NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

September 28, 2010

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U.S. Environmental Protection Agency
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Re: Comments on the Hydraulic Fracturing Study to be Undertaken by the Environmental Protection Agency

Dear Ms. Dean:

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

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, NRDC 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.

In recent years, there has been much emphasis on the potential for natural gas to serve as an important transition fuel as we move away from heavy fossil fuels such as oil and coal to a lower carbon society. And recent innovations in technologies used to extract natural gas from so-called "unconventional plays," including shale formations, have generated significant enthusiasm about the possibility that the United States could produce substantial quantities of natural gas domestically.

Yet there remain serious questions and a need for greater scientific understanding as to the safety of the technologies employed to extract natural gas from these sources, particularly hydraulic fracturing and horizontal or directional drilling. There are numerous documented cases, and many more personal testimonies, of harm to public health and the environment from natural gas production utilizing these technologies. Such harms include contamination to drinking and surface water supplies, air quality degradation and exposure to hazardous air pollutants, toxic waste generation, landscape and habitat alteration, disruptions to community character and more.

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NRDC applauds EPA for undertaking this critically needed examination into the potential adverse impacts that hydraulic fracturing could have on drinking water. As explained in our comments below, we believe that the agency has largely set forth a thorough and reasonable approach to addressing this important question. We submit specific suggestions as to the design of the study and the case studies, as well as nominations for specific case studies. Attached hereto and referenced below are several reports prepared on behalf of NRDC by technical consultants who reviewed and analyzed New York State's Draft Supplemental Generic Environmental Impact Statement, which contain analysis and recommendations relevant to EPA's study.

We also renew our request that EPA make every effort to ensure that the study is as broad-based as possible, including examining impacts beyond those that some commenters may strictly define as drinking water impacts and considering the full range of technologies that are utilized in conjunction with hydraulic fracturing to extract natural gas.

<u>General Comments</u>

We commend EPA for its stated intention to address impacts from a lifecycle perspective. It is critical that a full lifecycle analysis be utilized so that EPA can comprehensively evaluate the full range of potential environmental impacts from gas development, including hydraulic fracturing. Rather than narrowly focusing solely on the limited process of hydraulic fracturing *per se*, it is necessary to employ a broad, comprehensive lifecycle assessment approach to evaluate the potential impacts associated with all stages of gas development utilizing hydraulic fracturing.

These impacts may arise from the full range of activities associated with fracturing, including: water quantity and quality impacts associated with the large amounts of fresh water used in fracturing; spills, leaks and accidents associated with the transportation, storage and disposal of hydraulic fracturing chemicals before fracturing takes place, as well as the used hydraulic fracturing fluids, and production wastewaters and solid wastes; stormwater and erosion and sedimentation impacts from land clearing for well pads, access roads and feeder pipelines; and all potential pathways for groundwater contamination from the drilling and well construction process (e.g., casing and cementing of wellbores) and hydraulic fracturing.

Due in large measure to the extensive exclusions and exemptions that the oil and gas industry enjoys from the nation's major environmental statutes,[1] the regulation of natural gas development has been largely left to the states, which employ a patchwork of regulatory approaches to the practice. An appropriately comprehensive, thorough evaluation of the full lifecycle impacts associated with natural gas development could serve as an important basis for not only informing federal regulation but also for ensuring that the states' regulatory programs are based on the best available science and require

[1] *See* NRDC, "Drilling Down: Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production" ("Drilling Down"), Oct. 2007, pp. iv, 31-33.

the most up-to-date technologies and practices to protect public health and the environment.

The Study Should Examine All Activities Associated with Natural Gas Development Utilizing Hydraulic Fracturing

We are concerned that the study not be unduly narrowly focused on the process of hydraulic fracturing to the exclusion of the other activities and technologies – from exploration and production through post-production – that are inextricably intertwined with hydraulic fracturing, and which may have an impact on drinking water. These include land clearing; drilling, casing and cementing of wellbores; pre- and post-fracturing subsurface investigation and fracture confirmation; management of chemicals and waste both prior to and after hydraulic fracturing.

