February 28, 2011

Mr. Edward Hanlon
Designated Federal Officer
SAB Staff Office
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., NW
Mailcode 1400R
Washington, DC 20460

Re: Comments on the Draft Hydraulic Fracturing Study Plan to be Undertaken by the Environmental Protection Agency

Dear Mr. Hanlon:

Thank you for the opportunity to submit these comments on the Environmental Protection Agency's ("EPA") Draft Hydraulic Fracturing Study Plan.

The Natural Resources Defense Council ("NRDC") is a national, non-profit legal and scientific organization with 1.3 million members and activists worldwide. Since its founding in 1970, NRDrC has been active on a wide range of environmental issues, including fossil fuel extraction and drinking water protection. NRDC is actively engaged in issues surrounding natural gas development and hydraulic fracturing, particularly in the Rocky Mountain West and Marcellus Shale regions.

NRDC commends EPA for taking a broad, lifecycle approach to assessing the risks to drinking water from all stages of the hydraulic fracturing process. The practice of hydraulic fracturing is becoming increasingly widespread, making it inextricably linked with all stages of drilling an oil or gas well. In many instances, the act of hydraulic fracturing *per se* may be only one of several factors that, when combined, lead to drinking water contamination and as such, an all-inclusive risk analysis is appropriate and necessary. We therefore strongly support EPA's decision to examine the potential impacts to drinking water from the full hydraulic fracturing lifecycle.

General Comments

Confirmed or suspected incidences of drinking water contamination have been linked to all stages of the hydraulic fracturing water lifecycle and, as such, NRDC strongly supports EPA's decision to examine the risks from each stage, both separately and cumulatively. The examples cited below illustrate why EPA's decision to examine lifecycle risks is appropriate.

1. Water Acquisition Stage: Large volumes of water are required for hydraulic fracturing operations, anywhere from tens of thousands to several million gallons of water per well.[1] The water is sourced from local surface or subsurface water bodies. With large scale development, this could mean a net loss from local water supplies of millions of gallons of water per day. Because fresh water is contaminated by the hydraulic fracturing process, it generally cannot be returned to the reservoir from which it was sourced. This could potentially have an adverse impact on water quality and availability, and aquatic species and habitat. For example, levels of total dissolved solids (TDS) exceeded drinking water standards in 2008 and 2009 in the Monongahela River, an important source of drinking water, and were linked in part to water withdrawals for Marcellus shale drilling.[2,3]

2. Chemical Mixing Stage: Leaks or spills from the tanks used to mix water, chemicals, and proppant for hydraulic fracturing have the potential to contaminate groundwater and surface water. In 2010, the Pennsylvania Department of Environmental Protection investigated a spill of at least 13,000 gallons of hydraulic fracturing fluid resulting from an open valve on a frac fluid tank. The fracturing fluid polluted a tributary and spring and initial tests of nearby water and soil showed elevated levels of total dissolved solids, indicating the presence of fracturing fluid.[4]

3. Well Injection Stage:

    a. Improperly constructed and/or maintained wellbores can provide a leakage pathway for hydrocarbons, drilling fluid, or hydraulic fracturing fluid to contaminate groundwater. If wellbores are not properly maintained, degradation of the cement and casing may occur over time due to corrosion, erosion, or high pressure forces.[5] In 2007, an explosion occurred in a house in Bainbridge Township, OH due to the presence of methane in the home's water well. Subsequent investigation resulted in the disconnection of 26 domestic water wells and bottled drinking water being provided to 48 residences due to methane contamination. The investigation determined that an inadequate primary cement job and the decision to hydraulically fracture the well without addressing the cementing problems were among the primary causes of gas invasion into the drinking water aquifer.[6]

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[1] GWPC (Ground Water Protection Council) & ALL Consulting. (2009). *Modern shale gas development in the United States: A primer.* Contract DE-FG26-04NT15455. Washington, DC: United States Department of Energy, Office of Fossil Energy and National Energy Technology Laboratory.

[2] *See* Crall, Michael P., "Submittal to Science Advisory Board Environmental Engineering Committee for Evaluation and Comment on EPA's Proposed Research Approach for Studying the Potential Relationships Between Hydraulic Fracturing and Drinking Water Resources", March 26, 2010. p.2.

