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February 26, 2010, corrected March 1, 2010

Via Electronic Mail: OW-Docket@epa.gov
Mr. Carey A. Johnston
Water Docket
Environmental Protection Agency

Re: Comments on Notice of Availability of Preliminary 2010 Effluent Guidelines Program Plan, Docket ID No. EPA–HQ–OW–2008–0517

Dear Mr. Johnston:

On behalf of the 63 undersigned environmental organizations and landowners' associations, Earthjustice respectfully submits these comments on the Notice of Availability of Preliminary 2010 Effluent Guidelines Program Plan that the Environmental Protection Agency ("EPA") published in the Federal Register on December 28, 2009. 74 Fed. Reg. 68599 (Dec. 28, 2009). These comments specifically address EPA's question "whether it should expand its detailed study of coalbed methane extraction to include all oil and gas exploration, stimulation, and extraction techniques that result in contamination of surface and groundwater, including hydraulic fracturing in all formations." *Id.* at 68607-08. Based on our experience with oil and gas exploration, stimulation, and extraction, we strongly urge EPA to expand its study to include all techniques that may result in contamination of surface water or groundwater, including hydraulic fracturing in all formations. We believe, however, that expanding the scope of the study should not delay initiation of an Effluent Limitation Guideline specifically for coalbed methane discharge water.

The comments we submit often focus on our experience with gas development in the Marcellus Shale and the desperate need for more serious study of the potential risks to surface water and groundwater. The absence of adequate data collection and independent analysis that we identify here is not limited, however, to development of that formation. EPA should consider the points we raise here as illustrative of problems more widely presented by oil and gas exploration, stimulation, and extraction techniques in all formations. A comprehensive and detailed study of those techniques and related technologies is essential to protection of water resources providing drinking water supplies and aquatic habitat across the nation.

I. Introduction

Potential risks from shale gas development to surface water and groundwater arise from a variety of sources. The "muds" and fracturing fluids used for well drilling and stimulation are known to contain many chemicals that are hazardous to human health and wildlife. The drilling muds usually are stored in pits that can leak or may be buried at the wellsite, where they may leach into groundwater. Fracturing fluids have been spilled where they contaminate streams, as have diesel fuels used for vehicles and heavy machinery, and the drilling and high-pressure

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injection of fracturing fluids may cause methane intrusion and other pollution of groundwater, especially when wells are inadequately cased, cemented, and monitored for excessive pressure. Unfortunately, the oil and gas industry has refused fully to disclose the chemical composition of additives it uses for drilling and fracturing, so independent research cannot be conducted into the toxicity of the products and potential exposure pathways.

Industry representatives often claim that there is no documented proof of groundwater contamination caused by hydraulic fracturing. The dearth of peer-reviewed journal articles about the problem is evidence, however, not of the safety of the process but rather of industry's success in impeding systematic research. When industry drills without adequate baseline testing for the chemical components of drilling and fracturing additives that will be used at each wellsite, does not routinely monitor groundwater near the site for migration of the chemicals, and refuses fully to disclose the identity of the chemicals, it prevents landowners or technical experts from doing their own testing or monitoring and makes it next to impossible to link contamination reliably with its source. EPA's study is especially important because industry not only is failing to provide adequate documentation proving the safety of its practices but also is resisting other efforts to secure data for independent analysis.

The risks to water resources from oil and gas development arise not only from the use of toxic additives in drilling and stimulation but also from substances in the formation or formation waters that would otherwise be trapped underground. The formation waters produced from the Marcellus Shale region are highly saline, with elevated levels of total dissolved solids ("TDS"), heavy metals, hydrocarbons—including benzene, toluene, ethylbenzene, and xylene (the "BTEX" compounds)—and normally occurring radioactive materials ("NORM"). These formation waters emerge both with the fluids that resurface after fracturing—as "flowback"—and after extraction of most of the recoverable fracturing fluids, while the well is in production—as "produced waters." The wastewater containing this toxic soup also may spill, leak from (sometimes unlined) impoundments, or cause contamination from inadequate treatment and disposal. Moreover, because there is inadequate industrial wastewater treatment and disposal capacity in the Northeast, some operators are intentionally dumping untreated wastes in unlawful locations.

