January 11, 2013

Attn: Draft HVHF Regulations Comments
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-6510

Re: Revised Proposed Regulations for High-Volume Hydraulic Fracturing

Dear Sir or Madam:

Enclosed please find the collective comments of the Catskill Mountainkeeper, Delaware Riverkeeper Network, Earthjustice, Natural Resources Defense Council, Riverkeeper, Inc., and the Sierra Club on the Revised Proposed Regulations for High-Volume Hydraulic Fracturing ("HVHF") in New York State (Revised Proposed Express Terms 6 NYCRR Parts 52, 190, 550-556, 560 and 750).

At the outset, our groups wish to register our strong objection to the decision by the New York State Department of Environmental Conservation ("NYSDEC") to revise the proposed regulations *prior* to completing the on-going environmental review process pursuant to the State Environmental Quality Review Act ("SEQRA") and the health review process being undertaken by the Department of Health ("DOH"), and to require public comment on these revisions prior to the completion of SEQRA and DOH review. The fundamental purpose of SEQRA is to inform agency decision making. 6 NYCRR § 617.1(c). Issuing the Revised Proposed Regulations prior to completing the SEQRA process turns that sound, common sense purpose on its head.

Likewise, while we agree that a review of the potential health impacts of HVHF is necessary, NYSDEC's issuance of draft HVHF regulations before the completion of that review prevents that review from serving its purpose. And we remain extremely concerned that the health review process is operating under an inexcusable veil of secrecy. While the State deserves credit for its decision to conduct such an evaluation, it should not allow its efforts to be squandered. It is not too late for the Department to correct these shortcomings; the ongoing health review still represents an unprecedented opportunity for State decision-makers to more fully consider the potential health threats of proposed HVHF and to do so before irretrievable commitments to proceed are made.

We further wish to make clear that our comments on the Revised Proposed Regulations should not be read as indicating that our groups would support a decision to proceed with HVHF at this juncture. We reaffirm our position that no decision as to whether or how to proceed with HVHF can or should be made until those review documents are complete and until we and the public more generally have had the opportunity to analyze and comment on them.

Finally, we address the critical issue of agency staffing and resources. This is a matter that we and others have raised repeatedly, including in numerous comments on the Revised Draft Supplemental Generic Environmental Impact Statement and prior Proposed Regulations. To restate the obvious, the State cannot possibly ensure that the environment and health of its residents would be protected if any drilling operations were to proceed unless state and local officials have the resources to fully and effectively oversee and enforce any final HVHF regulatory program.

We recognize that NYSDEC cannot address its severe staffing and resource limitations through regulatory revisions, and that, ultimately, legislative action would be required. But, under these circumstances, NYSDEC can – and must - refrain from finalizing any proposed HCHF regulatory program and from processing and issuing drilling permits unless and until the resource questions have been fully considered and addressed.

In July 2011, NYSDEC appointed an Advisory Panel on HVHF with the express purpose of assisting in its review of necessary staffing and resource increases to effectively and safely administer an HVHF program. At various times, NYSDEC indicated that it would not finalize a regulatory program until that Panel's work was done. Now, NYSDEC should reaffirm that commitment, and further commit that it will not make any final determinations on HVHF until the Panel has been reconvened and its recommendations received, considered and, as appropriate, acted upon by the Legislature. The same commitment should be made with respect to financial assurances, bonding requirements and any other necessary statutory measures that NYSDEC has identified as outside the scope of its regulatory authority but necessary for the responsible implementation of any final HVHF program.

To his credit, Governor Cuomo has pledged: "New York State must ensure that, if and when the State's natural gas is obtained, it does not come at the expense of human health or have adverse environmental impacts." But, as we document in the attached comments, as of today, that remains a promise that yet to be fulfilled.

Sincerely,

Wes Gillingham
Catskill Mountainkeeper

Maya van Rossum
the Delaware Riverkeeper

Deborah Goldberg
Earthjustice

Kate Sinding and Eric A. Goldstein
Natural Resources Defense Council

Kate Hudson
Riverkeeper

Nathan Matthews
Sierra Club

Comments Submitted to the New York State Department of Environmental Conservation

on Proposed Revisions to 6 New York Codes, Rules and Regulations Parts 52, 190, 550-556, 560, and 750

Prepared with technical, scientific and regulatory support from:
Harvey Consulting, LLC, and Tom Myers, Ph.D.

On behalf of:
Catskill Mountainkeeper;
Delaware Riverkeeper Network;
Earthjustice;
Natural Resources Defense Council;
Riverkeeper; and
Sierra Club

January 11, 2013

Table of Contents

Introduction and General Comments

The following comments were prepared with the technical, scientific, and regulatory support of Harvey Consulting, LLC and Tom Myers, Ph.D. and are submitted on behalf of Catskill Mountainkeeper, Delaware Riverkeeper Network, Earthjustice, the Natural Resources Defense Council, Riverkeeper, and the Sierra Club. These comments present recommendations for improving the Revised Proposed Express Terms of 6 NYCRR Parts 52, 190, 550–556, 560, and 750 ("Revised Proposed Regulations"), which were filed with the Secretary of State by the New York State Department of Environmental Conservation ("NYSDEC" or the "Department") on November 29, 2012. These comments should be read in the context of the detailed technical recommendations that we submitted on January 12, 2012 ("2012 Recommendations"), regarding the Revised 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 Reservoirs, issued September 7, 2011 ("RDSGEIS"), as well as on the then-proposed regulations, issued September 28, 2011. We hereby reaffirm the 2012 Recommendations in full and incorporate them by reference.[1]

Appendix A to these comments is a separate technical memorandum concerning how flood flows and floodplains have changed since the 1970s, when the Federal Emergency Management Agency ("FEMA") maps referenced in the RDSGEIS were produced. Appendix A also addresses the increases in frequency and intensity of recent and future storms (and, consequently, the increases in rainfall and flooding) that have occurred and are expected to continue as a result of climate change. Appendix A expands upon the comments and recommendations regarding flooding issues that were included in the 2012 Recommendations.[2]

The Revised Proposed Regulations do not provide for the responsible regulation of natural gas development using high-volume hydraulic fracturing ("HVHF") in the Marcellus shale and other low-permeability formations in New York. We respectfully request that NYSDEC examine and prepare a comprehensive response to both these comments and our 2012 Recommendations—as well as complete its review of the environmental and health impacts associated with the permitting of HVHF gas development—before finalizing the Revised Proposed Regulations.

[1] The 2012 Recommendations included the reports of Harvey Consulting, LLC ("Harvey Report"), Tom Myers, Ph.D. ("Myers Report"), Glenn Miller, Ph.D. ("Miller Report"), Ralph Seiler, Ph.D. ("Seiler Report"), Susan Christopherson, Ph.D. ("Christopherson Report"), Meliora Design LLC ("Meliora Report"), The Louis Berger Group, Inc. ("LBG Report"), Kevin Heatley, M.EPC LEED AP ("Heatley Report"), Kim Knowlton, DrPH ("Knowlton Report"), Gina Solomon, M.D., M.P.H. ("Solomon Report"), and Briana Mordick ("Mordick Report"), which appeared, respectively, as Attachments 1 through 11 to the Joint Comments of Catskill Mountainkeeper, Delaware Riverkeeper Network, Earthjustice, NRDC, and Riverkeeper on the RDSGEIS, filed January 12, 2012 ("Joint Comments").

[2] *See* Knowlton Report.

Overall Comments

1. NYSDEC May Not Apply the Revised Proposed Regulations to Low-Permeability Gas Reservoirs Other Than the Marcellus Shale without Examining the Different and Potentially Significant Impacts of Development in Those Formations.

Of continuing concern, NYSDEC has maintained the position that the new regulations it has proposed for 6 NYCRR Part 560 will apply to HVHF gas development in low-permeability gas reservoirs other than the Marcellus shale. As previously discussed in the 2012 Recommendations, the RDSGEIS does not analyze the impacts from HVHF gas development in formations other than the Marcellus shale – *e.g.*, the Utica shale. Because the impacts associated with the development of different low-permeability gas reservoirs are formation-specific, the analysis of Marcellus development impacts contained in the RDSGEIS cannot serve as the basis for permitting HVHF gas development in all other formations throughout the State.

NYSDEC has not provided any technical, scientific, or legal justification for applying the Part 560 Revised Proposed Regulations to any formation other than the Marcellus. NYSDEC, therefore, must either expressly limit the scope of the Revised Proposed Regulations to HVHF gas development operations in the Marcellus shale only or thoroughly analyze the potential impacts of developing other low-permeability formations and revise the RDSGEIS and the Revised Proposed Regulations accordingly.

2. NYSDEC Has Provided No Environmental Analysis to Justify Application of the 6 NYCRR Parts 550–556 Regulations to Wells Fractured with More Than 80,000 but Less Than 300,000 Gallons of Water.

We reiterate our concern over the application of the 6 NYCRR Part 550–556 regulations to hydraulic fracturing operations using more than 80,000 but less than 300,000 gallons of water. The impacts of these operations were excluded from consideration under the RDSGEIS, and NYSDEC has not provided any justification for its implicit conclusion that such impacts were adequately evaluated in the 1992 Final Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program ("1992 GEIS") or that they will be appropriately mitigated by the requirements included in the Part 550–556 regulations. As is discussed in our 2012 Recommendations, the 1992 GEIS addressed the hydraulic fracturing only of wells where 80,000 or fewer gallons of water were used and, therefore, cannot serve as the basis for the permitting of fracturing operations using more than 80,000 gallons of water.

NYSDEC has not provided any environmental analysis of the impacts associated with well fracturing that utilizes more than 80,000 but less than 300,000 gallons of water, let alone any consideration of the cumulative impacts of the permitting of such operations in conjunction with operations that use 300,000 or more gallons of water. NYSDEC cannot permit fracturing operations that use more than 80,000 but less than 300,000 gallons of water unless it first analyzes the impacts of such operations and revises the RDSGEIS and the applicable regulations accordingly.

3. NYSDEC Does Not Justify Its Refusal to Update the Part 550–556 Regulations Governing Non-HVHF Oil and Gas Wells.

NYSDEC has continued to rely on the 1992 GEIS as the basis for both the RDSGEIS and the Revised Proposed Regulations without addressing the fact that the technology available in 1992 and the practices required at that time are more than two decades old. Since 1992, numerous best technology and best management practice improvements have been made in the oil and gas industry. Nevertheless, NYSDEC

disputes the fact that its regulations are antiquated, *see* Response 3789, and proposes to retain, with little revision, existing regulations that are based on antiquated technology and practices for all oil and gas development in New York other than HVHF operations. New Yorkers, thus, are left with a technically and scientifically unsupported two-tiered system for oil and gas regulation in the State.

As currently drafted, the Revised Proposed Regulations would require industry to use standard best technology and operating practices only for HVHF wells. NYSDEC has not, but should, identify current best technology and operating practices and include those practices in regulation at Parts 550–556, so that they are applicable to all wells in New York State. Then, NYSDEC should capture in Part 560 only those unique best technology and operating practices required to develop the Marcellus shale using HVHF.

NYSDEC resists the extension of best practices to all wells by arguing throughout its Assessment of Public Comment that revising Parts 550–556 to include the best technology and operating practices now proposed only for HVHF would be unreasonable or impractical for the geothermal or shallow monitoring wells also governed by those Parts. If NYSDEC finds that widely acknowledged best practices for oil and gas wells are unreasonable or impractical for geothermal or shallow monitoring wells, it should move the regulations governing geothermal and shallow monitoring wells into a separate Part or allow for a waiver of the requirements for geothermal or shallow monitoring wells, where technically justified.

4. Generally Applicable Mitigation Measures Proposed in the RDSGEIS Should Be Codified in the Revised Proposed Regulations.

Many of the measures that NYSDEC has identified in the RDSGEIS as necessary to mitigate a variety of the major adverse environmental impacts of HVHF operations (and that our 2012 Recommendations suggested be codified in regulations) are absent from the Revised Proposed Regulations. For example, restrictions on air pollution emissions, limits on wellpad lighting use, minimization of noise levels, and best management practices for reducing impacts to ecosystems and wildlife that appear as proposed mitigation measures in the RDSGEIS still have no enforceable counterpart in the Revised Proposed Regulations. Despite its recognition of the need to protect against the air quality impacts associated with HVHF gas development, NYSDEC has not included in its proposed regulations the many specific measures—aside from some limited restrictions on well venting and flaring—that would control emissions of nitrogen oxides, sulfur oxides, sulfuric acid, particulates, benzene, formaldehyde, and other toxic pollutants.

In response to public comments calling for the codification of mitigation measures in regulations (including comments by the U.S. Environmental Protection Agency ("EPA"), *see* Comment 3831), NYSDEC contended that implementing RDSGEIS mitigation measures as permit conditions rather than as regulatory requirements will provide the Department with the flexibility necessary to best achieve its environmental protection objectives as technology advances. *See, e.g.*, Responses 3779, 3831. However, NYSDEC can maintain flexibility by adopting requirements that serve as a regulatory floor and reserving the discretion to add more stringent requirements as special permit conditions. Where site-specific differences come into play, the regulations can set forth the specific criteria that would be applied. Without minimum requirements codified in regulations, the public runs the risk that NYSDEC will eliminate mitigation measures or lower standards without any opportunity for public review.

The applicability and enforceability of important mitigation measures is made further uncertain by the inconsistencies between the Revised Proposed Regulations and the permit conditions identified in the RDSGEIS, the latter of which include a number of items that NYSDEC has not proposed to codify in its regulations. For example, the permit conditions call for limits on benzene emissions, for ongoing water well monitoring and testing, for a limit on the number of wells that may be drilled annually on a single

well pad, for radiation surveys, for the use of ultra-low sulfur fuel in equipment engines, for the implementation of visual impact and greenhouse gas emissions mitigation plans, for a Department-approved transportation plan, and for an invasive species management plan. None of these important mitigation measures are identified in the Revised Proposed Regulations. Moreover, a patchwork of requirements located in a variety of documents will be difficult for the public to understand, for NYSDEC staff to administer, and for industry to follow. Indeed, industry has made similar requests for consolidated regulation. *See* Comment 6094.

As our 2012 Recommendations explain, proposed mitigation measures that are intended as rules require formal promulgation as regulations pursuant to the State Administrative Procedure Act ("SAPA"). An attempt by NYSDEC to enforce the mitigation measures identified in the RDSGEIS as permit conditions applicable to all HVHF wells, without following formal rulemaking procedures, would run afoul of SAPA. If, however, NYSDEC does not intend such permit conditions to bind all applicants, then there is no guarantee that the SEQRA-required mitigation will ever be achieved. Therefore, NYSDEC must include all universally applicable mitigation measures in its regulations and reissue the Revised Proposed Regulations for public comment.

5. Many Specific Comments on the Proposed Regulations Remain Unaddressed.

Generally, we are disappointed with NYSDEC's Revised Proposed Regulations and find the Department's responses to public comments inadequate. NYSDEC did not address many of the issues identified in our 2012 Recommendations in either its Assessment of Public Comment or the Revised Proposed Regulations. In most instances where a response was provided, NYSDEC summarily rejected our recommendations, and those of other commenters, without providing a technical or scientific analysis or a justification for its decision, contrary to SAPA requirements.

Where commenters recommended the amendment of a specific regulation, but NYSDEC determined that the recommendation did not apply to the specified regulatory provision, the Department often dismissed the comment summarily, instead of considering how or where else the recommendation might apply. The rejection of well-supported recommendations on this basis elevates form over substance. In order to fulfill its obligation to respond to public comments, NYSDEC should revisit prior comments and clarify whether a recommendation has been rejected outright or has been accepted but incorporated into a regulatory provision other than the one identified by the commenter.

In addition, NYSDEC ignored most recommendations where the commenter suggested a revision but did not identify a specific subsection for amendment. With respect to our recommendations that did not specify the regulation to be amended, we reiterate those here and include suggestions of where they may best fit in the NYCRR.

6. Inconsistencies and Typographical Errors Should Be Eliminated.

Our examination of the Revised Proposed Regulations revealed a number of inconsistencies among the definitions and regulatory provisions included under various 6 NYCRR Parts. For example, in 6 NYCRR § 550.3(au), NYSDEC defines "potable fresh water" in virtually the same language as the definition of "fresh water supply" in 6 NYCRR § 750-3.2(b)(21). It is confusing and inconsistent to use two different terms that are defined by the same standard. Similarly, NYSDEC interchangeably uses the term "freshwater supply" and "fresh water supply" throughout 6 NYCRR § 750.3. If NYSDEC continues to use this term, it should retain one consistent spelling. There are also disparities between existing setback requirements in 6 NYCRR § 553.2 and proposed setbacks in 6 NYCRR § 560.4 and 6 NYCRR § 750-3.

NYSDEC should revise its existing regulatory provisions governing oil and gas development to provide for consistent setbacks for all drilling operations in the state.

It appears that certain requirements governing technical aspects of HVHF gas development operations have been proposed for inclusion under both Part 560 and Part 750 – *e.g.*, setback requirements are proposed for 6 NYCRR § 560.4 and 6 NYCRR § 750-3. As is noted above, NYSDEC's current proposal should be consolidated in order to facilitate a proper understanding of the regulatory regime by industry and the public. If all requirements governing oil and gas wells are located in one place, inconsistencies and contradictions in regulatory language will be more easily eliminated. At the very least, inconsistencies between the spelling of regulatory terms—*e.g.*, "fresh water" (6 NYCRR §§ 555.5(a)(3); 560.2(b)(14)) and "freshwater" (6 NYCRR §§ 560.6(b)(2), (c)(4))—should be corrected.

In addition, many of the definitions and a number of the substantive provisions in 6 NYCRR § 750 conflict with those in the 2011 draft of the State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from HVHF. Appendix B to these comments provides a list of conflicting definitions of terms found in § 750-3.2(b) and the SPDES General Permit. The SPDES General Permit should be revised to be consistent with applicable regulatory provisions and reissued for public comment.

7. Legislative Action Should be Sought Where Necessary to Provide Critical Mitigation Prior to Finalization of the Revised Proposed Regulations.

NYSDEC's Assessment of Public Comment identifies a number of statutory amendments that are needed to provide the Department with the legal authority to regulate Marcellus shale HVHF gas development adequately and to improve its current regulation of other oil and gas wells. To ensure that NYSDEC does not codify a set of regulations that are based on known gaps in the law and its authority, the Department should seek the required statutory amendments and defer finalization of the Revised Proposed Regulations until the necessary amendments to State law are in effect.

For example, NYSDEC noted that current law precludes the Department from requiring financial assurances that would cover adequately all liabilities that could arise from oil and gas development and dictates the maximum amount of penalties that can be imposed for violation of the regulations. Both the current maximum financial assurance amounts and the maximum penalty amounts are too low. The financial assurance requirements do not guarantee the availability of the funds necessary to restore a water supply or other natural resource in the event of contamination. In addition, the current penalty structure for violations of the oil and gas regulations provides for civil penalties no greater than $8,000 per violation, plus $2,000 per day for continuing violations. Such minimal penalties will have little deterrent effect as they will simply represent the cost of doing business for most oil and gas companies. These significant issues must be addressed through appropriate legislation before NYSDEC commences the permitting of HVHF gas development operations.

Specific Comments

Specific comments on NYSDEC's Proposed Revisions to 6 NYCRR Parts 52, 190, 550-556, 560, and 750 are provided below in numeric order.

6 NYCRR § 52 and 190 Use of State Lands

Revised Proposed Regulation: NYSDEC proposes new regulations at 6 NYCRR Parts 52 and 190 that prohibit surface disturbances associated with gas well drilling on State lands but allow for the drilling of gas wells under State lands, providing in substantially similar language as follows at 6 NYCRR § 52.3 and 6 NYCRR § 190.8(ag), respectively:

> *Notwithstanding any other provision of this title, surface disturbance associated with the drilling of a natural gas well subject to Part 560 of this Title on State lands is prohibited and no permit shall be issued authorizing such activity. This prohibition shall apply to any pre-existing leases and any new leases issued for oil and gas development on State lands. This prohibition shall not apply to subsurface access to subsurface resources located under State lands from adjacent private areas.*
>
> *Notwithstanding any other provision of this title, surface disturbance associated with the drilling of a natural gas well subject to Part 560 of this Title on State owned lands is prohibited and no permit shall be issued authorizing such activity. This prohibition shall apply to any pre-existing and new leases issued for oil and gas development on State owned lands. This prohibition shall not apply to subsurface access to subsurface resources located under State owned lands from adjacent private areas.*

"Surface disturbance" is defined as "*any actions taken to alter the existing vegetation or soil of a site, such as clearing, grading, filling, and excavating*." Proposed 6 NYCRR § 52.2(a)(3); § 190.0(b)(14).

Prior Comment and Response: Our 2012 Recommendations requested that the Department prohibit *all* HVHF gas development of State-owned lands, including development activities on *and under* State-owned forests, reforestation areas, wildlife management areas, and public conservation easements as well as the siting of HVHF gas development ancillary facilities on State-owned lands.

NYSDEC bases its determination that "it is not necessary to prohibit subsurface access to mineral resources underneath State lands from adjacent private lands, nor would such access be inconsistent with the purposes for which these State lands were acquired" on the assumptions that the mitigation measures identified in Sections 7.4.1.1 and 7.4.1.2 of the RDSGEIS – which are not codified in regulation – will protect terrestrial habitats and wildlife sufficiently and that permeability characteristics of shale formations subject to HVHF will prevent vertical migration of fracturing fluid. [Response 5746].

Taking NYSDEC's justifications in turn, mitigation measures that are not included as generally-applicable regulatory requirements cannot guarantee adequate protection of the unique environmental resources that are found on State-owned lands. As discussed previously in our 2012 Recommendations and in these comments, NYSDEC should include all applicable mitigation measures in its regulations. Absent a codification of the protections that the Department itself has identified as necessary, such measures should not be relied upon to allow for HVHF gas development on State-owned lands.

The claim that vertical migration will not occur given the permeability of the Marcellus is unsupported. As explained in our 2012 Recommendations, a hydraulic fracture treatment injected into the Marcellus Shale could exit the shale formation (as in the case of an out-of-zone fracture) and place hydraulic fracture fluid into intervening strata between protected water and the Marcellus. If there is an inadequate confining layer, natural fractures, or other pathways to vertical migration, ground water contamination can occur. Moreover, the RDSGEIS includes no evaluation whatsoever of the geological characteristics

of or the impacts associated with the development of shale formations other than the Marcellus. Low-permeability gas reservoirs present at depths shallower than the Marcellus and closer to water resources have not been studied at all. Thus, NYSDEC's conclusion that vertical migration is not a risk must be reconsidered.

NYSDEC's rejection of the recommendation that all surface disturbances associated with HVHF gas development, including well site activities and pipeline construction and maintenance, be prohibited is similarly unsupported. NYSDEC's Assessment of Public Comment states that "pipelines will be permitted on State-owned lands only if certain provisions of the ECL are met" [Response 5731], but does not identify those provisions or to explain how they will protect against adverse environmental impacts. As discussed in our 2012 Recommendations, pipelines fragment forests, disturb habitats, and adversely impact aquatic organisms, resulting in the disruption of vital ecological processes. [LBG Report at 33; Heatley Report at 6-7.] Activities that jeopardize the health of the State's ecosystems should not be allowed on State-owned lands.

Recommendations: NYSDEC should prohibit subsurface access to gas reservoirs located under State-owned lands and should prohibit the construction of gas pipelines on State-owned lands.

6 NYCRR § 550-556 and 560 Use of Term "Horizontal Well"

Revised Proposed Regulations: NYSDEC proposes regulations in 6 NYCRR §§ 552, 553, 554, 556, and 560 that use a number of inconsistent terms to describe wells that are directionally drilled. In some cases, the regulations apply to all directionally drilled wells, regardless of the degree to which the wellbore is turned; however, in some cases, the regulations specifically use the term "horizontal" which, using the standard dictionary definition of "horizontal", would eliminate directionally drilled wellbores that are not turned from vertical and drilled precisely 90^{o} to true vertical through the hydrocarbon zone.

Most wells make a gradual transition from the vertical section of the wellbore to the section running through and parallel to the hydrocarbon zone, which may not be precisely 90^{o} to true vertical. It is not accurate to assume that a directionally drilled well is "horizontal," since a significant portion of the wellbore (and potentially all of it) is vertical or deviated at an angle less than "horizontal."

The term "horizontal well" or "horizontal wellbore" could exclude all other directionally drilled wells that are not constructed at a right angle to the vertical plane, potentially exempting wells from meeting certain requirements if the wells are not drilled on a true horizontal plane.

In 6 NYCRR § 750-3.2(b), NYSDEC has defined horizontal drilling to include a well with a vertical component, and a wellbore that is parallel to the objective formation. However, even this definition excludes wells that are directionally drilled but do not remain completely parallel to the formation throughout the entire objective formation.

We are recommending that the regulations clearly apply to all directionally drilled wells, regardless of the degree to which the wellbore is turned.

For example:

- 6 NYCRR § 552.1(a) requires an application to deepen or plug back a new "horizontal well," presumably exempting all other directionally drilled wells that are not turned 90^{o} to true vertical. Instead, 6 NYCRR § 552.1(a) should requires applications to deepen or plug back all directionally drilled wells,

- 6 NYCRR § 553.1(a)(1)-(2) and § 553.1(a)(9)-(12) require only a "horizontal well" to meet the proposed spacing requirements, presumably exempting all other directionally drilled wells that are not turned 90^{o} to true vertical. Instead, 6 NYCRR § 553.1(a)(1)-(2) and § 553.1(a)(9)-(12) should require all directionally drilled wells to meet the proposed spacing requirements.

- 6 NYCRR § 553.1(a)(6)-(7) requires only a "horizontal wellbore" or "horizontal well" in a shale gas pool to meet the proposed spacing requirements, presumably exempting all other directionally drilled wells that are not turned 90^{o} to true vertical. Instead, 6 NYCRR § 553.1(a)(6)-(7) should require all directionally drilled wells in a shale gas pool to meet the proposed spacing requirements.

- 6 NYCRR § 554.5(a) is more comprehensive by specifying that the exception applies to wells drilled directionally, including those drilled horizontally.

- 6 NYCRR § 554.5(d) clarifies that "controlled directional drilling" includes horizontal drilling.

- 6 NYCRR § 556.2(g)(4) exempts a new "horizontal well" within the producing horizon of a pool from submitting an application to deepen or plug back a well within the producing horizon of a pool, presumably requiring such an application from all other directionally drilled wells that are not turned 90^{o} to true vertical.

- 6 NYCRR § 560.1(a) is more comprehensive by clarifying that the new HVHF regulations apply to all "vertical and directionally drilled wells, including horizontal wells."

- 6 NYCRR § 560.6(c)(7) requires closed-loop tanks to be used only for "horizontal drilling" in the Marcellus Shale; presumably exempting all other directionally drilled wells that are not turned 90^{o} to true vertical in the Marcellus, or any other directionally drilled well drilled in any other formation, including but not limited to all "other low-permeability shales." Instead, 6 NYCRR § 560.6(c)(7) should require closed-loop tanks to be used for all wells drilled in the Marcellus.[3]

- 6 NYCRR § 560.7(g) requires a site-specific acid rock drainage mitigation plan only for "horizontal drilling" in the Marcellus Shale if the operator proposes to bury the cuttings onsite; presumably exempting all other directionally drilled wells that are not turned 90^{o} to true vertical in the Marcellus, or any other directionally drilled well drilled in any other formation, including but not limited to all "other low-permeability shales." We have requested that no cuttings be buried on site.

Recommendation: Revise the definitions of "horizontal drilling" and "horizontal well" as set forth below, and apply the revised definition throughout Parts 550, 560, and 750 to clarify that the regulations apply to all directionally drilled wells, including all wells drilled at an angle through or into the objective formation whether those wells are drilled parallel or nearly parallel through the objective formation:

> 'Horizontal drilling' shall mean the deviation of the borehole from vertical so that the borehole penetrates the objective formation in a manner parallel, or nearly parallel, to the objective formation.

[3] See also our comments at "6 NYCRR § 560 Marcellus Shale Only."

> 'Horizontal well' shall mean any well completed using "horizontal drilling," as defined above.

6 NYCRR § 550.3(ai) and § 550.3(au) Surface Casing and Protected Water Definitions

Revised Proposed Regulation: NYSDEC proposes no changes to its surface casing definition at 6 NYCRR § 550.3(au) and did not define "protected water."

NYSDEC's current regulations define surface casing as:

> *6 NYCRR § 550.3(au): Surface casing shall mean casing extending from the surface through the potable fresh water zone.*

NYSDEC's current regulations define potable fresh water as:

> *6 NYCRR § 550.3(ai): Potable fresh water shall mean any water containing less than 250 parts per million of sodium chloride or 1,000 parts per million of total dissolved solids.*

NYSDEC's current regulations do not include a definition of "protected water."

Well construction regulations at 6 NYCRR § 550–559 instruct operators to construct oil and gas wells in a manner that protects potable fresh water, *i.e.*, only water containing less than 250 ppm of sodium chloride or less than 1,000 ppm of TDS. 6 NYCRR § 550.3 (ai).

Prior Comment and Response: As we noted in our 2012 Recommendations, the NYCRR does not protect, under its definition of "potable fresh water," water resources with less than 10,000 ppm TDS but greater than 1,000 ppm TDS, which could qualify as underground sources of drinking water (USDWs) under the Safe Drinking Water Act (SDWA). *See* 40 CFR §§ 144.3, 146.4.[4] Regulations at 6 NYCRR § 554.1 require operators to prevent pollution to "surface or ground fresh water"; however, this term is not defined by the NYCRR, so it is unclear what additional fresh water beyond "potable fresh water" would be protected or how. We recommended revision of the surface casing definition to clarify that the setting depth should be at least 100 feet below the deepest "protected groundwater," defined to encompass both potable fresh water and USDWs. *See* Harvey Report Recommendations Nos. 3, 4, 5, 9, and 11 and Myers Report at 4–6, for discussion of the hydrogeology of the shallow aquifers.

NYSDEC disagreed with our recommendation, stating:

> *The Department disagrees with the proposed change to the definition of surface casing. The existing definitions of surface casing and potable fresh water provide a clearer indication of where surface casing should extend. The use of "protected" groundwater, as suggested in the comment, would be vague.* [Response 6275]

NYSDEC's rejection of the term "protected groundwater" as vague ignores the substantial comments submitted to NYSDEC on the need to revise the regulations to protect all USDWs, as required by federal

[4] The regulations promulgated under the SDWA define a USDW as an aquifer or part of an aquifer, which is not exempted (per 40 CFR § 146.4), and: (1) which supplies a public water system; or (2) which contains a sufficient quantity of groundwater to supply a public water system and either supplies drinking water for human consumption or contains fewer than 10,000 milligrams/liter of Total Dissolved Solids (TDS) [10,000 ppm TDS]. 40 CFR §§ 144.3, 146.4.

law, not just the limited subset of USDWs currently included in NYSDEC's potable fresh water definition at 6 NYCRR § 550.3(ai). Indeed, these detailed comments were submitted in response to the vagaries inherent in the current regulation's failure to define the term "surface or ground fresh water."