Industry claims that currently as many as 90% of gas wells are stimulated using hydraulic fracturing.[2] Given this fact, it is simply not possible to evaluate the impacts of hydraulic fracturing in isolation. It is essential to understand at what point in the overall development process accidents or other failures can lead to environmental and health impacts. Therefore, to examine impacts resulting from the hydraulic fracturing process alone, i.e., from when fracturing begins to when it ends, will exclude much needed analysis of the practices and technologies that may be available to prevent serious impacts associated with other stages of the overall development process. For example, we have well-documented evidence of drinking water contamination resulting from poorly constructed well bores.[3] EPA should bring its expertise and resources to bear on a full examination that can inform regulatory requirements and industry best practices throughout the natural gas development process.

The Study Should Evaluate the Full Range of Environmental and Public Health Impacts from Natural Gas Development

To fully evaluate the potential impacts associated with natural gas production utilizing hydraulic fracturing, it is also important to evaluate the full measure of impacts not only with respect to water quantity and quality, but also to air quality, landscapes, habitat, and community character. Many such impacts are a direct result of the same practices that are required for hydraulic fracturing. For example, storage of toxic wastewater in open-air pits and tanks all result in emissions of hazardous air pollutants

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[2] Casselman, Ben and Russell Gold. "Drilling Tactic Unleashes a Trove of Natural Gas—and a Backlash," *The Wall Street Journal* (Jan. 21, 2010), available at: http://online.wsj.com/article/SB10001424052748703837004575012952816154746.html.

[3] *See, e.g.,* www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=2418&typeid=1 (Pennsylvania DEP press release dated Nov. 4, 2009, entitled "DEP Reaches Agreement with Cabot to Prevent Gas Migration, Restore Water Supplies in Dimock Township: Agreement Requires DEP Approval for Well Casing, Cementing").

that can volatilize off the wastewater and result in air contamination.[4] This is a direct impact of hydraulic fracturing and the wastewaters it generates.

Similarly, the large amounts of water needed to conduct fracturing – particularly in shale formations – translate into huge numbers of truck trips to and from each well pad.[5] A full accounting of the impacts of gas production using hydraulic fracturing would account for the significant air emissions associated with these truck trips. This same truck traffic has serious impacts on community character, particularly in the many rural and agricultural communities in which gas production occurs.

We recognize that EPA is prioritizing an examination of drinking water impacts from hydraulic fracturing in accordance with the resources currently allocated to this study. While such prioritization is appropriate, at the same time EPA should request adequate resources to develop a study considering the full measure of all categories of potential impacts arising from the range of processes that are associated with hydraulic fracturing.

Comments on the Proposed Study Design

EPA has solicited input to help inform the development of its study design. Keeping in mind the four framing questions presented by EPA,[6] following are NRDC's comments relative to design of the hydraulic fracturing study.

The Study Should Include Stormwater Runoff and Erosion and Sedimentation Impacts

The four broad categories of water-related impacts identified in EPA's proposed Study Design (i.e., (1) acquisition of water for well drilling and fracturing operations; (2) mixing water with chemicals and proppant for the fracturing operation itself, injection of fracking fluids, and return of wastewater to the surface; (3) storage of wastewater; and (4) treatment, disposal, or recycling of wastewater[7]) are overall comprehensive, but seem to exclude stormwater runoff and erosion and sedimentation impacts from land clearing associated with construction of well pads, access roads and feeder pipelines. This is an important category of water-related impacts that can affect drinking water quality and other ecological considerations,[8] and should be explicitly included in the Study Design.

The Study Should Explicitly Include Produced Water, Even Where Not Mixed with Flowback

[4] *See* Attachment A, Harvey Consulting, LLC, "Review of DSGEIS and Identification of Best Technology and Best Practice Recommendations," Dec. 28, 2009, pp. 37-39.
[5] U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, "Modern Shale Gas Development in the United States: A Primer," April 2009, pp. 72-73.
[6] EPA, "Opportunity for Stakeholder Input on EPA's Hydraulic Fracturing Research Study: Study Design" ("EPA Study Design"), Jul. 14, 2010, p. 3.
[7] *Id.*
[8] Drilling Down at 18-20.

EPA identifies flowback, i.e., recovered fracturing fluids, as a type of wastewater requiring storage, handling and disposal.[9] EPA does not mention produced water – i.e., that water that naturally exists in a target formation and comes to the surface as part of the gas production process – as a distinct type of wastewater that has the potential to result in drinking and surface water contamination.[10] It is critical that EPA differentiate and evaluate the risks associated with both types of wastewater. With respect to flowback, much of the concern involves the chemicals used in the original fracturing fluids; with produced water, the concern involves naturally occurring contaminants including heavy metals, volatile organic compounds, radionuclides and salts.[11] Although EPA further refers to high levels of total dissolved solids ("TDS") – i.e., salts, which are typically associated with produced water – as having the potential to affect surface water quality,[12] it should be made explicit that the study will evaluate the potential impacts associated with both types of wastewater.