II. EPA Should Expand Its Study to Obtain Reliable Information about the Chemical Components of Drilling Muds and Fracturing Fluids.

Both drilling muds and fracturing fluids contain chemicals that are hazardous to human health and the environment. Drilling mud controls the hydrostatic pressure in the well-bore and commonly includes barite, a weighting agent that exhibits high levels of mercury.[1] Drilling mud also may contain cadmium, prompting EPA to regulate cadmium concentration for muds disposed offshore.[2] Standard criteria for the contents of drilling muds have not been further developed, and the contents of the muds may not be disclosed to the public. For example, the Draft Supplemental Generic Environmental Impact Statement ("DSGEIS") prepared in 2009 by

[1] Harvey Consulting, LLC., *Review of DSGEIS and Identification of Best Technology and Best Practice Recommendations* [hereinafter Harvey Report] 10 (Dec. 28, 2009).
[2] *Id. at* 11.

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the New York State Department of Environmental Conservation ("NYSDEC") contains a lengthy list of chemicals used for fracturing but states only that horizontal wells in the Marcellus Shale "may be drilled with a mud that may be water-based, potassium chloride/polymer-based with a mineral oil lubricant, or synthetic oil-based."[3]

Fracturing fluids for stimulation of oil and gas wells also contain an array of chemical additives, such as corrosion inhibitors, biocides, emulsion breakers, coagulants, flocculants, clarifiers, and solvents.[4] NYSDEC has identified approximately 260 chemicals in the additives used for fracturing the Marcellus Shale,[5] but there is no discussion of the actual formulations used.[6] Moreover, many of the additives are merely listed as commercial products with no specific chemical information.[7] Even without that information, the agency acknowledges that the categories of chemicals used for fracturing have the potential to cause cancer, to affect reproduction, to impair the nervous system, and to cause a raft of other health impacts to humans and animals.[8]

Among the additives used in the Marcellus region and throughout the country are petroleum distillates, which contain BTEX compounds, including high levels of carcinogenic benzene.[9] These chemicals are used for dehydration, sulfide removal and the inhibition of hydrates during the gas exploration and extraction process.[10] Approximately 30 petroleum distillates, including kerosene and paraffin oil, are being used for fracturing purposes in the Marcellus Shale alone, although we still do not know which companies use what chemicals, in what combination, or at what location. Benzene may be present in kerosene at a level one million times the EPA's safe level in water.[11] The distillates and other additives are generally mixed with clean groundwater, surface water, or seawater for fracturing, but recently industry has been reporting the recycling of flowback for re-use in the fracturing process. While recycling flowback has benefits, this practice may add an additional level of contamination to the injected fluids.

Currently, diesel is the only substance restricted for use as a fracturing fluid under the Underground Injection Control program of the Safe Drinking Water Act.[12] However, state

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[3] NYSDEC, DSGEIS on the Oil, Gas and Solution Mining Regulatory Program [hereinafter SGEIS] 5-29 (Sept. 2009).

[4] Deborah Elcock, Markus G. Puder, Robert J. Redweik & John A. Veil, *A White Paper Describing Produced Water from Production of Crude Oil, Natural Gas, and Coal Bed Methane* [hereinafter White Paper], 4 (Jan. 2004).

[5] DSGEIS, Tables 5-6 and 5-7.

[6] Glenn Miller, *Review of the DRAFT Supplemental Generic Environmental Impact Statement on 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* [hereinafter Miller Report], 1 (Dec. 29, 2009).

[7] *Id.* at 2.