NYSDEC did not respond to the particular recommendation that protected groundwater depth be verified prior to setting casing or that the casing be set at least 100' below the deepest protected groundwater. NYSDEC's rejection of a specific, quantifiable setting depth (100') is unsupported, especially when NYSDEC currently requires a 100' setting depth in its Existing Fresh Water Aquifer Supplementary Permit Conditions Required for Wells Drilled in Primary and Principal Aquifers.[5]

The proposed surface casing definition now offers no minimum setting depth measurement at all.

Harvey pointed out that the NYCRR does not provide the operator with instructions on how to determine protected groundwater depth. The RDSGEIS explains that the depth of potable freshwater in NYSDEC is typically 850' deep, but this depth will vary across the state. Using the 850' benchmark may not sufficiently protect all groundwater covered under the SDWA. The NYCRR should be revised to provide instructions to the operator on how to estimate protected water depth in drilling applications and well construction designs. The NYCRR should require that depth be confirmed before setting surface casing.

Recommendations:

1. 6 NYCRR § 550.3(au) should be revised to read: "'Surface casing' shall mean casing installed and cemented from the surface, through protected groundwater, to a point at least 100' below the deepest protected groundwater."

2. A new definition for the term "protected groundwater" should be added to 6 NYCRR § 550.3, to ensure that New York's long-term water needs are met. The new definition should provide: "'Protected groundwater' shall mean potable fresh water and all underground sources of drinking water, as defined in 40 CFR §§ 144.3, 146.4, including all primary and principal aquifers."

3. The NYCRR should require that the protected groundwater depth be estimated in the drilling application to aid in well construction design. Specifically, Parts 554.4 and 560.6(c) should be amended to require that: (1) protected groundwater depth be verified with a resistivity or electric conductivity log or other sampling method during drilling, and (2) if the protected groundwater depth is deeper than estimated, an additional string of intermediate casing should be required. NYS could include a provision in the regulations allowing for a waiver of the verification requirement if there is statistically significant data in the area from prior drilling that accurately identifies the protected groundwater depth.

6 NYCRR § 550.3(bg) and § 550.3(s) Workover and Hydraulic Fracturing Definitions

Revised Proposed Regulations: NYSDEC added a new definition for "workover" at 6 NYCRR § 550.3(bg) and a new definition for "hydraulic fracturing" at 6 NYCRR § 550.3(s).

> *6 NYCRR § 550.3 (bg): 'Workover' shall mean any downhole operation in an existing well performed after initial completion that is* ***designed to sustain, restore or increase***

[5] 2011 NYSDEC RDSGEIS, Appendix 9.

> ***efficiency****, make the well safer, or correct a known or potential environmental hazard [emphasis added].*
>
> *6 NYCRR § 550.3(s): 'Hydraulic Fracturing' or 'Fracturing' shall mean a stimulation technique involving the pumping of hydraulic fracturing fluid, possibly with a proppant, into a formation to create fractures to increase formation permeability and productivity,* ***but shall not include other operations during a workover*** *[emphasis added].*

Recommendations: The new definitions for workover and hydraulic fracturing are useful additions, but two revisions are required. The first reflects the fact that industry typically uses the term "workover" to refer to operations that require re-entry into the well to stimulate or repair the well. These operations could include a re-fracture treatment or another type of well stimulation, which should be expressly referenced in the regulation. The second clarifies that provisions applicable to fracturing also apply to re-fracturing. The terms "re-fracture" and "re-fracturing" appear later in the regulations (*e.g.*, 6 NYCRR § 556.2(g)(6)), but are not defined. We recommend that:

1. 6 NYCRR § 550.3(bg) should be amended to add the italicized language: "'Workover' shall mean any downhole operation in an existing well performed after initial completion, *including re-fracturing*, that is designed to sustain, restore or increase efficiency, make the well safer, or correct a known or potential environmental hazard."

2. 6 NYCRR § 550.3(s) should be amended to add the italicized language: 'Hydraulic Fracturing' or 'Fracturing' shall mean a stimulation technique involving the pumping of hydraulic fracturing fluid, possibly with a proppant, into a formation to create fractures to increase formation permeability and productivity, *and shall include re-fracturing*, but shall not include other operations during a workover."

3. 6 NYCRR § 550.3 should be amended to add a definition for "re-fracturing" as follows: "'Re-fracturing' shall mean any hydraulic fracturing stimulation that is conducted on a well after the first hydraulic fracture stimulation has been performed."

6 NYCRR § 551.1(a)

Revised Proposed Regulation: NYSDEC does not propose to include a requirement in 6 NYCRR § 551.1(a) that out-of-state environmental compliance records be disclosed as a condition of permitting.

Prior Comment and Response: Comments 3109 and 7798 recommended that 6 NYCRR § 551.1(a) be amended to require that out-of-state environmental compliance records be disclosed as a condition of permitting and that operators with poor records be denied permits. NYSDEC's only response is to refer to the Department's Record of Compliance Policy. DEC does not explain how the Policy can be implemented without disclosure of the information identified in the comments.

Recommendation: NYSDEC should require disclosure of all permit applicants' compliance records, including at a minimum all prior administrative or judicial enforcement actions or criminal proceedings against the applicant in New York or any other state and all denials of permits in any state.

6 NYCRR § 551.5 and § 551.6 Amount of Financial Security

Revised Proposed Regulation: There is no proposed revision to the amount of financial security for wells up to 6,000' deep. 6 NYCRR § 551.5. For wells between 2,500' and 6,000' in depth, NYSDEC

requires only $5,000 financial security per well, with the overall total per operator not to exceed $150,000.

For wells drilled more than 6,000' deep, NYSDEC is proposing a regulatory revision that requires the operator to provide financial security in an amount based on the anticipated cost for plugging and abandoning the well (6 NYCRR § 551.6). The amount of that financial security is capped at the anticipated cost of plugging and abandoning that well to an unknown amount "specified by the department."

Prior Comment and Response: NYSDEC concludes that increasing financial security amounts for wells 6,000' deep or shallower would require legislative action, because the amounts for such wells are set in statute at ECL § 23-0305(8)(k)(1). [Response 3112]

For wells more than 6,000' deep, we recommended that each operator provide a bond of at least $100,000 per well. Additionally, we recommended that NYSDEC require Commercial General Liability Insurance, including Excess Insurance, Environmental Pollution Liability Coverage, and a Well Control Policy, of at least $5,000,000. We recommended that if NYSDEC deviates from these financial assurance requirements, it should be justified with a rigorous economic assessment that is provided to the public for review and comment.

Our 2012 Recommendations were based on information from NYSDEC's own consultant and from practices in other states. In 2003, ICF completed a report for the New York State Energy Research and Development Authority (NYSERDA) on NYS oil and gas wells. ICF's report advised NYS that well plugging and abandonment can range from $5,000 per well to more than $50,000 per well depending on the well depth, well condition, site access, and site condition. ICF's 2003 report recommended that NYS consider increased financial security requirements. NYSDEC's current requirement of only $5,000 financial security per well is clearly insufficient, as ICF determined in 2003 that the cost could be as much as $50,000 per well. Today's cost would likely be higher than the decade-old ICF estimate, which did not contemplate the longer, more complex wells envisioned for development of the Marcellus Shale.

In Ohio, an operator is required to obtain liability insurance coverage of at least $1,000,000 and up to $3,000,000 for wells in urban areas. The Ohio Code at Title 15, Chapter 1509 requires:

> *1509.07 Liability insurance coverage. An owner of any well, except an exempt Mississippian well or an exempt domestic well,* ***shall obtain liability insurance coverage from a company authorized to do business in this state in an amount of not less than one million dollars bodily injury coverage and property damage coverage to pay damages for injury to persons or damage to property caused by the drilling, operation, or plugging of all the owner's wells in this state.*** *However,* ***if any well is located within an urbanized area, the owner shall obtain liability insurance coverage in an amount of not less than three million dollars for bodily injury coverage and property damage coverage to pay damages for injury to persons or damage to property caused by the drilling, operation, or plugging of all of the owner's wells in this state****. The owner shall maintain the coverage until all the owner's wells are plugged and abandoned or are transferred to an owner who has obtained insurance as required under this section and who is not under a notice of material and substantial violation or under a suspension order. The owner shall provide proof of liability insurance coverage to the chief of the division of oil and gas resources management upon request. Upon failure of the owner to provide that proof when requested, the chief may order the suspension of any outstanding*

permits and operations of the owner until the owner provides proof of the required insurance coverage [emphasis added].

Except as otherwise provided in this section, an owner of any well, before being issued a permit under section 1509.06 of the Revised Code or before operating or producing from a well, shall execute and file with the division of oil and gas resources management a surety bond conditioned on compliance with the restoration requirements of section 1509.072, the plugging requirements of section 1509.12, the permit provisions of section 1509.13 of the Revised Code, and all rules and orders of the chief relating thereto, in an amount set by rule of the chief.

Fort Worth, Texas requires an operator drilling 1-5 wells to provide a blanket bond or letter of credit of at least $150,000, with incremental increases of $50,000 for each additional well. Therefore, under Fort Worth, Texas requirements, an operator drilling 100 wells would be required to hold a bond of $4,900,000, as compared to $150,000 in NYS.

In addition to the bond amount, Fort Worth, Texas also requires the operator to carry multiple insurance policies:

1. Standard Commercial General Liability Policy of at least $1,000,000 per occurrence. The Standard Commercial General Liability insurance must include: "premises, operations, blowout or explosion, products, completed operations, sudden and accidental pollution, blanket contractual liability, underground resources and equipment hazard damage, broad form property damage, independent contractors' protective liability and personal injury."

2. Excess or Umbrella Liability of $5,000,000;

3. Environmental Pollution Liability Coverage of at least $5,000,000 "applicable to bodily injury, property damage, including the loss of use of damaged property or of property that has not been physically injured or destroyed; cleanup costs; and defense, including costs and expenses incurred in the investigation, defense or settlement of claims…coverage shall apply to sudden and accidental, as well as gradual pollution conditions resulting from the escape or release of smoke, vapors, fumes, acids, alkalis, toxic chemicals, liquids or gases, waste material or other irritants, contaminants or pollutants."

4. Control of Well Policy of at least $5,000,000 per occurrence/combined single limit with a $500,000 sub-limit endorsement for damage to property for which the Operator has care, custody and control; and

5. Other insurance required by Texas (e.g. Workers Compensation Insurance, Auto Insurance, and other corporate insurance required to do business in the state of Texas).

Even though NYSDEC's own consultant recommended higher financial security amounts than proposed by the agency, as we noted in our 2012 Recommendations, NYSDEC neither evaluated the financial security amounts required by other hydrocarbon producing states as benchmarks for improving NYSDEC's requirements nor provided an economic assessment to justify alternative financial security amounts.

Instead, NYSDEC pointed to limitations at ECL § 23-0305(8)(e) that limit financial security amounts and limit financial security to plugging and abandonment costs only. [Responses 3112, 3114, and 3118]. Although current law constrains the amount and type of financial security that NYSDEC may require for wells 6,000' deep or shallower, the law does not limit the type or amount of financial security that the agency can require for wells more than 6,000' deep. ECL § 23-0305(8)(k)(3) allows NYSDEC to promulgate regulations requiring "additional financial security" for wells deeper than 6,000'.

Recommendations: NYSDEC should not finalize the regulations prior to proposing and obtaining a legislative amendment that would authorize it to require adequate financial assurance from operators for all liabilities potentially arising from oil and gas development and for all wells regardless of depth. The proposed legislation should not limit NYSDEC's financial assurance requirements to the cost for plugging and abandoning a well. Instead, the legislation should authorize a combination of bonding and insurance that guarantees payment of the full costs and risks of long-term monitoring; publicly incurred response and cleanup operations; site remediation and well abandonment; and adequate compensation to the public for adverse impacts (e.g., water well contamination). Financial assurance amounts set pursuant to the legislative amendments should apply to each well, with no aggregate cap for multiple wells, and the amounts should be indexed to inflation to reflect changes in actual costs.

If NYSDEC proceeds with this rulemaking without first securing the recommended legislative amendment, it should exercise its authority to require "additional financial security" for wells more than 6,000' deep. That security should include a combination of bonding and insurance that guarantees payment of the full costs and risks of long-term monitoring; publicly incurred response and cleanup operations; site remediation and well abandonment; and adequate compensation to the public for adverse impacts (e.g., water well contamination). Financial assurance amounts should apply to each well, with no aggregate cap for multiple wells, and the amounts should be indexed to inflation to reflect changes in actual costs. If NYSDEC retains the discretion to cap required financial security, the agency should identify and justify the criteria it uses to fix the caps. Amounts should equal or exceed the amounts suggested in the 2012 Recommendations as set forth above unless NYSDEC provides an economic assessment to justify lower financial security amounts.

6 NYCRR § 552.1(a) Applications and Fees

Revised Proposed Regulation: NYSDEC proposed the following language to revise 6 NYCRR § 552.1(a):

> (*a) It shall be unlawful for any owner or operator to commence operations to construct the well pad or access road; drill, deepen, plug back or convert a well for oil and gas exploration, production, input, or storage purposes to any depth; or drill, deepen, plug back or convert a well for disposal, geothermal, or stratigraphic purposes* ***to any depth greater than a true vertical depth of 500 feet*** *until [he] the owner or operator has filed an application with the department and has received a permit as specified below. Except for the drilling of a new horizontal well exclusively within the producing horizon of a pool, this application shall not be required for deepening or plug back operations to be conducted exclusively within the producing horizon of a pool [emphasis added].*

NYSDEC's proposed change would not require a permit for a disposal well drilled from the surface to 500.'

Prior Comment and Response: NYSDEC states that ECL § 23-0305(14) limits NYSDEC's jurisdiction under the Oil, Gas and Solution Mining Law to brine disposal wells drilled deeper than five hundred feet;

concluding that any regulation of disposal wells less than 500' was out of scope. [Responses 6580 and 7800].

Recommendation: NYSDEC should clarify in regulation that disposal wells drilled in NYS are, regardless of depth, prohibited from injecting waste into any USDW and must be drilled to comply with the federal UIC program.

6 NYCRR § 552.1(b) Surveyor and Engineering Requirements

Revised Proposed Regulation: NYSDEC revised 6 NYCRR § 552.1(b) to require NYS licensed land surveyors and NYS licensed professional engineers to certify plats.

Prior Comment and Response: Comment 3872 requested licensed land surveyors and licensed professional engineers to certify plats. NYSDEC agreed. [Response 3872].

Recommendation: We support this change.

6 NYCRR § 552.1(b), § 560.3(b), § 560.6(a)-(b) Location Accuracy

Revised Proposed Regulation: NYSDEC's proposed regulations use "decimal latitude and decimal longitude" throughout, including in 6 NYCRR §§ 552.1(b), 560.3(b), 560.6(a) and (b). The regulation should specify precision on the decimal. For example, 40.5 degrees is much less precise than 40.51832 degrees.

Recommendation: Require decimal latitude and decimal longitude to be reported to a 6 decimal accuracy.

6 NYCRR § 552.1(b) Water Well Location on Plat

Revised Proposed Regulation: NYSDEC did not add a requirement at 6 NYCRR § 552.1(b) to include the location and distance of private water wells within 2,000' of the proposed well.

Prior Comment and Response: Commenter 7799 requested that the plat include the location and distance of private water wells within 2,000' of the proposed well, for wells that are hydraulically fractured in NYSDEC, not just HVHF wells.

NYSDEC explained that water well location on the plat is required for HVHF as part of the EAF Addendum, but refused the request to include this requirement in NYCRR without justification. [Responses 7799 and 7805].

Recommendation: Add a requirement to include the location and distance of all items requiring setbacks from the proposed well on the well plat for all hydrocarbon wells in NYS that undergo hydraulic fracturing stimulation treatment, not just HVHF wells.

6 NYCRR § 552.1(b) Abandoned Well Location on Plat

Revised Proposed Regulation: NYSDEC did not include a requirement at 6 NYCRR § 552.1(b) to identify abandoned wells on the plat.

Prior Comment and Response: Comment 7805 recommended NYSDEC include a requirement at 6 NYCRR § 552.1(b) to identify any abandoned wells within 2,500' of the furthest fracture zone extent and to verify that the abandoned well has been effectively plugged prior to conducting hydraulic fracturing operations.

NYSDEC explained that abandoned well identification is required for HVHF wells on the well plat submitted for an Application for a Permit to Drill, but did not respond to the Commenter's recommendation that this standard be met for all wells that are hydraulically fractured in NYSDEC, not just HVHF wells. [Response 7805].

Recommendation: Include a requirement to identify any abandoned wells within 2,500' of the furthest fracture zone extent and to verify that the abandoned well has been effectively plugged prior to conducting hydraulic fracturing operations for all hydrocarbon wells in NYS that undergo hydraulic fracturing stimulation treatment, not just HVHF wells.

6 NYCRR § 552.2(b) Plat

Revised Proposed Regulations: 6 NYCRR § 552.2(b): This section specifies the requirements for a "neat, legible plat."

Recommendation: 6 NYCRR § 552.2(b) should require that the applicant include on the plat all of the items from which setbacks are required under § 553.2 and § 560.4, such that the plat can be used to verify that setbacks will be achieved. Alternatively, NYSDEC could require that the applicant submit an additional map demonstrating that setbacks will be achieved.

All information required to be disclosed to the Department under 6 NYCRR § 552.2(b) should be made publicly available on NYSDEC's website.

6 NYCRR § 552.1(c) Pre-Fracture Notice and Disclosure of Chemicals

Revised Proposed Regulation: NYSDEC did not include a requirement for pre-fracture notice and disclosure of chemicals at 6 NYCRR § 552.1(c).

Prior Comment and Response: Comment 7796 recommended pre-fracture notice and disclosure of chemicals to both the Department and the landowner, consistent with Wyoming's and Colorado's regulations. NYSDEC explained that pre-fracture notice and disclosure is required for HVHF wells under Part 560, but did not respond to the Commenter's recommendation which was to require this standard to be met for all wells that are hydraulically fractured in NYSDEC, not just HVHF wells. [Response 7796].

Recommendation: Include a requirement for pre-fracture notice and disclosure of chemicals for all wells that undergo hydraulic fracturing stimulation treatment, not just HVHF wells.

6 NYCRR § 552.1(c) Approval to Re-Fracture a Well

Revised Proposed Regulation: NYSDEC did not include a requirement at 6 NYCRR § 552.1(c) for an operator to submit a Sundry Well Notice and Report Form for re-fracture treatment of an existing well.

Prior Comment and Response: Comment 7801 recommended that NYSDEC require an operator to submit an application prior to re-fracturing a well. [Comment 7801].

NYSDEC explained that a Sundry Well Notice and Report Form for re-fracture treatment of an existing well is required for HVHF wells under Part 560, but did not respond to the Commenter's recommendation that this standard be met for all wells that are hydraulically fractured in NYSDEC, not just HVHF wells. [Response 7801].

Recommendation: Include a requirement for a Sundry Well Notice and Report Form for re-fracture treatment of an existing well for all wells that undergo hydraulic fracturing stimulation treatment, not just HVHF wells.

6 NYCRR § 552.2(c) Permit Term

Revised Proposed Regulation: 6 NYCRR § 552.2(c) proposes the following language extending the permit term from 180 days to two years.

> *"If the operations for which the permit is granted have not commenced and been pursued in a diligent manner within [180 days] two calendar years from the date of issuance of the permit, said permit shall expire."*

Recommendation: NYSDEC should either reduce the permit term to 180 days or require that the operator resurvey and update its plat within 30 days prior to commencement of the second year, to verify continued compliance with all required surface setbacks.

6 NYCRR § 552.2(e) Verbal Issuance of a Permit

Revised Proposed Regulation: NYSDEC proposes no changes to 6 NYCRR § 552.2(e), which allows verbal approval to commence operations prior to issuing a permit, as follows:

> *Under unusual or emergency circumstances, or for other good cause, the department may permit the commencement of operations by verbal authority of the director prior to the issuance of a formal permit.*

Prior Comment and Response: NYSDEC disagreed with several Commenters who recommended that the verbal approval authority be removed unless the rationale for and circumstances under which verbal authority are allowed are clearly laid out [Responses 3876 and 7803].

NYSDEC responded that verbal approvals are permitted under the existing regulations, but provides no justification for retention of verbal approval. NYSDEC reminds the commenters that the applicant would still be required to meet the regulations and an application would need to be on file.

NYSDEC does not explain how issuing a verbal approval ahead of a complete and thorough permit review and environmental assessment is equivalent to issuing a formal written permit approval.

NYSDEC has not provided any rationale for retaining the existing regulatory language, nor has it explained what type of unusual or emergency circumstances may occur that would prevent the agency from issuing a letter clearly stating what operations are or are not approved. The only indication of possible situations where a verbal approval might be granted is explained in Response 7803, where NYSDEC states it might issue a verbal approval for an emergency remedial operation or drilling a relief well. In both these cases an operator would need its engineering team to develop a remediation plan or

relief well plan, which can take one to several days. There is sufficient time for NYSDEC to work with the operator's engineering team to understand the proposed plan and issue an expedited written approval.

Recommendation: No operations should commence without a formal written permit approval. Even in the case of unusual or emergency circumstances, there is sufficient time for NYSDEC to issue a brief letter clearly stating what operations are or are not approved and justifying the unusual or emergency circumstances that prompted the expedited approval. If NYSDEC continues to allow operations prior to issuance of a permit, the agency should clearly delineate in the regulation the type of unusual or emergency circumstances that would warrant and justify a verbal approval and are so urgent that no written documentation can be accomplished.

6 NYCRR § 553.1(c) Three-Year Drilling Limit

Revised Proposed Regulation: NYSDEC revised 6 NYCRR §§ 553.1(a)(6) and 553.1(c) to remove the requirement to drill infill wells within a three-year period.

Prior Comment and Response: Industry Comment 6308 requested relief from the proposed requirements at 6 NYCRR § 553.1(a)(6) and 6 NYCRR § 553.1(c) to drill all infill wells from a common well pad within three years of the data that the first well in the unit commences drilling. Industry wrote:

> ***The Part 553.1(a)(6) requirement that all horizontal wells be drilled from the common well pad within three years of the date the first well in the unit commences drilling may be unrealistic.*** *The same is true for the 553.1(c) requirement that infill wells deemed necessary must be drilled within three years from the date the first well in the unit commences drilling.* ***Industry recommends that Part 553.1(c) be more flexible to accommodate potential legislative changes*** *and, therefore, should be amended to read as follows: In a spacing unit established pursuant to paragraph (6) of subdivision (e) of this section, infill wells shall be deemed necessary to satisfy the policy objectives of Part 550 of this Title [emphasis added].*

NYSDEC accepted this comment by changing 6 NYCRR § 553.1(c) to eliminate the following bold text:

> *The department may issue permits to drill infill wells on a reasonably uniform pattern within the spacing unit after an integration order has been issued, if required, and only if it determines that drilling infill wells is necessary to satisfy the policy objectives of Part 550 of this Title. . . . In a spacing unit established pursuant to paragraph (6) of subdivision (a) of this section, infill wells shall be deemed necessary,* ***and the number of infill wells required to satisfy the policy objectives of Part 550 of this Title must be drilled within three years of the date the first well in the unit commences drilling*** *[emphasis added].*

The effect of this revision is to eliminate completely not only the three-year deadline for drilling infill wells but also the need for any determination that the Part 550 policy objectives have been met.

Recommendation: The 2011language of 6 NYCRR § 553.1(a)(6) and 6 NYCRR § 553.1(c), requiring that all infill wells be drilled from the common well pad within three years of the date the first well in the unit commences drilling, was derived directly from express language in ECL §§ 23-0501(1)(b)(1)(vi) and 23-0503(4). NYSDEC does not have the authority to adopt regulations that eliminate a statutory

requirement. The 2011 language of 6 NYCRR § 553.1(a)(6) and 6 NYCRR § 553.1(c) should be restored.

6 NYCRR § 553.2 Surface Restrictions

Revised Proposed Regulation: NYSDEC did not propose any improvements to existing surface restrictions at 6 NYCRR § 553.2. Existing regulations require wells to be set back at least:

- 100' from any inhabited private dwelling house without written consent of the owner;
- 150' from any public building or area which may be used as a place of resort, assembly, education, entertainment, lodging, trade, manufacture, repair, storage, traffic or occupancy by the public;
- 75' feet to the traveled part of any State, county, township, or municipal road or any public street, road or highway; and
- 50' feet from any public stream, river or other body of water.

Prior Comment and Response: NYSDEC responded that it increased the well set back to 500' for HVHF wells located near inhabited private dwellings and places of assembly, which is an improvement over the existing setback requirements of 100 and150' respectively; however, NYSDEC did not apply the 500' standard to all wells. Nor did NYSDEC provide any scientific or technical analysis to justify its 500' distance, or to justify its decision not to increase any other surface setback distances, despite extensive comment received on this topic from a number of commenters.

NYSDEC did not adequately address Comment 4231 that recommended that NYSDEC increase well setbacks for all wells, not just HVHF wells, to:

- 500' from homes and public buildings;
- 1,000' from homes whose owners did not sign a lease;
- 1,000' from schools;
- 2,000' from any water body; and
- 5,000' from residential and municipal water well sources.

NYSDEC did not adequately address Comment 7806 that recommended NYSDEC increase well setbacks for all wells, not just HVHF wells, to:

- 3,000' from any stream, river, other body of water or private water well; and
- Adopt California's ¼ mile setback from public buildings to account for air quality impacts.

NYSDEC did not acknowledge or respond to our 2012 Recommendations on surface setbacks at all. Specifically, the Harvey Report Recommendations Nos. 61-72 proposed that NYSDEC complete the following scientific and technical assessment and establish improved surface setbacks for all wells in NYS, not just HVHF wells.

- **Recommendation No. 1**: The SGEIS should provide scientific and technical justification for each setback distance proposed to demonstrate how that distance is protective of the nearby sensitive receptor. A hazard identification analysis should be completed to assess the safe distance from human and sensitive environmental receptors to proposed shale gas drilling and

HVHF operations. The analysis should assess blowout radius, spill trajectory, explosion hazards, other industrial hazards, fire code compliance, human health, agricultural health, and quality-of-life factors. Improved setbacks as a result of this analysis should be included in the SGEIS as a mitigation measure and codified in the NYCRR.

- **Recommendation No. 2**: The SGEIS and NYCRR should allow local zoning authorities to establish more protective setbacks than statewide regulations to address unique and site-specific local concerns and community characteristics. The ability to improve local setbacks should be included in the SGEIS as a mitigation measure and codified in the NYCRR.

- **Recommendation No. 3**: The process for revising the 500' setback from primary and principal aquifers and the 2,000' setback from a public water supply in two and three years, respectfully, is unclear. NYSDEC should clarify the review process, including an explanation of its plans for public review and comment. NYSDEC should revise its regulations at 6 NYCRR § 617.4(b) to provide that the siting of any oil or gas well within 500' of a primary aquifer or within 2,000 of a public water supply is a Type I action.

- **Recommendation No. 4**: The SGEIS should examine whether waivers to the 500' private water well setback comport with federal law and the requirement to protect Underground Sources of Drinking Water (USDWs). The SGEIS should provide technical justification for any reduction in this setback, and should not allow a private well owner to reduce the setback such that it poses a risk to its water supply, as well as other user in the area. Private land owners should not be allowed to waive setbacks from private water wells and adversely affect the water quality of neighboring wells.

- **Recommendation No. 5**: The conflicting language between the 150' setback requirement and 2,000' setback requirement for lakes, rivers, and streams needs to be resolved in both the SGEIS and the NYCRR. As drafted, neither the RDSGEIS nor the NYCRR are clear which lakes, rivers, and streams would be protected by the 150' setback, and which would be protected by a 2,000' setback. NYSDEC should indicate whether it intends to apply the 150' setback only to surface water resources that are not actual or potential public drinking water supplies. NYSDEC should also explain whether the 150' set back is sufficient to protect those water resources, or whether this setback should be increased. Improved setbacks as a result of this analysis should be included in the SGEIS as a mitigation measure and codified in the NYCRR.

- **Recommendation No. 6**: The 4,000' setback from NYC and Syracuse watersheds should be added to the proposed regulatory revisions for operations associated with HVHF at 6 NYCRR § 560.4. The SGEIS and NYCRR should also clarify if activities associated with HVHF drilling and completions will be prohibited underneath the watershed as well as on the surface.

- **Recommendation No. 7**: The setback increases proposed in the RDSGEIS should apply to all oil and gas drilling in NYS and should be codified at 6 NYCRR § 553.2.

- **Recommendation No. 8**: Improved setbacks should be included in the SGEIS as a mitigation measure and codified in the NYCRR. Specifically, the SGEIS and NYCRR should be revised at 6 NYCRR § 553.2 to include the following minimum setbacks: homes, public buildings, and schools (1,320'; ¼ mile); private and public wells, primary aquifers, and other sensitive water resources (4,000'); and other water resources (660'; 1/8 mile). Additionally, NYSDEC should clarify the authority of local zoning authorities to establish minimum setbacks that are more

protective than NYS' minimum standards in order for localities to address unique and site-specific local concerns and community characteristics.

- **Recommendation No. 9**: The NYCRR should be revised at 6 NYCRR § 552.3 to allow the well location to be adjusted by 75' without a permit amendment only if all the statewide and local setback requirements are still preserved.

- **Recommendation No. 10**: The NYCRR should be revised at 6 NYCRR § 553.2 to include a wetland setback of at least 100' as described in the RDSGEIS.

- **Recommendation No. 11**: The NYCRR should be revised at 6 NYCRR § 750-3.3, 6 NYCRR § 750-3.2, 6 NYCRR § 553.2, and 6 NYCRR § 560.4 to provide consistent setback requirements that are protective of water sources, including rivers, streams, lakes, and private water supplies.

- **Recommendation No. 12:** NYCRR and the SGEIS should clarify that setbacks are measured from the edge of the well pad. Wells should be centered on the well pad and should be set back at least 100' from the pad edge, to maximize well setbacks from sensitive receptors.

The Myers Report, an annexed portion of our comments, also recommended that:

- NYSDEC examine existing setbacks to verify if they have been successful or whether increased setbacks are warranted;
- Wells be set back at least 500' from wells and springs;
- Wells be set back at least 4,000' from primary aquifers and public water supplies; and
- Well not be placed within the 500-year flood plain.

While NYSDEC stresses the importance of establishing setbacks, it does not provide any scientific or technical assessment to demonstrate that its proposed setbacks meet its own stated criteria. Instead, NYSDEC's reasoning behind its proposed setback distances is often uncertain or unspecified.