[3] Pennsylvania DEP Press Release dated April 6, 2010 entitled "PA Must Take Action to Protect Water Resources from Drilling Wastewater, Other Sources of TDS Pollution"

[4] Pennsylvania DEP Press Release dated November 22, 2010 entitled "DEP Investigating Lycoming County Fracking Fluid Spill at XTO Energy Marcellus Well"

[5] Dusseault, M.B., M. Gray and Nawrocki, P.A., Why oil wells leak: cement behaviour and long-term consequences. SPE 64733-MS. Proc. SPE Int. Oil & Gas Conf. and Exhib. Beijing, China, Nov. 7-10, 2000.

[6] 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

b. Rock mechanical properties, local stress conditions, geologic structure and stratigraphy, geochemistry, allowable wellbore pressures, well construction and many other factors must be taken into account to properly design a hydraulic fracture treatment.[7] If these factors are not properly accounted for, out-of-zone fracture growth can occur, in which the fractures propagate further than intended. If the fractures grow into a wellbore that has been improperly constructed or abandoned[8], a migration pathway between the producing formation and groundwater may be created. The fractures can also grow into other formations[9], potentially including groundwater aquifers, depending on how much separation there is between the producing formation and the aquifer.

c. Many geologic formations are extensively naturally faulted and fractured.[10] Hydraulically induced fractures may link up to these natural fracture networks. Over years or decades, these fractures could provide a pathway for contaminants or hydrocarbons to reach groundwater.[11]

4. Flowback and Produced Water Stage: In addition to the chemicals that were initially injected, flowback and produced water may also contain hydrocarbons and other contaminants[12], including heavy metals, salts, and naturally occurring radioactive material (NORM)[13], as a result of contact with subsurface formations and fluids. Various waste storage and management options all have the potential to lead to drinking water contamination. For example, if surface pits are improperly constructed, if they leak, or are overfilled, they can pollute drinking water. Countless such incidences have been reported across the country.[14]

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[7] API (American Petroleum Institute). (2009, October). Hydraulic fracturing operations—well construction and integrity guidelines. API Guidance Document HF1. Washington, DC: American Petroleum Institute.

[8] Kelm, C.H., and Faul, R.R., 1999, Well Abandonment – A "Best Practices" Approach Can Reduce Environmental Risk: SPE Asia Pacific Oil and Gas Conference and Exhibition, 20-22 April 1999, Jakarta, Indonesia., DOI: 10.2118/54344-MS.

[9] BC Oil and Gas Commission, SAFETY ADVISORY 2010-03, May 20, 2010: COMMUNICATION DURING FRACTURE STIMULATION

[10] Jacobi, R.D., Agle, P.A., Smith, G., Lugert, C., Seever, J., Cross, G., and Lowenstein, S., 2008. Faulting and Fracture Heterogeneity in Black Shales of the Appalachian Basin of New York State: 2008 Joint Meeting of The Geological Society of America, Soil Science Society of America, American Society of Agronomy, Crop Science Society of America, Gulf Coast Association of Geological Societies with the Gulf Coast Section of SEPM., Geological Society of America Abstracts with Programs, Vol. 40, No. 6, p. 233.

[11] Tom Myers, Ph.D., Review and Analysis of DRAFT Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory Program Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs September 2009, Dec. 28, 2009, pp. 9-14. http://docs.nrdc.org/energy/files/ene_10092901d.pdf

[12] Kirby, C.S., Pritz, M.E., Lunde, A.S., and Tate, G.P., 2010, Inorganic Geochemistry of Marcellus Shale Natural Gas Hydrofracturing Waters: Geological Society of America *Abstracts with Programs*, Vol. 42, No. 5, p. 556

[13] Bank, T., Malizia, T., and Andresky, L., 2010, Uranium Geochemisty in the Marcellus Shale: Effects on Metal Mobilization: Geological Society of America *Abstracts with Programs*, Vol. 42, No. 5, p. 502

[14] See, e.g.,
Pennsylvania DEP Press Release dated August 17, 2010 entitled "DEP Fines Atlas Resources for Drilling Wastewater Spill in Washington County"
Pennsylvania DEP Press Release dated October 7, 2010 entitled "DEP Fines Seneca Resources Corp. $40,000 for Violations at Marcellus Operation in Tioga County"

5. Wastewater Treatment and Waste Disposal Stage: After hydraulic fracturing, millions of gallons of flowback and produced water must be disposed of properly. Current approaches include surface disposal, reuse in another well, re-injection into a disposal well, evaporation, or transport to a treatment facility. If such facilities are not available locally, the water may have to be transported great distances. Each of these activities carries its own inherent risks, including spills, leaks, and the threat to groundwater associated with disposal wells. Uncertainty remains around the availability of treatment facilities and whether those which are available will be able to manage the volume and types of waste generated by oil and gas activities.