[8] SGEIS at 5-62 through 5-66; *see also* The Endocrine Disruption Exchange, *Products and Chemicals Used in Fracturing* (Feb. 2009), *available at* http://www.endocrinedisruption.com/files/ProductsandChemicalsUsedinFracturing2-16-09.pdf.

[9] Dusty Horwitt, Environmental Working Group, *Drilling Around the Law* [hereinafter EWG Report], 2, *available at:* http://www.ewg.org/files/EWG-2009drillingaroundthelaw.pdf.

[10] White Paper at 4.

[11] EWG Report at 10.

[12] *Id.* at 2.

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agencies are not tracking the use of fracturing fluids, and officials in some states have reported that companies continue to use diesel as a fracturing fluid in contravention of the federal permitting requirements.[13] Two major service companies—B.J. Services Co. and Halliburton—recently confirmed the reports in response to a direct congressional inquiry.[14] Diesel contains extremely high levels of BTEX chemicals and can cause serious adverse health effects when ingested by humans.[15]

In sum, the precise contents of drilling muds and fracturing fluids are not well known, yet the potential toxicity of the additives used in these processes is widely recognized. Given the rapidly increasing use of hydraulic fracturing process throughout the United States, EPA should expand its study to ascertain the specific chemical components of fracturing fluids and drilling muds used in all formations.

III. EPA Should Expand Its Study to Obtain Reliable Information about the Hydrogeology of Regions Likely to See Intensive Oil or Gas Development.

Prior to the commencement of oil or gas drilling in a region, it is necessary to understand the hydrogeology of the specific location where development will occur. Without this basic information it is extremely difficult, if not impossible, to determine how changes brought about by hydraulic fracturing operations may affect groundwater flows and related contaminant transport.[16] A proper hydrogeologic study would address the properties of the target and intermediate formations, flow rates and properties, hydraulic properties, groundwater levels, discharge points, recharge rates and zones, and the water balance for the area.[17] A study to determine the systemic hydrogeological conditions of each region where oil or gas development occurs would provide insight into its possible future repercussions, including increases in the potential for vertical conductivity and the resulting pollution of drinking water aquifers.[18]

Currently, there is no federal regulatory program requiring such a study. Significant risk and contingencies could be evaluated, however, with the information that would be gathered from that research. We therefore urge EPA to expand its study to include oil and gas development techniques in all formations, with attention to the hydrogeologic properties of those formations and the regions where substantial oil and gas development is likely to occur.

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[13] *Id.* at 3.
[14] Mike Soraghan, *Two Oil-Field Companies Acknowledge Fracking with Diesel*, New York Times (Feb. 19, 2010), *available at* http://www.nytimes.com/gwire/2010/02/19/19greenwire-two-oil-field-companies-acknowledge-fracking-w-90863.html.
[15] EWG Report at 7.
[16] Tom Myers, Ph.D., Hydrologic Consultant, *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* [hereinafter Myers Report], 5 (Dec. 28, 2009).
[17] *Id.* at 5-6.
[18] *Id.*

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IV. EPA Should Expand Its Study to Obtain Reliable Information about the Risks of Leaks, Spills, and Underground Migration of Contaminants Associated with Inadequate Management of Oil and Gas Development.

Improper management of drilling muds, fracturing fluids, and oil and gas waste waters can have significant environmental impacts. The additives and fuels used and wastes generated throughout the development process pose a threat to human health, aquatic life, and vegetation, including crops.[19] Gas migration into groundwater also presents a serious safety hazard.[20]

Hydraulic fracturing fluids can contaminate ground and surface water in a variety of ways. Oil and gas waste water may spread underground through natural or induced fissures that occur during the hydraulic fracturing process.[21] The short-term pressure applied to fracture a shale formation can cause pressure changes that increase the risk of transport of fluid contaminants toward freshwater aquifers, even after injection pressure has ceased.[22] Groundwater may also be contaminated by improperly constructed or damaged wells that allow injected fluids, naturally occurring contaminants, and methane to seep into an aquifer.[23] The potential for contamination may persist or increase over time long after wells have been abandoned.[24]