For example, NYSDEC states that it requires setbacks "to conservatively provide a margin of safety should the operational mitigation measures fail or not be implemented in a particular instance" and that "setbacks serve as a means of helping to prevent a spill from reaching and contaminating critical water resources. Depending on the scope of the setback (**the larger the distance the greater the protection**), a spill can potentially be contained, or sufficiently delayed before reaching the water source to reduce the potential impact." [Response 6136; emphasis added]. If these are NYSDEC's primary goals, then sites that are on a flowpath either downstream or downgradient from a gas well should be farther from the gas well than a site cross-gradient or upgradient from the gas well.

In general, NYSDEC does not respond to Commenters' concerns about setbacks with logic and reasoning – it just disagrees. For example, in response to Comment 3826 about the need for increased setback distances, NYSDEC writes: "*The Department **does not agree** that the commenter's proposed prohibitions are necessary. Exiting Parts 550 – 559 regulations, the proposed Part 560 regulations and the prohibitions/restrictions found in the rdSGEIS **provide adequate protections** for the public drinking water supplies, and the environment. The presence of FIDs or faults does not mean these features are open and able to transmit fluids at depth."* [Response 3826]. Here, NYSDEC simply asserts a disagreement and states that regulations are adequate without providing any reasoning. As for faults, some may not transmit fluids, but many do, and NYSDEC has chosen to ignore that possibility.

Recommendation: Include a requirement to increase all well surface setbacks in NYS on the basis of a scientific and technical analysis to justify all proposed surface setback distances. Respond to Comments 4231 and 7806 as wells as our 2012 Recommendations, including the Harvey Report Recommendations Nos. 61- 72 and the Myers Report recommendations on setbacks.

6 NYCRR § 553.3(f) Input from Affected Persons

Revised Proposed Regulation: In 6 NYCRR § 553.3, NYSDEC included a new requirement to seek input from all affected persons on spacing units, stating:

> *The Department may, upon its own initiative or at the request of the owner or operator, upon good cause shown, modify an order establishing a spacing unit or a spacing unit which conforms to statewide spacing without conducting a hearing if a finding has been made that no facts are in dispute after all affected persons have been provided a reasonable opportunity to comment. For spacing units established pursuant to paragraph (6) of subdivision (a) of section 553.1 of this Part, failure to drill infill wells pursuant to subdivision (c) of section 553.1 of this Part shall constitute good cause for the department to initiate a modification of the spacing unit.*

Prior Comment and Response: Comment 7807 requested that NYSDEC define the term "affected persons" to include, at minimum, landowners and local governments and to define what constitutes a "reasonable opportunity to comment." NYSDEC rejected the recommendation to include a local government in the definition of "affected persons" but did not define what an "affected person" is. [Response 7807]. NYSDEC stated that it responded to a comment seeking a definition of "reasonable opportunity to comment" in Response 4326; however, this response does not appear to exist.

Recommendation: NYSDEC should clearly define the term "affected persons" and "reasonable opportunity to comment" in 6 NYCRR § 553, and should include local governments in the definition of "affected persons."

6 NYCRR § 553.4(a) Public Comment on Variance Applications

Revised Proposed Regulation: NYSDEC has proposed a revision to language in 6 NYCRR § 553.4(a) which currently provides for a mandatory public hearing when an applicant seeks an exception from a well spacing requirement. Under the proposed change, the application would instead trigger a public comment period of 15 days after NYSDEC's publication in the Environmental Notice Bulletin ("ENB") of a notice of intent to issue a variance to the well spacing provisions of 6 NYCRR § 553. The proposed regulations do not specify what information is required in such notice.

Prior Comment and Response: Comment 10942 states that the elimination of mandatory hearings for each variance application "severely limit[s] the role of public participation." In Response 10942, NYSDEC states that the requirement in 6 NYCRR § 553.4 to hold a public comment period prior to scheduling a hearing makes the variance review process consistent with the public notice and hearing requirements found in other parts of ECL Article 23, such as § 23-0503(3) and § 23-0503(6). However, ECL § 23-0503(3) provides for a 30-day public comment period in contrast to the 15-day comment period proposed herein. As a result, 6 NYCRR § 553.4 is not consistent with Article 23 with regard to the required public comment timeframe.

Moreover, the public notice provision in § 553.4(a) does not specify what information must be included in the ENB notice and does not state that publication of the permit and variance application is required. NYSDEC should adopt the Uniform Procedures Act (UPA) regulatory requirements for the content of the ENB notice. As required by 6 NYCRR § 621.7(b)(6), this subsection should provide that the ENB notice contain:

> *(1) The applicant's name; (2) A brief description of the proposed project and its location; (3) A list of all department permits for the project for which application has been made, and identification numbers for those applications; (4) The name and telephone number of the department representative and, where applicable, of any lead agency representative to contact for further information; (5) The status of environmental reviews conducted under SEQR . . . .*

Lastly, notice in the ENB alone is insufficient to alert key stakeholders of the pending variance application. Residents who would be most affected may not be aware of such an application, especially given the short timeframe provided for public comment. The UPA regulations provide that the Department may require the applicant to provide other reasonable notice of a complete application, such as distribution or posting of information, public information meetings, or translation of notices for non-English speaking communities. 6 NYCRR § 621.7(e). The regulations further require that a notice of complete application be provided to agencies that have jurisdiction to fund or to approve or that are directly undertaking the project; agencies with which the Department is required to consult prior to its determination of completeness, including but not limited to those responsible for historic preservation and costal management; and any person on a mailing list, developed by the Department, of persons interested in such projects. 6 NYCRR § 621.7(i).

In addition, the public must be granted access to the variance application and supporting documentation. Without access to the variance application and supporting materials the public cannot assess the accuracy of those documents nor comment meaningfully on the application.

Recommendation: NYSDEC should amend 6 NYCRR § 553.4(a) to provide for a 30-day comment period consistent with that required by ECL § 23-0503(3), and incorporate the language of 6 NYCRR § 621.7(b) specifying the information required in the ENB notice. NYSDEC should also make variance applications and all supporting documentation publicly available on its website. Finally, the notice of intent to issue a permit and spacing variance should be provided to all authorities listed in 6 NYCRR 621.7(i), as well as to the municipal and county chief executive officers and all residents and property owners of the spacing unit in which HVHF operations would take place.

6 NYCRR § 553.4(b) Public Hearing for Variance Applications

Revised Proposed Regulation: NYSDEC has proposed a revision to 6 NYCRR § 553.4 to eliminate the provision for a mandatory public hearing when an applicant seeks a variance from a well spacing provision.

Prior Comment and Response: Comment 10942 states that the elimination of mandatory hearings for each variance application "severely limit[s] the role of public participation." Response 10942 does not address this concern, stating simply:

> "*[t]he only difference between the existing and proposed regulations is that a public comment period will provide an opportunity for the Department to receive comments on*

the application before scheduling a hearing and Department staff will be provided an opportunity to determine whether a hearing is even necessary." [Response 10942].

NYSDEC mischaracterizes the proposed change. Instead of a mandatory hearing, the change would leave such hearing wholly within NYSDEC's discretion. When NYSDEC decides that no hearing is necessary, the public's ability to present oral testimony and participate in NYSDEC decision-making will be eliminated.

Recommendation: NYSDEC should not modify this subsection to eliminate mandatory public hearings. If NYSDEC decides nevertheless to eliminate mandatory hearings, it should specify that the determination to hold a hearing and the hearing process pursuant to NYCRR § 553.4(b) will be governed by the UPA and its implementing regulations at 6 NYCRR § 621.8.

6 NYCRR § 554 Secondary Containment for Fuel Tanks

Revised Proposed Regulation: Proposed 6 NYCRR § 560.6(b)(1)(i) requires secondary containment for HVHF operation fuel tanks, but NYSDEC did not revise 6 NYCRR § 554 to require any improved secondary containment requirements for other wells drilled in NYS.

Prior Comment and Response: Comment 5798 requested "*Secondary containment requirements for fuel tanks should extend to all hydrocarbon drilling and high-volume hydraulic fracturing operations in New York State. The requirements should not be limited to shale gas drilling and high-volume hydraulic fracturing operations. These recommendations should be captured in 6 NYCRR 554.*"

NYSDEC only reaffirmed its plan to required improved secondary containment for HVHF well fuel tanks, but did not respond at all to the recommendation to improve secondary containment for fuel tanks used for all other wells drilled in NYS. [Response 5798].

Recommendation: NYSDEC should revise 6 NYCRR § 554 to require improved secondary containment requirements for all wells drilled in NYS, or provide a technical basis for requiring improved secondary containment for some fuel tanks and not others.

6 NYCRR § 554 Casing Requirements for All Wells

Revised Proposed Regulation: NYSDEC did not include improved regulations under Part 554 for conductor, surface, intermediate and production casing for hydrocarbon wells drilled in NYS that do not meet the HVHF definition.

Prior Comment and Response: NYSDEC did not respond our 2012 Recommendations that casing requirements be improved for all wells, not just HVHF wells (see Harvey Report Recommendations for conductor, surface, intermediate and production casing, which are reproduced in full below).

Recommendations:

NYSDEC should revise its Part 554 regulations to include best practice for oil and gas well construction for all wells drilled in NYS, or provide technical and scientific data and analysis to explain why only HVHF wells deserve to be constructed to current best practice standards and all other wells do not.

Recommendations for Conductor Casing:

Conductor casing requirements listed in the Proposed Supplementary Permit Conditions for HVHF and Existing Fresh Water Supplementary Permit Conditions Required for Wells Drilled in Primary and Principal Aquifers should be codified in the NYCRR and should apply to all wells drilled in NYS, not just HVHF wells. Additionally, NYSDEC should set a conductor casing depth criterion, requiring conductor casing be set to a sufficient depth to provide a solid structural anchorage. Regulations should specify that conductor casing design be based on site-specific engineering and geologic factors. More specifically it should include:

1. New conductor casing must be set to stabilize unconsolidated sediments and isolate shallow groundwater.

2. Conductor casing must be set to a depth sufficient to provide solid structural anchorage for a diverter system, unless the operator provides sufficient technical justification to that the absence of conductor casing will not jeopardize well control.

3. Conductor casing must be new casing and be placed across the entire length of the conductor casing hole.

4. Conductor casing may be driven into the ground, or a hole may be drilled into the ground and the conductor casing set and cemented in that hole.

5. Conductor casing design and setting depth must be based on engineering and geologic factors relevant to the immediate vicinity, including the presence or absence of hydrocarbons, and potential drilling hazards.

6. Conductor casing set in a drilled hole must be cemented by filling the annular space with cement from the shoe to the surface. At least two centralizers must be run with one at the shoe and one at the middle of the casing string. Operator must verify cement is returned to the surface and that the annular space is completely filled with cement.

7. A mechanical or cement seal must be installed at the surface to block downward migration of surface pollutants.

Recommendations for Surface Casing:

Surface Casing Setting Depth: NYSDEC should include 100' protection for all oil and gas wells. Additionally, NYSDEC needs to clarify whether this setting depth is intended to protect potable freshwater only, or include a broader definition of protected groundwater, which would result in deeper surface casing depths. Surface casing must be set deep enough and into a competent formation to ensure the BOP can contain any formation pressure that many be encountered when drilling the next section of the hole below the surface casing shoe. This requirement should apply to all NYS wells.

Protected Water Depth Verification: The freshwater depth should be estimated in the drilling application to aid in well construction design. The actual protected water depth should be verified with a resistivity or electrical conductivity log or other sampling method. If the actual protected water depth extends beyond the estimated protected water depth, an additional string of intermediate casing should be required. This requirement should apply to all NYS wells.

Cement Sheath Width: A cement sheath of at least 1-1/4" should be installed on all oil and gas wells. Thin cement sheaths are easily cracked and damaged. This requirement should apply to all NYS wells.

Amount of Cement in Annulus: The surface casing annulus should be completely filled with cement; this should be clearly specified. There should be no void space in the annulus. This requirement should apply to all NYS wells.

Shallow Gas Hazards: If a shallow gas hazard is encountered, surface hole drilling must stop and surface casing must be set and cemented before drilling deeper into hydrocarbon resources. All oil and gas well designs and applications should plan for shallow gas hazards. Any shallow gas hazards encountered while drilling should be recorded. This requirement should apply to all NYS wells.

Excess Cement Requirements: 25% excess cement is standard practice, unless a caliper log is run to more accurately assess hole shape and required cement volume. This requirement should apply to all NYS wells.

Cement Type: The cement must conform to API Specification 10A, Specifications for Cement and Material for Well Cementing (April 2002 and January 2005 Addendum). Further, the cement slurry must be prepared to minimize its free water content, in accordance with the same API specification, and it must contain a gas-block additive. HVHF cement quality requirements (including API specifications and the use of gas-blocking additives) is best practice. Cement must include additives in areas where CO_2 and H_2S, and other lithologic and physical conditions exist surrounding the wellbore to protect the casing from corrosion and the cement from subsequent deterioration and resist degradation by chemical and physical conditions anticipated in the well. These practices should apply to all wells, not just HVHF wells.

Cement Mix Water Temperature and pH Monitoring: Best practice is for the free water separation to average no more than six milliliters per 250 milliliters of tested cement, in accordance with the current API RP 10B. Best practice is to test for pH to evaluate water chemistry and ensure cement is mixed to manufacturer's recommendations. This requirement should apply to all NYS wells, not just HVHF wells.

Lost Circulation Control: Lost circulation control is best practice. This requirement should apply to all NYS wells, not just HVHF wells.

Spacer Fluids: The use of spacer fluids to separate mud and cement, to avoid mud contamination of the cement, is best practice. This requirement should apply to all NYS wells, not just HVHF wells.

Hole Conditioning: Hole conditioning before cementing is best practice. Require mud to be circulated and conditioned with a minimum of two hole volumes; adjusting drilling fluid rheology to optimize conditions for displacement of the drilling fluid and ensuring that the wellbore is static and that all gas flows are killed. This requirement should apply to all NYS wells, not just HVHF wells.

Cement Installation and Pump Rate: The requirement for cement to be pumped at a rate and in a flow regime that inhibits channeling of the cement in the annulus is a good practice. Float valves must be used and verified to have held to prevent cement backflow in the drill string. This requirement should apply to all oil and gas wells, not just HVHF wells.

Rotation and Reciprocation: Rotating and reciprocating casing while cementing is a best practice to improve cement placement. This requirement should apply to all NYS wells.

Centralizers: The proposed conditions reference an outdated API casing centralizer standard. Best practice is to use at least two centralizers and follow API RP 10D-2 (July 2010). This requirement should apply to all NYS wells, not just HVHF wells.

Casing Quality: New casing should be used in all wells. Once installed, surface casing remains in the well for the life of the well, and typically remains in place when the well is plugged and abandoned. It is important that the surface casing piping string (known as "the water protection piping string") is of high quality to maximize the corrosion allowance and life-cycle of the piping. The installation of older, used, thinner pipe, with less remaining corrosion allowance, may be a temporary solution, but not a long-term investment in groundwater protection. Used piping may pass an initial pressure test; however, it will not last as long as new piping, and will not be as protective of water resources in the long-term.

Casing Thread Compound: The requirement to use casing thread compound that conforms to API RP 5A3 (November 2009) is a good practice. This requirement should apply to all oil and gas wells, not HVHF wells.

Drilling Mud: The use of compressed air or WBM (with no toxic additives) is best practice when drilling through protected water zones. This should be a requirement for all NYS wells.

Cement Setting Time: Best practice is to have surface casing strings stand under pressure until the cement has reached a compressive strength of at least 500 psi in the zone of critical cement, before drilling out the cement plug or initiating a test. Additionally, the cement mixture in the zone of critical cement should have a 72-hour compressive strength of at least 1,200 psi. This requirement should apply to all NYS wells.

NYS Inspectors: Best practice is to have a state inspector on site during cementing operations, to verify surface casing cement is correctly installed, before attaching the blowout preventer and drilling deeper into the formation. This requirement should apply to all NYS wells.

Cement QA/QC: Circulating cement to the surface is one indication of successfully cemented surface casing, but it is not the only QA/QC check that should be conducted. Cement circulation to surface can be achieved even when there are mud or gas channels, or other voids in the cement column. Circulating cement to the surface also may not identify poor cement to casing wall bonding. These integrity problems, among others, can be further examined using a cement evaluation tool and temperature survey.

Formation Integrity Test: It is best practice to complete a formation integrity test to verify the integrity of the cement in the surface casing annulus at the surface casing shoe. The test should be conducted after drilling out of the casing shoe, into at least 20 feet, but not more than 50 feet of new formation. The test results should demonstrate that the integrity of the casing shoe is sufficient to contain the anticipated wellbore pressures identified in the application for the Permit to Drill. This requirement should apply to all NYS wells.

BOP Installation: The Appendix 8 requirement is best practice. Additionally, the surface casing should be pressure tested to ensure it can hold the required working pressure of the BOP. This requirement should apply to all NYS wells.

Record Keeping: Best practice is to keep permanent records for each well, even after the well is plugged and abandoned (“P&A'd”). This information will be needed by NYSDEC and industry during the well's operating life, will be critical for designing the P&A, and may be required if the well leaks post-P&A.

This requirement should apply to all NYS wells, not just HVHF wells. P&A'd wells do occasionally leak, and well information is may be needed to develop a re-entry, repair, re-P&A plan.

Additional Casing or Repair: NYSDEC should reserve the right to require industry to install additional cemented casing strings in wells, and repair defective casing or cementing, as deemed necessary for environmental and/or public safety reasons. This requirement should apply to all wells, not just HVHF wells.

Pressure Testing: Casing and piping should be pressure tested. Complete a formation integrity test to verify the integrity of the cement in the surface casing annulus at the surface casing shoe. The test must be conducted after drilling out of the casing shoe, into at least 20 feet, but not more than 50 feet of new formation. The test results must demonstrate that the integrity of the casing shoe is sufficient to contain the anticipated wellbore pressures identified in the application for the Permit to Drill. Pressure test surface casing should be pressure tested to ensure it can hold the required working pressure of the BOP.

Intermediate Casing Recommendations for All Wells:

Setting Depth: Best practice is to set intermediate casing at least 100' below the deepest protected groundwater, to seal off anomalous pressure zones, lost circulation zones, and other drilling hazards. Although intermediate casing setting depth is site specific, there should be criteria for determining that depth. This requirement should apply to all NYS wells.

Protected Water Depth Verification: The freshwater depth should be estimated in the drilling application to aid in well construction design. The actual protected water depth should be verified with a resistivity log or other sampling method during drilling, ensuring intermediate casing protects that groundwater. This requirement should apply to all NYS wells where intermediate casing is set.

Cement Sheath Width: A cement sheath of at least 1-1/4" should be installed. Thin cement sheaths are easily cracked and damaged. This requirement should apply to all NYS wells where intermediate casing is set.

Amount of Cement in Annulus: It is best practice to fully cement intermediate casing if technically feasible to isolate protected water zones, and to seal off anomalous pressure zones, lost circulation zones, and other drilling hazards. If the casing cannot be fully cemented, most states require cement to be placed from the casing shoe to a point at least 500-600' above the shoe. This requirement should apply to all wells where intermediate casing is set.

Excess Cement: 25% excess cement is standard practice, unless a caliper log is run to assess the hole shape and required cement volume. This requirement should apply to all wells where intermediate casing is set.

Cement Type: Cement must conform to API Specification 10A, Specifications for Cement and Material for Well Cementing (April 2002 and January 2005 Addendum). The cement slurry must be prepared to minimize its free water content, in accordance with the same API specification, and it must contain a gas-block additive. HVHF cement quality requirements (including API specifications and the use of gas-blocking additives) are best practice. Cement must include additives in areas where CO_2 and H_2S, and other lithologic and physical conditions exist surrounding the wellbore to protect the casing from corrosion and the cement from subsequent deterioration and resist degradation by chemical and physical conditions anticipated in the well. However, these practices should apply to all wells where intermediate casing is installed, not just HVHF wells.

Cement Mix Water Temperature and pH Monitoring: Best practice is for the free water separation to average no more than six milliliters per 250 milliliters of tested cement, in accordance with the current API RP 10B. Best practice is to test for pH to evaluate water chemistry and ensure cement is mixed to manufacturer's recommendations. These requirements should apply to all NYS wells where intermediate casing is required, not just HVHF wells.

Lost Circulation Control: Lost circulation control is best practice. This requirement should apply to all NYS wells where intermediate casing is required.

Spacer Fluids: The use of spacer fluids to separate mud and cement, to avoid mud contamination of the cement, is best practice. This requirement should apply to all NYS wells where intermediate casing is used, not just HVHF wells.

Hole Conditioning: Hole conditioning before cementing is best practice. Require mud to be circulated and conditioned with a minimum of two hole volumes; adjusting drilling fluid rheology to optimize conditions for displacement of the drilling fluid and ensuring that the wellbore is static and that all gas flows are killed. This requirement should apply to all NYS wells, not just HVHF wells.

Cement Installation and Pump Rate: The requirement for cement to be pumped at a rate and in a flow regime that inhibits channeling of the cement in the annulus is a good practice. Float valves must be used and verified to have held to prevent cement backflow in the drill string. This requirement should apply to all oil and gas wells, not just HVHF wells.

Rotation and Reciprocation: Rotating and reciprocating casing while cementing is a best practice to improve cement placement. This requirement should apply to all NYS wells.

Centralizers: The proposed conditions reference an outdated API casing centralizer standard. Best practice is to use at least two centralizers and follow API Recommended Practice for Centralizer Placement, API RP 10D-2 (July 2010). This requirement should apply to all NYS wells where intermediate casing is installed.

Casing Quality: The use of new pipe conforming to API Specification 5CT is best practice. This requirement should apply to all NYS wells where intermediate casing is set.

Casing Thread Compound: The requirement to use casing thread compound that conforms to API RP 5A3 (November 2009) is a good practice. This requirement should apply to all oil and gas wells, not just HVHF wells.

Drilling Mud: The use of compressed air or WBM (with no toxic additives) is best practice when drilling through protected water zones. This should be a requirement for all wells during the period when drilling occurs through protected water zones.

Cement Setting Time: Best practice is to have casing strings stand under pressure until cement reaches a compressive strength of at least 500 psi in the zone of critical cement, before drilling out the cement plug or initiating a test. Additionally, the cement mixture in the zone of critical cement should have a 72-hour compressive strength of at least 1,200 psi. This requirement should apply to all NYS wells, not just HVHF wells.

NYSDEC Inspector: Best practice is to have a state inspector onsite during cementing operations. This requirement should apply to all NYS wells where intermediate casing is installed.

Cement QA/QC: The use of a cement evaluation logging tool is best practice. This requirement should apply to all wells where intermediate casing is set.

Record Keeping: Best practice is to keep permanent records for each well, even after the well is plugged and abandoned ("P&A'd"). This information will be needed by NYSDEC and industry during the well's operating life, will be critical for designing the P&A, and may be required if the well leaks post P&A. This requirement should apply to all NYS wells, not just HVHF wells. P&A'd wells do occasionally leak, and well information is may be needed to develop a re-entry, repair, re-P&A plan.

Additional Casing or Repair: NYSDEC should reserve the right to require industry to install additional cemented casing strings in wells, and repair defective casing or cementing, as deemed necessary for environmental and/or public safety reasons. This requirement should apply to all wells.

Pressure Testing: Casing and piping should be pressure tested.

Production Casing Recommendations for All Wells:

Casing Design: For all wells, it is best practice for the productive horizon(s) to be determined by coring, electric log, mud-logging, and/or testing to aide in optimizing final production string design and placement. Casing used to isolate protected water must not be used as the production string in the well in which it is installed, and may not be perforated for purposes of conducting a hydraulic fracture treatment through it. It is best practice to install production casing on a case-by-case basis for most wells; however, it is best practice to install a full string of production casing on HVHF wells to provide a conduit for the HVHF job and provide an extra layer of casing and cement.

Cement Sheath Width: A cement sheath of at least 1-1/4" should be installed on all oil and gas wells. Thin cement sheaths are easily cracked and damaged. This requirement should apply to all NYS wells.

Amount of Cement in Annulus: Cementing production casing to surface if technically feasible (becomes more difficult with increasing depth), or at least 500' into the intermediate casing string is best practice. This requirement should apply to all NYS wells where production casing is set.

Excess Cement Requirements: 25% excess cement is standard practice, unless a caliper log is run to assess the hole shape and required cement volume. This requirement should apply to all wells where production casing is set.

Cement Type: Cement must conform to API Specification 10A, Specifications for Cement and Material for Well Cementing (April 2002 and January 2005 Addendum). Further, the cement slurry must be prepared to minimize its free water content in accordance with the same API specification and it must contain a gas-block additive. HVHF cement quality requirements (including API specifications and the use of gas-blocking additives) are best practice. Cement must include additives in areas where CO_2 and H_2S, and other lithologic and physical conditions exist surrounding the wellbore to protect the casing from corrosion and the cement from subsequent deterioration and resist degradation by chemical and physical conditions anticipated in the well. However, these practices should apply to all wells where production casing is installed, not just HVHF wells.

Cement Mix Water Temperature and pH Monitoring: Best practice is for the free water separation to average no more than six milliliters per 250 milliliters of tested cement, in accordance with the current API RP 10B. Best practice is to test for pH to evaluate water chemistry and ensure cement is mixed to

manufacturer's recommendations. These requirements should apply to all NYS wells where production casing is required, not just HVHF wells.

Lost Circulation Control: Lost circulation control is best practice. This requirement should apply to all NYS wells where production casing is required.

Spacer Fluids: The use of spacer fluids to separate mud and cement, to avoid mud contamination of the cement, is best practice. This requirement should apply to all NYS wells where production casing is used, not just HVHF wells.

Hole Conditioning: Hole conditioning before cementing is best practice. Require mud to be circulated and conditioned with a minimum of two hole volumes; adjusting drilling fluid rheology to optimize conditions for displacement of the drilling fluid and ensuring that the wellbore is static and that all gas flows are killed. This requirement should apply to all NYS wells, not just HVHF wells.

Cement Installation and Pump Rate: The requirement for cement to be pumped at a rate and in a flow regime that inhibits channeling of the cement in the annulus is a good practice. This requirement should apply to all oil and gas wells, not just HVHF wells.

Rotation and Reciprocation: Rotating and reciprocating casing while cementing is a best practice to improve cement placement. This will become more difficult with a deviated wellbore, but should be attempted if achievable. This requirement should apply to all NYS oil and gas wells, not just HVHF wells.

Centralizers: Best practice is to use at least two centralizers and follow API Recommended Practice for Centralizer Placement, API RP 10D-2 (July 2010). This requirement should apply to all NYS wells where production casing is installed.

Casing Quality: The use of new pipe conforming to API Specification 5CT is best practice. This requirement should apply to all NYS wells where production casing is set.

Casing Thread Compound: The requirement to use casing thread compound that conforms to API RP 5A3 (November 2009) is a good practice. This requirement should apply to all oil and gas wells, not just HVHF wells.

Cement Setting Time: Best practice is to have casing strings stand under pressure until cement reaches a compressive strength of at least 500 psi in the zone of critical cement, before drilling out the cement plug or initiating a test. This requirement should apply to all NYS wells, not just HVHF wells.

NYSDEC Inspector: Best practice is to have a state inspector onsite during cementing operations. This is more typical for surface and intermediate casing, but can be considered for production casing as well.

Cement QA/QC: The use of a cement evaluation logging tool is best practice. This requirement should apply to all wells where production casing is set.

Record Keeping: Best practice is to keep permanent records for each well, even after the well is P&A'd. This information will be needed by NYSDEC and industry during the well's operating life, will be critical for designing the P&A, and may be required if the well leaks post P&A. This requirement should apply to all NYS wells, not just HVHF wells. P&A'd wells do occasionally leak, and well information is may be needed to develop a re-entry, repair, re-P&A plan.

Additional Casing or Repair: NYSDEC should reserve the right to require industry to install additional cemented casing strings in wells, and repair defective casing or cementing, as deemed necessary for environmental and/or public safety reasons. This requirement should apply to all wells, not just HVHF wells.

Pressure Testing: Casing and piping should be pressure tested.

6 NYCRR § 554 Prohibit Fracture Treatment Additives

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 to limit the type of chemicals used in hydraulic fracture or re-fracture treatments.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC: develop a list of recommended/approved fracture treatment additives that have been scientifically and technically reviewed by NYSDEC and NYSDOH and confirmed to pose little or no risk to human health or the environment; develop a list of prohibited fracture treatment additives based on the known list of chemicals currently used in hydraulic fracturing; and develop a process to evaluate newly proposed chemicals to determine if they should be allowed or prohibited. *See* Harvey Report Recommendations Nos. 37 and 39.

NYSDEC did not respond to this comment.

Recommendation: NYSDEC should revise 6 NYCRR § 554 to include a list of prohibited fracture treatment additives based on the known list of chemicals currently used in hydraulic fracturing. The list of prohibited fracture treatment additives should apply to all hydraulic fracture treatments, not just HVHF treatments. NYSDEC should also develop a process to evaluate newly proposed hydraulic fracturing chemical additives to determine whether they should be added to the prohibited list. No chemical should be used until NYSDEC and/or the NYSDOH has assessed whether it is protective of human health and the environment, and has determined whether or not it warrants inclusion on the list of prohibited hydraulic fracturing chemical additives for NYS. The burden of proof should be on industry to demonstrate, via scientific and technical data and analysis and risk assessment work, that the chemical is safe.

In addition to a list of prohibited chemicals, NYSDEC should develop a list of recommended/approved fracture treatment additives that have been scientifically and technically reviewed by NYSDEC and NYSDOH and confirmed to pose little or no risk to human health or the environment. This list could be provided to industry for immediate use and would provide industry with a simplified list of chemicals that have already been determined to pose the least risk. Any chemical not found on this list, or on the list of prohibited chemicals, could be proposed by industry for future use but would be subject to an in-depth scientific and technical justification and risk assessment review process before being added to the approved chemical list for NYS.

6 NYCRR § 554 Hydrogen Sulfide

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 to require close monitoring of hydrogen sulfide (H_2S) for human health protection and explosion mitigation.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC require H_2S monitoring and reporting requirements. *See* Harvey Report Recommendation No. 84.

NYSDEC did not respond to this comment.

While NYS did include a requirement for industry to meet its own unspecified "industry standards" if H_2S is encountered at a HVHF well (6 NYCRR § 560.6(c)(4)), there is no requirement to monitor, report or notify the public. The very limited H_2S requirements at Part 560 apply only to HVHF wells and would not apply to all other wells drilled and operated in NYS that could present a H_2S hazard.

Recommendation: NYSDEC should revise 6 NYCRR § 554 to include H_2S monitoring and reporting requirements. Operators should be required to follow H_2S detection and handling procedures to protect employees and the public. Initial H_2S testing should be conducted at each well pad. Subsequent test frequency should be based on the results of initial testing. H_2S levels can increase over time as gas fields age and sour. H_2S requirements should be included in the regulations for both drilling and production operations, and should not just be relegated to a drilling permit condition. Additionally, when H_2S is present, nearby neighbors, local authorities, and public facilities should be notified, and provided information on the safety and control measures that the operator will undertake to protect human health and safety. In cases where elevated H_2S levels are present, audible alarms should be installed to alert the public when immediate evacuation procedures are warranted.