<u>The Study Should Devote Particular Attention to the Potential for Contamination from Hydraulic Fracturing and Seismic Activity</u>

One of the most significant areas in which additional research and scientific investigation is necessary is the potential for fractures from hydraulic fracturing operations to propagate "out of zone" and/or intersect with naturally occurring fractures, improperly abandoned wells or other potential migration pathways, resulting in short- or long-term contamination of underground aquifers. Although technologies exist that can help in the identification and possible mitigation of such events (e.g., pre-fracture microseismic three-dimensional subsurface mapping, use of chemical and/or short half-life radioactive tracers, post-fracture microseismic monitoring), they are rarely employed in the field. Instead, companies largely rely exclusively on pre-fracture computer modeling. Such modeling cannot adequately identify whether communication between fractures and potential contamination pathways might or has occurred. This threat is of particular concern because contamination in such an event might not show up in drinking water supplies for years or even decades.[13]

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[9] EPA Study Design, p. 1.

[10] Moreover, the Science Advisory Board (SAB) repeatedly refers to flowback water and produced water that is commingled with the flowback water, without identifying uncommingled produced water as a distinct potential source of contamination and focus of investigation. EPA Science Advisory Board letter to the Honorable Lisa P. Jackson re: Advisory on EPA's Research Scoping Document Related to Hydraulic Fracturing ("SAB Comments"), Jun. 24, 2010, pp. 11-12, 24.

[11] *See* Attachment B, Glenn Miller, Ph.D., "Review of the DRAFT Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program Toxicity and Exposure to Substances in Fracturing Fluids and in the Wastewater Associated with the Hydrocarbon-Bearing Shale," Dec. 29, 2009. Of course, in the real world, there is inevitably some commingling between flowback and produced water. EPA should consider the risks of each type of wastewater, as well as their combined risks.

[12] EPA Study Design, p. 2.

[13] *See* Attachment C, Tom Myers, Ph.D., "Review and Analysis of DRAFT Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory

To best understand the potential risks of hydraulic fracturing, EPA should investigate technologies and practices used to collect pre-fracture data, determine fracture growth concurrent with hydraulic fracturing operations, and conduct post-fracture monitoring of movement of fracture fluids and groundwater chemistry.

An integral part of understanding how hydraulically induced fractures could create migration pathways to and potentially contaminate groundwater is a thorough understanding of the current geologic and hydrologic regimes.[14] We recommend EPA investigate technologies and practices available to conduct pre-fracture investigations that include but are not limited to:

- Detailed study of regional and local geologic structure including faults, fractures, stress regimes, rock mechanical properties, etc. through the use of 3D seismic surveys, outcrop analog studies, collection of core and relevant analysis, well logs including FMI/image logs, etc.
- Detailed pre-drill maps of the extent and chemical composition of groundwater aquifers.
- Hydrologic flow and transport data collection and modeling.
- Thorough identification of existing wellbores, determination of the integrity of those wellbores (i.e. casing, cement, etc.), and mitigation where necessary.[15]

EPA should examine the accuracy and quality of methods of directly measuring hydraulic fracture growth including preferred fracture orientation, fracture half-length, and fracture height growth,[16] and the implications for environmental risk. Currently such methods are very limited and are often supplemented with modeling.[17] Reports of unintended fracturing out of zone[18] or into offset wellbores[19] underscores the need to

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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.

[14] Olson, J., Dahi-Taleghani, A., "The Influence of Natural Fractures on Hydraulic Fracture Propagation: Search and Discovery Article #40583", 2010 (adapted from oral presentation at AAPG Annual Convention and Exhibition, New Orleans, Louisiana, Apr. 11-14, 2010).

[15] *See* Attachments C, *infra*, and D, Harvey Consulting, LLC, "New York State (NYS) Casing Regulation Recommendations," Sept. 16, 2009.

[16] Zhang, G.M., Liu, H., Zhang, J., Wu H.A., Wang, XX., "Three-dimensional finite element simulation and parametric study for horizontal well hydraulic fracture," *Journal of Petroleum Science and Engineering*, vol. 72, issue 3-4, 2010, pp. 310-317.

