, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater." Natural Resources Defense Council, May 2012; also recommended by the American Petroleum Institute in API Guidance Document HF1, First Edition, October 2009, *Hydraulic Fracturing Operations – Well Construction and Integrity Guidelines*.

20 Recommended by the American Petroleum Institute in API Guidance Document HF1, First Edition, October 2009, *Hydraulic Fracturing Operations—Well Construction and Integrity Guidelines*.

21 Id at 14