6 NYCRR § 554 Secondary Containment for Chemical Storage

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 to improve secondary containment requirements for well site chemical storage.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC improve secondary containment requirements for well site chemical storage. *See* Harvey Report Recommendation No. 85.

NYSDEC did not respond to this comment.

Chemicals, especially corrosive chemicals, can result in storage container leaks and spills to the environment. Best practice for permanent chemical storage is to install secondary containment under the storage container and ensure the containers are not in contact with soil or standing water.

Recommendation: NYSDEC should revise 6 NYCRR § 554 to include secondary containment for chemicals stored on the well pad or, alternatively, require the use of double-wall tanks.

6 NYCRR § 554 Storage Tank Inspections

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 to require storage tank inspections and alarm systems.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC require storage tank inspections and alarm systems. *See* Harvey Report Recommendations No. 97 and 98.

NYSDEC did not respond to this comment.

Recommendation: NYSDEC should revise 6 NYCRR § 554 to require storage tank inspections and alarm systems including periodic fuel tank inspections to examine structural conditions and document corrosion or damage; the installation of high-liquid-level alarms that sound and display in an immediately recognizable manner; the installation of high-liquid-level automatic pump shutoff devices, which are

designed to stop flow at a predetermined tank content level; and a means of immediately determining the liquid level of tanks. NYSDEC should clarify whether vaulted, self-diking, and double-walled portable tanks will be allowed, and codify in the NYCRR the requirements for the use of those tanks, including inspections and spill prevention alarm systems.

6 NYCRR § 554 Reference Errors and Inconsistencies

Revised Proposed Regulations: NYSDEC did not remove the reference errors or make the surface casing requirement changes in 6 NYCRR § 554 as recommended by commenters.

Prior Comment and Response: NYSDEC did not respond to our 2012 Recommendations on reference errors and changes to surface casing requirements. *See* Harvey Report Recommendation No. 10.

Harvey recommended that NYCRR § 554.4 should be revised to be consistent with the proposed RDSGEIS surface casing conditions and to remove reference errors. 6 NYCRR § 554.4(a) provides the operator with a **choice of installing surface casing** in accordance with 6 NYCRR § 554.1(b) (which appears to be a typo and should read 554.1(***d***)) **or by cementing the production casing** from below the deepest potable fresh water level to the surface.

6 NYCRR § 554.1(b) is a general pollution prohibition that does not relate specifically to surface casing. 6 NYCRR § 554.1(d) provides: "*Except as hereinafter provided, sufficient surface casing shall be run in all wells to extend below the deepest potable fresh water level.*"

6 NYCRR § 554.4(a) does not provide any specific direction on the type or amount of surface casing to be installed, other than to say that it must be set below *the deepest potable fresh water level*, but the minimum depth that the casing must be set below the deepest freshwater located is not specified.

Harvey recommended that 6 NYCRR § 554.1(d) and 6 NYCRR § 554.4(a) should be combined or at least be made consistent by requiring the surface casing setting depth to be at least 100' below protected groundwater.

6 NYCRR § 554.4(b) correctly requires that cement be placed by the pump and plug or displacement methods; that cement be placed in the entire annulus; and that there be a wait on cement time before further drilling. However, 6 NYCRR § 554.4(b) does not include the best practices listed in the permit conditions (Appendices 8 and 9). Additionally, many of the best practices included in Appendix 10 for HVHF wells should be included in regulations for all oil and gas wells.

Recommendation: 6 NYCRR § 554.1(d) and 6 NYCRR § 554.4(a) should be combined or at least be made consistent by requiring the surface casing setting depth to be at least 100' below protected groundwater.

6 NYCRR § 554.4(b) should be revised to be consistent with the proposed Appendices 8 and 9 permit conditions. Also, the best practices listed in Appendix 10 for HVHF should apply to all oil and gas wells and be included in 6 NYCRR § 554.4(b).

6 NYCRR § 554.1(a) Surface Casing Setting Depth

Revised Proposed Regulations: NYSDEC did not improve the surface casing setting depth for oil and gas wells regulated under Part 554.

Prior Comment and Response: Comment 6371 recommended the surface casing setting depth for all oil and gas wells regulated under NYCRR § 554.1(a) be increased from 75' to 100' to provide additional water resource protection and reduce the risk of contamination. We also made this same request.

NYSDEC responded that the existing surface casing setting depth of 75' provided "adequate protection." NYSDEC provided no technical justification for retaining a 75' standard or analysis of increased protection and reduced risk associated with increasing the setting depth to 100', especially when NYSDEC currently requires a 100' setting depth in its Existing Fresh Water Aquifer Supplementary Permit Conditions Required for Wells Drilled in Primary and Principal Aquifers.[6]. [Response 6371].

Recommendation: NYSDEC should revise Part 554 to increase the surface casing setting depth to 100' or provide a technical justification for rejecting this recommendation.

6 NYCRR § 554.1(c) Drilling Fluid Type Limits Through USDWs

Revised Proposed Regulations: NYSDEC did not propose any drilling fluid type limitations when drilling through USDWs.

Prior Comment and Response: NYSDEC did not respond to our 2012 Recommendations that drilling fluid types be limited when drilling through USDWs. *See* Harvey Report Recommendation No. 40.

Recommendation: 6 NYCRR § 554.1(c)(1) should be revised to limit the types of drilling muds that can be used while drilling through subsurface formations that contain protected groundwater. Drilling muds should be limited to Water-Based Muds ("WBM") or drilling with air. Any additives required for safe drilling through the protected groundwater interval with WBM should be limited to additives that are bio-degradable, are non-toxic, and do not bio-accumulate.

6 NYCRR § 554.1(c) Baseline Aquifer Testing

Revised Proposed Regulations: NYSDEC included a new requirement for baseline water testing in Part 560 for HVHF wells under some conditions, but did not revise 6 NYCRR § 554.1(c) to require baseline testing prior to drilling other hydrocarbon wells in NYS.

Prior Comment and Response: Comment 4596 requested that NYCRR § 554.1(c) be amended to require that "*. . .the aquifer be tested for concentrations of hydrocarbons, arsenic, mercury, total dissolved solids, and radium before drilling commences so that a baseline of background concentrations is known and the Department will know whether gas well drilling and production have contaminated an aquifer.*"

NYSDEC rejected the recommendation to apply baseline testing requirements to all wells without explanation and without providing technical justification for why baseline testing is necessary only in the case of HVHF wells under some conditions. [Response 4596].

Recommendation: NYSDEC should require baseline aquifer testing for all wells subject to hydraulic fracture treatment in NYS, regardless of hydraulic fracture treatment volume and size. The detailed recommendations provided below in connection with 6 NYCRR § 560.5(d)(1)-(2) should be incorporated

[6]2011 NYSDEC RDSGEIS, Appendix 9.

into 6 NYCRR § 554.1(c), to protect water sources potentially affected by all hydraulically fractured oil and gas wells.

6 NYCRR § 554.1(c)(1) Reuse and Recycling

Revised Proposed Regulations: NYSDEC added 6 NYCRR § 554.1(c)(1), which provides in part:

> *The owner or operator must state in its plan that it will maximize the reuse and/or recycling of used drilling mud, flowback water and production brine to the maximum extent feasible . . .*

Prior Comment and Response: NYSDEC's Response to Comments stated:

> *Recycling and reuse of flowback water is anticipated and encouraged by the Department. On-site processing of hydraulic fracturing fluids and reuse may not always be practical, technically viable and/or economical, and therefore it is not a requirement of the proposed regulations.* [Response 3422].

Recommendation: NYSDEC should clearly define the term "to the maximum extent feasible" or revise this regulation to require all drilling mud, flowback water and production brine to be reused and recycled, whether it is processed on-site or at an off-site facility, unless the operator provides a technical infeasibility determination showing that the drilling mud, flowback water, or production brine is too contaminated to be processed for reuse.

6 NYCRR § 554.1(c) Drilling Fluid Disposal

Revised Proposed Regulations: NYSDEC did not make any improvements at 6 NYCRR § 554.1(c)(1) to drilling fluid disposal requirements.

Prior Comment and Response: Our 2012 Recommendations include improvements to drilling fluid disposal requirements. *See* Harvey Report Recommendation No. 41, 44, 79, 81 and 83. NYSDEC did not respond to our comments.

The NYCRR does not instruct the operator on how to properly dispose of drilling fluids. The NYCRR requires a disposal plan and that drilling fluids be removed from the well pad within 45 days; however, 6 NYCRR § 554.1(c)(1) does not provide specific instructions or criteria for acceptable drilling mud disposal plans. This problem was identified by Harvey in 2009 and is still unresolved.

This problem is magnified in light of new language in the 2011 RDSGEIS that appears to contemplate allowing drilling muds to be spread on non-active agricultural fields and other soils. The 2011 RDSGEIS includes a discussion on proposed Agricultural District requirements. One of the requirements discussed is for "spent drilling muds to be removed from active agricultural fields." The RDSGEIS is silent on provisions for non-active agricultural fields and other soils, and it is unclear what NYSDEC has planned for drilling mud disposal. NYSDEC should clarify its intentions in regards to spreading drilling muds.

The 2011 RDSGEIS correctly notes that drilling mud can be reconditioned and used at more than one well, but it must eventually be disposed. Drilling muds may contain mercury, metals, naturally occurring radioactive material ("NORM"), oils, and other contaminants. This is especially true for Marcellus Shale operations, where NORM and potential acid generating material are present in the shale drill cuttings and mud mixture. Therefore, drilling muds require proper handling and disposal.

Solid waste management regulations at 6 NYCRR Chapter IV, Subchapter B (Solid Waste) provide the authority by which the state (through the Division of Solid and Hazardous Materials) establishes standards and criteria for solid waste management operations, including landfills and land application. However, Part 554 is unclear about what disposal options will be allowed when approving a well plan.

Recommendation: 6 NYCRR § 554.1(c)(1) should be revised to provide specific instructions on the best practices for drilling mud handling and disposal, including detailed instructions on collection, testing, transportation, treatment, and disposal of waste.

1. NYSDEC should explicitly state that land and road spreading for any purpose is prohibited. Drill cuttings should be tested for NORM prior to disposal in a landfill.
2. Onsite burial of drill cuttings should be prohibited.
3. A maximum allowed NORM threshold for drill cuttings disposal in the landfill should be clearly established and scientifically justified. Testing and threshold requirements should be included in the SGEIS as a mitigation measure and codified in the NYCRR. Waste exceeding the established NORM threshold should be handled under NYS' radioactive waste handling rules.

6 NYCRR § 554.1(d) Surface Casing Requirements for All Wells

Revised Proposed Regulations: NYSDEC included improved surface casing requirements for HVHF wells in Part 560, but did not include improved practices in Part 554 that would apply to all other hydrocarbon wells.

Prior Comment and Response: Comments 6361 and 6362 stated that best surface casing practices proposed for HVHF wells are standard industry best practices that should be applied to all oil and gas wells. These requirements should be included in Part 554 (drilling practices for all oil and gas wells) and not contained just in Part 560 (drilling practices for HVHF wells).

NYSDEC responded that it would be unreasonable and/or impractical for an operator of a geothermal, monitoring, or shallow oil well to comply with the same surface casing requirements as a HVHF well [Response 6361]. NYSDEC distorts the comment by suggesting that the comment recommended HVHF surface casing requirements to be applied to geothermal or shallow monitoring wells; it did not. The recommendation was specific to improving surface casing practices of all oil and gas wells in NYSDEC. As stated above, if NYSDEC finds that these widely acknowledged best practices for oil and gas wells are unreasonable or impractical for geothermal or shallow monitoring wells, it could extract the requirements for geothermal or shallow monitoring wells into a separate NYCRR part or allow a waiver for geothermal or shallow monitoring wells, where technically justified.

NYSDEC argues that HVHF surface casing requirements could not be met by a shallow oil well, but provides no technical justification for its response and makes no effort to explain what would be unreasonable or impractical. [Response 6361].

NYSDEC is silent on why improved surface casing requirements would not be a best practice for all other oil and gas wells that do not fit the definition of a HVHF well, and are not "shallow oil wells." [Responses 6361 and 6362].

NYSDEC does not explain what constitutes a "shallow oil well," yet uses this term throughout its response to reject most best practice improvements for hydrocarbons drilled in NYSDEC that do not meet the HVHF definition, ignoring all the other oil and gas wells that don't fit within NYSDEC's "shallow oil well" or HVHF definition.

NYSDEC restates its Part 554 standard that requires surface casing to be installed 75' below potable water, but provides no technical justification for rejecting a 100' best practice standard. [Response 6361].

NYSDEC incorrectly concludes that the Harvey Report recommendations for surface casing only related to HVHF wells. [Response 6362]. Harvey clearly recommended that surface casing best practices for HVHF wells at Part 560 should also apply to all other NYSDEC oil and gas wells to modernize the Part 554 regulations which were last revised in 1992, over two decades ago. *See* Harvey Report Recommendations No. 7-14 and Appendix A.

Recommendation: NYSDEC should revise Part 554 to include best surface casing practices proposed for HVHF wells for all other oil and gas wells in the state, or NYSDEC should provide technical justification why it would be unreasonable and/or impractical to implement these best practices for oil and gas wells other than HVHF wells.

NYSDEC should respond to all the points made in our comments and comments 6361 and 6362. NYSDEC's response only addressed a fraction of the comments, and most of NYSDEC's response lacked technical justification, distorted the comment, or did not address substantive portions of the recommendations made. The recommendations listed in Comment 6361 and 6362 are all valid and should be considered seriously in the revised rulemaking.

6 NYCRR § 554.2 Well Spud Notification

Revised Proposed Regulations: NYSDEC revised 6 NYCRR § 554.2 to clarify that the county must be notified at least 24 hours prior to spudding the well, but there is no requirement to notify the local government or nearby landowners. Landowners may need time to find alternative places to stay to avoid high noise levels, especially at night.

Recommendation: Revise 6 NYCRR § 554.2 to include a requirement to notify the local government at least 24 hours prior to spudding the well, in addition to the county. Landowners within 1 mile of the well should be notified at least 7 days prior to spudding.

6 NYCRR § 554.3 Cable Tool Drilling

Revised Proposed Regulations: NYSDEC did not propose any changes to 6 NYCRR § 554.3.

Prior Comment and Response: NYSDEC did not respond to our 2012 Recommendations inquiring about the current and projected future use of cable tool drilling in NYSDEC and suggesting regulatory revisions to ensure that wells drilled using cable tool methods did not construct sub-standard wells.

Recommendation: NYSDEC should verify whether cable tool drilling is still anticipated in NYS. If cable tool drilling is still allowed, 6 NYCRR § 554.3 should be revised to require these wells be constructed to the same quality standards as wells drilled with rotary drilling equipment.

6 NYCRR § 554.4(c) Requirement for a Blowout Preventer

Revised Proposed Regulations: NYSDEC did not propose changes to 6 NYCRR § 554.4(c) to clarify when a blowout preventer would be required. The regulation provides:

> *In areas where the subsurface formations and pressures have been reasonably well established by prior drilling experience, **the use of blowout equipment shall be in accordance with the established local practice** [emphasis added].*

Prior Comment and Response: Comment 3788 opposed this potential exemption not to require a blowout preventer in certain cases: "*Part 554.4(c) seems to allow operators to not use blowout equipment in areas where subsurface formations and pressures have been reasonably well established by prior drilling practice if it is in accordance with established local practice. Yet Section 5.2.1 of the rdSGEIS states that Part 554.4 requires blowout equipment to be maintained and in proper working order during operations with no such caveat mentioned. Part 554.4(c) should state that blowout equipment is always required.*"

NYSDEC rejected the recommendation stating that it would be unreasonable to require installation of blowout preventer equipment for geothermal, monitoring or shallow oil wells. NYSDEC points out that it requires all HVHF wells to install a blowout preventer, but does not explain why other oil and gas wells in NYSDEC could be exempt from installing a blowout preventer if drilled under Part 554 regulations [Response 3788].

It is best practice to always install a blowout preventer when drilling an oil well or any well where hydrocarbons (oil, gas, gas condensates) may be encountered after surface casing is set. Surface casing should be set and cemented prior to drilling into any formations that may contain hydrocarbons. The blowout preventer should be installed on the surface casing.

NYSDEC should explain under what circumstances it thinks that a blowout preventer should not be installed on a hydrocarbon well when drilling below surface casing, and provide a technical assessment to support such a proposal.

The current regulatory language at 6 NYCRR § 554.4(c) allows the decision whether a blowout preventer is required to be based on whether: (1) pressures have been "reasonably well established by prior drilling experience;" and (2) a blowout preventer is "in accordance with established local practice." The quoted phrases are undefined and offer only a subjective basis for the decision. Are pressures "reasonably well established by prior drilling experience" when there have been a dozen well penetrations and pressure measurements in an area, or is just one pressure point sufficient?

NYSDEC should revise this regulation to provide specific quantitative limits and criteria for when a blowout preventer is not required. For example, NYSDEC should establish the maximum reservoir pressure, above which a blowout preventer is mandatory.

NYSDEC should remove the term "local practice" and set objective criteria. As written, it is unclear to whose local practice this regulation refers. Does this mean that if local drilling operators are not electing to use blowout preventers, NYSDEC will default to that local practice, even when it is not the best or safest plan? Who records local practices, and how can a member of the public, industry, or NYSDEC staff reference a generally accepted local practice to know what NYSDEC would actually be relying on to enforce this regulatory requirement?

Recommendation: The regulation should be revised to provide objective standards for use of blowout preventers that are identical to the standards applied to HVHF wells. If NYSDEC's objective is to not require a blowout preventer for a geothermal or shallow monitoring well that has no risk of spilling hydrocarbons at high pressure, then the regulation should clearly state that these types of wells are exempt from the blowout preventer requirement. If NYSDEC refuses to revise the regulation to allow only the

narrow exemption for such wells, it should include a technical justification of its decision not to require blowout preventers for oil and gas wells other than HVHF wells.

6 NYCRR § 554.5(d) Directional Drilling Requirements

Revised Proposed Regulations: NYSDEC did not improve directional drilling reporting or baseline monitoring requirements for oil and gas wells drilled under NYCRR § 554.5(d).

Prior Comment and Response: Comment 6372 recommended "*Part 554.5(d): The required information for horizontal or directional wells under this subsection must also include the names and contact information for landowners, the location of any water wells within one mile of the down hole location, baseline monitoring data for each of those water wells, and documentation of delivery of that baseline data to each water well owner.*"

NYSDEC responded that "*. . .it would be unreasonable and/or impractical for an operator of a non-vertical geothermal, monitoring or solution mining well to comply with the same requirements placed on high-volume hydraulically fractured wells."* [Response 6372].

NYSDEC can easily avoid the problem it identifies by revising the regulation to exclude geothermal, monitoring, or solution mining wells from requirements that would be reasonable for all oil and gas wells in NYS.

Recommendation: NYSDEC should revise 6 NYCRR § 554.5(d) to include recommended Comment 6372 as it applies to oil and gas wells in NYS. Geothermal, monitoring, and solution mining wells could be exempt from this requirement.

6 NYCRR § 554.7 As-Built Drawing and Well Completion Report Contents

Revised Proposed Regulation: NYSDEC did not require an as-built well construction drawing to be filed with NYSDEC at 6 NYCRR § 554.7 to document the actual manner in which the well was constructed or to certify that the well was constructed to meet all applicable NYCRR requirements. Absent submittal of an as-built drawing the regulator would only have on file a draft plan to construct and complete a well; however, the as-built drawing provides the actual specifications of how the well was constructed. Additionally, NYSDEC did not specify the required well completion report contents.

Prior Comment and Response: Commenter 4558 proposed an improved well completion report requirement. NYSDEC refused to include the improvement in the NYCRR, citing the need for flexibility in applying requirements to future permits. [Response 4558]. The response is inadequate because the requested improvement sets a regulatory floor but does not bind operators to a particular technology, which could improve over time.

Recommendation: Add the following requirements in 6 NYCRR § 554.7:

1. Upon completion of each well, an as-built well construction drawing, along with a casing and cementing report, shall be filed with the Department.

2. The as-built well construction drawing and casing and cementing report shall be signed by the owner or operator's lead engineer certifying that the well has been constructed to meet all applicable requirements specified in the NYCRR.

3. The completion report shall include: a complete description and list of all materials installed in the well; specifications for all materials installed in well; casing length, grade and weight; hole sizes and condition; depth of lost circulation zones, depth of over-pressured zones and pressure; cement type and grade; list of all cement additives; mix water pH and temperature; cement volume, yield, and density; amount of cement returned to surface; cement pumping rate and pressures; a complete description of the sequence of events during the cementing operation; a copy of all temperature logs and cement evaluation tool tests; a complete description of the sequence of events during all required BOP and casing tests and copies of test results; depth of protected water zone and data used to determine this depth; depth and type of all hydrocarbons encountered; and results of coring, electric log, mud-logging, or testing.

The information required to be submitted pursuant to 6 NYCRR § 554.7 should be made publicly available on NYSDEC's website.

6 NYCRR § 554.7(b) and § 550.3(az) Well Logs to be Submitted

Revised Proposed Regulations: 6 NYCRR § 554.7(b) requires well logs to be provided to the Department with the Well Drilling and Completion Report:

> *[Each copy of the completion report on form OG10] The Well Drilling and Completion Report also shall be accompanied* ***by a well log*** *and such other information as the department may specifically require. The measurement datum for the well log and all other measurements in connection with the well shall be clearly . . .[emphasis added].*

6 NYCRR § 550.3(az), which is not proposed to be changed by NYSDEC, provides the definition of a well log:

> *Well log shall mean the written record progressively describing the strata and any oil, gas or water encountered in drilling the well together with such additional information as volumes, pressures, rate of fill up, water depths, caving strata, casing record, etc., as is usually recorded in the normal procedure of drilling. The term shall include, if taken or performed, any electrical or other surveys and the details of all cores, and all drill stem tests, including depth tested, cushion used, significant time intervals, flowing and shut-in pressures, and recoveries.*

NYSDEC does not respond to any comments regarding well logs other than to say they cannot make them public information without legislative approval. [Response 4602]. The existing requirements include strata and descriptions of oil, gas, and water encountered during drilling. Additional logging would assist the Department, public, and researchers to analyze the potential for movement of fluid and gas from the formation and from leaks in the wellbores. It will be critical to collect information on confining layers to prevent vertical movement, fractures and faults, and water quality specifically conductivity to identify freshwater zones. For this reason, the Department should require the operator to obtain geophysical logs to improve the understanding of the aquifers and potential for transport above the formation. Caliper logs help identify the location of fractures. Gamma logs identify layers of clay and shale which may serve as confining layers. Resistivity logs can identify among all lithologies. Electrical conductivity helps to identify fresh and salty water.

Recommendation: NYSDEC should amend 6 NYCRR § 550.3(az) as follows:

> *Well log shall mean the written record progressively describing the strata and any oil, gas or water encountered in drilling the well together with such additional information,*

including but not limited to volumes, pressures, rate of fill up, water depths, caving strata, and casing record recorded in the procedure of drilling from the ground surface to the target formation. The term shall include any electrical or other surveys and the details of all cores, and all drill stem tests, including depth tested, cushion used, significant time intervals, flowing and shut-in pressures, and recoveries. For oil and gas wells, the following geophysical logs should be completed at a minimum for all formations from the ground surface to the target formation and submitted to the Department:

(1) Caliper logs in open or uncased wellbore

(2) Gamma logs

(3) Resistivity logs or single point resistance logs

(4) Electrical conductivity or specific conductivity

Well logs should be made publicly available on NYSDEC's website.

6 NYCRR § 554.7(e) Data Confidentiality

Revised Proposed Regulations: NYSDEC revised NYCRR § 554.7(e) to reduce the amount of time data can be held as confidential to a six-month period, with extensions up to a total of two years. However, NYSDEC deleted the requirement for the operator to demonstrate sufficient good cause to extend the time period.

Prior Comment and Response: We have consistently supported increased public access to oil and gas records, and support this change. However, we recommend additional language be added to NYCRR § 554.6(e) to specify the criteria for granting an extension beyond the six month confidentiality period.

Recommendation: Revise NYCRR § 554.7(e) to require an operator to show good cause for extending data confidentiality time period, including proof that drilling has been continuous throughout the prior period, as is required by ECL § 23-0313.

6 NYCRR § 555 Plugging and Abandonment of Existing Wells

Revised Proposed Regulation: NYSDEC did propose improved regulations to address the backlog of improperly abandoned wells that could potentially create vertical pathways for contamination to reach USDWs or explosion hazards.

Prior Comment and Response: Comment 4908 raises concerns about inadequate staffing, funding, and plugging of existing wells prior to approving additional drilling operations.

NYSDEC acknowledges this significant problem, but defers resolution to a future process with an unknown outcome. NYSDEC states "*. . . The Department has recognized for some time that its personnel resources would be a limiting factor on the rate of development of proposals for high-volume hydraulic fracturing. However, it is not within the Department's sole discretion to either hire additional staff or increase funding (bonding). The advisory panel assembled to advise the Department will assess the needs of all."* [Response 4908].

NYSDEC points out that the HVHF regulations require improperly plugged and abandoned ("P&A'd") wells to be identified. [Response 4908]. However, NYSDEC does not explain why this is not a

requirement for other oil and gas wells that may be hydraulically fractured under Parts 550-555. NYSDEC does not specifically require improperly abandoned wells nearby new hydrocarbon drilling operations to be P&A'd.

Comment 4918 raises concerns about explosions from existing gas wells that were not properly P&A'd in Bradford Pennsylvania and other wells that were not properly P&A'd.

NYSDEC points out that the RDSGEIS documents hazards from improperly P&A'd wells, but NYSDEC offers no improved NYCRR requirement to remedy the known problems. [Response 4918].

Recommendation: NYSDEC should revise 6 NYCRR § 555 to prohibit any operator from drilling a new well in NYSDEC until all the wells it is financially responsible for in NYS that are no longer producing and are not properly P&A'd are P&A'd consistent with NYSDEC's new Part 555 regulations.

Additionally, NYSDEC should make it clear in 6 NYCRR § 555 and 6 NYCRR § 560 that operators applying for a permit to drill a new well nearby an improperly P&A'd well must either locate the well's owner and arrange for the well to be P&A'd consistent with NYSDEC's new Part 555 regulations or the operator applying for the permit to drill the new well must P&A the well before NYSDEC issues a permit.

It is not acceptable for NYSDEC to defer resolution of improperly P&A'd wells to a future, yet-to-be-determined process with an unknown outcome, and proceed with approval of new wells. New wells drilled and hydraulically fractured near improperly P&A'd wells can result in groundwater contamination.

6 NYCRR § 555 Plugging and Abandonment Cement Type and Verification

Revised Proposed Regulation: NYSDEC does not require wells to be plugged using cement containing gas blocking additives, or require all cement plugs to be tagged and verified.

Prior Comments and Response: Comment 6567 from the Harvey Report recommended: "*The regulations and the rdSGEIS mitigation measures should be revised to require cement quality standards, including the use of gas blocking cement. The regulations should require tagging of all cement plugs and provide instructions on when additional cement evaluation tools must be run.*"

While NYSDEC agreed with Harvey on both recommendations, it made no change to the proposed regulation to include these best practices. [Response 6567]. NYSDEC notes it has discretion under NYCRR § 555.5(a) to require plug tagging, but that does not make it a mandatory requirement. And, as NYSDEC noted in Response 4911, it does not have adequate resources to be present at all P&A jobs. Therefore, cement plugs would only be tagged if an inspector was present and the inspector required it, meaning very few plugs would be verified. It is best practice to tag all cement plugs to verify placement depth; this should not be an optional, discretionary procedure.

Recommendation: NYSDEC should revise NYCRR § 555 to require wells to be plugged using cement containing gas blocking additives, and require all cement plugs to be tagged and verified. The information required to be submitted pursuant to 6 NYCRR § 555.5 should be made publicly available on NYSDEC's website.

6 NYCRR § 555.5 Logging Prior to P&A

Revised Proposed Regulation: NYSDEC did not propose changes to NYCRR § 555.5 to require casing and cement well logs prior to plugging and abandoning a well to verify the casing and cement condition and develop an optimized plan to permanently seal the well to prevent ground water contamination and well leaks.

Prior Comments and Response: Comment 4913 submitted by the U.S. Fish and Wildlife Service recommended that: "*the Department require evaluation logs (on the well casing and cement) for all wells to be plugged, and that this not be a discretionary requirement. This evaluation would be important to determine the integrity of the casing and cement along with the proper procedure and materials needed for a successful plugging of the well.*"

NYSDEC agreed that: ". . .*quality cement bond evaluation logs are valuable tools in the assessment of well integrity. However, it may not be prudent to mandate this costly procedure in all cases. Older or abandoned wells may contain obstructions, such as production tubing, that preclude the use of down-hole tools for logging. In other circumstances, some wells may have been installed by driving casing, so there would be no cement to evaluate.*" [Response 4913].

NYSDEC agrees casing and cement logging is an important step, when technically feasible, but instead of including this additional requirement in the proposed regulations at NYCRR § 555.5, NYSDEC dismisses the recommendation, taking no action, by focusing only on the exceptions to the rule.

Recommendation: NYSDEC should revise NYCRR § 555.5 to require casing and cementing logs for all wells unless there is a well obstruction that is technically infeasible to remove or cement was not installed at all (in which case the cementing log would not be run, but the casing inspection log would be).

6 NYCRR § 556.2(b), § 556.2(c) and § 556.2(g)(7) Gas Venting and Flaring

Revised Proposed Regulations: NYSDEC's proposed change to 6 NYCRR § 556.2(b) allows wells to vent to the atmosphere for 48 hours after a completion, stimulation, or workover and for 24 hours during well testing. NYSDEC allows additional gas venting for an indeterminate amount of time for an undefined set of other "operational requirements" that may result in gas venting.

NYSDEC removed the automatic administrative extensions of time for the 48- and 24-hour gas venting periods in the current version of 6 NYCRR § 556.2(b), but created the ability to request extensions for periods of flaring in a newly created regulation at 6 NYCRR § 556.2 (g)(5). Therefore there is potentially no upper limit on the amount of gas flaring that could be approved by NYSDEC, and no criteria have been set in 6 NYCRR § 556.2(g)(5) for granting applications for extended gas flaring.

NYCRR § 556.2(c) requires a flare permit to be submitted if gas released from a well will be flared; but flaring is not mandatory under NYCRR § 556.2(b); the gas could be vented to the atmosphere.

Prior Comment and Response: Comments 3084, 3085, and 3095 all recommend that gas venting not be allowed during well completions; that instead green completions be used; and that flaring, where necessary for safety, be minimized.

Our 2012 Recommendations included suggestions for reduced gas venting and flaring that NYSDEC did not address. *See* Harvey Report Recommendations No. 52- 55.