Above-ground spills and leaks also pose a risk of contamination to surface and ground water. Hydraulic fracturing requires the transportation and onsite storage of fuel and chemical additives in bulk quantities before fracturing. After fracturing, large amounts of contaminated flowback often are stored on-site.[25] In addition to spills that may occur during transportation, on-site flowback is often stored in open-air pits.[26] These pits may be lined or unlined, but even lined pits can leak, and contaminated flowback may pass very quickly through a break in the lining where a single liner is being used.[27] Any type of spill presents a significant threat to water

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[19] White Paper at 11.

[20] Abrahm Lustgarten, *Water Problems from Drilling are More Frequent than PA Officials Said*, ProPublica (July 31, 2009), *available at* http://www.propublica.org/feature/water-problems-from-drilling-are-more-frequent-than-officials-said-731 (reporting on methane leaks attributed to gas drilling in Pennsylvania, including one instance that caused an explosion, killing a couple and their infant child).

[21] EWG Report at 15.

[22] Myers Report at 10-11.

[23] *Id.* at 20-21; *see also* Myers Report at Appendix B, 11-25; Abraham Lustgarten, *Does Natural-Gas Drilling Endanger Water Supplies?*, Business Week (Nov. 11, 2008), *available at:* http://www.businessweek.com/magazine/content/08_47/b4109000334640.htm (reporting that in 2004 "a well casing shattered beneath a rig at Divide Creek, a tributary of the Colorado River, which supplies water to seven states.").

[24] Environmental Protection Agency, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Resevoirs* 6-4 – 6-5 (June 2004) (stating that the Colorado Oil and Gas Conservation Commission believes "that increased methane concentrations in water wells and buildings in some areas are partially due to old, improperly abandoned gas wells"). There is no reason to believe that improper construction and abandonment would not also occur in some of the thousands of oil and natural gas wells proposed for future development.

[25] Myers report at 14-15; EWG Report at 14-15.

[26] EWG Report at 14-15.

[27] *Id.*; Myers Report at 16.

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quality, as some of the chemicals used in hydraulic fracturing can pollute water in small amounts.[28]

Contamination from hydraulic fracturing operations for the production of oil and natural gas is not merely speculative. Incidents of water contamination have been reported from Wyoming to Pennsylvania.[29] In June of 2008, a rancher in Parachute, CO, was hospitalized after drinking well water containing benzene from his tap.[30] Four gas operators in that area have been held responsible by the Colorado Oil & Gas Conservation Commission for spilling waste fluids.[31] In New Mexico, the state's Oil Conservation Division has "identified more than 400 cases of groundwater contamination from oil and gas pits statewide."[32]

The number of incidents of contamination from hydraulic fracturing can be expected only to increase in the future. The number of new wells drilled each year for natural gas alone has jumped from 36,966 in 2004 to 52,349 in 2008.[33] In addition, gas exploration is moving closer to more populated areas, such as the area surrounding the Marcellus Shale in the northeastern United States, where the risks associated with hydraulic fracturing will impact larger numbers of people.[34] New York City officials estimate that contamination of their water supply by fracturing operations would have clean up costs of more than $20 billion.[35] In response to these concerns, Chesapeake Energy announced in 2009 that it would not drill in the New York City watershed. However, this decision does not account for additional owners of mineral rights in the watershed and the millions of people supplied by other watersheds in the Northeast.[36]

The substantial evidence of leaks, spills, and gas migration demonstrates real risks and problems in the regulatory regime. Contamination of drinking water supplies could have potentially devastating human health and financial costs. The increasing possibility of future contamination requires a more systematic study of oil and gas development techniques and the adverse environmental impacts they pose to drinking water supplies.

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[28] EWG Report at 7, 9-11 (discussing the ability of contaminants found in diesel to pollute waters in small amounts and then discussing how many of the unregulated petroleum distillates contain many of the same toxins). As companies do not disclose the composition of their fracturing fluids, it is not known how much of these contaminants are present in those fluids.

