The Network for Public Health Law

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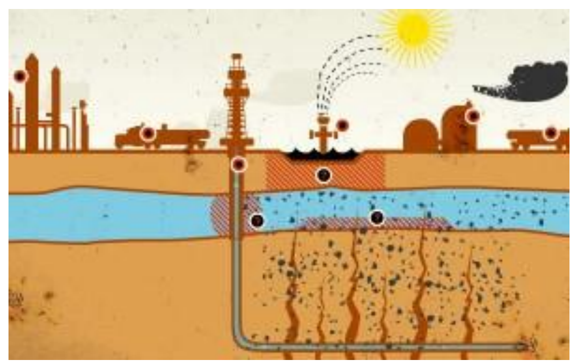
ENVIRONMENTAL HEALTH – HYDRAULIC FRACTURING

Fact Sheet

Environmental Impacts Associated with Hydraulic Fracturing

Toxic Chemicals and Radioactive Materials



The primary environmental impacts associated with hydraulic fracturing (fracking) result from the use of toxic chemicals during the fracking process and the subsequent release of additional toxic chemicals and radioactive materials during well production. Fracking fluid flowback – the fluid pumped out of the well and separated from oil and gas – not only contains the chemical additives used in the drilling process but also contains heavy metals, radioactive materials, volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) such as benzene, toluene, ethylbenzene and xylene (BTEX). Moreover, as the image to the right illustrates, numerous pathways exist throughout the fracking process for the release of these toxic and radioactive materials. As a result, the proper handling of the toxic and radioactive materials associated with fracking is essential throughout the lifecycle of a well.

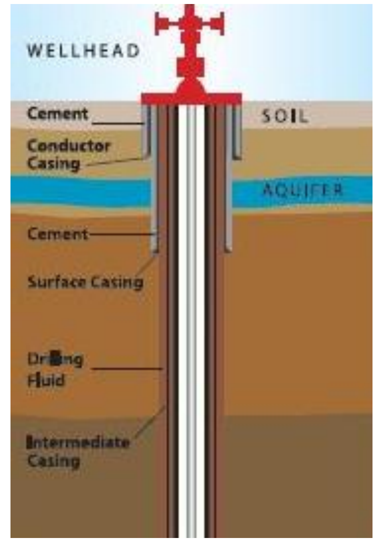
Sources of Water Contamination

In response to concerns over drinking water contamination, Congress directed the Environmental Protection Agency (EPA) to conduct a study addressing the potential risks to drinking water associated with fracking.[1] In the study, the EPA plans to research the full lifecycle of water during fracking. The potential impacts on water quality during the fracking process include:

Water Acquisition: Two to four million gallons of water is required to hydraulically fracture a single shale well.[2] This "source water" is generally stored on site in tanks or surface impoundment pits. The removal of significant amounts of source water may impact water availability from local sources and adversely impact existing water quality.

On-site Chemical Mixing: An average well requiring 3 million gallons of water requires the injection of 15,000 to 60,000 gallons of chemical additives into the well.[3] Due to the large amount of chemical additives required, there is a risk of releasing to surface and ground water through on-site spills or leaks and a risk of releasing through chemical transportation accidents.

Well Injection: Shale formations commonly contain natural gas, carbon dioxide, hydrogen sulfide, organic acids, BTEX, VOCs, trace elements (mercury, lead and arsenic) and naturally occurring radioactive elements (radium, thorium and uranium).[4] As a result, improper cementing or well casings risk the release of these substances into drinking water aquifers during the injection process. An interactive feature of the drilling process is available from the New York Times.[5]



Flowback and Produced Water: Following the fracking process, flowback containing the initial fracking fluids as well as naturally occurring toxic and radioactive substances return to the surface. The flowback process continues for several weeks and, in the Marcellus Shale, only 10–30 percent of the fluid is recovered.[6] The recovered fluids are typically stored either in containment/evaporation pits or storage tanks. Here, improper well construction presents a risk of contamination to drinking water aquifers, while improper pit containment may result in contamination of surface waters.