NYSDEC responded that it will require green completions for HVHF wells. [Response 3084]. NYSDEC does not explain why the green completion requirement does not apply to all other oil and gas wells drilled in NYS.

NYSDEC maintains that gas flaring and venting is needed for operational safety in some circumstances, but provides no technical basis for setting a predetermined 48-hour and 24-hour allowance. [Response 3095]. Nor do the proposed regulations set any upper bounds on the maximum volume of gas venting or gas flaring.

While the commenters recommend a prohibition of raw gas venting (uncombusted), NYSDEC responds that gas released from the wells will always be flared under a flare permit required at § 556.2(c). However, the regulations at § 556.2(b) allow the "release" (venting) of gas, instead of flaring. The required flare permit under § 556.2(c) does not appear to apply to the "release" of gas that is not flared. Therefore, as written, § 556.2(b) allows gas to be vented near homes, schools and other sensitive locations for a period of several days, without the permit identified under § 556.2(c). If NYSDEC will not allow venting, both § 556.2(b) and § 556.2(c) should be revised to eliminate the term "release" and to state expressly that venting is prohibited.

Additionally, NYSDEC proposes to allow continued gas flaring beyond the 48- and 24-hour periods for an indeterminate amount of time for an undefined set of other "operational requirements."

NYSDEC refuses to establish in regulation any flaring efficiency standards or best practice technology requirements for flares. [Response 7817].

Recommendation: NYSDEC should revise NYCRR § 556.2(b) and § 556.2(c) as follows:

- prohibit intentional, planned gas venting from wells, unless it occurs during an unavoidable emergency well control event;
- Use green completion equipment to capture gas and liquids coming out of wells as they are being drilled, repaired, or stimulated during hydraulic fracturing.
- Coordinate drilling and well completion operations with gas line installation, enabling green completions for all wells drilled subsequent to the initial exploration well.
- For operations without a gas line, use collected gas onsite to generate power, or provide it to local residents as an affordable fuel supply.
- If green completions are not technically feasible, require that gas released during the allowed 48- and 24-hour periods for completion, stimulation, or workover must be routed through a flare.
- Set limits on the maximum amount of gas that can be vented per well;
- Define other "operational requirements" that will justify gas venting or flaring and set limits on gas venting and flaring to the amount required for emergency or safety purposes only, that cannot otherwise be eliminated by prudent operational planning; and
- Limit planned[7] flaring and venting during gas production to the smallest amount possible and allow even that amount only for purposes of safety. A minimum flare efficiency of 98% should

[7] There is a difference between planned flaring and emergency flaring. Emergency flaring is conducted to safely route combustible and potentially toxic gas (e.g. hydrogen sulfide gas) and in most cases cannot be avoided. Planned flaring can be avoided in most cases.

be achieved. Gas should be collected for sale, or used as fuel, unless it is proven to be technically and economically unfeasible.

Additionally, NYSDEC should respond to and revise the NYCRR to address Harvey Report Recommendations Nos. 52-55.

- **Recommendation No. 12**: Planned flaring should be limited to no more than three days. In all other cases flaring should be limited to safety purposes only. If NYSDEC finds there is an operational necessity to flare an exploration well for more than a three-day period, the SGEIS impact analysis should evaluate the air pollutant impact, particularly the potential for relatively high short-term emission impacts from longer flaring events, before approving such operations. Flaring restrictions should be included in the SGEIS as a mitigation measure and codified in the NYCRR. This requirement should apply to all natural gas operations, not just HVHF operations.

When flaring or venting does occur, there is the potential for relatively high short-term VOC and CO emission impacts that need to be considered.[8] The RDSGEIS states that industry only plans to flare for a maximum of three days, and NYSDEC only modeled a 3-day impact; yet, the RDSGEIS states that flaring can occur for up to a month (30 days) in some cases.[9] NYS's proposed regulations allow planned flaring for three days (48 hours+ 24 hours) in the case of a well completion, stimulation, testing period, but also allow for more gas to be flared and vented if an extension of time is requested or if other operational issues arise. NYS has not modeled the air quality impacts of more than 3 days of flaring, and has not modeled the impacts at all of raw gas venting near populated areas.

Modeling needs to represent a reasonable worst case scenario. Because only a three day flaring period was considered in the RDSGEIS modeling, planned flaring should be limited to no more than three days. Alternatively, modeling analysis should be based on the maximum time period that flaring would be allowed.

- **Recommendation No. 13**: The SGEIS should provide justification for allowing a maximum of 5 MMscf of vented gas and 120 MMscf of flared gas at a well pad during any consecutive 12-month period. The RDSGEIS does not contain information to show that these limits are equivalent to the lowest levels of venting and flaring that can be achieved through used of best practices, and it is unclear if these rates were used in the modeling assessment. Flaring and venting limits, once justified, should be included in the SGEIS as a mitigation measure, codified in the NYCRR, and should apply to all natural gas operations, not just HVHF operations.

NYSDEC examined maximum gas venting and flaring scenarios in the SGEIS but did not set any corresponding gas volume limits in regulation.

- **Recommendation No. 14**: The SGEIS should require flare systems to be designed in a manner that optimizes reliability, safety, and combustion efficiency, including requirements to: minimize the risk of flare pilot blowout by installing a reliable flare system; ensure sufficient exit velocity or provide wind guards for low/intermittent velocity flare streams; ensure use of a reliable ignition system; minimize liquid carry over and entrainment in the gas flare stream by ensuring a suitable liquid separation system is in place; and maximize combustion efficiency by proper control and optimization of flare fuel/air/steam flow rates. Flare design requirements should be

[8] 2011 NYSDEC, RDSGEIS, Page 6-103.

[9] 2011 NYSDEC, RDSGEIS, Table 5.29 on Page 5-136 shows that well cleanup and testing can take 12 hours to 30 days. Modeling on Page 6-192 assumes only 3 days of flaring.

included in the SGEIS as a mitigation measure and codified in the NYCRR. These requirements should apply to all natural gas operations, not just HVHF operations.

NYSDEC did not include any improved technical specifications for flare combustion efficiency. Harvey recommended that NYSDEC should require operators to flare gas as a preferred method over venting. Gas flaring is environmentally preferable over venting because flaring reduces HAP, VOC, and GHG emissions.[10] Proposed revisions to 6 NYCRR § 560.6(c)(28) would require that gas be flared whenever technically feasible instead of vented,[11] which is a significant improvement, but this corresponding improvement is not found at Part 556 for all NYS wells.

- **Recommendation No. 15**: Drilling and well completion operations should be coordinated with gas line installation, enabling RECs for all wells drilled subsequent to the initial exploration well. Alternatively, methane gas should be used onsite to generate power, re-injected to improve well performance, or provided to local residents as an affordable fuel supply. NYSDEC should not defer the decision to implement RECs for two more years. The requirement to use RECs in all practicable situations should be included in the SGEIS as a mitigation measure and codified in the NYCRR. This requirement should apply to all natural gas operations, not just HVHF operations.

NYSDEC required green completions only for HVHF wells and not all hydrocarbon wells in NYS.

Additionally, there are alternatives to piping methane such as using it onsite to generate power, re-injecting it to improve well performance, or providing it to local residents as an affordable power supply. Therefore, RECs do not need to rely solely on the installation of a nearby pipeline.

6 NYCRR § 556.2(g)(7) Verbal Approval to Commence Operations

Revised Proposed Regulation: NYSDEC added a new regulation at 6 NYCRR § 556.2(g)(7) allowing NYSDEC to grant a verbal approval to commence operations in cases of unusual or emergency circumstances, or for other good cause shown, as long as a Sundry Well Notice and Report form request is on file. NYSDEC does not explain what circumstances would trigger "*cases of unusual or emergency circumstances, or for other good cause shown*."

Recommendation: No operations should commence without a formal written permit approval. Even in the case of unusual or emergency circumstances, there is sufficient time for the Department to issue a brief letter clearly stating what operations are or are not approved and justifying the unusual or emergency circumstances that prompted the expedited approval. If NYSDEC wants to allow operations without a written permit, the agency should clearly delineate in the regulation the type of unusual or emergency circumstances that would warrant and justify a verbal approval.

6 NYCRR § 554 and 556 Corrosion and Erosion Mitigation and Integrity Monitoring

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 or 6 NYCRR § 556 to require corrosion and erosion mitigation and integrity monitoring.

[10] Fugitive and Vented methane has 21 times the global warming potential as combusted methane gas. Methanetomarkets.org; epa.gov/gasstar.

[11] 2011 NYSDEC, RDSGEIS, Page 7-117.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC require corrosion and erosion mitigation and integrity monitoring because downhole tubing and casing, surface pipelines, pressure vessels, and storage tanks used in oil and gas exploration and production can be subject to internal and external corrosion. Corrosion can be caused by water, corrosive soils, oxygen, corrosive fluids used to treat wells, and the carbon dioxide (CO_2) and H_2S present in gas. High velocity gas contaminated with water and sediment can internally erode pipes, fittings, and valves. *See* Harvey Report Recommendation No. 99.

Well casing, once installed and cemented into place, will remain in the well for its entire lifecycle and is often abandoned in place. Therefore, it is in the operator's best economic interest to ensure that its casing investment is protected from corrosion and erosion.

It would be shortsighted for NYS to require a robust well casing program and not build in a corrosion and erosion control program. Chemicals, metallurgy, monitoring, and repair techniques are available to the operator to manage corrosion and erosion downhole (in the well) and at its surface facilities (e.g. corrosion inhibitors, cathodic protection systems, and coatings).

Corroded well casings can provide a pathway for gas and well fluids to leak into protected aquifers. Therefore, it is important to install a robust casing system, and it's equally important to ensure that the casing system's integrity is maintained during the well's life.

Corrosion measured on production casing is an important piece of information because corrosive fluids are known to also degrade the quality of the cement barrier. Corrosive fluids reduce the cement strength and make it more permeable, potentially providing a pathway for hydrocarbons to migrate from zones of higher pressure to lower pressure freshwater zones.

Additionally, the bond between the casing and cement can be compromised over the well's life, creating a "micro-annulus" (a space between the outer pipe wall and cement sheath) that allows vertical migration of hydrocarbons along the outside of the pipe wall. Micro-annuluses can be formed during initial cementing, or later in the well's life due to: pipe wall thinning; cement deterioration; the shock of additional well workover activities (perforations, stimulation, drilling); pressure and temperature changes in the well; or by seismic vibrations.

Failures of equipment handling or producing natural gas occur in the absence of an adequate corrosion-control program. A successful program is shown to include (1) anticipation of corrosion in design factors of all equipment, (2) detection of corrosion within the system and measurement of its severity for future reference, (3) use of mitigation measures, and (4) continual follow-up and adjustment of control techniques.

Corrosion and erosion programs that are instituted early can prolong the life of equipment and well casings, and reduce environmental risk. Delayed attention to corrosion and erosion mitigation can result in increased safety, environmental, and human health risks.

NYSDEC did not respond to this comment.

Recommendation: NYSDEC should revise 6 NYCRR § 554 and 6 NYCRR § 556 to require equipment be designed to prevent corrosion and erosion; monitoring programs be put into place to identify corrosion and erosion over the well and equipment operating lifetime; and repair and replacement of damaged wells and equipment be completed.

6 NYCRR § 554 and 556 Emergency Response Plan

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 or 6 NYCRR § 556 to require improved emergency response planning.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC require improved emergency response planning. *See* Harvey Report Recommendations Nos. 100-102.

NYSDEC did not respond to this comment.

Recommendation: NYSDEC should revise 6 NYCRR § 554 and 6 NYCRR § 556 to:

- Require a well blowout response plan (either included in the Emergency Response Plan (ERP) or as a separate plan), a contract retainer with an emergency well control expert, and prearranged access to a relief well rig.
- Identify an ERP review, approval, and audit process to ensure that quality plans are developed, including adequately trained and qualified personnel and the availability of adequate equipment.
- Require, if local emergency response resources are relied on in the ERP, that operators ensure they are trained, qualified, and equipped to respond to an industrial accident, and if not should be required to provide its own industrial response equipment and personnel.
- Require that NYSDEC conduct audits of drills, exercises, equipment inspections, and personnel training.
- Require that the plan be submitted to NYSDEC with the well application for NYSDEC review and approval.

6 NYCRR § 554 and 556 Seismic Data Acquisition

Revised Proposed Regulation: NYSDEC did not add any new regulations at 6 NYCRR § 554 or 6 NYCRR § 556 to include seismic data acquisition regulations.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC include seismic data acquisition regulations. *See* Harvey Report Recommendations Nos. 105-107.

NYSDEC did not respond to this comment.

Recommendation: NYSDEC should revise 6 NYCRR § 554 and 6 NYCRR § 556 to establish regulatory requirements for seismic data collection to reduce impacts to the environment and the public including:

- A permitting process for these activities and institute mitigating measures in the SGEIS to minimize surface impacts and disruptions, and require rehabilitation of impacted areas.
- The best practices and model permit requirements proposed in Harvey Consulting, LLC., Onshore Seismic Exploration Best Practices & Model Permit Requirements Report to: Sierra Club and Natural Resources Defense Council, January 20, 2011.

All information required to be submitted pursuant to 6 NYCRR § 556 should be made publicly available on NYSDEC's website.

6 NYCRR § 560 Marcellus Shale Only

Revised Proposed Regulations: NYSDEC proposes new regulations at 6 NYCRR Part 560 for all operations associated with HVHF wells targeting the Marcellus Shale and other low-permeability formations in NYS.

Prior Comments and Response: NYSDEC did not respond to our 2012 Recommendations, which criticized the agency's attempt to develop regulations for all shale and low-permeability reservoirs in NYS, while evaluating data and potential impacts in the SGEIS only with respect to the Marcellus Shale. *See* Harvey Report Recommendation No. 1 and Joint Legal Memorandum at 2.

In our 2012 Recommendations we stated:

> *The SGEIS should either include additional information and analysis on the impacts of exploring and developing the Utica Shale and other unnamed low-permeability gas reservoirs, or acknowledge that there is insufficient information and analysis to study the impacts of this development. In the latter case, the SGEIS should conclude that its examination of impacts and mitigation measures is limited to the Marcellus Shale Gas Reservoir, and therefore any Utica Shale or other unnamed low-permeability gas reservoir development will warrant a site-specific supplemental environmental impact statement review or should be covered under another, future SGEIS process.*

As explained in the Harvey Report, there are low-permeability gas reservoirs that are present at depths shallower than the Marcellus Shale which were not studied at all. Those unnamed, unanalyzed low-permeability reservoirs are in closer proximity to protected water resources and warrant a complete technical and scientific assessment. Most importantly, HVHF modeling and fracture design requirements should be established to ensure that man-made induced fractures in these shallower reservoirs do not propagate in a manner that pollutes protected groundwater resources. Man-made induced fractures in shallower formations will tend to propagate on the horizontal plane; however, the size of that horizontal fracture must be constrained so that it does not intersect with existing improperly constructed or improperly abandoned wells or transmissive faults and fractures that can provide a direct pollution pathway to protected groundwater resources.

It is also important not to site shallower HVHF operations in locations above Marcellus Shale, because the industry relies on these low permeability formations to prevent vertical movement of contaminants from the target shale to the surface.

Best technology and best practices and cumulative impacts, in many cases, are reservoir specific. Because the RDSGEIS does not contain information on the depth, type, activity, or equipment requirements for the general category called "***other*** *low-permeability gas reservoirs,*" it is not possible to determine if the maximum impact assessment for a Marcellus Shale well sufficiently covers the maximum impact from "***other*** *low-permeability gas reservoirs.*" Nor is it possible to determine whether best technology and best practices developed for the Marcellus Shale would apply to the Utica Shale, or other shale formations since there is very little information and understanding of the optimal Utica Shale stimulation method at this time.

Therefore, developing 6 NYCRR Part 560 regulations to cover all HVHF wells in NYS, based on a SGEIS that examined only the Marcellus Shale, may result in regulations that are not appropriate for the wide range of low-permeability gas resources.

NYSDEC's proposed regulations at 6 NYCRR § 560.6(c)(7) and 6 NYCRR § 560.7(g), NYSDEC only proposes to require certain best practices only for the Marcellus Shale because it hasn't studied other "low-permeability reservoirs" in NYS enough to know where to establish best practice requirements for other "low-permeability reservoirs."

For example, 6 NYCRR § 560.6(c)(7) requires closed-loop tanks to be used only for "horizontal drilling" in the Marcellus Shale and 6 NYCRR § 560.7(g) requires a site-specific acid rock drainage mitigation plan only for "horizontal drilling" in the Marcellus Shale. Closed loop tanks and acid rock drainage mitigation plans were not required in NYCRR for any other low-permeability reservoirs, but that decision is not supported by either the RDSGEIS or NYSDEC's response to comments.

Recommendation: We recommend that NYS make it clear that Part 560 applies to HVHF operations only in the Marcellus Shale and that no other HVHF operations be permitted until a SGEIS is developed to thoroughly analyze the impact of developing other formations. Once that SGEIS work is completed, Part 560 can be amended or a new 6 NYCRR Part can be developed to regulate those formations in the event that different mitigation measures are determined through proper analysis to be necessary.

6 NYCRR § 560.2(b)(2) Definition of Additive

Revised Proposed Regulation: NYSDEC proposes a new definition of the term "additive" at 6 NYCRR § 560.2(b)(2) to mean "a substance composed of one or more chemical constituents that is intentionally added to a base fluid."

We support the inclusion of a new definition of the term "additive" but do not support its limitation to chemical constituents that are intentionally added to a base fluid. Any chemical constituents that are known by the operator to exist in a base fluid, including any proppant, should be disclosed, whether added by the operator or another entity.

Recommendation: 6 NYCRR § 560.2(b)(2) should be amended to read as follows:

> "'additive' shall mean a substance composed of one or more chemical constituents that is ~~intentionally added~~ known by the operator to be present in a base fluid, including any proppant."

6 NYCRR § 560.2(b)(7) Definition of Chemical Disclosure Registry

Revised Proposed Regulation: NYSDEC proposes a new definition of the term "chemical disclosure registry" to mean the industry-operated website FracFocus.org.

Prior Comments and Response: Our 2012 Recommendations noted that the RDSGEIS "propose[d] to provide a listing of high-volume hydraulic fracturing additive product names and links to the associated MSDSs on an individual basis on [the NYSDEC's] website." While noting that this requirement was not reflected in the then-proposed regulations, we praised NYSDEC's decision to require disclosure on its own website rather than FracFocus.org, which suffers from several crippling limitations. Joint Legal Memorandum at 20.

NYSDEC did not respond to this comment, but did respond to a comment recommending pre-fracture notice and disclosure of chemicals to the Department and landowners, similar to those employed in Wyoming and Colorado, by including a new requirement for pre-fracture disclosure to the Department and post-fracture disclosure to the Department and via FracFocus.org. [Response 7796].

In addition to adding a new definition of the term "chemical disclosure registry" at 6 NYCRR § 560.2(b)(7) to mean FracFocus.org, 6 NYCRR § 560.5(h)(4) requires post-fracture disclosure of hydraulic fracturing fluid information via the chemical disclosure registry.

While we support NYSDEC's inclusion of a regulatory requirement for post-fracture disclosure of hydraulic fracturing fluid contents, we do not support the use of FracFocus.org for that purpose. As noted in our 2012 Recommendations, FracFocus.org suffers from a number of critical limitations. Most significant among these deficiencies is the inability to search and aggregate data. The Natural Gas Subcommittee of the Secretary of Energy Advisory Board, which was directed by the President to make recommendations about improving the safety and environmental performance of hydraulic fracturing, recommended that regulators ensure that disclosures are "posted on a publicly available website that includes tools for searching and aggregating data by chemical, well, by company, and by geography."[12]

It is our understanding that FracFocus.org is in the process of improving search capabilities. This is an important improvement. However, FracFocus.org prevents aggregation, which unnecessarily restricts full public access and use of the information. The Natural Gas Subcommittee explained that one significant "limitation of FracFocus.org is that the information is not maintained as a database. As a result, the ability to search for data is limited and there are no tools for aggregating data."[13] Unfortunately, the limitations with FracFocus.org are not only technical ones. The website's terms of use also purport to prohibit others from compiling the data and publishing it elsewhere.[14] NYSDEC should not require the use of any site which claims to prevent public use of data collected for the public benefit. Public access to the information provided in hydraulic fracturing disclosures is not only useful on a well-by-well basis, but allows scientists to develop a better understanding of the effects of hydraulic fracturing.

Accordingly, NYSDEC should follow the path proposed in the RDSGEIS, and develop its own site for publication of fracturing fluid constituents, independent of FracFocus.org. Alternatively, if NYSDEC chooses to adopt FracFocus.org, NYSDEC must ensure that FracFocus.org is improved to cure the technical and potential legal deficiencies identified above. We are not aware of any reason why these deficiencies could not be solved on a very short timeframe. Thus, it would be appropriate for NYSDEC to follow Colorado's lead in stipulating that unless these deficiencies are cured within a fixed period of time, NYSDEC will adopt (creating, if necessary) an alternative disclosure registry.[15]

Recommendation: The term "chemical disclosure registry" should be redefined to mean a registry that will be maintained and monitored on NYSDEC's website, and which is searchable and permits for aggregation of data. In the event the Department continues to define this term to mean FracFocus.org, it must create and implement a plan to ensure that each disclosure made to the registry is reviewed by NYSEC staff for full compliance with the Department's disclosure requirements as set forth in 6 NYCRR §§ 560.3(d) and 560.5(h).

[12] Natural Gas Subcommittee of the Secretary of Energy Advisory Board, 90-Day Report, 24 (Aug. 18, 2011) (emphasis added), *available at* http://www.shalegas.energy.gov/.

[13] *Id.*

[14] *See* http://fracfocus.org/terms-of-use Section 7.

[15] 2 Colo. Code Regs. § 404-1:205A(b)(2)(3).

6 NYCRR § 560.2(b)(12) and § 560.2(b)(13) Flowback Definitions

Revised Proposed Regulation: In 2011 NYSDEC proposed a definition of flowback (to include solids and liquids) and flowback fluid (to include only liquids).

> *'flowback' shall mean **liquids and solids produced** during initial completion and clean-up of the well or clean-up of a well following a re-fracture or workover" [emphasis added].*
>
> *'flowback fluids' shall mean **liquids** produced following drilling and initial completion and clean-up of the well or clean-up of a well following a re-fracture or workover" [emphasis added].*

In 2012 NYSDEC revised the definition of flowback to mean a period of time and flowback water to mean liquids and solids:

> *'flowback' shall mean **phase or period** during initial completion and clean-up of the well or clean-up of a well following a re-fracture or workover" [emphasis added].*
>
> *'flowback water' shall mean **liquids and solids** produced following drilling and initial completion and clean-up of the well or clean-up of a well following a re-fracture or workover" [emphasis added].*

The definitions do not follow common usage. The term "flowback" is not a period of time in common oil and gas industry usage. It is fluid that returns to the surface after a hydraulic fracture treatment. The phase or period of time during which flowback is produced would be the "flowback period."

Recommendation: The definition of "flowback water" should be deleted. The term flowback should be restored to its form in the 2011 proposed regulations and defined as follows:

> *'Flowback' shall mean liquids and solids produced following drilling and during initial completion and clean-up of the well or during clean-up of a well following a re-fracture or workover.*

6 NYCRR § 560.2(b)(20) and § 560.2(b)(21) Primary and Principal Aquifer Definition

Revised Proposed Regulation: 6 NYCRR §§ 560.2(b)(20) and (21) provide as follows:

> *(20) 'primary aquifer' shall mean a highly productive aquifer presently being utilized as a source of water supply by a major municipal supply system.*
>
> *(21) 'principal aquifer' shall mean an aquifer known to be highly productive or whose geology suggests abundant potential water supply, but which is not intensively used as a source of water supply by a major municipal system at the present time.*

The only difference between a principal and primary aquifer is that the primary aquifer is currently being utilized as a water supply by a "major municipal supply system." NYSDEC does not define "major" or how few people can be using a principal aquifer without it being considered a primary aquifer. Currently, there are setbacks from primary but not principal aquifers – indeed, there is only one reference to principal aquifers anywhere in the regulations other than in the definitions. NYSDEC is choosing not to

protect aquifers that are water sources for private wells and may be important sources for municipal supply systems in the future.

Prior Comment and Response: Comment 6089 states the Department "*continues to illogically distinguish between principal and primary aquifers*" based on the number of people served. NYSDEC's response claims that setbacks are to provide a margin of safety and to balance "*the protection of the water resource*" with promotion of gas development. [Response 6089 (emphasis added)]. Basically, NYSDEC claims that setbacks are for current drinking water supplies, meaning individual well owners would not qualify for protection and that potential future water supplies will not be protected under the proposed regulations. If failure to protect a principal aquifer results in its contamination with drilling fluids or other pollutants, prohibitive remediation costs likely will mean that the water source is lost permanently.

Recommendation: NYSDEC should provide the same protection to principal aquifers that it currently proposes for primary aquifers. The definitions do not require revisions, but each regulation addressing a primary aquifer should be amended to apply equally to principal aquifers. *See, e.g.*, our recommendations and proposed revisions to 6 NYCRR §§ 750-3.3(a)(2) and 3.11(d).

6 NYCRR § 560.3 Application Requirements, Procedures and Fees

Revised Proposed Regulation: 6 NYCRR § 560.3 lists additional application requirements, procedures and fees required for HVHF.

NYSDEC improved the HVHF application requirements at 6 NYCRR § 560.3(a)(5) to include scaled distance to water "*intakes*" and "*water well or spring used for water supply for crops or livestock."*

NYSDEC included a requirement that a HVHF application must "*include measures being used to prevent new invasive species from being transported to the site*" at 6 NYCRR § 560.3(a)(17).

NYSDEC limited the transportation plan required in the HVHF application at 6 NYCRR § 560.3(a)(18) to cover only delivery of water to the site, instead of covering all "*raw materials and chemical additives*," which would include water, among other things. The transportation plan does not include produced water transportation plans, but should. As explained in Attachment 3 to our 2012 Recommendations (Miller Report) produced water quality can be as bad as, or worse than, flowback water especially if there is significant naturally occurring radioactive material ("NORM") in the water.

NYSDEC reduced the distance required from a well pad to a primary or principal aquifer boundary, perennial or intermittent stream, wetland, storm drain, lake, or pond, and any surface water body that is a tributary to a public drinking water supply from the 660' proposed in 2011 to 500.' *See* 6 NYCRR § 560.3(a)(6). NYSDEC also deleted its 2011 proposal that the application include "*the capacity of the rig fueling tanks and their proposed distance to any public or private water well, domestic-supply spring, reservoir, perennial or intermittent stream, storm drain, wetland, lake or pond within 500 feet.*"

Prior Comment and Response: Our 2012 Recommendations requested that Parts 550-556 be modernized to include best available technology and operating practices for all oil and gas wells drilled and completed in NYS, including but not limited to oil and gas wells that are hydraulically fractured with less than 300,000 gallons of water.

The application requirements at 6 NYCRR § 560.3(a), which are intended to apply only to HVHF wells, would improve the quality of the application for all oil and gas wells because the protections they provide are not specific to HVHF operations in all cases. For example:

- 6 NYCRR § 560.3(a)(1), § 560.3(c), and § 560.3(f) requires the operator to identify the depth to the objective formation and provide maps of the planned wellbore and area and pay all required fees. This should be an application requirement for all wells in NYS, not just HVHF wells.

- 6 NYCRR § 560.3(a)(2) requires the operator to identify the depth of "potential freshwater", such that casing can be set at the correct depth. This should be an application requirement for all wells in NYS, not just HVHF wells. Additionally, the term "potential fresh water" should be revised to our recommended term "protected ground water," which would protect all potable fresh water and all USDWs.

- 6 NYCRR § 560.3(a)(3)-(4), § 560.3(a)(11), § 560.3(a)(19) and § 560.3(d) requires the operator to identify water uses, tankage for handing flowback, and chemical additives for hydraulic fracturing operations. These requirements should apply to all wells in NYS that conduct hydraulic fracturing operations, not just HVHF wells. Multiple wells conducting hydraulic fracture operations in an area, even if less than 300,000 gallons per treatment, can cumulatively use a significant amount of water and chemicals and NYSDEC should be aware of, and mitigate, that potential adverse impact.

- 6 NYCRR § 560.3(a)(5)-(7) requires the application to include scaled distances to sensitive receptors. This should be an application requirement for all wells in NYS, not just HVHF wells.

- 6 NYCRR § 560.3(a)(9)-(10), § 560.3(a)(12)–(18), and § 560.3(b) require the application to include information in reserve pits, tank systems, air emission sources, availability of pipelines to conduct RECs, waste disposal plans, blowout preventer use and testing, invasive species mitigation, site reclamation, transportation plans, and GPS coordinates for access roads. The issues addressed by these application requirements are not unique to HVHF and should be addressed by application requirements for all wells in NYS, not just HVHF wells.

While NYSDEC made a number of improvements to the Part 560 regulations, it did not carefully examine and specify which improvements should apply only to HVHF wells, and which should apply to all oil and gas wells in NYS. NYSDEC provides no basis for improving the 6 NYCRR § 560.3 Application Procedures and Fee regulations, while leaving the Part 552 regulations unchanged and seriously outdated. NYSDEC responds only that HVHF operations have higher impacts than smaller HF operations, but does not explain why standard application contents would not be required for both. [Response 3789].

Recommendation: The proposed requirements at 6 NYCRR § 560.3 described above should also be included in Part 552, or NYSDEC should justify why these same requirements should not apply to other oil and gas wells in NYS.

We support the improvements made to 6 NYCRR § 560.3(a)(5) and § 560.3(a)(17).

We urge NYSDEC to eliminate the proposed changes at 6 NYCRR § 560.3(a)(6) and § 560.3(a)(18), as well as the deletion of the 2011 proposed language that required "*the capacity of the rig fueling tanks and their proposed distance to any public or private water well, domestic-supply spring, reservoir, perennial or intermittent stream, storm drain, wetland, lake or pond within 500 feet*" to be included in the application. Additionally, please see our recommendations for setback improvements at 6 NYCRR § 553.2 which, if adopted, will require the 660' requirement to increase.

Revise 6 NYCRR § 560.3(a)(18) to include produced water.

The information required to be submitted pursuant to 6 NYCRR § 560.3 should be made publicly available on NYSDEC's website.

6 NYCRR § 560.3(a)(2) Depth to Protected Water

Revised Proposed Regulation: 6 NYCRR § 560.3(a)(2) proposes that a HVHF well application include

> *the estimated maximum depth and elevation of bottom of potential fresh water, and the basis for such estimate (water well information, other well information, previous drilling on the well pad, published or private reports, or other department-approved source).*

Recommendation: Revise 6 NYCRR § 560.3(a)(2) to specify that the protected water measurement must be provided all along the wellbore for non-vertical wells not just within the vertical section of the wellbore. This is necessary to be certain the entire wellbore is the proper distance below the bottom of protected water.