[17] Enderlin, M., Mullen, M., Tamayo, C., "Is That Frac Job Really Breaking Rock? Or Just Pumping Down a Pre-existing Plane of Weakness: The Integration of Geomechanics and Hydraulic Fracture Diagnostics", 2010, AAPG Annual Convention, Unmasking the Potential of Exploration & Production, Apr. 11-14, 2010, New Orleans, Louisiana, - Abstracts, #90104 (2010).

[18] Eisner, L., Fischer, T., Le Calvez, J.H., "Detection of repeated hydraulic fracturing (out-of-zone growth) by microseismic monitoring," *The Leading Edge*, v. 25, no. 5, 2006, pp. 548-554.

improve those techniques which are available, such as microseismic monitoring[20] and chemical and radioactive tracers, and develop new techniques for measuring fracture growth. This is crucial to determining if induced fractures communicate with natural fracture networks and potentially groundwater.

EPA should also investigate how well we understand how groundwater could be compromised indirectly through fault reactivation,[21] mobilization of naturally occurring contaminants, displacement of groundwater, and similar effects as a consequence of the intense pressures associated with hydraulic fracturing.[22] The displacement and contamination of groundwater and surface water as a result of seismic activity, even from great distances (i.e., more than hundreds of kilometers) is well documented[23,24,25] but research is lacking into whether similar consequences could be seen as a result of fracturing.

Equally critical is robust post-fracture monitoring. EPA should study injected volumes of fracture fluids as well as flowback volumes, and how these are reported to regulatory agencies, to better understand the potential for migration. In order to effectively monitor where fracture fluids go and whether they or the chemicals they contain interact with groundwater, it is essential for EPA to analyze the exact chemical composition of all constituents involved in the drilling and completion process, including but not limited to:

- Drilling fluids/mud
- Fracture fluid
- Connate water/produced water

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[19] British Columbia Oil and Gas Commission, "Communication During Fracture Stimulation, Safety Advisory 2010-03," available at: http://www.ogc.gov.bc.ca/documents/safetyadvisory/SA%202010-03%20Communication%20During%20Fracture%20Stimulation.pdf.

[20] Brooks, Nicholas., Gaston, Graham., Rangel, Jaime, " Three Different Methods of Mapping the Characteristics of Induced Fractures Related to Both Hydraulic Frac and Production as Measured With Microseismic Array Technology from Observation Wells, Treatment Wells and in a Permanent Setting," SPE Deep Gas Conference and Exhibition, Jan. 24-26, 2010, Manama, Bahrain, p. 10.

[21] Maxwell, S., Jones, M., Parker, R., Leaney, S., Dorval, D., Logel, J., D'Amico, D., Hammermaster, K., " Microseismic Evidence of Fault Activiation During Hydraulic Fracturing," 2010 AAPG Annual Convention, Unmasking the Potential of Exploration & Production, Apr. 11-14, 2010, New Orleans, Louisiana, - Abstracts, #90104 (2010).

[22] http://www.dec.ny.gov/docs/materials_minerals_pdf/ogdsgeischap5.pdf, pp. 5-91

[23] 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.

[24] Montgomery, D.R., Manga, M., " Streamflow and Water Well Responses to Earthquakes," *Science*, vol. 300, no. 5628, 2003, pp. 2047-49.

[25] Brodsky, E. E., E. Roeloffs, D. Woodcock, I. Gall, and M. Manga, "A mechanism for sustained groundwater pressure changes induced by distant earthquakes," *J. Geophys. Res.*, 108(B8), 2390, doi:10.1029/2002JB002321, 2003.

- Geochemistry of producing formations and formations which serve as potential barriers between the producing formation and any aquifer

EPA must analyze the potential for using groundwater monitoring wells prior to field development and regularly monitored over the life of the field to mitigate against identified impacts. EPA should further assess the extent to which it is crucial to establish baseline water chemistry prior to any oil and gas development activity and to know the exact chemical compositions of any fluids introduced as a result of such activity in order to properly interpret the results from such monitor wells.[26]

The results of the research listed above will not only benefit our health and human safety and the safety of our environment, but will also benefit the oil and gas industry by helping it to more effectively and safely design hydraulic fracturing programs and maximize the amount of oil and gas that can be recovered while minimizing the amount of wells that need to be drilled in order to do so.