Conclusively linking hydraulic fracturing to drinking water contamination has been difficult at best either due to a lack of investigation or because regulators and the public have lacked the necessary data or technology to do so. There are countless incidents around the country where drinking water has been contaminated and hydraulic fracturing is a suspected cause. We cannot emphasize strongly enough how crucial it is for EPA to develop and test hypotheses regarding this type of drinking water contamination. In all the cases listed below, which represent only a small subset of all the *reported* incidents[15], the timing of hydraulic fracturing operations relative to water contamination potentially suggests a causal relationship.

- Garfield County, CO: In 2004, methane began seeping out of the West Divide Creek in the Mamm Creek Natural Gas Field. A sampling program subsequently found methane and increased total dissolved solids in multiple domestic water wells. Numerous field studies have been conducted in the area and have concluded that the gas operations were a contributing factor in the water contamination.[16,17,18,19] In the recommendations for future work in one such study, the authors suggested, "The effect on groundwater due to the introduction of drilling or well completion/hydrofracturing fluids into the shallow aquifer was not investigated for this study. A study evaluating possible local effects of drilling or hydrofracturing fluids on domestic groundwater should be considered."[20]

Pennsylvania DEP Press Release dated August 2, 2010 entitled "DEP Fines Talisman Energy USA for Bradford County Drilling Wastewater Spill, Polluting Nearby Water Resource"

[15] Mall, Amy, NRDC Switchboard Blog, posted February 7 2011, updated February 15, 2011 entitled "Incidents where hydraulic fracturing is a suspected cause of drinking water contamination"

[16] 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.

[17] Papadopulos & Associates, Inc., 2008, Phase II hydrogeologic characterization of the Mamm Creek Field area, Garfield County, Colorado: Prepared for the Board of County Commissioners, Garfield County, Colorado, 41 p.

[18] Thyne, Geoffrey, 2008, "Review of Phase II Hydrogeologic Study prepared for Garfield County" available here: http://cogcc.state.co.us/Library/Presentations/Glenwood_Spgs_HearingJuly_2009/(1_A)_ReviewofPhase-II-HydrogeologicStudy.pdf

[19] 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.

[20] Ibid, 17.

- In 2007, the Lytle family in Seneca County reported contamination of drinking water the morning after hydraulic fracturing of a nearby natural gas well owned by Chesapeake Energy Corporation. The water turned gray and was full of sediment.[21]

- In 2009, the Zimmerman family of Washington County reported contamination of drinking water after hydraulic fracturing of nearby natural gas wells owned by Atlas Energy. Water testing on their farm found arsenic at 2,600 times acceptable levels, benzene at 44 times above limits, naphthalene at five times the federal standard, and mercury and selenium levels above official limits.[22]

- The Hagy family in Jackson County, West Virginia, is suing four oil and gas companies for contaminating their drinking water. They say their water had "a peculiar smell and taste" and the parents as well as their two children are suffering from neurological symptoms. A news article reports that the lawsuit makes the connection between the drinking water contamination and the hydraulic fracturing process.[23]

- Tarrant County Commissioner J.D. Johnson, who lives in the Barnett shale area, reported groundwater contamination immediately after two gas wells on his property were hydraulically fractured. His water turned a dark gold color and had sand in it.[24]

In these and many other cases, rigorous explanations of the causes of water contamination have not been established and the potential link to hydraulic fracturing has not been sufficiently investigated.

<u>Scope of Study</u>

Due to the fact that this study will focus specifically on drinking water resources, EPA has deemed several proposed topics of research to be outside the scope of this study. We believe, however, that several of these excluded topics do fall within the bounds this study, specifically:

1. **Seismic and related risks:** Reactivation of faults and induced seismicity may endanger drinking water by

    a. Mobilizing naturally occurring contaminants, including sediment, or
    b. Creating pathways to groundwater for oil, gas, brine, fracturing fluids, or other contaminants by altering the transmissibility of faults or opening new faults or fractures.