6 NYCRR § 560.3(a)(2) should be revised to read:

> *the estimated maximum depth and elevation of bottom of* ***protected ground water*** *must be provided for the vertical section of the wellbore and* ***along the entire non-vertical section of the wellbore when deviated (high-angle or horizontal) wells are planned*** *and the basis for such estimate (water well information, other well information, previous drilling on the well pad, published or private reports, or other department-approved source).*

6 NYCRR § 560.3(d)(2)-(3) & 560.5(h)(2)-(3) HF Fluid Disclosure Trade Secret Protection

Revised Proposed Regulations: NYSDEC's proposed regulations governing pre- and post-fracture disclosure of hydraulic fracturing fluid contents at 6 NYCRR §§ 560.3(d)(2) and 560.5(h)(2) provide that: "the [D]epartment will disclose to the public the information submitted [on hydraulic fracturing fluid contents] except that owner [sic] or operators or other persons who supply [such] information . . . may request such records to be exempt from disclosure as trade secret as provided by [6 NYCRR] Part 616 . . . ."

Prior Comments and Response: Our 2012 Recommendations encouraged NYSDEC to adopt the trade secret standards of the federal Emergency Planning and Community Right to Know Act ("EPCRA"). Joint Legal Memorandum at 18-19. NYSDEC did not respond to this comment.

Regarding other comments recommending that no trade secret protection should be afforded to hydraulic fracturing fluid contents, NYSDEC provided the following response:

> *Existing state law, [Public Officers Law ("POL")] 87(2)(d), recognizes the right of persons who submit information to the Department to request that such information be excepted from public disclosure if the information qualifies as a trade secret. The Department's existing Records Access Regulations, 6 NYCRR 616.7, which implement POL 87(2)(d), lay out the process for making such requests, as well as the Department's procedure for independently evaluating whether the subject information qualifies as trade secret. Additive information determined by the Department to be trade secret could not be disclosed to the public; however, all other additive information would be made available to the public. [Response 6116].*

Since submission of our 2012 Recommendations, we have done further legal research and policy analysis concerning the issue of the trade secret exemption to disclosure of hydraulic fracturing fluids. We have come to share the view that there is no sound legal or policy justification for permitting companies to claim, or for NYSDEC to honor, any trade secret privilege with respect to hydraulic fracturing and gas production operations. Indeed, the State of Alaska has just proposed a new disclosure rule that eliminates trade secret protection.[16]

NYSDEC's response to the comment requesting full disclosure, *i.e.*, no trade secret exemption, was incomplete. NYSDEC stated that: "Existing state law, [Public Officers Law ("POL")] 87(2)(d), recognizes the right of persons who submit information to the Department to request that such information be excepted from public disclosure if the information qualifies as a trade secret." [Response 6116]. Although persons may request this protection, the statute does not require that agencies honor such requests. The cited section of the statute provides that: "Each agency *shall*, in accordance with its published rules, make available for public inspection and copying all records, except that such agency *may* deny access to records or portions thereof that: . . . (d) are trade secrets . . . which if disclosed would cause substantial injury to the competitive position of the subject enterprise." POL § 87(2)(d) (emphasis added). Courts have appropriately summarized these exemptions in discretionary language, explaining, for example, that records meeting the exemption are "*not required* to be disclosed and *may* be redacted."[17] Moreover, the Revised Proposed Regulations governing disclosure will not require disclosure of any formulae for the additives or other information that ordinarily might qualify for protection. Although NYSDEC's own Records Access Regulation (6 NYCRR § 616.7) presently does require the Department to exempt qualified trade secrets from disclosure, as summarized in Response 6116, the Department can and should amend this regulation to abrogate trade secret protection in the context of hydraulic fracturing fluid constituents.

At a minimum, NYSDEC should amend 6 NYCRR § 616.7 to provide for immediate disclosure of trade secrets to emergency and health professionals when such information will assist these professionals in their duties. [*See* Joint Legal Comment at 19; *see also* Comment 6125]. Colorado, for example, requires disclosure of otherwise confidential or trade secret information in these circumstances.[18] Such disclosure is necessary because, for instance, if the identities of certain chemicals are withheld, physicians may be unaware of certain chemicals to which a patient may have been exposed. This may make it difficult or impossible to accurately diagnose and treat the patient, or to understand the interactive effects that chemicals can have on a patient's health. Because complete information is necessary to "ensure that acute exposures are handled appropriately and to ensure that surveillance programs are optimized," the Pediatric Environmental Health Specialty Units, a network of experts in children's environmental health, have recommended full disclosure of all chemical information.[19]

In responding to comments regarding disclosure to emergency responders, NYSDEC observed that section 616.7(b) "does not provide for the disclosure of trade secret information by the Department in the

[16] *See* http://doa.alaska.gov/ogc/hear/HydraulicFrac.pdf.

[17] *Prof'l Standards Review Council of Am. Inc. v. New York State Dep't of Health*, 193 A.D.2d 937, 940, 597 N.Y.S.2d 829, 831 (1993) (emphasis added).

[18] 2 Colo. Code Regs. § 404-1:205A(b)(5).

[19] Pediatric Environmental Health Specialty Units, *PEHSU Information on Natural Gas Extraction and Hydraulic Fracturing for Health Professionals* 3 (Aug. 2011), *available at* http://aoec.org/pehsu/documents/hydraulic_fracturing_and_children_2011_health_prof.pdf.

event of non-routine incidents or emergencies." [Response 6125]. An appropriate solution, if NYSDEC chooses to protect trade secrets regarding fluid constituents generally, is for the NYCRR to simply specify that section 616.7 does not apply when disclosure of hydraulic fracturing fluid constituents is necessary to allow an emergency or health professional to discharge their duties. As section 616.7 is NYSDEC's own regulation, NYSDEC has the authority to craft exemptions thereto. Alternatively, NYSDEC could compel well operators to provide this information directly to emergency and health professionals when warranted. Section 616.7, as currently drafted, poses no barrier to this option. Of course, these options are not mutually exclusive, and by adopting both concurrently, NYSDEC would ensure that emergency and health professionals would be able to secure needed information from whichever entity was able to respond most quickly.

If NYSDEC maintains any exemption to disclosure for trade secrets, which we recommend strongly against, NYSDEC must ensure that the exception from disclosure remains narrow and is stringently enforced. As New York courts have explained, under the POL provisions at issue "there is 'a broad standard of disclosure upon the State and its agencies', with exemptions to be construed narrowly."[20] To be exempt from disclosure, it is not enough that a purported trade secret provide some advantage to the controlling entity – the entity must affirmatively show, in its initial claim for secrecy, that "disclos[ure] would likely cause substantial injury to the competitive position of the subject enterprise."[21] Stringent enforcement of this standard is crucial because, as other states' experience demonstrates, failure to construe the exemptions narrowly can lead to the granting of unwarranted claims of trade secrecy. For example, in Wyoming, many companies have sought and received trade secret protection on the basis of vague and unsupported assertions of competitive harm. Here, if NYSDEC exercises its discretion under the Public Officers Law to exempt trade secrets from disclosure, NYSDEC must ensure that it will have sufficient resources in place to review the legitimacy of any claims of trade secrecy at the time the information is submitted. If NYSDEC instead waits until a member of the public challenges a claim of trade secrecy to review whether the exemption is appropriate, this will defeat the underlying purpose of the rule requiring prior public disclosure of hydraulic fracturing fluid constituents generally. For example, by the time a member of the public succeeds in challenging an unwarranted claim of trade secrecy, it is likely that the fracturing job will already have occurred (absent an expensive and uncertain effort to secure immediate injunctive relief), eliminating the possibility of baseline testing for the undisclosed ingredients. The regulations should also make clear that the Department's determination to afford trade secret protection to a disclosure is itself subject to review in any appeal under Part 616.

Recommendations: NYSDEC should require full public disclosure of all relevant information, including but not limited to the composition, concentration, and chemical identities of all hydraulic fracturing fluids. 6 NYCRR §§ 560.3(d)(2)-(3) and 560.5(h)(2)-(3) should be deleted, and 6 NYCRR § 616.7 should be amended to make information disclosed pursuant to 560.3(d)(1) ineligible for trade secret protection. Specifically, 6 NYCRR § 616.7(b)(1) should be amended as follows:

> *<u>Except for information submitted pursuant to 6 NYCRR § 560.3(d) or 6 NYCRR § 560.5(h),</u> i<u>[I]</u>nformation submitted as provided in subdivision (a) of this section shall be excepted from disclosure and be maintained apart by the department from all other records until 15 days after the entitlement to such exception has been finally determined by the department or such further time as ordered by a court of competent jurisdiction. <u>Pursuant to paragraph (d) of subdivision</u>*

[20] *New York State Elec. & Gas Corp. v. New York State Energy Planning Bd.*, 221 A.D.2d 121, 124, 645 N.Y.S.2d 145, 147 (1996) (quoting *Capital Newspapers Div. of Hearst Corp. v. Burns*, 67 N.Y.2d 562, 565-66, 505 N.Y.S.2d 576, 496 N.E.2d 665)

[21] 6 NYCRR § 616.7(a)(4).

(2) of section 87 of the Public Officers Law, the department will decline to exempt from disclosure any trade secret or confidential commercial information submitted pursuant to 6 NYCRR § 560.3(d) or 6 NYCRR § 560.5(h).

In the event that NYSDEC continues to allow for the claiming of trade secret protection, NYSDEC should make two critical additions to the proposed regulations.

First, a provision should be added providing for an appeal of the denial of access to records on the basis of trade secret protection. Specifically, a new subsection 6 NYCRR §§ 560.3(d)(4) should be added (with the existing subsection (4) renumbered as subsection (6)) that reads as follows:

(4) When a request for trade secret protection is made, the owner or operator or other persons who supply information pursuant to paragraph (1) [(ix) and/or (x)] of this subdivision shall submit both redacted and un-redacted versions of the application or report containing the information for which trade secret protection is requested. Until a grant or denial of the trade secret protection request has been made by the department, the redacted version shall be used for purposes of public disclosure and in response to requests for information received by the department pursuant to Part 616 of this Title. A person whose request to inspect or copy a public record is denied, in whole or in part, because of a grant of trade secret protection may file an appeal with the Public Access Officer in accordance with 6 NYCRR § 616.28 for the purpose of reviewing whether the department properly determined that the trade secret protection should be granted.

Second, NYSDEC should allow for immediate disclosure of hydraulic fracturing fluid contents to medical professionals and first responders. Medical professionals require full access to information on what their patients may have been exposed to, and in what concentrations, for diagnosis and treatment. First responders need access to all information related to well stimulation in order to appropriately respond to accidents and emergencies. A number of state hydraulic fracturing rules include provisions allowing medical professionals and first responders to obtain trade secret information. These states include Arkansas, Colorado, Montana, Ohio, Pennsylvania and Texas. New York must also ensure that all information is accessible to these parties. To ensure that information is provided without delay, medical professionals and first responders should be allowed to obtain the information either from the Department or the operator.

Specifically, a new subsection 6 NYCRR §§ 560.3(d)(5) should be added that reads:

(5) Notwithstanding any other provision of this subdivision, any health professional or emergency responder who states a need for disclosure of information submitted pursuant to this subdivision in order to respond to an emergency situation shall be provided such information immediately even if otherwise exempt from disclosure as trade secret or confidential commercial information. Any such health professional or emergency responder may share such information with the affected patient and with any other health professionals involved in the diagnosis and treatment of that patient. In such an emergency situation the information shall be available from both (1) the applicable operator, supplier, or vendor, and (2) the department. In a non-emergency situation, any health professional or emergency responder who states a need for disclosure of information submitted pursuant to this subdivision in order to treat a patient may obtain such information from the department even if otherwise exempt from disclosure as trade secret or confidential commercial information, if, after 10 days or less if the professional considers such information necessary to perform their duties , reasonable efforts to obtain the

information immediately from the operator, supplier, or vendor, have been unsuccessful. No provision of 6 NYCRR § 616.7 shall limit the disclosure provided for by this subsection.

Lastly, all of the information identified in other sections as information that should be disclosed publicly should be posted on a portion of the NYSDEC's website that is available for public review, as amended by our specific recommendations on those sections, including the information required to be provided under 6 NYCRR §§ 550.3(az); 551.1(a); 552.1(b); 553.4(a); 554.7; 555.5; 556; 560.3(a)-(d); 560.3(e)(5); 560.5(a)-(c), (d)(3), (e)-(h); 560.6(c)(3), (4), (10)(x), (11), (13), (15), (21), (22), (26)(ix); 560.7(g), (i), (k), (l); 750-3.6(d), (e); 750-3.7(k)(40, (o); 750-3.8; 750-3.12(f).

6 NYCRR § 560.3(e) Denial of Permits for Bad Actors

Revised Proposed Regulation: The revised proposed regulations do not expressly contain a provision by which NYSDEC may deny permit applications based on an applicant's history of violations.

Previous Comment and Response: Our 2012 Recommendations suggested that NYSDEC revise its regulations to include provisions similar to those under UPA regulations, which give NYSDEC the right to deny, suspend, modify, or revoke permits for cause. [Joint Legal Comments at 26.] NYSDEC did not respond to this comment. Considering the extremely small penalties that may be assessed against violators of the oil and gas law and regulations, in the absence of such provisions NYSDEC cannot adequately protect New Yorkers against companies that engage or have engaged in the past in repeated violations of those laws and regulations.

Recommendation: NYSDEC should revise its regulations to include provisions similar to those promulgated under the UPA, 6 NYCRR § 621.13, which give NYSDEC the authority to deny, suspend, modify, or revoke permits for, *inter alia*, materially false statements, failure to comply with permit conditions, or exceeding the scope of the permitted project.

6 NYCRR § 560.3(e)(5) Public Comment on HVHF Applications

Revised Proposed Regulation: NYSDEC has proposed a new subsection 6 NYCRR § 560.3(e)(5) to require a public notice period of at least 15 days after publication of a draft HVHF permit in the ENB. The proposed regulations do not specify any required information for such notice. Nor do they specify how a copy of the draft well permit would be made available to the public, other than to require that a copy be published on a publicly available website.

Prior Comment and Response: In our 2012 Recommendations, we commented on the lack of opportunity for public involvement in HVHF permit applications and called for a 30-day public review period. [Joint Legal Comments at 23-24.] We strongly support the inclusion of public review provisions for HVHF permit applications in 6 NYCRR § 560.3(e)(5). However, the 15-day period that this subsection provides is insufficient to guarantee meaningful public involvement in the permitting process. NYSDEC has provided no justification for requiring only a 15-day public review period rather than the 30-day period found in other parts of ECL Article 23, such as in § 23-0503(3). Moreover, the public notice provision in this subsection does not specify what information must be included in the ENB notice. NYSDEC should adopt the UPA regulatory requirements with respect to the content of the ENB notice. As required by 6 NYCRR § 621.7(b)(6), this subsection should provide that the ENB notice contain:

(1) The applicant's name; (2) A brief description of the proposed project and its location; (3) A list of all department permits for the project for which application has been made, and

> *identification numbers for those applications; (4) The name and telephone number of the department representative and, where applicable, of any lead agency representative to contact for further information; (5) The status of environmental reviews conducted under SEQR . . . .*

Notice in the ENB alone is insufficient to alert key stakeholders of the pending HVHF permit application. Residents who would be most affected may not be aware of such an application or the publication of the draft permit, especially given the short timeframe provided for public comment. The UPA regulations provide that the Department may require the applicant to provide other reasonable notice of a complete application, such as distribution or posting of information, public information meetings, or translation of notices for non-English speaking communities. 6 NYCRR § 621.7(e). The regulations further require that a notice of complete application be provided to agencies which have jurisdiction to fund or to approve or are directly undertaking the project; agencies with which the Department is required to consult prior to its determination of completeness, including but not limited to those responsible for historic preservation and costal management; and any person on a mailing list, developed by the Department, of persons interested in such projects. 6 NYCRR § 621.7(i).

In addition, providing for publication of the draft well permit on "a publicly available website," without specifying that the publication will be on NYSDEC's website, does not ensure that the draft well permit will be easily reviewable by the public. Without reasonable and timely access to the permit application and supporting documentation, including the draft permit, the public cannot assess the accuracy of those documents nor comment meaningfully on the application within the time frames provided.

Recommendation: NYSDEC should amend 6 NYCRR § 560.3(e)(5) to provide for a 30-day comment period consistent with that required by ECL § 23-0503(3), and incorporate the language of 6 NYCRR § 621.7(b) specifying the information required in the ENB notice. NYSDEC also should post the permit application and all supporting documentation, including a copy of the draft permit, on the Department's website. Finally, notice of a complete permit application and a copy of the draft permit should be provided to all authorities listed in 6 NYCRR 621.7(i), as well as to the municipal and county chief executive officers and all residents and property owners of the spacing unit in which HVHF operations would take place.

6 NYCRR § 560.3(e) Public Hearings for HVHF Permits

Revised Proposed Regulation: New subsection 6 NYCRR § 560.3(e) does not provide for public hearings.

Prior Comment and Response: In our 2012 Recommendations, we commented on the lack of public involvement in HVHF permit applications and called for a 30-day public review period. [Joint Legal Comments at 23-24.] We support NYSDEC's inclusion of public review provisions for HVHF applications in 6 NYCRR § 560.3(e), but strongly recommend that NYSDEC include a provision in this subsection that affords the same opportunity for a public hearing provided for by 6 NYCRR § 553.4 in the case of an application for a permit and spacing variance. Controversial applications for draft permits may raise substantive and significant issues that should be the subject of a public hearing. NYSDEC should specify that this hearing decision and process will be governed by the UPA and its implementing regulations at 6 NYCRR § 621.8. NYSDEC has not provided any justification as to why it should not afford the opportunity for public hearing on HVHF permit applications in the same manner that it does for variance applications.

Recommendation: NYSDEC should revise 6 NYCRR § 560.3(e) to include a hearing provision similar to that proposed in 6 NYCRR § 553.4(b) and specify that the determination to hold a hearing and the hearing process be governed by the UPA and its implementing regulations at 6 NYCRR § 621.8.

6 NYCRR § 560.3(e)(7) Applications for Permitting of Additional Wells

Revised Proposed Regulation: NYSDEC has proposed a new subsection 6 NYCRR § 560.3(e)(7) which provides:

> *Unless otherwise required by law, applications for the permitting of additional wells on a well pad associated with any well that has already been granted a permit pursuant to this Part shall not be subject to the public notice or comment period provided for under this section.*

We disapprove of NYSDEC's proposed addition to 6 NYCRR § 560.3, which does not require public notice and comment for draft HVHF permits for additional wells on a well pad. NYSDEC has not justified this provision, which allows HVHF operators to drill multiple wells on a well pad without notifying the public or providing the opportunity to comment on each well.

The public should have the opportunity to comment on the draft permit with an understanding of the additional wells and well locations that will be authorized under that permit. In addition, NYSDEC should have an opportunity to prepare for additional wells before HVHF operations commence, to make certain that it has the regulatory and enforcement resources and staff in place to handle the number of wells that may be permitted.

Recommendation: NYSDEC should revise 6 NYCRR § 560.3(e)(7) to require that an HVHF operator's first application for a HVHF permit identify all wells intended for a well pad. Any wells not previously identified in an application should be subject to the notice and comment provision of 6 NYCRR § 560.3(e)(5), modified as recommended by our comments on that subsection.

6 NYCRR § 560.4 Setbacks

Revised Proposed Regulation: NYSDEC did not improve the setback requirements for HVHF wells at 6 NYCRR § 560.4 as requested by many commenters.

Prior Comment and Response: NYSDEC received public comment that overwhelmingly requested increased setback distances for HVHF wells. [*See* Comments 3826, 3837, 3842, 3843, 4407, 4409, 6099, 6126, 6127, 6128, 6129, 6130, 6131, 6132, and 6133]. The only opposition to the setback distances was from IOGA [Comment 6136], but as explained below in our comments on 6 NYCRR § 560.4(c), IOGA's request to reduce or waive setbacks was not scientifically, technically, or statistically supported.

As explained in our extensive setback comments provided above on 6 NYCRR § 553.2, we requested increased setback distances for all oil and gas wells in NYS, including HVHF wells. Our setback comments on 6 NYCRR § 553.2 also apply to 6 NYCRR § 560.4, and they are listed here again for completeness.

NYSDEC responded that it increased the well setback to 500' for HVHF wells located near inhabited private dwellings and places of assembly, which is an improvement over the existing setback requirements of 100' and 150' respectively; however, NYSDEC did not apply the 500' standard to all wells. Nor did NYSDEC provide any scientific or technical analysis to justify its 500' distance, or to justify its decision not to increase any other surface setback distances despite extensive comment received on this topic from a number of commenters.

NYSDEC did not adequately address Comment 4231 that recommended that NYSDEC increase well setbacks for all wells, not just HVHF wells, to:

- 500' from homes and public buildings;
- 1,000' from homes whose owners did not sign a lease;
- 1,000' from schools;
- 2,000' from any water body; and
- 5,000' from residential and municipal water well sources.

NYSDEC did not adequately address Comment 7806 that recommended NYSDEC increase well setbacks for all wells, not just HVHF wells, to:

- 3,000' from any stream, river, other body of water or private water well; and
- ¼ mile setback from public buildings, as California does, to account for air quality impacts.

NYSDEC did not acknowledge or respond to our 2012 Recommendations on surface setbacks at all. Specifically, the Harvey Report Recommendations Nos. 61-72 proposed that NYSDEC complete the following scientific and technical assessment and establish improved surface setbacks for all wells in NYS, not just HVHF wells.

- **Recommendation No. 61**: The SGEIS should provide scientific and technical justification for each setback distance proposed to demonstrate how that distance is protective of the nearby sensitive receptor. A hazard identification analysis should be completed to assess the safe distance from human and sensitive environmental receptors to proposed shale gas drilling and HVHF operations. The analysis should assess blowout radius, spill trajectory, explosion hazards, other industrial hazards, fire code compliance, human health, agricultural health, and quality-of-life factors. Improved setbacks as a result of this analysis should be included in the SGEIS as a mitigation measure and codified in the NYCRR.
- **Recommendation No. 62**: The SGEIS and NYCRR should allow local zoning authorities to establish more protective setbacks than statewide regulations to address unique and site-specific local concerns and community characteristics. The ability to improve local setbacks should be included in the SGEIS as a mitigation measure and codified in the NYCRR.
- **Recommendation No. 63**: The process for revising the 500' setback from primary and principal aquifers and the 2,000' setback from a public water supply in two and three years, respectfully, is unclear. NYSDEC should clarify the review process, including an explanation of its plans for public review and comment. NYSDEC should revise its regulations at 6 NYCRR § 617.4(b) to provide that the siting of any oil or gas well within 500' of a primary aquifer or within 2,000 of a public water supply is a Type I action.
- **Recommendation No. 64**: The SGEIS should examine whether waivers to the 500' private water well setback comport with federal law and the requirement to protect Underground Sources of Drinking Water (USDWs). The SGEIS should provide technical justification for any reduction in this setback, and should not allow a private well owner to reduce the setback such that it poses a risk to its water supply, as well as other user in the area. Private land owners should not be allowed to waive setbacks from private water wells and adversely affect the water quality of neighboring wells.

- **Recommendation No. 65:** Our 2012 Recommendations noted inconsistencies between the RDSGEIS and the proposed regulations concerning setbacks around lakes, rivers and streams. Those inconsistencies have since been resolved. In our comments on Revised Proposed § 750-3.3(a)(5), set forth below, we recommend a 500' setback from lakes, rivers and streams that are tributaries to a public water supply, beyond one mile. In our comments on Revised Proposed § 750-3.11(d), we recommend a 660' setback requiring individual SPDES coverage for perennial or intermittent streams that are not tributaries to a water supply. We reiterate that recommendation here.
- **Recommendation No. 66**: The 4,000' setback from NYC and Syracuse watersheds should be added to the proposed regulatory revisions for operations associated with HVHF at 6 NYCRR § 560.4. The SGEIS and NYCRR should also clarify if activities associated with HVHF drilling and completions will be prohibited underneath the watershed as well as on the surface.
- **Recommendation No. 67**: The setback increases proposed in the RDSGEIS should apply to all oil and gas drilling in NYS and should be codified at 6 NYCRR § 553.2.
- **Recommendation No. 68**: Improved setbacks should be included in the SGEIS as a mitigation measure and codified in the NYCRR. Specifically, the SGEIS and NYCRR should be revised at 6 NYCRR § 553.2 to include the following minimum setbacks: homes, public buildings, and schools (1,320'; ¼ mile); private and public wells, primary aquifers, and other sensitive water resources (4,000'); and other water resources (660'; 1/8 mile). In our comments on Revised Proposed §§ 750-3.3(a) and 750-3.11(d), we now recommend a 4000' setback from both primary and principal aquifers. We reiterate that recommendation here. Additionally, NYSDEC should clarify the authority of local zoning authorities to establish minimum setbacks that are more protective than NYS' minimum standards in order for localities to address unique and site-specific local concerns and community characteristics.
- **Recommendation No. 69**: The NYCRR should be revised at 6 NYCRR § 552.3 to allow the well location to be adjusted by 75' without a permit amendment only if all the statewide and local setback requirements are still preserved.
- **Recommendation No. 70**: We previously requested a setback of at least 100' from wetlands. We now recommend a wetland setback that is the same as the 300' buffer for wetlands provided for in 6 NYCRR § 750-3.11(d).
- **Recommendation No. 71**: The NYCRR should be revised at 6 NYCRR § 750-3.2, 6 NYCRR § 750-3.11(d), 6 NYCRR § 553.2, and 6 NYCRR § 560.4 to provide consistent setback requirements that are protective of water sources, including rivers, streams, lakes, and private water supplies.
- **Recommendation No. 72:** NYCRR and the SGEIS should clarify that setbacks are measured from the edge of the well site, as defined in Revised Proposed 6 NYCRR § 750-3.2(b)(52). Wells should be centered on the well pad and should be set back at least 100' from the pad edge, to maximize well setbacks from sensitive receptors.

The Myers Report also recommended that:

- NYSDEC examine existing setbacks to verify if they have been successful or whether increased setbacks are warranted;
- Wells be set back at least 4,000' from primary aquifers and public water supplies; and
- Well not be placed within the 500-year flood plain.

While NYSDEC stresses the importance of establishing setbacks, it does not provide any scientific or technical assessment to demonstrate that its proposed setbacks meet its own stated criteria. Instead, NYSDEC's reasoning behind its proposed setback distances is often uncertain or unspecified.

For example, NYSDEC states that it requires setbacks "to conservatively provide a margin of safety should the operational mitigation measures fail or not be implemented in a particular instance" and that "setbacks serve as a means of helping to prevent a spill from reaching and contaminating critical water resources. Depending on the scope of the setback (**the larger the distance the greater the protection**), a spill can potentially be contained, or sufficiently delayed before reaching the water source to reduce the potential impact." [Response 6136]. If these are NYSDEC's primary goals, then sites that are on a flowpath either downstream or downgradient from a gas well should be farther from the gas well than a site cross-gradient or upgradient from the gas well.

In general, NYSDEC does not respond to Commenters' concerns about setbacks with logic and reasoning – it just disagrees. For example, in response to Comment 3826 about the need for increased setback distances, NYSDEC writes: "*The Department **does not agree** that the commenter's proposed prohibitions are necessary. Existing Parts 550 – 559 regulations, the proposed Part 560 regulations and the prohibitions/restrictions found in the rdSGEIS **provide adequate protections** for the public drinking water supplies, and the environment. The presence of FIDs or faults does not mean these features are open and able to transmit fluids at depth."* [Response 3826]. Here, NYSDEC simply asserts a disagreement and states that regulations are adequate without providing any reasoning. As for faults, some may not transmit fluids, but many do, and NYSDEC has chosen to ignore that possibility.

Additionally, NYSDEC's responses categorically dismiss increased setbacks stating that the work completed in the RDSGEIS was sufficient to support the setbacks. We disagree. For example, NYSDEC provides no basis for its decision not to include requirements for site-specific SEQRA determinations in regulation. [Response 3842]. A patchwork of requirements located in various documents will be difficult to administer, and for the public and industry to refer to and follow. We have repeatedly requested that NYSDEC consolidate all requirements applicable to all oil and gas operations into regulations so that the public and industry alike can refer to one document that contains a complete set of requirements.

NYSDEC's Response 6136 argues that setbacks "conservatively provide a margin of safety should the operational mitigation measures fail" and also worries that additional prohibitions "may lead to a waste of natural gas." We disagree that these setbacks are conservative. Moreover, we disagree that potential "waste of natural gas" is a valid basis for rejecting setbacks that are established to protect health, safety and/or the environment consistent with NYSDEC's primary mission. NYSDEC references setbacks required under others of its programs, but provides no facts or studies to demonstrate those setbacks are adequate.

Additionally, 6 NYCRR § 560.4 (a)(2) only requires a 500' setback from an "inhabited dwelling" or "place of assembly;" whereas, 6 NYCRR § 553.2 requires setback protection for more types of buildings and locations that could be inhabited, including "any public building or area which may be used as a place of resort, assembly, education, entertainment, lodging, trade, manufacture, repair, storage, traffic or occupancy by the public."

Recommendation: As explained in our extensive setback comments provided above on 6 NYCRR § 553.2, setback distances should be increased for all oil and gas wells in NYS, including HVHF wells. Our setback comments on 6 NYCRR § 553.2 and 6 NYCRR § 750-3.3(a) and 3.11(d) should also apply to 6 NYCRR § 560.4.

6 NYCRR § 560.4(c) Setback Variances

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.4(c) that grants the Department broad discretion to grant variances to the setback requirements at 6 NYCRR § 560.4(a)(1)-(2) and at 6 NYCRR § 750-3.3(a)(6).

