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Science Advisory Board Staff Office
Mailcode 1400R
1300 Pennsylvania Avenue, NW
Washington, DC 20004

Re: U.S. EPA Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Dear Mr. Hanlon:

The City of New York submits the following comments on the U.S. EPA Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources.

The New York City (NYC) water supply provides high quality drinking water to nearly half the population of the State of New York – over eight million people in New York City and one million people in upstate counties. The New York City Department of Environmental Protection (DEP) is the City agency with primary responsibility for overseeing the operation, maintenance and management of the water supply, its infrastructure, and the protection of the 1,969 square mile watershed. The Marcellus shale underlies the entire West-of-Hudson portion of the New York City water supply which typically supplies over 90% of the City's drinking water, a source of such high quality that the water does not require filtration.

The City appreciates the opportunity to comment on the Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, and commends the U.S. EPA on the completeness of the proposed study. It is challenging to define a discrete study plan with a topic as complex as potential impacts of hydraulic fracturing on drinking water resources.

However, there are a few notable omissions in the draft study plan. First, the study plan fails to define what constitutes an "impact" or "contamination" for the purposes of this study. It should be stressed that regulations governing water utilities are very conservative. The plan should therefore define both "impact" and "contamination" conservatively, to account for the broad range of potentially negative impacts to a utility from hydraulic fracturing, including regulatory, financial, operational, and public perception impacts. Furthermore, while the plan addresses the issue of cumulative impacts in connection with water acquisition, cumulative impacts are not considered in the contexts of

chemical mixing, well injection, flowback and produced water, or wastewater treatment and waste disposal. Since cumulative impacts from all hydraulic fracturing activities have the potential to be more severe than may be indicated by analyzing individual wells, they should be included in the study plan.

Second, the draft study plan does not explicitly include an evaluation of the adequacy of existing and proposed state regulations to mitigate identified impacts. Given the wide variations at the state level, there is a strong possibility that the effectiveness of state regulations and the capacity for inspections and enforcement will be a determining factor as to the potential for impacts to water quality and water supply. The draft study plan repeatedly references the existence of various state regulations for certain activities but that does not provide any insight on the adequacy of states' efforts to ensure compliance with those regulations or whether those regulations are sufficiently protective of drinking water supplies and infrastructure.

Additional detailed comments on the draft study plan are attached for your consideration. The concerns and issues raised are supported by the investigation the City has independently conducted on the potential impacts of natural gas drilling on the NYC watershed with the assistance of Hazen and Sawyer/Leggette, Brashears and Graham. The final report on this assessment was previously submitted to the Science Advisory Board during review of the study scope. In closing, we hope that these comments are helpful and we look forward to the results of this much needed study.

Sincerely,

Paul V. Rush, P.E.

Attachment

c: Joe Martens, Commissioner, New York State Department of Environmental Conservation

Comments on:

U.S. EPA Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

Chapter 1 Introduction and Purpose of Study

General Comments

The stated goal of the study is to evaluate the potential for impacts from hydraulic fracturing activities to drinking water supplies and the conditions under which impacts occur. The study plan also refers to modeling and other work to understand the potential for contamination of drinking water supplies. However, the study plan fails to define "impact" or "contamination," both of which are used liberally throughout the document. Contamination could mean the introduction of any hydraulic fracturing-related material into drinking water supplies, or it could mean a violation of a maximum contaminant level (MCL) for a water utility. It is important to clarify that the study is not limited to contamination or impacts causing MCL violations. Emerging contaminants (e.g. endocrine disrupting compounds) that are currently unregulated should fall within the bounds of the study, as should cumulative impacts from regulated chemicals for which thresholds may be lowered in the future.

The definition of impact must also be as conservative as possible to account for the range of disruptions that could affect water utilities. For example, all spills in a drinking water watershed will typically require remedial action (water quality monitoring, rerouting water in the system, taking reservoirs offline, etc.) on the part of the utility to ensure the protection of the public water supply. Repeated incidents could adversely impact the reliability of the system, strain utility staff and labs, and negatively affect public perception of the safety of the water supply.

Recommendations

The definition of 'impacts' and 'contamination' should specifically and accurately encompass the full range of regulatory, financial, and operational concerns of drinking water utilities.