<u>The Study Should Assess the Availability of Wastewater Treatment and Disposal Capacity, as Well as the Impacts and Risks Associated with such Facilities</u>

An emerging issue of significant concern is the storage, treatment and disposal of wastewater – both non-recycled flowback and produced water – from hydraulic fracturing. Well-documented episodes of excessive TDS levels in the Monongahela River and other water bodies resulting from insufficient pre-disposal treatment of gas production wastewaters have led the Pennsylvania Department of Environmental Protection to conduct a regulatory process to review and revise the state's effluent limitations and treatment standards for drilling wastewaters.[27] In New York, there are no wastewater treatment facilities that are presently permitted to handle wastewaters from hydraulic fracturing in the Marcellus Shale or other shale formations. This is critical because to date regulators have concluded that the Marcellus Shale region is inappropriate for deep well injection of wastewaters such as occurs in other regions of the country.[28]

In the absence of adequate wastewater treatment capacity, the only options are long-term storage, which presents the risks of spills, leaks, overflows, etc. (leaking pits were linked to drinking water contamination with benzene in Colorado), or transport to regions in which deep well injection is permitted, which carries its own impacts associated with both the risk of spills, risks of the injection wells, and the energy usage to transport significant quantities of water large distances. On the other hand, many of the new treatment technologies that are proposed for use or in use in Pennsylvania are highly energy intensive in their own right, e.g., evaporators to address the very high levels of salts found in drilling wastewater.

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[26] *See* Attachment C, Appendix C.

[27] "With Natural Gas Drilling Boom, Pennsylvania Faces an Onslaught of Wastewater," Propublica, Oct. 4, 2009.

[28] *See* http://extension.psu.edu/naturalgas/news/2010/06/updatewaterqualityrules.

The full range of impacts associated with the storage, handling, treatment and ultimate disposal of natural gas production wastewaters should be analyzed in the EPA study.

The Study Should Evaluate 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.

The Study Should Consider Available Technologies and Best Practices for Minimizing Risks

As part of a broad-based examination of the potential impacts associated with natural gas production utilizing hydraulic fracturing, EPA should evaluate the existence and viability of both existing technologies and practices, as well as those that are under development or could be developed, to minimize any identified risks. For example, much is known about technologies and practices for well construction, including casing and cementing of wellbores, and monitoring of well construction and hydraulic fracturing, that could result in fewer accidents and incidents of drinking water contamination. Attached hereto and incorporated herein is a report by Susan Harvey, expert consultant to NRDC, identifying such measures.[29] EPA should evaluate these technologies and render its opinion as to the extent to which they could help mitigate risks.

Other examples include: (1) recycling and reuse of flowback and produced water; (2) "green" completions; (3) "green" fracturing fluids; (4) use of microseismology and tracers to map and track fractures as discussed above; (5) groundwater monitoring protocols;[30] and (6) monitoring of the hydraulic fracturing process.

As discussed above, EPA's study could serve as the basis for strengthening federal policies as well as the patchwork of state regulations governing natural gas development. As such, a thorough investigation into available and future technologies and best practices to address risks could help inform our evolving regulatory approaches.

The Study Should Consider Risks to Human Food Supply

We urge the EPA to consider the risks to the human food supply, either tainted livestock or produce, posed by hydraulic fracturing. There have been reports of livestock becoming ill when exposed to hydraulic fracturing chemicals through ingesting hydraulic

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[29] *See* Attachment D.
[30] *See* Attachment C, Appendix C.

fracturing fluid that was spilled on the surface or contaminated drinking water, including cattle, goats or lambs that may provide milk or meat.[31] Some animals have died. It is important to know what happens to the dead animals, but also what are the impacts on any animals that survive and the humans that may ingest these animals' meat or milk. We also encourage EPA to analyze the potential impacts if contaminated water were used to irrigate crops, or if crops are planted on land with contaminated groundwater.

Comments Regarding Case Studies

NRDC commends EPA for its intention to conduct case studies as part of the study, including some number of actual field studies rather than relying upon existing data and information from state regulators and others. Too often, known or suspected cases of water contamination and other ill effects from natural gas development have been inadequately investigated, with a resulting dearth of scientifically sound information as to the causes and implications of such contamination. EPA can add greatly to the scientific understanding of the risks associated with hydraulic fracturing through the development of rigorous, in-depth, unbiased field investigations.