    As part of Underground Injection Control regulations, EPA has recognized that fluid injection poses a risk of induced seismicity, which in turn may endanger USDWs.[25] If

[21] Gashler, Krisy, “6,000 sign petition asking DEC to strengthen natural gas drilling regulations”, Press Connects, Dec. 8, 2009
[22] Hurdle, John, “Pennsylvania lawsuit says drilling polluted water”, Reuters, Nov. 9, 2009
[23] Smith, Lawrence, “Suit claims gas drilling contaminated drinking water”, The West Virginia Record, Dec. 10, 2010
[24] Smith, Jack Z., “The Barnett Shale search for facts on fracking”, Star-Telegram, Sept. 4, 2010

induced seismicity results in a large magnitude earthquake, changes in groundwater quantity and quality can occur.[26] Consequently, EPA should analyze the risk for hydraulic fracturing to endanger drinking water through seismic activity.

2. **Impacts to aquatic and terrestrial species:** Water quality and availability have a direct impact on the aquatic and terrestrial species which depend upon that water source. The health of these species is inextricably linked to the health of the stream and vice versa, as well as to humans if they become part of the food chain. Impacts to aquatic and terrestrial species should be evaluated by this study to the extent they relate to the water quality and availability category of impacts as well as potential impacts to human health. A recent investigation of ecological function in watersheds in Pennsylvania has found water impairment downstream from high drilling density areas, along with a 25% reduction in salamanders and sensitive insects.[27]

3. **Research Prioritization: EPA states that the** study will focus on hydraulic fracturing in shale formations and only research hydraulic fracturing in coalbed methane reservoirs and tight sands "when possible." While we understand that investigating only one type of formation is a more manageable project, hydraulic fracturing is a suspect in cases of drinking water contamination in tight sands or coalbed methane formations around the country, as well as in shale formations. We think it is essential that the EPA look at the hydraulic fracturing risks to drinking water in all types of formations.

While recognizing that this study is focused specifically on drinking water contamination, we continue to encourage EPA to fully examine the potential risks that oil and gas production utilizing hydraulic fracturing poses to air, land, wildlife, public health, and community character.

Cumulative Impacts

It is critical that EPA evaluate potential impacts not only per wellpad but also cumulatively. While there is much important information that can be generated from analyzing the impacts at a single wellpad, critical information with respect to potential impacts must be evaluated on a cumulative basis. For example, meaningful assessment of the impacts associated with water usage; wastewater storage, treatment and disposal capacity; seismic activity; and other aspects of the development process must be done cumulatively to understand the full measure of potential impacts, as well as whether technologies or practices exist that can mitigate such impacts.[28]

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[25] U.S. Environmental Protection Agency, Dec. 2010, "Protecting Drinking Water: UIC Class VI Fact Sheets, Underground Injection and Seismic Activity"

[26] Fleeger, G.M., Goode, D.J., Buckwalter, T.F. and Risser, D.W., "Hydrologic effects of the Pymatuning earthquake of September 25, 1998 in northwestern Pennsylvania," *USGS Water Resources Investigation Report*, 1999, pp. 99–4170.

[27] Velinksy, David, Testimony on the Economic and Environmental Impacts of Hydraulic Drilling of Marcellus Shale on Philadelphia and the Surrounding Region Before The Joint Committees on the Environment and Transportation & Public Utilities of the Council of the City of Philadelphia. September 23, 2010.

[28] As EPA itself has documented, "While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources." See e.g., "Consideration of Cumulative Impacts in EPA Review of NEPA Documents," U.S. Environmental Protection Agency, Office of Federal Activities (2252A), EPA 315-R-99-002/May 1999.

Best Available Technology and Best Management Practices
For all stages of the hydraulic fracturing process, EPA should compare

1. Standard or typical industry practice,
2. Best available technologies and practices, and
3. Technologies that are under development or could be developed.

EPA should identify any gaps between standard practices/technologies and best practices/ technologies. A cost/benefit analysis should be performed to determine whether there is any cost to upgrade to best practices and technologies and the extent to which risk mitigation would be improved by best practices and technologies and any other benefits.

Comments on the Proposed Study Plan

3 OVERVIEW OF UNCONVENTIONAL GAS PRODUCTION

References are made in this section and others, including the list of possible case studies, to examining the risks to drinking water from hydraulic fracturing of unconventional oil reservoirs in addition to gas reservoirs. We agree with EPA in this approach and feel it is important to assess the risks in all instances where hydraulic fracturing is utilized, regardless of the type of hydrocarbon produced. Last year there was a blow-out during hydraulic fracturing operation of an oil well in North Dakota where it was estimated that more than 60,000 gallons of hydraulic fracturing fluid plus 7,000 gallons of oil were blown out of the well into the environment.[29] As such, it may be useful to change the heading of this section as well as add content on oil production practices to clarify that hydraulic fracturing of both oil and gas formations will be included in this study.