[29] Jad Mouawad & Clifford Krauss, *Dark Side of a Natural Gas Boom*, New York Times (December 7, 2009), *available at:* http://www.nytimes.com/2009/12/08/business/energy-environment/08fracking.html (reporting on incidents of water contamination in Bainbridge, OH, Dimock, PA, and Pavilion, WY all likely caused by gas drilling operations); *see also* Myers Report at Appendix B 11-25.

[30] Lustgarten, *supra* note 20.

[31] *Id.*

[32] EWG Report at 15.

[33] ProPublica, *How Big is the Gas Drilling Regulatory Staff in Your State?*, http://projects.propublica.org/gas-drilling-regulatory-staffing/.

[34] Mouwad & Krauss, *supra* note 29.

[35] James F. Gennaro, *Letter from James F. Gennaro, Chairman, New York City Council Committee on Environmental Protection, to Pete Grannis, Commissioner, New York State Department of Environmental Conservation* (Feb. 19, 2009), *available at*: http://www.ewg.org/files/letter-grannis-gennaro-final.pdf.

[36] EWG report at 8.

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V. EPA Should Expand Its Study to Obtain Reliable Information about the Risks Presented by Oil and Gas Waste Water and the Availability of Adequate and Safe Oil and Gas Waste Treatment and Disposal.

The wastes associated with oil and gas development typically are even more toxic than drilling muds and fracturing fluids, because the wastes include not only the contaminants injected into wells but also contaminants naturally occurring underground that emerge with produced waters. Drilling operations in acidic gas shale, such as the Marcellus Shale, may cause acidic material along with pyrite or aluminum to be brought to the surface with the mud. Aluminum discharges already have been reported in Pennsylvania, where aluminum was found in a seep near the drill pad. Marcellus Shale waste waters have shown high levels of saline TDS, BTEX hydrocarbons, heavy metals, and NORM. The presence of Uranium-238 and Radium-226 has been reported in the Marcellus Shale,[37] where NORM levels may reach 1,000 times the drinking water standard.[38] In other words, it takes just 0.1% of gas waste water with NORM at that level to contaminate drinking water beyond the legal limit.[39]

Proper disposal of these waste waters is necessary to ensure the safety of the drinking water supply and aquatic habitat. Factors that may influence the severity of contamination from discharged waste water include precipitation, adsorption onto particulate matter, reaction with other chemicals present in the water, biodegradation, the volatilization of low molecular weight hydrocarbons, and the amount and toxicity of the effluent.[40] Discharges to small, inland streams may have catastrophic environmental impacts, because the limited volume of water forecloses dilution effects.[41]

Disposal is a significant and expensive problem in the Northeast because there are a limited number of underground well disposal facilities in New York and Pennsylvania, and it is unclear whether the geology there will support construction of new disposal wells. Although some industrial waste or sewage treatment plants in Pennsylvania are able to process oil and gas waste waters, most already are operating at capacity.[42] With predictions of high-TDS wastewater reaching as high as 20 million gallons per day by 2011, the rapid pace of gas development in that state has outstripped treatment and disposal capacity.[43] These capacity problems will only intensify in the future as new gas drilling facilities commence or expand operation. Already, incidents of illegal dumping have been confirmed in Pennsylvania, where

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[37] Harvey Report at 13.
[38] Miller Report at 2.
[39] *Id.* at 6.
[40] White Paper at 11.
[41] *Id.*; *see also* Mark Levy & Vicki Smith, *Appalachia Gas Drilling Infect Drinking Water, Kills Fish*, Huffington Post (Feb. 2, 2010), *available at* http://www.huffingtonpost.com/2010/02/02/appalachia-gas-drilling-i_n_446382.html.
[42] *Id.*
[43] Charles Abdalla & Joy Drohan, *Shaping Proposed Changes to Pennsylvania's Total Dissolved Solids Standard*, 4 (2009) ("Other TDS disposal means are needed because that amount of salt in this additional wastewater cannot be diluted in the state's waterways."), *available at* http://agenvpolicy.aers.psu.edu/Pubs/TDS_CORREX_highres.pdf.