To develop the most comprehensive information, EPA should consider conducting as many such studies as resources allow (possibly more than the 5-10 suggested by the SAB).[32] EPA is appropriately seeking to ensure that the studies represent as diverse a geographic and geologic range as possible, including sites at which fracturing is planned, ongoing and completed.[33]

Comments Regarding Site Selection Criteria

The site selection criteria identified by EPA appear overall to be sound. NRDC offers the following suggested additions to the criteria set forth in Table 1 of the EPA Case Studies document[34]:

- For the first stage ("Siting of production wells, construction, and well development and completion"), the likely or known existence of naturally occurring faults and/or seismic activity should be added to the potential site selection criteria.
- For the second stage ("HF of targeted geologic formation"), the location of naturally occurring faults, improperly abandoned wells and/or other potential migration pathways should be added to the information needed.

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[31] *See* Lustgarten, Abrahm, "A Fracking First in Pennsylvania: Cattle Quarantine," Propublica, Jul. 2, 2010; Legere, Laura, "Other areas offer insight into gas drilling in NEPA," Republican Herald, Jun. 23, 2010; Associated Press, "EPA hears from gas drillers, angry Pa. residents," Jul. 23, 2010; Stingley, Alisa, "Hours passed before DEQ was told of cow deaths," Shreveport Times, Aug. 6, 2009.
[32] SAB Comments, p. 1.
[33] EPA, Opportunity for Stakeholder Input on EPA's Hydraulic Fracturing Research Study: Criteria for Selecting Case Studies ("EPA Case Studies"), Jul. 14, 2010, p. 3.
[34] *Id*., p. 4.

- For the third stage ("Management of wastewater and residuals"), consideration should be given to utilizing a system of "sentinel" wells to conduct groundwater monitoring as part of the field activities.[35] In addition, the potential for contaminant migration from deep well injection of wastewaters should be included in the potential site selection criteria, as should the availability and impacts associated with appropriate surface treatment and disposal facilities.

Nominations for Specific Case Studies

NRDC recommends the following locations experiencing past and/or on-going gas production operations for specific study. We are prepared to provide EPA with additional information regarding these sites.

North Fork Ranch, Colorado: In June, 2010, the day after the start of a nearby hydraulic fracturing operation, landowner Tracy Dahl checked his cistern and found approximately 500 gallons of grayish brown murky water, which had previously run clear for over seven years.[36] The Dahls have extensive water testing documentation going back many years, verifying that their water has always been clean and clear. The Colorado Oil and Gas Conservation Commission ("COGCC") staff stated that the water could not be tested for chemicals in the hydraulic fracturing fluid because they do not have sufficient information. During the drilling of the well in question, two different employees of the operator, on separate occasions, told the Dahls that they were having trouble with the cement job. Three monitor wells on the ranch are now producing methane at an escalating rate. There is extensive baseline testing of surface water in the area. The North Fork Ranch has a long history of drilling blow-outs, pit spills, and other problems.

Barnett shale area: We are aware of multiple reports of drinking water contamination after hydraulic fracturing in the Barnett shale area. In 2007, three families in Grandview reported contamination of drinking water after hydraulic fracturing of a nearby well; they experienced strong odors in their water, changes in water pressure, skin irritation, and dead livestock. Water testing found toluene and other contaminants.[37] In 2009, the Smith family of DISH noticed their water turned gray and full of sediment after hydraulic fracturing near their home; testing is reported to have found high levels of arsenic, lead, chromium, butanone, acetone, carbon disulfide, and strontium, as well as benzene, ethylbenzene, styrene, toluene and xylene.[38] The Scoma family in Johnson County claims that their drinking water was contaminated with benzene and petroleum by-products after hydraulic fracturing of natural gas wells near their home; their drinking water sometimes runs an orange-yellow color, tastes bad and gives off a foul

[35] *See* Attachment C at Appendix C.
[36] Woock, Randy, "EPA gathers input on hydraulic fracturing," *The Trinidad Times*, Jul. 16, 2010.
[37] Gorman, Peter, "Water Foul: An aquifer is at risk – along with property values, livestock, and dreams – after gas wells move in," *Fort Worth Weekly*, Apr. 30, 2008.
[38] Heinkel-Wolfe, "Filmy water vexes family," *Denton Record-Chronicle*, Jun. 5, 2010.