Wastewater Treatment and Waste Disposal: The final stage of the lifecycle ends with treatment or disposal of flowback waters. Following treatment, water may be reused or discharged into surface waters. Currently, publicly owned treatment facilities are not designed to treat fracking wastewaters, especially the radioactive materials. A recent New York Times article confirmed the presence of excessive levels of radium, uranium and benzene in rivers and streams due to improper treatment at facilities prior to discharging wastewater into surface waters.[7]

Sources of Air Contamination

Currently, the scope of EPA's study is limited to water impacts. However, there are several sources of air contamination during the fracking process. The primary sources of air contamination include:

Venting and Flaring: Following the initial fracking process, a mixture of gas and flowback fluid returns to the surface for several weeks. During this period, it is not economical to separate the mixture of gas and water. As a result, the gas may be either vented – released directly into the atmosphere – or flared – burned upon release. EPA indicates these methods account for one of the largest sources of air emissions prior to well production. [8]

For example, venting a single well in Wyoming's Jonah field is estimated to emit 115 tons of VOCs and 4 tons of HAPs. [9]

In addition, flaring reduces the emissions of VOCs to 29 tons and HAPs to 1 ton, but releases more than a ton of nitrogen oxides, and almost half a ton of carbon monoxide. [10]

Dehydration Units: To remove water during well production, the process utilizes tri-ethylene glycol dehydrators. These units release the VOCs and HAPs contained in the gas.

Condensate Tanks: If wells produce a semi-liquid condensate (liquid hydrocarbons) along with the gas, a condensate tank is utilized. The condensate tanks are designed to vent vapors of these chemicals directly into the atmosphere.

Evaporation Pits: Next, pits are used to evaporate fracking flowback and dehydration unit wastewater. Both the original fracking chemicals and any of the chemical compounds naturally present in the gas (lighter hydrocarbons, benzene, toluene, hydrogen sulfide, etc.) that combined with the fluid during the fracking process are evaporated into the atmosphere. Misters, which spray flowback and wastewater, are commonly employed to speed up the process.

Fugitive Emissions: Fugitive emissions are unintentional emissions arising from leaks in pipelines, storage tanks or other equipment. These emissions contain HAPs and VOCs.

Engines: Engines are used to run gas compressors to increase the pressure of the gas for pipelines. These engines release nitrogen oxides, carbon monoxide and VOCs.

Truck Traffic: Finally, truck traffic is a major source of air emissions. Due to the volume of water and chemicals required, the estimated truck traffic for a single well is between 300 to 1,300 trucks.[11] These trucks are large emitters of nitrogen oxides, carbon monoxide and hydrocarbons. Moreover, the use of dirt roads impacts air quality.

SUPPORTERS

Robert Wood Johnson Foundation

The Network for Public Health Law is a national initiative of the Robert Wood Johnson Foundation with direction and technical assistance by the Public Health Law Center at William Mitchell College of Law.

This document was developed by Kathleen Dachille, director of the Network for Public Health Law - Eastern Region at the University of Maryland Carey School of Law, with assistance from student attorneys in the Public Health Law Clinic—Beau Burton, Sanjay De, Molly Madden and Helena Mastrogianis. The Network for Public Health Law provides information and technical assistance on issues related to public health. The legal information and assistance provided in this document does not constitute legal advice or legal representation. For legal advice, please consult specific legal counsel.

[1] EPA, *Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*, (2011), http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711.pdf [hereinafter *EPA Draft Plan*].

[2] *Id.* at 19.

[3] *Id.* at 24.

[4] *Id.* at 30.

[5] G. Roberts et al., *Extracting Natural Gas from Rock*, N.Y. Times, Feb. 26, 2011, http://www.nytimes.com/interactive/2011/02/27/us/fracking.html?ref=drillingdown.

[6] *EPA Draft Plan* at 36.

[7] J. White et al., *Toxic Contamination From Natural Gas Wells*, N.Y. Times, Feb. 26, 2011, http://www.nytimes.com/interactive/2011/02/27/us/natural-gas-map.html?ref=us.

[8] *EPA Draft Plan* at 55.

[9] Environ International Corporation, *Oil and Gas Emission Inventories for the Western States*, Dec. 2005, at 75**,** *available at* http://www.wrapair.org/forums/ssjf/documents/eictts/OilGas/WRAP_Oil&Gas_Final_Report.122805.pdf.

[10] *Id.*

[11] *EPA Draft Plan* at 55.