Chapter 3 Overview of Unconventional Natural Gas Production

3.5 The study plan indicates that state regulations may be assessed in a separate effort and the efficacy of the federal regulatory structure will not be addressed. The effectiveness of the federal and state regulatory frameworks give rise to realistic concerns that should be addressed in the EPA study. State regulations may be a determining factor influencing the potential for hydraulic fracturing activities to result in water quality and water supply impacts. It is unclear how EPA will be able to conduct a study of potential impacts while ignoring these regulations. The regulatory environment must also be assessed as part of the case studies to provide context. This should include proposed as well as existing regulatory frameworks. In New York, for instance, the New York State Department of Environmental Conservation (DEC) has issued a draft Supplemental Generic Environmental Impact Statement (SGEIS) proposing, as mitigation for identified impacts associated with hydrofracking in the Marcellus Shale. While far short of binding regulations that are a protective regulatory framework, the adequacy of the draft SGEIS and NYSDEC's enforcement record and capabilities should be assessed by the EPA. [citation.]

Examples of regulated activities that are critical to the analysis, but which vary by state, are listed below:

- Water acquisition: withdrawal permits, consumptive use, inter-basin transfers, water rights structures, water plans, monitoring requirements, etc. (Section 6.1)
- Chemical management: required BMPs, water quality monitoring, effective enforcement mechanisms, etc. (Section 6.2)
- Well injection: well construction standards, required state inspections, casing and grouting integrity testing requirements, etc. (Section 6.3)
- Flowback and produced water: on-site storage practices (Section 6.4)
- Wastewater treatment: disposal practices, effluent standards, acceptance of wastes at municipal wastewater treatment plants, industrial pretreatment programs, etc. (Section 6.5)

Recommendations

- The results of the EPA study may be inconclusive without an analysis of existing and proposed regulatory structures to control for major variations in federal and state oil and gas and water resource regulations. The study plan should include a review of the efficacy of state regulatory programs to limit water quality and water supply impacts.

Chapter 4 The Hydraulic Fracturing Water Lifecycle

General Comments

Given the magnitude of truck trips needed for a single well, significant development within an area could lead to increased risks of transportation accidents resulting in contamination of water resources from spills. Further, accidental spills that occur away from well drilling sites may be more likely to contaminate water supplies due to failure to properly contain, clean up, and report spills. The transportation of chemicals and wastes for hydraulic fracturing is inconsistently addressed in the study plan.

Recommendations

- In order to comprehensively address the potential for impacts to water resources, transportation of water, chemicals, and wastes should be added as a separate use on the hydraulic fracturing water lifecycle.

Chapter 5 Approach

5.1 As described in Chapter 7, there will be three to five retrospective case study sites and two to three prospective case study sites. Whereas the case studies will be informative for the overall study, the small number of case studies will prevent them from being broadly applicable, particularly given the wide variations in state regulations, geology, hydrology, etc. across the country.

5.1 The study should include a comprehensive review of problems reported at hydraulic fracturing wells and at traditional wells to the extent that they can provide insights about safeguards that must exist to address risks. State permitting agencies, for example, should have records of reported problems, detected well failures, and any follow up by state

regulators. One study[1] of New York State Department of Environmental Conservation records found hundreds of failures with little enforcement or mitigation, and cases were often administratively closed when transferred to a different division. The extent of such regulatory failures may not be captured by a handful of case studies or desktop scenario exercises.

5.2 Evaluation and modeling of scenarios may provide some generic indication of potential impacts; however, it is unlikely that hypothetical scenarios, regardless of how realistic they may be, will be applicable to specific circumstances. Simplifying assumptions of multiple potential variations and uncertainties (water system design, source water quality, level of watershed development, level of oil and gas development, hydraulic fracturing chemical properties, operator experience, drilling proximity to water supplies, geology, hydrology, state regulations, etc.) will limit the applicability of models and scenarios developed as part of this study.

5.2 The underlying assumptions in the model scenarios must be carefully chosen and evaluated or the results will not be meaningful. To illustrate this point, as part of the environmental review process in New York State,[2] some spill scenarios were modeled for the New York City water supply. The results indicated that impacts were highly unlikely and the modeling assumptions were portrayed as conservative. However, when examined closely many assumptions were not conservative and some were physically implausible.[3] As one example, the spill scenarios assumed complete and instantaneous mixing in the reservoir and stated that a spill directly to a reservoir was highly unlikely. In fact, complete mixing in reservoirs with volumes as large as NYC's reservoirs is not a reasonable assumption under most circumstances. Short-circuiting, stratification, or spills in proximity to inlet structures must also be taken into consideration. Additionally, given the large volume of heavy truck traffic required to develop the Marcellus shale and the proximity of major regional highways to most NYC reservoirs, it is not unreasonable to assume that at some point a chemical spill would result in direct contamination of a reservoir.