> *(c) The **department may permit reasonable well location variances to the setback requirements in sections 560.4(a) (1), 560.4(a) (2) and 750-3.3 (a)(6)** of this Title. Any such variance to the setback requirement of section 560.4(a) (1) or Section 750-3.3(a)(6) of this Title shall be subject to the written consent of the landowner or landowners whose residential water well, domestic supply spring, or water well or spring used for livestock or crops is located within 500 feet of the proposed well pad. Any variance to the setback requirement of section 560.4(a) (2) of this Part shall be subject to the written consent of the landowner of the inhabited dwelling or place of assembly within 500 feet of a well pad, and, in the case of an inhabited dwelling, the written consent of all tenant(s), if any. The applicant for a variance must show that there are no reasonable allowable alternative locations within the spacing unit where the well pad could be sited consistent with the setback requirements of this section and the well spacing requirements of Part 553 of this Title. In approving a variance, the department shall maximize the separation distance by granting the minimum variance that it deems necessary and adequate. The department shall have the authority to impose such reasonable and necessary conditions to minimize any adverse impact on the water supplies, inhabited dwellings or places of assembly within 500 feet of the well pad [emphasis added].*

Prior Comment and Response: Industry Comment 6136 from the Independent Oil and Gas Association (IOGA) requested:

> *. . .**broad waiver provisions be included in the regulations to allow setbacks to be waived** by the Department for good cause shown based upon the **application of superior technology** [emphasis added].*

IOGA challenges NYSDEC's estimate that only 3% of the hydrocarbons will not be accessed using its proposed setbacks:

> *Industry estimates that the cumulative impact of these prohibitions and setbacks will strand approximately 50% of the acreage that is prospective for shale development in New York State.*

We reviewed IOGA's January 11, 2012 comment to NYDEC in more detail to see if IOGA's claim of 50% was technically supported. We found that IOGA's comments (page 66) based its 50% claim on the analysis of **one operator** that reports it purchased 50-60% of leases in Chemung County in primary aquifer areas. IOGA does not provide any technical analysis of this single situation to show that "superior technology" could not be used to access the hydrocarbons under this **one operator's** acreage in a single NYS county. Nor does IOGA provide any scientific, technical or statistical analysis of all leases in NYS to support its claim that 50% of NYS's hydrocarbon resources would be stranded, based on this reported problem from one operator.

NYSDEC responded that:

> *However, for now, the Department expects to implement the Part 560 prohibitions without discretion and does not have plans to incorporate a provision allowing variances from the prohibitions proposed in 560.4(a)(3)-(5). Note that proposed Part 560.4 has been revised to permit reasonable well location variances to the setbacks from certain private water wells, inhabited dwellings and places of assembly where written consent has been given by potentially affected landowners. [Response 6136]*.

While we support NYSDEC's proposal not to grant waivers to the setback provisions at 6 NYCRR § 560.4(a)(3)-(5), we do not support NYSDEC's proposal to grant waivers to setbacks from "*private water wells, inhabited dwellings and places of assembly where written consent has been given by potentially affected landowners*" at 6 NYCRR § 560.4(a)(1)-(2) and at 6 NYCRR § 750-3.3(a)(6).

Our 2012 Recommendations opposed NYSDEC's proposal to allow landowners to waive setbacks,. *See* Myers Report at 24 and 28. Landowners should not be allowed to waive setbacks for short-term, personal financial gain, because such waivers place other humans and air and water resources at risk of adverse impacts.

Comment 4405 also opposed NYSDEC's proposal to allow landowners to waive setbacks, putting protected water resources at risk. NYSDEC did not provide a scientific or technical basis for dismissing Comment 4405, and only pointed generally to the RDSGEIS and ECL and regulations.

> *The Department does not agree that a decision by the landowner to waive the 500-foot setback will endanger the water quality for the aquifer. The protections and requirements found in the rdSGEIS, Environmental Conservation Law, and Regulations provide protection to the aquifer and the environment. Likewise the Department does not agree that an attempt to waive the 500-foot setback should require that the action be classified as Type 1*. [Response 4405].

At a minimum, NYSDEC should have provided scientific and technical analysis to demonstrate that a reduction of the 6 NYCRR § 560.4(a)(1)-(2) and at 6 NYCRR § 750-3.3(a)(6) setbacks could be achieved and that there would not be a direct pathway for contaminant transport between the gas well and water resource or long-term human health or environmental impact; however, NYSDEC did not provide such an analysis.

Recommendation: The newly proposed waiver provision for setbacks at 6 NYCRR § 560.4(c) should be deleted in its entirety.

6 NYCRR § 560.5(a) Emergency Response Plan

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.5(a) requiring an emergency response plan (ERP). The requirement applies only to HVHF wells, includes an unspecified scope, and must be submitted only three days prior to spudding a well.

> 6 NYCRR § 560.5(a) *An emergency response plan* ***containing elements specified by the department*** *must be prepared by the owner or operator and kept on-site during any well operation from well spud through well completion. The well's name and number, its location in decimal latitude and longitude in North American Datum 83, the location of the access road entrance in decimal latitude and longitude in North American Datum 83 and a list of emergency contact numbers for the area in which the well site is located must be included in the emergency response plan, and such information must be*

> *prominently displayed on a weatherproof sign at the well site during operations covered by the department-issued permit to drill, deepen, plug back or convert.* ***A copy of the emergency response plan must be provided to the department at least three days prior to well spud*** *[emphasis added]*.

NYSDEC does not require the ERP to be approved by the Department for adequacy prior to drilling.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC require improved emergency response planning. *See* Harvey Report Recommendations Nos. 100-102.

NYSDEC included a requirement for an ERP for HVHF wells but did not include all the elements recommended in our comments. And, while NYSDEC's proposed requirement for an ERP for HVHF wells at 6 NYCRR § 560.5(a) is an improvement and prescriptively lists some contents (*e.g.* well name, well number, GPS data, location of access road, and emergency phone numbers), it provides the Department with broad discretion to define (outside of regulation) the mandatory minimum requirements for an ERP. We do not agree that critical components of the plan should be left unspecified; this creates uncertainty for the public and industry alike.

Commenter 6137 also requested that the ERP content be specified. NYSDEC disagreed. [Response 6137].

Commenter 6138 opposed the short 3-day window for NYSDEC to review and approve an ERP, and recommended that the ERP be provided to and approved by local emergency response personnel and the town supervisor before the permit is issued. NYSDEC disagreed, stating that it had authority to suspend any permit, but never explaining how it could possibly review and approve a company's ERP, which typically is a large, complex document, in three days, especially when plans could arrive on a Friday or over a holiday. [Response 6173].

Recommendation: NYSDEC should revise 6 NYCRR § 560.5(a) to:

- Require a well blowout response plan (either included in the ERP or as a separate plan), a contract retainer with an emergency well control expert, and prearranged access to a relief well rig.

- Identify an ERP review, approval, and audit process to ensure that quality plans are developed, including adequately trained and qualified personnel, and the availability of adequate equipment.

- Require that, if local emergency response resources are relied on in the ERP, operators ensure the local personnel are trained, qualified, and equipped to respond to an industrial accident, and if such personnel are not available, operators should be required to provide their own industrial response equipment and personnel.

- Require NYSDEC audits of drills, exercises, equipment inspections, and personnel training.

- Require that the ERP be submitted to NYSDEC with the well application for review and approval prior issuing the permit to drill.

The information required to be submitted to the Department pursuant to 6 NYCRR § 560.5(a) should be made publicly available on NYSDEC.

6 NYCRR § 560.5(b) County Notification - Emergency Response

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.5(b) requiring the county emergency management office to be notified prior to spudding the well, flaring or HVHF operations. The regulation does not specify the advance notice time requirement, nor does it require the owner/operator to provide the county with a copy of its ERP required at 6 NYCRR § 560.5(a).

Recommendation: NYSDEC should revise 6 NYCRR § 560.5(b) to include a requirement that all local government offices and volunteer organizations that may be required to respond to an emergency be provided with a copy of the ERP upon submission to NYSDEC and be notified at least 7 days prior to spudding the well, flaring, or HVHF operations. This process will provide local emergency response teams time to get familiar with the site and emergency response procedures that might be required.

6 NYCRR § 560.5(c) Incident Notification

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.5(c) that requires incident reporting for "non-routine incidents" and proposes to require HVHF operations to cease after "non-routine incidents," only to resume upon NYSDEC approval:

> *6 NYCRR § 560.5 (c) Any* ***non-routine incident of potential environmental and/or public safety significance during access road and well pad construction, well drilling and stimulation, well production, and well plugging that may affect the health, safety, welfare, or property of any person*** *must be verbally reported to the department within two hours of the incident's known occurrence or discovery, with a written report detailing the non-routine incident to follow within twenty-four hours of the incident's known occurrence or discovery.* ***Non-routine incidents of potential environmental and/or public safety significance may include, but are not limited to: casing, drill pipe or hydraulic fracturing equipment failures, cement failures, fishing jobs, fires, seepages, blowouts, surface chemical spills, observed leaks in surface equipment, observed pit liner failure, surface effects at previously plugged or other wells, observed effects at water wells or at the surface, complaints of water well contamination, anomalous pressure and/or flow conditions indicated or occurring during hydraulic fracturing operations, or other potentially polluting non-routine incident or incident that may affect the health, safety, welfare, or property of any person****. Provided the environment and public safety would not be further endangered, any action and/or condition known or suspected of causing and/or contributing to a non-routine incident must cease immediately upon known occurrence or discovery of the incident, and appropriate initial remedial actions commenced. The required written non-routine incident report noted above must provide details of the incident and include, as necessary, a proposed remedial plan for department review and approval.* ***In the case of suspended hydraulic fracturing pumping operations and non-routine incident reporting of such, the owner or operator must receive department approval prior to recommencing hydraulic fracturing activities in the same well.*** *The department may issue an order to take appropriate actions consistent with this subdivision, including an order to cease all activities [emphasis added].*

Prior Comment and Response: Comment 3762 requested that NYSDOH also be notified of all non-routine incidents. NYSDEC disagreed. [Response 3762].

Recommendation: We support NYSDEC's requirement for industry to rapidly notify the Department of incidents and take immediate remedial action. In addition:

1. NYSDEC should notify nearby residents of all reported incidents.

2. NYSDEC should expand its requirement at 6 NYCRR § 560.5(c) to require cessation of all operations associated with all non-routine incidents of potential environmental and/or public safety significance, not just HVHF operations, and require Department approval to re-commence any operation (other than responding to the incident) at any oil or gas well.

3. The term "*anomalous pressure and/or flow conditions indicated or occurring during hydraulic fracturing operations*" should be further defined to specify what constitutes an anomalous pressure or flow.

4. The term "*non-routine*" should be deleted. The term "*incident*" followed by the clause "*of potential environmental and/or public safety significance*" is clear. The use of the term "*non-routine*" indicates "*routine*" incidents of potential environmental and/or public safety significance need not be reported to NYSDEC. All such incidents should be reported, although the timeframe for doing so may vary based on the magnitude of the incident.

6 NYCRR § 560.5(d)(1) Water Well and Spring Testing Radius & Test Parameters

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.5(d)(1) that requires water well and spring testing:

> *6 NYCRR § 560.5(d)(1) prior to site disturbance for a new pad or a new well spud for an existing pad, the* ***owner or operator must*** *make all reasonable attempts, with the landowner's permission, to* ***sample and test, at the owner's or operator's expense, all residential water wells, domestic supply springs, and water wells and springs that are used as water supply for livestock or crops, that are within 1,000 feet of the well pad*** *for the parameters specified by the department, which at a minimum include barium, chloride, conductivity, gross alpha/beta, iron, manganese, dissolved methane and ethane, pH, sodium, static water level (when possible), total dissolved solids (TDS), and volatile organic compounds (VOCs), specifically BTEX.* ***If no wells or springs are available for sampling within 1,000 feet of the well pad****, either because there are none of record or because any landowners within 1,000 feet of the well pad deny the owner or operator permission to sample their wells or springs, then* ***the owner or operator must*** *make all reasonable attempts, with the landowner's permission, to* ***sample and test such water wells and springs within 2,000 feet for the parameters specified by the department****. The landowner of any water well or spring tested must be provided with a copy of the test results within 30 days of the owner's or operator's receipt of the results [emphasis added].*

Prior Comment and Response: NYSDEC did not respond to our 2012 Recommendation to require testing for specific hydraulic fracturing fluids planned for use, and toxic volatiles (benzene, toluene, xylenes). *See* Miller Report, Recommendation at 14. Dr. Miller wrote that "[t]he analytes that should be determined should include, at a minimum, the components of natural gas (methane, ethane, etc.) and also toxic volatiles from the formation water (benzene, toluene, xylenes), salts and relevant inorganic contaminants, **and the additive used during the hydraulic fracturing.**" Miller Report at 16 (emphasis added).

Comment 3764 requested that a specific list of test parameters be specified in regulation. NYSDEC agreed and included a proposed list in 6 NYCRR § 560.5(d)(1). [Response 3764].

In response to a suggestion that the test parameters be more inclusive, NYSDEC replied that operators could "include additional parameters at their discretion." [Response 3764]. Additionally, NYSDEC responds that it could "specify additional parameters it may deem necessary on a site-specific basis" without providing guidance to the Department regarding additional parameters. [Response 6124].

Comment 6513 requested that all wells within a five-year transport zone around the proposed well should be located and included in the testing program and that dedicated monitoring wells also should be established within this zone and included in the testing program. NYSDEC responded that well testing will be used to investigate complaints from well owners, and that it may require a ground water monitoring program, but neither response provided any technical reasons to ignore the commenter's request for well testing and a monitoring program in a 5-year transport zone. [Response 6513].

Comment 6146 indicated that wells should be tested based on the potential for contaminant migration, but, in lieu of that, requested wells to be tested to 2,500' or 5,000' from the proposed gas well. NYSDEC responded that a monitoring plan may be required at Part 750, but did not address the commenter's recommendation to increase the testing radius. [Response 6146]. It should also be noted that the groundwater monitoring added to the Part 750-3 regulations applies only if the Department chooses to require it and also does not provide specifics as to what must be considered. See the discussion below.

Comment 3849 requested that qualified professionals and labs be used:

> *Part 560.5(d) should specify in accordance with page 7-47 of the rdSGEIS that the water samples be collected by a qualified professional and analyzed utilizing a laboratory approved by the New York State Department of Health's Environmental Laboratory Approval Program, including the use of proper sampling and laboratory protocol, in addition to the use of proper sample containers, preservation methods, holding times, chain of custody, analytical methods, and laboratory quality assurance/quality control.*

NYSDEC responded that it did not include a requirement for qualified professionals and labs because it wanted the flexibility to change permit conditions included in the RDSGEIS over time, and didn't want to be bound by this requirement in NYCRR. [Response 3849].

Comment 6147 requested that NYSDOH oversee and quality control the water testing program to ensure the use of certified procedures and a scientific, unbiased protocol. Comment 6148 requested independent third-party testing. NYSDEC responded that results will be provided to NYSDOH and a certified lab is required by the RDSGEIS, but did not explain why this requirement was not codified in NYCRR.

Recommendation: To optimize the sampling and monitoring regime, the operator or NYSDEC should complete a detailed contaminant transport analysis to identify the likely pathways for contaminant movement away from the well or well pad which would then be used to select wells and springs for sampling, as well as identify monitoring well locations as recommended in Part 750-3. In lieu of a detailed scientific analysis, NYSDEC could require sampling of wells within a mile of the well pad or a minimum of 1,000' from any point along the horizontal wellbore where, whichever is greater.

Sampling from the vertical portion of the well ignores the potential for contamination away from the horizontal wellbore. Osborn found that water wells within a kilometer of Marcellus wells had significantly higher methane concentrations.[22] Myers found that vertical movement of fluids was possible from the area of the shale that receives a hydraulic fracturing treatment. Eventually, all wells that lie above developed gas plays may have a potential for contamination.

Proposed regulation 6 NYCRR § 560.5(d)(1) requires that the operator sample all wells and water supply springs within 1,000' of the gas well, and up to 2,000' of the gas well only if water wells within 1,000' are nonexistent or inaccessible. Sampling of nearby wells and springs is an important new requirement; but the sampling distance is insufficient. For one, it is unusual to require all wells and springs be sampled out to a radius of 2,000' only if no wells or springs could be found within 1,000'. In other words, NYSDEC suggests sampling is complete even if just one sample can be taken within 1,000' of the gas well; if that cannot be done, the operator must sample all sources within an additional area, the incremental area between 1,000' and 2,000', which is three times larger than the original area. If sampling all sources to 2,000' is proper, and it is, it should be the default and not the fallback position to use only if there are no wells to be sampled within 1,000'. However, we find the 1,000' and 2000' radii to be insufficient as described further in this section.

Proposed regulation 6 NYCRR § 560.5(d)(1) includes a prescriptive list of tests that need to be conducted on each water sample, which is an improvement. However, we find the required list of tests insufficient because it does not include contaminants that have been found at other sites and does not include test parameters that even industry groups recommend.

In Table 1 below, we compared the NYSDEC proposed list of test parameters to the list of contaminants potentially linked to hydraulic fracturing found in groundwater near Pavillion Wyoming,[23] and with parameters recommended by the Colorado Oil and Gas Association (COGA)[24] for testing. At a minimum, NYSDEC should include each of the testing parameters as mandatory minimum testing requirements at 6 NYCRR § 560.5(d)(1).

We support NYSDEC's proposal to include gross alpha/beta because of the potential for NORM in the formation water.

[22] Osborn SG, Vengosh A, Warner NR, Jackson RB (2011) Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing. Proceedings of the National Academy of Sciences pnas:1100682108.

[23] DiGiulio DC, Wilkin RT, Miller C, Oberly G (2011) DRAFT: Investigation of Ground Water Contamination near Pavillion, Wyoming. U.S. Environmental Protection Agency, Office of Research and Development, Ada, OK

[24] Colorado Oil and Gas Association (COGA) 2011 Voluntary baseline groundwater quality sampling program, Example sampling and analysis plan, Developed in cooperation with the Colorado Oil and Gas Conservation Commission.

Table 1: The three columns indicate whether the constituent was either elevated or detected at Pavillion WY (DiGuilio et al 2011), recommended for sampling by COGA (2011), or recommended by NYSDEC in 6 NYCRR § 560.5(d)(1)			
Constituent	Elevated concentration or detectable at Pavillion	COGA Listed	NYSDEC
pH	X	X	X
Specific conductance	X	X	X
Total Dissolved Solids		X	X
Alkalinity	X	X	
Bromide		X	
Barium			X (2)
Chloride		X	X
Sulfate		X	
Nitrate and nitrite (N)		X	
Phosphorus		X	
Arsenic	**(1)**		**(2)**
Boron		X	
Calcium		X	
Iron		X	X
Magnesium		X	
Manganese		X	X
Potassium	X	X	
Selenium		X	
Sodium		X	**X**
Strontium		X	
Gross alpha/beta			X
Methane	X	X	X
Ethane	X	X	X
Propane	X	X	
Benzene	X	X	X
Toluene	X	X	X
Ethylbenzene	X	X	X
Xylene	X	X	X
Trimethylbenzenes	X		
Isopropanol	X		
Diethylene glycol	X		
Triethylene glycol	X		
Tert-butyl alcohol	X		
Gasoline range organics	X		
Diesel range organics	X		
Naphthalene	X		
(1) Arsenic was noted in drilling fluids at Pavillion and was detected but not an exceedance in groundwater.			
(2) Arsenic and barium were found in wells at Dimock, PA[25]			

6 NYCRR § 560.5(d)(1) should be revised to:

1. Expand the minimum mandatory well and spring testing radius to one mile from the edge of the well pad or a minimum of 1,000' from any point along the horizontal wellbore where, whichever is greater.

[25] Memorandum: Request for Funding for a Removal Action at the Dimock Residential Groundwater Site, Intersection of PA Routs 29 and 2024, Dimock Township, Susquehanna County, Pennsylania. From Richard M. Fetzer, Eastern Response Branch to Dennis P Carney, Hazardous Site Cleanup Division, January 19, 2012.

2. In lieu of the sampling wells and springs according to those distance requirements, the operator could perform a detailed contaminant transport analysis and sample all wells and springs within a five year travel time from the well. The analysis must account for the movement of gas as well as fluids.

3. Expand the minimum mandatory well and spring testing parameters, as described above.

4. Require an independent third party contractor to obtain and test the composition of the water samples prior to commencing any drilling or hydraulic fracturing operations. The independent third party contractor must be qualified to collect water samples, complete the required tests, and include as summary of its training, qualifications, quality control, quality assurance and chain of custody procedures in each report.

More specifically, the section 6 NYCRR § 560.5(d)(1) should be revised to read:

> *Prior to site disturbance for a new pad or a new well spud for an existing pad, the owner or operator must make all reasonable attempts, with the landowner's permission, to sample and test, at the owner's or operator's expense, all water wells, domestic supply springs, and water wells and springs that are used as water supply for livestock or crops, that are within one mile from the edge of the well pad or a minimum of 1,000' from any point along the horizontal wellbore where, whichever is greater.*
>
> *Alternatively, the operator may submit a detailed contaminant transport analysis to show how far a conservative (non-reactive) contaminant could be transported within five years and sample all water sources within that potentially affected area.*
>
> *The sampling should include the following parameters specified by the department, which at a minimum include: static water level (when possible) pH, specific conductance, total dissolved solids (TDS), alkalinity, bromide, barium, chloride, sulfate, nitrate and nitrite (N), phosphorus, arsenic, boron, calcium, iron, magnesium, manganese, potassium, selenium, sodium, strontium, gross alpha/beta, methane, ethane, propane, benzene, toluene, ethylbenzene, xylene, trimethylbenzenes, Isopropanol, diethylene glycol, triethylene glycol, tert-butyl alcohol, gasoline range organics, diesel range organics, naphthalene and other polycyclic aromatic hydrocarbons (PAHs), and all other chemicals planned to be used in hydraulic fracturing operations or drilling.*
>
> *An independent third party contractor must be used to obtain and test the composition of the water samples prior to commencing any drilling or hydraulic fracturing operations. The independent third party contractor must be qualified to collect water samples, complete the required tests, and include as summary of its training, qualifications, quality control, quality assurance and chain of custody procedures in each report.*
>
> *The landowner of any water well or spring tested must be provided with a copy of the test results within 30 days of the owner's or operator's receipt of the results.*

6 NYCRR § 560.5(d)(2) Water Well and Spring Testing Intervals and Restoration or Replacement of Affected Water Supplies

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.5(d)(2) that requires water wells and springs to be tested at unspecified intervals subject to broad NYSDEC discretion, and requires reporting of "significant" deviations from baseline compositions:

> *(2) the owner or operator must sample and test residential water wells and springs in the same manner as provided in paragraph (1) of this subdivision, **at other intervals specified by the department** after the well reaches total measured depth specified on an application for a permit to drill. Any and all **significant deviation**(s) from the baseline compositions must be reported to the Department within 5 business days of determining any such deviation [emphasis added].*

Prior Comment and Response: In our 2012 Recommendations, we argued strongly for a dedicated groundwater monitoring system (Myers Report at 17-19) and for routine testing of water wells for at least 20 years after a nearby well is constructed (Miller Report, Recommendation 14). See also our comments at 6 NYCRR § 750-3.7(o) pertaining to the need for mandatory dedicated ground water monitoring systems.

Comment 3779 pointed out that the proposed well testing intervals at 6 NYCRR § 560.5(d)(2) were inconsistent with Section 7.1.4.1 Private Water Well Testing of the RDSGEIS.

> *Part 560.5(d): Water well testing appears to deviate from section 7.1.4.1, Private Water Well Testing of the rdSGEIS. Section 7.1.4.1 outlines a schedule where the operator would have all identified residential water wells within the area of concern sampled and analyzed prior to the commencement of drilling for each well on a pad; sampled and analyzed three months after each well has reached total measured depth (TMD) if there is to be a hiatus greater than three months between reaching TMD and the next applicable milestone; and sampled and analyzed three months, six months, and one year after the conclusion of hydraulic fracturing operations of each well on the pad. 560.5(d) Water well testing only proposes sampling and analysis be completed prior to well spud (paragraph (1) and "at other intervals specified by the department after the well reaches total measured depth" paragraph (3). When a primary concern surrounding the high-volume hydraulic fracturing process is the potential contamination of residential water wells, it is imperative the regulations adopt the recommendations of the rdSGEIS and plainly state its schedule for sampling and analyzing.*

NYSDEC responded that it wanted the flexibility to change permit conditions included in the RDSGEIS over time, and didn't want to be bound by this requirement in NYCRR.

> *The Department acknowledges that in some cases the rdSGEIS is more detailed than a proposed regulation. Mitigation measures contained in the Final SGEIS will be required and enforced as permit conditions. This provides flexibility for other approaches to be implemented as operators and the Department gain experience. While the rdSGEIS reflects those approaches that the Department has determined would effectively achieve an environmental objective, there may be other ways to accomplish the same objective that exist now or that will be developed as technology advances. The Department always has the option to propose additional regulations should a specific approach to a given*

objective become standardized or be deemed the only acceptable alternative. [Response 3779].

Recommendation: 6 NYCRR § 560.5(d)(2) should be revised to:

1. If there is a dedicated monitoring plan pursuant to 6 NYCRR § 750-3.7(o), which we recommend be included as a mandatory requirement pursuant to our comments at Part 750, water wells and springs should be sampled and tested within three months after well spud, and annually thereafter. Well and spring testing should continue for 20 years after the hydrocarbon well has been plugged and abandoned.

2. If there is no a dedicated monitoring plan (we recommend against this option pursuant to our comments at Part 750), water wells and springs should be sampled and tested within three months after well spud, and quarterly thereafter. Quarterly testing should continue for at least two years after all the wells have been drilled on a well site; then testing frequency can be reduced to annually thereafter. Well and spring testing should continue for 20 years after the hydrocarbon well has been plugged and abandoned.

3. Increase testing frequency if contamination is observed.

4. Provide specific criteria for what constitutes a significant deviation from a baseline composition. Typically, a significant deviation may be considered as a certain percent of the mean established over a specified time frame. Ideally, it would be more than one standard deviation determined from a mean of eight quarterly samples. If it is not possible to establish a baseline over that time period, and NYSDEC recommends using just one sample collected prior to well spud, it is common to use 25% of the baseline, or simply the presence of any parameter that was not observed during baseline sampling.

5. Include a requirement to take immediate action to notify affected landowners and water well and spring users of significant deviation from a baseline composition.

More specifically, 6 NYCRR § 560.5(d)(2) should be replaced with the following:

The owner or operator must sample and test residential water wells and springs in the same manner as provided in paragraph (1) of this subdivision at the following intervals or other, more frequent intervals specified by the department after the well reaches total measured depth specified on an application for a permit to drill:

(i) if there is a dedicated monitoring plan pursuant to 6 NYCRR § 750-3.7(o), residential water wells and springs shall be sampled and tested within three months after each well is spud, and annually thereafter. Subsequent to that period, sampling and testing should occur annually and continue for at least twenty years after the final well on the pad has been abandoned properly.

(ii) if there is no dedicated monitoring plan, residential water wells and springs shall be sampled and tested within three months after each well is spud, and quarterly thereafter. Subsequent to that period, sampling and testing should occur annually and continue for at least twenty years after the final well on the pad has been abandoned properly.

(iii) if at any time one or more of the parameters being monitored increases or otherwise deviates more than 25% from baseline, or is detected in the case of parameters which had been non-detect

during baseline sampling, the sampling frequency shall be increased to monthly if the frequency was quarterly and to quarterly if the frequency had been decreased to annually. Where the testing frequency has been increased from yearly to quarterly, if two consecutive quarterly reports demonstrate more than a 25% increase of baseline for one or more of the monitored parameters, the testing frequency shall increase to monthly.

Any and all deviation(s) from the baseline compositions as described in subsection (d)(2)(iii) of this section must be reported to the department and to all affected landowners and water well and spring users within 5 business days of determining any such deviation and provide copies of subsequent quarterly or monthly testing reports required at subsection (d)(2)(iii) of this section.

Additionally we recommend that where monitoring reveals pollution or diminution of a water supply, the Department require the owner/operator to provide temporary replacement water to end users as well as, ultimately, a restored or replaced water supply adequate in quantity and quality for the purposes served by that supply. The Department should also evaluate an appropriate penalty to assure compliance with this new subsection, and provide that it may assess such a penalty in the event the owner or operator fails or refuses to provide temporary replacement water. Accordingly, a new subsection (e) should be added as follows (with the existing subsections (e)-(h) renamed subsections (f)-(i)):[26]

§ 560.5(e) Restoration or Replacement of Affected Water Supplies.

(1) An owner or operator who affects a public or private water supply including, but not limited to, a residential water well, domestic supply spring or water well or spring used as a water supply for livestock or crops, by pollution or diminution shall restore or replace the affected supply with an alternate source of water adequate in quantity and quality for the purposes served by the supply. For the purposes of this subsection "pollution" shall mean the throwing, discharging, draining, running, flowing, pumping or otherwise releasing of any organic or inorganic materials onto the surface lands or waters or into subsurface waters in such volume or manner as to make a public or private water supply fail to meet the criteria for adequacy outlined subsection (e)(6)(ii) of this section.

(2) A landowner, water purveyor or affected person suffering pollution or diminution of a water supply as a result of drilling, altering or operating an oil or gas well may so notify the department and request that an investigation be conducted.

(3) Within 5 days of the receipt of the investigation request, the department shall investigate the claim and shall, within 25 days of receipt of the request, make a determination. If the department finds that pollution or diminution was caused by the drilling, alteration or operation activities of the owner or operator the department shall issue orders to the well owner or operator necessary to assure compliance with this section simultaneously with the determination. If the department cannot identify the cause of the pollution or diminution within 25 days of the receipt of the request, but cannot conclusively rule out drilling, alteration, or operation activities of the owner or operator as the cause, and the pollution or diminution occurred after drilling, alteration, or operation activities of the owner or operator started, the department shall immediately issue orders the well owner or

[26] The recommended regulatory provision below is based substantially upon a similar provision of the Pennsylvania Administrative Code at 25 Pa. Code § 78.51, with appropriate improvements.

operator to provide temporary water supplies to all affected persons under subsection (e)(4) of this section until the department can confirm with certainty that the owner or operator is not responsible.

(4) If an owner or operator has affected a public or private water supply by pollution or diminution, the operator shall provide a temporary water supply as expeditiously as possible, but no later than 5 days after orders have been issued under subsection (e)(3) of this section if the affected water user is without a readily available alternative source of water. The temporary water supply provided under this subsection shall be adequate in quantity and quality for the purposes served by the supply. If the owner or operator refuses to or delays in providing temporary water supplies under this subsection, the department may assess penalties in the amount of [_____].

(5) Tank trucks or bottled water are acceptable only as temporary water replacement as specified in subsection (e)(4) and do not relieve the operator of the obligation to provide a restored or replaced water supply.

(6) A restored or replaced water supply includes any public or private water supply approved by the department, which meets the criteria for adequacy as follows:

(i) Reliability, cost, maintenance and control. A restored or replaced water supply, at a minimum, must:

(A) Be as reliable as the previous water supply.

(B) Be as permanent as the previous water supply.

(C) Not require excessive maintenance.

(D) Provide the water user with as much control and accessibility as exercised over the previous water supply.

(E) Not result in increased costs to operate and maintain. If the operation and maintenance costs of the restored or replaced water supply are increased, the operator shall provide for permanent payment of the increased operation and maintenance costs of the restored or replaced water supply.

(ii) Quality. The quality of a restored or replaced water supply will be deemed adequate if it:

(A) Does not exceed the primary and secondary maximum contaminant levels established under the New York Public Health Law (10 NYCRR at Part 5) and the federal Safe Drinking Water Act (40 C.F.R. Parts 141 to 143) or is comparable to the quality of the water supply before it was affected by the owner or operator if that water supply was of a better quality; and

(B) Does not contain contaminants as a result of the pollution of the water supply by the owner or operator that may affect the health of the supply's user or the usability of the supply.