6 PROPOSED RESEARCH

6.1.4.1 *Scenario Evaluation*

The scenario evaluations will be important tools for understanding cumulative impacts of water withdrawals for different development scenarios and NRDC commends EPA for this proposed work. We request that EPA provide additional clarification of the assumptions that will be used in each scenario. In the first scenario, additional clarification is needed regarding the phrase "full exploitation." There can be a wide range of estimates of the ultimate number of wells that may be drilled in various fields. Clarification is also needed regarding the second scenario, the "sustainability analysis." For instance, will this analysis assume all water is drawn from surface or subsurface water bodies or does it also include recycling and reuse of flowback and produced water and/or the use of non-potable water sources for hydraulic fracturing fluid?

6.2.5.1 *Chemical Identity and Toxicity: Analysis of Existing Data*

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[29] Donovan, Lauren, "Killdeer oil spill being cleaned up, officials investigate," *The Bismarck Tribune*, September 2, 2010.

One of the largest sources of uncertainty about hydraulic fracturing is the number, type, and toxicity of chemicals used in hydraulic fracturing fluid. NRDC fully supports EPA's proposed research into this topic.

6.3.2 *How effective are well construction practices at containing gases and fluids before, during, and after fracturing?*

Understanding the effectiveness of wellbore design and construction in preventing water contamination is crucial and NRDC commends EPA for its proposed analysis of this topic. However, EPA states that because it has "not been able to identify potential partners for a case study", this study will not consider the risks posed by refracturing or fracturing old/existing wellbores. Wellbore integrity inevitably degrades over time and therefore refracturing a well may pose an increased risk relative to the first time the well was fractured. Older wells which have never been hydraulically fractured may have been constructed using older and less protective standards, or may not have been designed to withstand the pressures associated with hydraulic fracturing. It is inappropriate for EPA to ignore this important category of risks. At a minimum, EPA should assess what information on this topic is currently publically available and identify gaps in data that must be filled in order to complete a comprehensive study.

6.3.3 *What are the potential impacts of pre-existing man-made or natural pathways/features on contaminant transport?*

EPA importantly has acknowledged that it is difficult to accurately predict and control the location and length of fractures, and that if hydraulic fractures combine with pre-existing faults or fractures that lead to aquifers or directly extend into aquifers, injection could lead to the contamination of drinking water supplies by fracturing fluid, natural gas, and/or naturally occurring substances. EPA states that a common assumption in shale gas formations is that natural barriers in the rock strata that act as seals for the gas in the target formation also act as barriers to the vertical migration of fracturing fluids, and are deeper than coalbed methane reservoirs. We request that EPA test this assumption as part of this study and evaluate how the risk to drinking water varies as a function of the depth of aquifers and the depth of hydraulic fracturing.

6.3.6.2 *Impacts of Natural and Manmade Pathways: Case Studies and Scenario Evaluation*

In addition to reviewing the data resulting from the technologies that are available to measure fracture growth, such as microseismic monitoring, tiltmeters, etc., EPA should also undertake a review of the technologies themselves. This study should examine what technologies are currently available, the quality of the resultant estimates of fracture growth, and the extent to which they are used. Understanding the reliability and limitations of these technologies is crucial. In addition, EPA should perform a cost/benefit analysis of these technologies to help determine in what circumstances they can best be applied.

6.3.6.3 *Physical/Chemical/Biological processes relevant to hydraulic fracturing: Laboratory Studies*

We support EPA's plan to conduct laboratory studies, including chemical degradation, biogeochemical reactions, and weathering reactions by pressurizing subsamples of cores, cuttings, or aquifer material in temperature-controlled reaction vessels. There are cases around the country where it appears that aquifers may have been contaminated by naturally occurring substances and this research is critical to understanding the various substances which may be mobilized by drilling and cause water contamination.