Recommendations

- The study plan should clearly articulate how the results of the case studies, scenario evaluations, and models are to be used.
- EPA should make the assumptions, calculations, and methods used for modeling and scenarios publicly available for review.
- In addition to case studies and scenario analysis, the study plan should include collection of spill and incident reports from state oil and gas regulators. This data, coupled with data on overall levels of development in each state, is already widely available and would provide a more complete data set from which probabilities of occurrence could be

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[1] Letter dated November 8, 2009 from Walter Hang, ToxicsTargeting Inc., to Governor Paterson. http://toxicstargeting.com/MarcellusShale/coalition_letter

[2] New York State Department of Environmental Conservation Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, September 30, 2009; http://www.dec.ny.gov/energy/58440.html

[3] NYCDEP comments on the Draft Supplemental Generic Environmental Impact Statement, dated December 22, 2009. [Should include page citations]

calculated. Further this data set would provide a more comprehensive understanding of the failure mechanisms most likely to result in water resource contamination.

Chapter 6 Proposed Research

6.1 Water Acquisition: How might large volume water withdrawals from ground and surface water impact drinking water resources?

6.1.2 Large volume withdrawals can adversely affect wetter regions of the country during periods of unseasonably low rainfall or drought.

6.1.4.1 Control areas should have similar state regulations and hydrology as well as baseline water demands in order to prevent regulatory and hydrology variations from influencing results of the comparison.

6.1.4.2 Current levels of development will influence the results of the prospective case studies on water quality impacts from water withdrawals for both groundwater and surface water. Areas with less development will have fewer anthropogenic pollution sources than more heavily developed areas. Similarly, geologic variations will also play an important role in whether large volume withdrawals result in water quality changes.

6.2 Chemical Mixing: What are the possible impacts of releases of hydraulic fracturing fluids on drinking water resources?

6.2.5.2 The study plan does not define mitigation when it refers to spills, so it is unclear whether this section refers to the availability or effectiveness of remediation measures after a spill occurs.

6.2.5.2 The study plan states that "Releases, in general, are not restricted to hydraulic fracturing operations, and can occur under a variety of conditions. Because these are common types of problems, there already exists a body of scientific literature that describes how a chemical solution released on the ground can infiltrate the subsurface and/or run off to a surface water body."

However, the study plan does not accurately present the complexity of the hydraulic fracturing process and the rates and pressures under which hydraulic fracturing is conducted, which may not be reflected in the existing scientific literature on infiltration from chemical releases on the ground. During a hydraulic fracturing operation there are hundreds of tons of chemicals and millions of gallons of water stored in dozens of tanks. Transfer of fluids between ponds, tanks, mixers, wellhead, etc. at very high pressures and rates on the order of 1,000s of gallons per minute means that there are multiple points of potential failure and even momentary failures could result in release of substantial volumes of contaminants.

Further, given the wide variations in types and toxicities of chemicals, individual chemical properties will dictate both the potential for mitigation and resulting impacts from a spill. For example, chemicals that mix readily with water cannot generally be recovered once introduced into a body of water.

6.2.6 The study plan indicates that some chemicals can exhibit chronic and/or acute toxicity, but the study plan does not explicitly state whether it will evaluate toxicity of chemicals from both an acute and chronic perspective.

6.2.6 The study plan does not include evaluation of cumulative impacts related to chemical releases. Based on data compiled by state oil and gas regulatory agencies, spills are a common occurrence at oil and gas drilling sites. Large-scale development across an area could result in substantial cumulative volumes of released chemicals that could adversely impact water quality to a much greater extent than may be indicated from a case study of an individual well site.

6.3 Well Injection: What are the possible impacts of the injection and fracturing process on drinking water resources?

6.3.1 Injection can result in contamination of surface drinking water supplies as well as USDWs, as has occurred during incidents when contaminated ground water enters surface waters.

6.3.1.1 The study plan fails to mention the importance of proper curing time for casing cement.

6.3.6.1 The study plan indicates that the retrospective case studies will evaluate mechanical integrity of wells near areas of reported drinking water contamination. The study plan does not define what it means by "near." Drilling and fracturing incidents have resulted in contamination moving through subsurface fractures up to two miles from the originating well. How will the EPA study identify the appropriate wells to test?

6.3.6.1 The study plan states that "From the potential list of thousands of hydraulic fracturing sites, EPA will select a representative sample of sites and request the complete well files for these sites." The study plan does not indicate the sampling approach or the sample size. If the goal of this data collection exercise is to evaluate the mechanisms for potential incidents or failures, it appears as though EPA is leaving it up to chance whether it will find any wells that experienced incidents or failures.

6.3.7 Will EPA develop a recommended water quality monitoring protocol for hydraulically fractured wells that can be implemented by water utilities concerned about natural gas development impacts?