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felony convictions have been entered for the disposal of more than 200,000 gallons of gas waste water in an abandoned oil well.[44]

Wastewater treatment and disposal options are beginning to change in response to the scope of the problem. In Pennsylvania, some developers claim to be recycling their flowback at the wellsite to reduce the need for treatment and disposal.[45] The Pennsylvania Department of Environmental Protection is seeing applications for the development of industrial waste water treatment plants that can recycle gas wastes for re-use in the field.[46] The public has no information about the on-site recycling, however, and very little reliable information about the efficacy of the technologies proposed to remove contaminants from oil and gas wastes. EPA's careful review of the recycling claims would be a very useful part of a comprehensive study of oil and gas development techniques.

VI. Conclusion

For the reasons described above, we urge EPA to expand its study to include all oil and gas exploration, stimulation, and extraction techniques that may result in surface and groundwater contamination. An expanded study would allow the EPA to obtain better information about the chemical composition of drilling muds and fracturing fluids. The study should evaluate the hydrogeologic characteristics of regions likely to see oil and gas development. The risks of contamination due to spills, leaks, and migration should be examined as well. Finally, the comprehensive study should assess the risks presented by waste water and the availability of safe oil and gas waste water treatment and disposal alternatives, including recycling and other zero-discharge options. Such a study could inform revisions to the effluent limitations contained in 40 C.F.R. Part 437, covering centralized wastewater treatment facilities.

The expanded study is of special urgency because shale gas production is rapidly increasing. In 2007, the United States produced 1,184 billion cubic feet of shale gas; in 2008, this number almost doubled to 2,022.[47] Shale gas production is likely further to increase in the foreseeable future, as coal-fired electric power plants seek or are forced to reduce their greenhouse gas emissions. Although discharges from coal-fired power plants "have the potential to impact human health and the environment" and have been associated with fish kills, drinking water contamination, and habitat damage, 74 Fed. Reg. at 68,606, replacing coal-fired power plants with gas facilities may not reduce net water pollution, if shale gas production is not properly characterized and regulated. An authoritative study of contamination related to shale

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[44] Sabrina Shankman, *Gas Drillers Plead Guilty to Felony Dumping Violations*, ProPublica (Feb. 22, 2010), *available at*: http://www.propublica.org/feature/gas-drillers-plead-guilty-to-felony-dumping-violations.

[45] A.W. Gaudlip, L.O. Paugh & T.D. Hayes, Range Resources Appalachia LLC, *Marcellus Shale Water Management Challenges in Pennsylvania*, *available at* http://s3.amazonaws.com/propublica/assets/monongahela/MarcellusShaleWaterManagementChallenges%2011.08.pdf.

[46] Ryan Decker, Pennsylvania Department of Environmental Protection, *Fact Sheet/Statement of Basis* (Dec. 9, 2009) (regarding permit application from Reserved Environmental Services LLC for facility that recycles wastewater for re-use).

[47] U.S. Energy Information Administration, Shale Gas Production, *available at* http://tonto.eia.doe.gov/dnav/ng/ng_prod_shalegas_s1_a.htm.

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gas production—and the impacts of oil and gas development on surface and ground water more broadly—thus will help to ensure that national and state energy policy does not undermine EPA's water pollution control efforts.

Finally, for all its urgency, the expanded study should not be used as an excuse to delay the study of coalbed methane extraction. That more limited study has been deferred for too long already and should be commenced without further delay. The lessons learned from design and implementation of the coalbed methane study can be applied to the expanded study requested here and help to ensure that the more comprehensive data collection and analysis is conducted as expeditiously and efficiently as possible.

Respectfully submitted,

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