6.4.3 *What factors may influence the likelihood of contamination of drinking water resources?*

EPA rightfully finds that there is a potential for releases, leaks, and/or spills associated with the storage and transportation of flowback and produced water, which could lead to contamination of shallow drinking water aquifers and surface water bodies. EPA also notes the concerns associated with the design, construction, operation, and closure of waste impoundment pits. Additionally, EPA should consider how "land application" and evaporation from pits may also lead to contamination of drinking water. These processes may introduce toxic substances in the fluid into the air through evaporation or direct spraying of fluids. These chemicals can eventually end up in surface or groundwater through precipitation, leaks, spills, or runoff. In Colorado, a fresh water spring that was a source of drinking water was contaminated by a leaking waste pit. Tests of the spring water found benzene levels at 32 times the state groundwater standards.[30] In Ohio, the back wall of a pit gave way in 2008, causing pit contents to spill and flow towards a creek.[31]

6.5.3.1 *Effectiveness of current treatment methods: Analysis of existing data, laboratory studies, and prospective case studies*

NRDC commends EPA for including waste treatment and disposal methods in this study. In addition to the topics listed, EPA should also assess the availability of treatment facilities in different geographic regions and the volumes of both solid and liquid waste these facilities would be expected to handle under various development scenarios. This is crucial to understanding how the pace of development and drilling will influence the ability to properly dispose of waste material. We request that EPA also evaluate the potential environmental impacts of the various treatment technologies themselves, for example energy intensity, water usage, air pollutants, and other impacts.

7 CASE STUDIES

EPA's inclusion of both retrospective and prospective case studies in this project is crucial to determining whether hydraulic fracturing has caused or may cause drinking water contamination. NRDC commends EPA for undertaking this important area of research. In making its final selection of sites, it would be useful for EPA to also consider the range of state regulations in its decision-making criteria. Picking locations that are subject to different levels and types of regulation is important to understanding how drinking water risks vary geographically.

[30] Colorado Oil and Gas Conservation Commission, Cause No. 1V, Order No. 1V, Docket No. 1008-OV-06
[31] Ohio Department of Natural Resources, Notice of Violation No. 2016754140, May 16, 2008

We recognize that in order to carry out these studies it will be important for EPA to coordinate with various stakeholders, such as local and state regulators, oil and gas companies, service providers, and landowners. However, we request that, to the extent possible, EPA also perform unannounced site visits and inspections. This is crucial to ensure that EPA will visit locations that are representative of standard operations and not just those which are being performed under the highest standards due to the knowledge that EPA will be visiting. Understanding the operations at a "typical" well site is necessary in determining whether current industry practices and state and federal regulation and enforcement are adequate to protect drinking water.

One area of concern in regard to hydraulic fracturing is that the process may cause the indirect contamination of drinking water by mobilizing naturally occurring contaminants. For the retrospective case studies, EPA should test this hypothesis by collecting data not only on the chemicals used in the hydraulic fracturing process but also on naturally occurring contaminants. EPA should investigate whether there is a link between the timing of contamination and the timing of hydraulic fracturing and attempt to establish causality.

EPA discusses the risks associated with abandoned wells, however the documented presence of abandoned wells does not seem to be included in the criteria for selecting case studies. This should be one of the criteria considered.

8 CHARACTERIZATION OF TOXICITY AND HUMAN HEALTH EFFECTS

EPA accurately and clearly states: "In almost all stages of the hydraulic fracturing water lifecycle, there is potential for fracturing fluids and/or naturally occurring substances to be introduced into drinking water resources." We strongly support EPA's proposal to investigate both chemicals used in hydraulic fracturing fluid as well as naturally occurring substances that may be released from subsurface formations during the hydraulic fracturing process. However, we urge EPA to look not only at the potential toxicity from drinking contaminated water, but also the risk from breathing in contaminated water that may have evaporated or may be misted or vaporized in water, for example during baths or showers or from open storage pits.

9 ENVIRONMENTAL JUSTICE

We support EPA's priority to consider the environmental justice implications of hydraulic fracturing, including whether people with a lower socioeconomic status may be more likely to consent to drilling arrangements because they may not have the resources to engage with policymakers and agencies to affect alternatives and whether tenants and neighbors are at risk. However, EPA states that drilling agreements are between landowners and well operators, when they are actually between mineral owners and operators. Therefore, there is a crucial need to consider the implications of split-estate situations – where landowners do not own the minerals beneath their land and have no say in how or where operations are conducted.

Conclusion

NRDC is very supportive of EPA's proposed hydraulic fracturing study plan. This research is crucial to developing scientific understanding of the impacts and risks to drinking water from the full hydraulic fracturing lifecycle. We continue to encourage EPA to make this study as comprehensive as time and funds will allow.

EPA must take all precautions to ensure that the study is unbiased, peer reviewed by impartial third parties, based on the best available science, and free of political pressure from any special interest.

Thank you for your consideration of these comments. NRDC is pleased that EPA is undertaking this study in recognition of the serious environmental and public health concerns associated with oil and gas production utilizing hydraulic fracturing.

Sincerely,

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