6.3.7 At what scale is the frequency and severity of failures going to be projected (formation level, county level, or entire U.S.)? Local and regional variations (regulations, geology, etc.) will influence frequency and severity of failures, which large scale aggregation of data will obscure.

6.3.7 The study plan does not include evaluation of cumulative impacts related to well injection. Large-scale development across an area could result in substantial changes to the confining layers necessary for maintaining separation between potable water resources and deeper formations to a much greater extent than may be indicated from a case study of an individual well site.

6.4 Flowback and Produced Water: What are the possible impacts of releases of flowback and produced water on drinking water resources?

6.4.4 The study plan indicates that "EPA is interested in gathering information relating to the current on-site management practices that are used to prevent and/or contain accidental releases of flowback and produced water to drinking water resources."

Off-site spills and releases, including illicit dumping, resulting from transporting wastewater are equally problematic. Transportation of wastewater has the potential to

result in releases far from originating wells and may not have the benefit of trained personnel or structural best management practices to contain or mitigate releases.

6.4.5.2 The scenario evaluation for flowback and produced water releases appears to only focus on well integrity issues related to accidental releases. On-site releases not related to well integrity and off-site releases related to transportation of wastes are also common occurrences that should be evaluated.

6.4.6 The study plan identifies that an outcome of the research activities will be a determination of the likelihood of contamination of drinking water resources from surface spills. It is not clear from the research description how the likelihood will be calculated.

6.4.6 The study plan identifies that an outcome of the research activities will be an evaluation of risks posed by on-site management of hydraulic fracturing wastewater. Off-site wastewater management during transportation and transfer between facilities also has the potential to impact water resources.

6.4.6 The study plan does not include evaluation of cumulative impacts related to releases of flowback and produced water. Based on data compiled by state oil and gas regulatory agencies, spills are a common occurrence at oil and gas drilling sites. Large-scale development across an area could result in a substantial number of flowback and produced water spills that could adversely impact water quality to a much greater extent than may be indicated from a case study of an individual well site.

6.5 Wastewater Treatment and Waste Disposal: What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?

6.5.4 The study plan indicates that a potential research outcome will be "long-term effects resulting from inadequate treatment of hydraulic fracturing wastewaters." However, the proposed research activities described in section 6.5.3 consist of analysis of existing data, lab studies, and prospective case studies and do not describe how long-term effects will be derived.

6.5.4 The study plan does not include evaluation of cumulative impacts related to inadequate wastewater treatment and disposal. Large-scale development across an area would result in substantial volumes of wastewater being generated and could adversely impact water quality to a much greater extent than may be indicated from a case study of an individual wastewater treatment plant.

Recommendations

- The evaluation of mitigation measures for spills should include prevention, containment, clean up, and recovery of spilled materials.
- The study should determine how well the industry actually follows the mitigation practices described in the trade organization publications related to the transportation, storage and handling of water and chemicals.
- The study should evaluate spills and releases from the perspective of hydraulic fracturing and not rely solely on general research on chemical spills
- The study plan should evaluate both chronic and acute toxicities of chemicals.

- The well integrity evaluation should be conducted by requesting data from state regulators on well incidents to get a large sample of data on failed wells in order to more comprehensively understand the causes and consequences of well incidents.
- The well integrity evaluation should include analysis of potential for impacts from hydraulically fracturing an improperly cased and grouted well.
- The flowback and produced water portion of the study should collect data, evaluate the likelihood of impacts, assess management methods, evaluate potential release scenarios, and analyze cumulative impacts from the following:
    - On-site surface releases;
    - On-site subsurface releases; and
    - Off-site surface releases.
- The study plan should more explicitly describe how long-term impacts from inadequate wastewater treatment will be determined.
- The study plan should include an evaluation of cumulative impacts from:
    - Well integrity incidents across a large region;
    - Releases of chemicals, produced water, and flowback to the environment; and
    - Inadequate wastewater treatment at the watershed scale.

Chapter 11 Areas of Concern outside the Scope of this Study

11.2 The air impacts from open evaporation pits should be within the scope of the study, as these may cause significant public health problems.

11.3 Invasive species have been described as being outside the scope of this study because it is implied that invasive species only impact terrestrial and aquatic ecosystems and not drinking water quality. However, invasive species can impact drinking water supplies due to terrestrial changes that impact source water quality, algae and other aquatic species that release toxins, and species such as zebra mussels that can impact water supply infrastructure.

Recommendations

- It is recommended that the spread of invasive species that could potentially impact drinking water supplies be included in the analysis.
- Many of the areas of concern stated to be outside the scope of the study have to potential to adversely impact public health. While we appreciate the need to limit the scope of this particular study it would be beneficial to provide information on when and how these will be evaluated in the future.