odor.[39] Tarrant County Commissioner J.D. Johnson 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.[40] The Executive Director of the Upper Trinity River Groundwater Conservation District in north Texas stated that the District "gets 'regular reports' from property owners who said that 'since a particular [gas] well had been fracked, they've had problems' with their water wells, such as sand in them, saltier water or reduced water output...."[41] Finally, Susan Knoll in Argyle reports that last year her drinking water became foamy right after hydraulic fracturing of a well adjacent to her property; as additional gas wells have been fractured near her home, her drinking water has continually gotten worse, sometimes foaming, becoming oily, and having strong odors.[42]

Wetzel County, West Virginia: We are aware of multiple reports of drinking water contamination in Wetzel County, West Virginia. Some residents have had their water tested and results show contamination with dangerous substances.[43] We understand some of these test results have already been submitted to the EPA. Families report health symptoms, such as rashes and mouth sores, as well as illness in their lambs and goats, which they suspect is linked to drinking water contamination.[44] We were told that the West Virginia Department of Environmental Protection refused to test the water of at least one family when requested.

Washington County, PA: We are aware of multiple reports of groundwater contamination in Washington County, Pennsylvania. In at least one case, that of the Zimmermann farm, there is reported to be baseline testing conducted before hydraulic fracturing that found no contamination in the groundwater. A newspaper article reported that groundwater testing after hydraulic fracturing found seven toxic chemicals above EPA screening levels, including benzene, arsenic, and naphthalene.[45] Other families we know of in Washington County with groundwater contamination are the Hallowich[46] and Smitsky[47] families, and we have been told that there are 5-10 additional families in Cross Creek Township and Avella that have groundwater contamination that is suspected to have occurred after hydraulic fracturing.

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[39] Newton, Melissa. "Local Couple Claims Gas Drilling Tainted Water," Fort Worth Channel 11, Jun. 18, 2010.
[40] Smith, Jack Z., "The Barnett Shale search for facts on fracking," *Fort Worth Star-Telegram*, Sept. 4, 2010.
[41] *Ibid*.
[42] E-mail correspondence from Susan Knoll to Amy Mall, Sept. 10, 2010.
[43] E-mail correspondence from Marilyn Hunt to Edward Hanlon, USEPA, Apr. 7, 2010, available at: http://yosemite.epa.gov/sab/sabproduct.nsf/A69A818E7BCEBA15852576FE0049479E/$File/Pub+Comments+Submitted+by+M+Hunt+4-7-10+for+EEC+Apr+7-8+2010+Meeting.pdf
[44] Personal conversations with Amy Mall, Aug., 14, 2010.
[45] Hurdle, Jon, "Pennsylvania lawsuit says drilling polluted water," Reuters, November 9, 2009.
[46] Crompton, Janice, "Wells of wealth -- or woe? Questions waft from Marcellus Shale drilling sites," *Pittsburgh Post-Gazette*, July 29, 2010.
[47] See *supra* 31, Legere, Laura.

Bradford County, PA: We are aware of multiple reports of groundwater contamination and spills of fracturing fluids that have contaminated surface water bodies in Bradford County, PA. Numerous families in the towns of Wyalusing, Granville Summit, Monroeton, Towanda, Troy and Spring Lake have reported their water turning black or brown and evidencing high levels of methane and other contaminants after fracturing has taken place at nearby wells. Others have witnessed contamination to surface water bodies from observed spills of fracturing fluids off of neighboring wellpads.[i]

Conclusion

EPA must ensure that its forthcoming study of hydraulic fracturing is as broad-based and comprehensive as resources allow. At a minimum, this means that EPA must adhere to its current intention to employ a full lifecycle analysis approach to understanding the full range of impacts associated with gas production utilizing hydraulic fracturing. To the extent necessary, EPA should request additional resources from Congress to allow the study to also consider the impacts associated with the array of production practices that are necessarily utilized in conjunction with hydraulic fracturing, as well as the full range of impacts beyond water quality and quantity, including air quality, landscapes, habitat and community character.

EPA must further take all precautions to ensure that the study is unbiased, peer reviewed by impartial third parties, 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 gas production utilizing hydraulic fracturing.

Sincerely,

Kate Sinding, Senior Attorney

Amy Mall, Senior Policy Analyst

Briana Mordick, Science Fellow

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[i] Personal conversations with Kate Sinding, May 20, 2010, Jun. 9, 2010, Aug. 19, 2010.