(iii) Adequate quantity. A restored or replaced water supply will be deemed adequate in quantity if it meets one of the following as determined by the department:

(A) It delivers the amount of water necessary to satisfy the water user's needs and the demands of any reasonably foreseeable uses.

(B) It is established through a connection to a public water supply system that is capable of delivering the amount of water necessary to satisfy the water user's needs and the demands of any reasonably foreseeable uses.

(C) For purposes of this paragraph and with respect to a water supply used for livestock or crops, the term reasonably foreseeable uses includes the reasonable expansion of use where the water supply available prior to drilling exceeded the actual use.

(iv) Water source serviceability. Replacement of a water supply includes providing plumbing, conveyance, pumping, or auxiliary equipment and facilities necessary for the water user to utilize the water supply.

(7) In addition to meeting the criteria for adequacy in subsection (e)(6) of this section, if the water supply is for uses other than human consumption, the owner or operator shall demonstrate to the department's satisfaction that the restored or replaced water supply is adequate for the purposes served by the supply.

(8) An owner or operator who receives notice from a landowner, water purveyor, or affected person that a water supply has been affected by pollution or diminution, shall report receipt of notice from an affected person to the department within 24 hours of receiving the notice.

6 NYCRR § 560.5(d)(3) Retention of Sampling Records

Revised Proposed Recommendation: 6 NYCRR § 560.5(d)(3) provides:

copies of test results and documentation related to delivery or attempted delivery of test results to the owners of water wells or springs must be submitted to the New York State Department of Health within 45 days of the owner or operator's receipt of the results, and must be made available to the Department upon Department request. Such records must be maintained and available to the Department for a period up to and including five years after the well is permanently plugged and abandoned consistent with Part 555 of this Title. For multi-well pads, the five-year term specified in this paragraph shall begin after the last well subject to Part 552 of this Title is permanently plugged and abandoned pursuant to a plugging permit issued by the Department.

Prior Comment and Response: Comment 6152 requested that records be maintained for 50 years because of the slow movement of contaminants through faults to shallow aquifers. NYSDEC's response did not consider the facts or potential of movement but said that five years is consistent with Department retention policies. [Response 6152].

The proposed regulation does not require the operator to provide the record to the Department. It would be preferable for all records to be maintained in a central location for the full period which should be at least 50 years for reasons in comment 6152 and as discussed elsewhere herein regarding vertical movement of contaminants.

Recommendation: NYSDEC should require that records be provided to the Department and change the retention time to fifty years. Records should be delivered and stored in electronic format, so that they can be easily retained for long periods of time and made available on-line for public review.

6 NYCRR § 560.5(e) Blowout Preventer Testing Recordkeeping and Reporting

Revised Proposed Regulation: NYSDEC added a new proposed regulation at 6 NYCRR § 560.5(e) requiring blowout preventer testing recordkeeping and reporting requirements for HVHF wells.

Prior Comment and Response: NYS provides no justification for requiring blowout preventer testing recordkeeping and reporting requirements for HVHF wells and not all other oil and gas wells drilled in NYS.

Recommendation: We support this requirement, but request that this blowout preventer testing recordkeeping and reporting requirements be required for all oil and gas wells in NYS, not just HVHF wells. NYSDEC also should require that records be provided to the Department. Records should be delivered and stored in electronic format so that they can be easily retained and made available on-line for public review. These requirements could be included at Part 554.

6 NYCRR § 560.5(f) and (g) Waste Tracking Recordkeeping and Reporting

Revised Proposed Regulation: NYSDEC added a new proposed regulations at 6 NYCRR § 560.5(f) and (g) requiring waste tracking recordkeeping and reporting requirements for HVHF wells.

Prior Comment and Response: NYS provides no justification for requiring waste tracking recordkeeping and reporting requirements for HVHF wells and not all other oil and gas wells drilled in NYS.

Recommendation: We support this requirement, but request that this waste tracking recordkeeping and reporting requirements be required for all oil and gas wells in NYS, not just HVHF wells. NYSDEC also should require that records be provided to the Department. Records should be delivered and stored in electronic format so that they can be easily retained and made available on-line for public review. These requirements should also be included at 6 NYCRR Part 554.

6 NYCRR § 560.5(h) HF Fluid Disclosure Following Well Completion

Revised Proposed Regulation: Following well completion, proposed 6 NYCRR § 560.5(h)(1)(vi) would require the owner or operator to report "the total volume of the water-based fluid used in the hydraulic fracturing treatment of the well." Proposed 6 NYCRR § 560.5(h)(1)(x) would require the reporting of "the actual or maximum concentration, in percent by mass, of each chemical constituent intentionally added to the base fluid" (emphasis added).

Owners or operators should be required to disclose the nature and source of the base fluid, as well as the actual concentrations of chemical constituents used. They should not be limited to disclosing only "intentionally" added constituents, because this would exclude chemicals that may be present in recycled flowback/produced water that may be present because they were disturbed in the stimulation process or are chemicals that were injected during previous operations. To the extent the industry claims that it is not possible to determine chemicals that are incidentally, *i.e.*, non-intentionally, present, owners and

operators could be required to demonstrate that such chemicals could not have been identified through reasonable sampling and analysis procedures.

Recommendations: While we generally support the requirement for post-well completion hydraulic fracturing fluid disclosure, we recommend that 6 NYCRR § 560.5(h)(1)(vii) be amended to read:

> *. . .the total volume of the water-based fluid used in the hydraulic fracturing treatment of the well, including the type of base fluid (whether fresh water, recycled flowback water, or some other fluid) and source of the fluid used.*

We recommend that 6 NYCRR § 560.5(h)(1)(x) be amended to read:

> *. . .the actual ~~or maximum~~ concentration, in percent by mass, of each chemical constituent ~~intentionally~~ added to the base fluid.*

In the event industry claims, and the Department concludes, that it cannot ascertain incidental chemicals, the following requirement could be added to this subsection:

> *The owner or operator, directly or through a service company and/or chemical supplier(s), is not responsible for disclosing ingredients that occur incidentally or are otherwise unintentionally present in the high volume horizontal hydraulic fracturing fluid, and could not have been identified through reasonable sampling and analysis procedures.*

6 NYCRR § 560.6 Well Production and Monitoring

Revised Proposed Regulation: NYSDEC did not propose new regulations at 6 NYCRR § 560.6 for monitoring well condition after drilling and completion operations are finished.

Prior Comment and Response: Commenter 4558 proposed improved well production and monitoring. NYSDEC refused to include the improvements in the NYCRR, citing the need for flexibility in applying requirements to future permits. [Response 4558]. The response is inadequate because the requested safety standard sets a regulatory floor but does not bind operators to a particular technology, which could improve over time.

Recommendations: It is recommended that a new section be added to 6 NYCRR § 560.6 to address well production and monitoring requirements as follows:

1. This subsection applies to all wells that have not been plugged and abandoned.

2. Each well shall be carefully monitored on a daily basis for the first 30 days and monthly thereafter, to identify any potential problems with the well's operation or integrity which could endanger any underground source of protected water or pose a health, safety or environmental risk. Immediate action must be taken to remedy the problem and notify the Department.

3. All surface wellhead control system equipment shall be maintained and tested at least quarterly to ensure pressure control is maintained throughout the life of the well.

4. Tubing and casing pressure shall be monitored at each well at least quarterly and reported to the Department within 7 days. If annular overpressure is observed, immediate action shall be taken

to remedy the overpressure situation, notify the Department, and institute a daily monitoring program until the Department specifies otherwise.

5. Each well shall be monitored at least weekly for surface equipment corrosion, equipment deterioration, hydrocarbon release or changes in well characteristics that could potentially indicate a deficiency in the wellhead, tree and related surface control equipment, production casing, intermediate casing, surface casing, tubing, cement, packers, or any other aspect of well integrity necessary to ensure isolation of any underground sources of protected water and prevent any other health, safety or environmental issue. Immediate action shall be taken to remedy any deficiencies found and notify the Department.

6. A casing inspection log, temperature log, and mechanical integrity test shall be run in each well at least once every 5 years and reported to the Department within 7 days. Immediate action shall be taken to remedy any deficiencies found and notify the Department.

These requirements should apply to all oil and gas wells, not just to HVHF wells; therefore, these requirements should also be included in Part 554.

The information required to be submitted to the Department pursuant to 6 NYCRR § 560.6 should be made publicly available on NYSDEC.

6 NYCRR § 560.6(a) Well Site Preparation

Revised Proposed Regulations: NYSDEC proposes new regulations at 6 NYCRR § 560.6(a) for well site preparation that will only apply to wells that will undergo a HVHF operation. The proposed regulation at 6 NYCRR § 560.6(a) includes standards for: access road location; topsoil excavation and remediation; reserve pit construction; and equipment used to handle flowback water.

NYSDEC revised its 2011 proposed regulation at 6 NYCRR § 560.6(a)(4) to delete the requirement to divert surface water and stormwater runoff away from reserve pits, drilling pits or mud pits and removed the requirement to maintain a two-foot freeboard.

Prior Comments and Response: Our 2012 Recommendations requested that all best technology and operating practices identified be applied to all oil and gas wells drilled in NYS, and not just apply to HVHF wells, unless the proposed technology or practice was unique to HVHF well operations.

The proposed standards for access road location, topsoil excavation and remediation, and reserve pit construction at 6 NYCRR § 560.6(a)(1)(2) and (4) should apply to all oil and gas wells in NYS. While we support these improved standards for HVHF wells, the problems they address are not unique to HVHF wells.

The proposed standards for equipment used to handle flowback water at 6 NYCRR § 560.6(a)(3) should apply to all oil and gas wells in NYS that are hydraulically fractured. While we support these improved standards for HVHF wells, the problems they address are not unique to HVHF wells.

We do not support NYSDEC's proposed regulation at 6 NYCRR § 560.6(a)(4) to the extent that it deletes the requirement to divert surface water and stormwater runoff away from reserve pits, drilling pits, or mud pits and removes the requirement to maintain a two-foot freeboard.

Recommendation: 6 NYCRR § 560.6(a)(1)(2) and (4) should apply to all oil and gas wells in NYS.

6 NYCRR § 560.6(a)(3) should apply to all oil and gas wells in NYS that are hydraulically fractured. These improved requirements should also be included in Part 554.

6 NYCRR § 560.6(a)(4) should be amended to restore the prior requirement that surface water and stormwater runoff be diverted away from reserve pits, drilling pits, or mud pits and that operators maintain a two-foot freeboard in all pits.

6 NYCRR § 560.6(b)(1)-(2) Well Site Maintenance

Revised Proposed Regulations: NYSDEC proposes new regulations at 6 NYCRR § 560.6(b)(1)-(2) for well site maintenance, including secondary containment requirements for fuel tanks, fuel tank siting requirements, fuel tank filling, and transfer spill prevention requirements, and limitations on the duration of on-site waste storage.

Prior Comments and Response: Our 2012 Recommendations requested that all best technology and operating practices identified be applied to all oil and gas wells drilled in NYS, and not just to HVHF wells, unless the proposed technology or practice was unique to HVHF well operations.
The proposed standards at 6 NYCRR § 560.6(b)(1)-(2) should apply to all oil and gas wells in NYS. While we support these improved standards for HVHF wells, the problems they address are not unique to HVHF wells.

Recommendation: 6 NYCRR § 560.6(b)(1)-(2) should apply to all oil and gas wells in NYS. These improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c) Conductor Casing and Cementing

Revised Proposed Regulation: NYSDEC did not propose new regulations at 6 NYCRR § 560.6(c) for conductor casing.

Prior Comments and Response: Our 2012 Recommendations made casing and cementing best technology and practice recommendations for conductor casing. *See* Harvey Report Recommendation No. 6. NYDEC did not respond to our recommendation.

Recommendation: We recommend adding the following conductor casing requirements to 6 NYCRR § 560.6(c):

1. New conductor casing must be set to stabilize unconsolidated sediments and isolate shallow groundwater.

2. Conductor casing must be set to a depth sufficient to provide solid structural anchorage for a diverter system unless the operator provides sufficient technical justification to that the absence of conductor casing will not jeopardize well control.

3. Conductor casing must be new casing and be placed across the entire length of the conductor casing hole.

4. Conductor casing may be driven into the ground, or a hole may be drilled into the ground and the conductor casing set and cemented in that hole.

5. Conductor casing design and setting depth must be based on engineering and geologic factors relevant to the immediate vicinity, including the presence or absence of hydrocarbons and potential drilling hazards.

6. Conductor casing set in a drilled hole must be cemented by filling the annular space with cement from the shoe to the surface. At least two centralizers must be run with one at the shoe and one at the middle of the casing string. Operator must verify cement is returned to the surface and that the annular space is completely filled with cement.

7. A mechanical or cement seal must be installed at the surface to block downward migration of surface pollutants.

These requirements should apply to all oil and gas wells, not just to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c) Confining Layer Analysis

Revised Proposed Regulation: 6 NYCRR § 560.6(c) does not require a confining layer analysis to be completed prior to a HVHF treatment.

Prior Comment and Response: Our 2012 Recommendations requested that a confining layer analysis be completed to prevent hydraulic fluids from contaminating water supplies. Owners/operators would be required to perform a geologic and hydrologic mapping and risk analysis to demonstrate geologic suitability and the presence of an appropriate confining zone to inhibit vertical migration of contaminants. *See* Myer Report at 6. NYSDEC did not respond to our comments.

In September 2012, NRDC provided more specific recommendations to BLM on requirements for completing a confining layer analysis.[27] We recommend these same requirements be adopted by NYSDEC.

Recommendation: 6 NYCRR § 560.6(c) should be revised to require the owner/operator to confirm that a confining zone will prevent hydraulic fluids from contaminating water supplies by performing a geologic and hydrologic mapping and risk analysis to demonstrate geologic suitability and the presence of an appropriate confining zone to inhibit vertical migration of contaminants. The owner/operator must complete the following prior to conducting a HVHF treatment:

1. Complete a confining layer analysis of sufficient areal extent to verify that a confining layer is sufficient to prevent the movement of fluids to USDWs, based on the projected lateral extent of hydraulically induced fractures, injected stimulation fluids, and displaced formation fluids over the life of the project. Verify that the confining layer:

    a. Is sufficiently impermeable to prevent the vertical migration of injected stimulation fluids or displaced formation fluids over the life of the project;

[27] Natural Resources Defense Council, Memorandum to Mike Pool, Acting Director of the Bureau of Land Management Re: Comments on Proposed Rule on Oil and Gas; Well Stimulation, Including Hydraulic Fracturing, on Federal and State Lands, September 10, 2012.

b. Is free of transmissive faults or fractures that could allow the movement of injected stimulation fluids or displaced formation fluids to USDWs; and

c. Contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of preventing or arresting vertical propagation of fractures.

2. Verify that the well is sited in a geologically suitable location prior to hydraulic fracture treatment by:

a. Completing a detailed analysis of regional and local geologic stratigraphy and structure including, at a minimum, lithology, geologic facies, faults, fractures, stress regimes, seismicity, and rock mechanical properties.

b. Completing a detailed analysis of regional and local hydrology including, at a minimum, hydrologic flow and transport data and modeling and aquifer hydrodynamics; properties of the producing and confining zone(s); groundwater levels for relevant formations; discharge points, including springs, seeps, streams, and wetlands; recharge rates and primary zones; and water balance for the area, including estimates of recharge, discharge, and pumping.

c. Completing a detailed analysis of the cumulative impacts of well stimulation on the geology of producing and confining zone(s) over the life of the project. This must include, but is not limited to, analyses of changes to conductivity, porosity, and permeability; geochemistry; rock mechanical properties; hydrologic flow; and fracture mechanics.

d. Making a determination that the geology of the area can be described confidently and that the fate and transport of injected fluids and displaced formation fluids can be accurately predicted through the use of models.

e. Collecting additional geophysical and reservoir data to support a reservoir simulation model.

3. Complete a geophysical description of the Area of Review ("AoR") by:

a. Providing geological names, a geological description, and the proposed measured and true vertical depth of the top and the bottom of the formation into which well stimulation fluids are to be injected, and of the confining zone.

b. Identifying the geologic structure, stratigraphy, and hydrogeologic properties of the proposed producing formation(s) and confining zone(s), including: maps and cross-sections of the area of review; the location, orientation, and properties of known or suspected faults, fractures, and joint sets that may transect the producing and confining zone(s) in the area of review, and a determination that they would not provide migration pathways for injected fluids or displaced formation fluids to USDWs.

c. Collecting data on the depth, areal extent, thickness, mineralogy, porosity, permeability, and capillary pressure of the producing and confining zone(s), including geology/facies changes based on field data which may include geologic cores, outcrop data, seismic surveys, well logs, and names and lithologic descriptions; geomechanical information on

fractures, stress, ductility, rock strength, and in situ fluid pressures within the producing and confining zone(s).

d. Collecting information on the seismic history, including the presence and depth of seismic sources and a determination that the seismicity would not affect the integrity of the confining zone(s).

e. Developing geologic and topographic maps and cross sections illustrating regional geology, hydrogeology, and the geologic structure of the local area's hydrologic flow and transport data and modeling.

f. Obtaining whole or sidewall cores of the producing and confining zone(s) and formation fluid samples from the producing zone(s) and conduct routine core analysis on core samples representative of the range of lithology and facies present in the producing and confining zone(s). Special Core Analysis (SCAL) should also be considered, particularly for samples of the confining zone, where detailed knowledge of rock mechanical properties is necessary to determine whether the confining zone can prevent or arrest the propagation of fractures.

4. Confirm the fluid temperature, pH, conductivity, reservoir pressure, and static fluid level of the producing and confining zone(s) and prepare a detailed report on the physical and chemical characteristics of the producing and confining zone(s) and formation fluids that integrates data obtained from well logs, cores, and fluid samples, including the fracture pressure of both the producing and confining zone(s).

5. Complete a fracture gradient analysis to ensure that hydraulic fracturing operations will not initiate fractures in the confining zone.

6. Provide the location, orientation, and a report on the mechanical condition of each well that may transect the confining zones and information sufficient to support a determination that such wells will not interfere with containment of the hydraulic fracturing fluid.

6 NYCRR § 560.6(c) Well Construction Design

Revised Proposed Regulation: NYSDEC did not propose new regulations at 6 NYCRR § 560.6(c) to specify minimum well construction design elements.

Recommendation: Add the following requirements in 6 NYCRR § 560.6(c):

1. Well drilling and casing design shall estimate and address, at a minimum: pore pressures; formation fracture gradient; potential lost circulation zones; shallow gas hazards; the potential to penetrate a mine, coal seam, or overpressured gas storage areas; depths to tops of significant marker formations; depth to base of protected groundwater; depth to hydrocarbon zones or abnormally pressured zones; depth to significant faults; drilling fluid weight; casing setting depth; and maximum anticipated surface pressures.

2. Well drilling and casing design shall describe plans and procedures that demonstrate the well will be drilled and completed safely, including verification of: the rated capacity of the drilling rig and major drilling equipment; minimum quantities of drilling fluid materials, including weighting materials, and cement to be kept onsite; hole size and casing size (including casing weights,

grades, collapse and burst values and setting depths); casing design safety factors used for tension, collapse, and burst, type and amount of cement planned for each casing string and additives; coring at specified depths (if planned); logging and sampling plans; maintaining safe drilling margins between drilling fluid weights and estimated pore pressures; a plan to have at least two independent tested barriers, including one mechanical barrier, across each flow path during well completion activities; and that the casing and cementing design is appropriate for the purpose for which it is intended under expected wellbore conditions.

These requirements should apply to all oil and gas wells, not just to HVHF wells; therefore, these requirements should also be included in Part 554.

6 NYCRR § 560.6(c) Wellhead Controls

Revised Proposed Regulation: NYSDEC did not propose new regulations at 6 NYCRR § 560.6(c) to specify wellhead assembly controls.

Prior Comment and Response: Commenter 4558 proposed improved wellhead controls. NYSDEC refused to include the improvements in the NYCRR, citing the need for flexibility in applying requirements to future permits. [Response 4558]. The response is inadequate because the requested safety standard sets a regulatory floor but does not bind operators to a particular technology, which could improve over time.

Recommendation: Add the following requirements in 6 NYCRR § 560.6(c):

1. Wellhead control systems shall be installed on all wells to maintain surface control of the well. Each component of the wellhead shall have a pressure rating at least 25% greater than the anticipated pressure to which the component might be exposed during the course of drilling, testing, completing, or producing the well.

2. All wellhead connections shall be assembled and tested prior to installation.

3. Wells shall be equipped to monitor casing pressure.

These requirements should apply to all oil and gas wells, not just to HVHF wells; therefore, these requirements should also be included in Part 554.

6 NYCRR § 560.6(c) Drilling Fluid Systems

Revised Proposed Regulation: NYSDEC did not propose new regulations at 6 NYCRR § 560.6(c) to specify drilling fluid system requirements.

Prior Comment and Response: Commenter 4558 proposed improved drilling fluid systems. NYSDEC refused to include the improvements in the NYCRR, citing the need for flexibility in applying requirements to future permits. [Response 4558]. The response is inadequate because the requested standards establish a regulatory floor but do not bind operators to a particular technology, which could improve over time.

Recommendation: Add the following requirements in 6 NYCRR § 560.6(c):

1. The drilling fluid system shall be designed to maintain control of the wellbore in an overbalanced condition and with rheological properties to minimize the potential of a hydrostatic pressure surge or swab when the drilling assembly is run into or pulled out of the wellbore.

2. Drilling fluid mud shall be in balance and conditioned to maintain drilling fluid properties within close tolerance to the properties necessary for well control as specified in the permit to drill.

3. Adequate supplies of drilling fluid shall be maintained at the well location. The wellbore shall be kept full of mud at all times. When pulling drill pipe, the mud volume required to keep the wellbore full shall be measured to assure that it corresponds with the displacement of pipe pulled.

4. A drilling fluid monitoring unit shall be used and continuously observed during drilling operations, including tripping, to monitor and record: gas entrained in the drilling fluid; drilling fluid density; drilling fluid salinity; the rate of penetration; and hydrogen sulfide.

5. The rig shall be equipped with a recording mud tank level indicator to determine mud tank volume gains and losses. This indicator shall include both a visual and an audible warning device.

6. Mud quality tests shall be made at least once per day, including: density, viscosity, and gel strength; hydrogen ion concentration (pH); filtration; and other tests the Department may require.

7. All drilling fluids shall be conditioned prior to cement placement. The wellbore shall be stable with respect to formation influx prior to placing the cement, and shall be kept stable after the cement is placed.

8. All hole intervals drilled prior to reaching the base of protected groundwater shall be drilled with air, fresh water, or a fresh water based drilling fluid. Freshwater drilling mud additives, if used, shall be non-toxic. Drilling with synthetic muds and oil based muds is prohibited when drilling though protected groundwater zones.

These requirements should apply to all oil and gas wells, not just to HVHF wells; therefore, these requirements should also be included in Part 554.

6 NYCRR § 560.6(c) Existing Well Condition Prior to Hydraulic Fracturing

Revised Proposed Regulation: NYSDEC did not propose new regulations at 6 NYCRR § 560.6(c) that require a well integrity review and Department approval prior to conducting hydraulic fracturing operations in an existing well (where "existing well" means a well that was constructed prior to the effective date of these regulations).

Recommendation: Add the following requirements in 6 NYCRR § 560.6(c):

1. Prior to hydraulically fracturing a well that was constructed prior to the effective date of these regulations, a well integrity analysis shall be completed to verify the well construction practices used, current condition of the well casing, tubing, cement, downhole and surface equipment meet the current standards of the NYCRR.

2. The well integrity analysis shall be submitted to the Department for review and approval prior to conducting hydraulic fracturing.

3. Hydraulic fracturing is prohibited in wells that do not meet the current standards of the NYCRR.

These requirements should apply to all oil and gas wells where hydraulic fracturing is planned, not just to HVHF wells; therefore these requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(1) Well Construction Plans

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(1) that would require an owner/operator planning to construct a HVHF well to provide the drilling company it hires with:

> *. . .a well prognosis indicating anticipated formation to top depths with appropriate warning comments prior to well spud.*

Recommendation: The proposed regulations at 6 NYCRR § 560.6(c)(1) are unclear and incomplete. It is insufficient to merely provide the drilling contractor with a well prognosis. The drilling contractor needs a complete copy of the well construction plan and a copy of all permits. Furthermore, the owner/operator should be required to verify that the drilling contractor is equipped, trained, and qualified to carry out the proposed well construction plan prior to hiring that contractor.

6 NYCRR § 560.6(c)(1) should be revised to require the owner/operator to:

1. Select a drilling company that is equipped, trained, and qualified to carry out the planned well construction operations;
2. Examine the health, safety, environment, and management systems of the drilling company to ensure that it can comply with NYCRR best industry practices for well construction and that it has a proven successful and safe track record;
3. Provide the drilling company with a complete well construction plan and a copy of all associated permits (not just the well prognosis, which is just a fraction of the plan), and verify that the drilling contractor is equipped, trained and qualified to construct the well and comply with all permit requirements; and
4. Complete a bridging document to ensure that the combined team of the owner's or operator's staff, drilling contractors, and other contractors brought to the well location have an integrated health, safety, environment, and management system plan, identifying those with lead and supporting roles, to ensure that the entire project functions as one system and one plan incorporating all contingency plans, including blowout and well control.

6 NYCRR § 560.6(c)(1), including the proposed revision above, should apply to all oil and gas wells, not just to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(2) Drilling Crew Responsibilities for Well Blowouts

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(2) requiring that drilling crew responsibilities be posted on a bulletin board and that the crew be made aware of its responsibilities prior to commencing drilling or well work. It also requires that one person at the well site have a well control certification, and that "appropriate pressure control procedures" are in place.

Prior Comments and Response: As explained in our 2012 Recommendations and comments at § 554, § 556, and § 560.5(a), the owner/operator should be required to have a complete emergency response plan (ERP) including a well blowout control plan and a contract retainer with an emergency well control expert. Additionally, the owner's or operator's drilling engineers and drilling contractor's key staff (not just one person at the site) should have well control certification and the rest of the drilling crew must be trained and experienced to carry out well control procedure instructions. All this training and certification should be completed well in advance of any planned well operations, and should be documented and audited.

While it is important to provide notification to drilling crew staff of any unique drilling risks or technical challenges on a planned well prior to construction by posting updates on the rig bulletin board, this is not an adequate replacement for ensuring that there is trained and qualified well control experts on staff on the rig.

Recommendation: In addition to posting drilling crew responsibilities on the bulletin board, proposed regulations at 6 NYCRR § 560.6(c)(2) should be substantially enhanced to require training and qualifications for well control and well safety to be implemented and verified prior to conducting any well operations. 6 NYCRR 560.6(c)(2) should include the following additional provisions:

1. The drilling contractor staff shall be provided with a copy of the well construction plan prior to drilling and the owner/operator shall verify that the drilling contractor's staff is trained and qualified to carry out all well control operations, including blowout well control, prior to spudding the well or conducting well workover operations on the well.

2. The owner/operator's drilling engineer and Company Person (otherwise referred to as "Company Man") responsible for overseeing the well construction plan, as well as the Drilling Contractor's "Tool Pusher," shall hold a current International Association of Drilling Contractors (IADC) well control certification, or equivalent.

3. The owner/operator and drilling company shall have a training program for all staff involved in well construction and workover for well control and well safety operating practices and document that all staff are trained and qualified prior to commencing any well operations.

6 NYCRR § 560.6(c)(2), including the proposed revision above, should apply to all oil and gas wells, not just to HVHF wells; therefore, these improved requirements should be included in Part 554.

6 NYCRR § 560.6(c)(3) Well Control Equipment and Testing

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(3) that requires notification prior to blowout preventer (BOP) testing, includes a minimum well control barrier policy, and includes a remote BOP actuator to be located at least 50' from the wellhead.

Prior Comments and Response: Our 2012 Recommendations recommended improvements in well control equipment and testing. NYSDEC made some improvements in the HVHF well control regulations but did not include all known best technologies and practices, nor did the Department apply improved standards to all oil and gas wells in NYS.

Recommendation: We support the proposed requirement for blowout preventer at 6 NYCRR § 560.6(c)(3); however, we recommend that the owner/operator also be required to include important well

control equipment and testing requirements found in major hydrocarbon resource extraction states such as Texas and Alaska:

1. Install a diverter system while drilling surface casing, unless waived by NYSDEC based on prior drilling data that confirms shallow gas and other drilling hazards are not present, to divert any wellbore fluids and gases away from the rig floor to a flare pit a safe distance from the well.
2. Install two diverter control stations, one on the drilling floor and one located at a safe distance and readily accessible away from the drilling floor.
3. Maintain the diverter system in effective working condition and function test the diverter system when installed and at regular intervals during drilling operations.
4. Discontinue drilling operations if a test or other information indicates the diverter system is unable to function or operate as designed.
5. Install and test a blowout preventer as soon as practicable but no later than prior to drilling out of the surface casing.
6. Use a BOP stack that includes at least an annular BOP, pipe rams and blind-shear rams. The blind-shear rams must be capable of shearing the drill pipe that is in the hole.
7. Include two BOP control stations, one on the drilling floor and one located at a safe distance and readily accessible away from the drilling floor.
8. Install an accumulator system that provides 1.5 times the volume of fluid capacity necessary to close and hold closed all BOP components, with an automatic backup.
9. Test the accumulator system to verify pre-charge of accumulator bottle, accumulator response time and the capability of closing on the minimum size drill pipe being used.
10. Install, operate, test, and maintain all blowout prevention equipment in accordance with API RP 53 (Recommended Practices for Blowout Prevention Equipment Systems).
11. Verify the required working pressure rating of all BOPs and related equipment shall be based on known or anticipated subsurface pressure, geologic conditions, or accepted engineering practices, and shall exceed the maximum anticipated pressure to be contained at the surface. In the absence of better data, the maximum anticipated surface pressure shall be determined by using a normal pressure gradient of 0.44 psi per foot and assuming that at least one-third of the drilling mud is evacuated from the wellbore when at the interval's deepest true vertical depth.
12. Test the blind-shear rams prior to drilling and test the ram-type blowout preventers during drilling operation by closing at least once each trip and test the annular-type preventer by closing on the drill pipe at least once each week.
13. Discontinue drilling operations if a test or other information indicates the BOP system is unable to function or operate as designed.
14. Complete a formation integrity test (FIT) if a BOP is installed on the surface casing. The FIT must be completed after drilling out below the surface casing shoe into at least 20 feet, but not more than 50 feet of new formation, in order to verify the integrity of the cement in the surface casing annulus at the surface casing shoe. The FIT results should demonstrate that the integrity of the casing shoe is sufficient to contain the anticipated wellbore pressures identified in the application for the Permit to Drill; no flow path exists to formations above the casing shoe; and that the casing shoe is competent to handle an influx of formation fluid or gas without breaking down.

15. Notify NYSDEC at least 24 hours prior to commencing any BOP testing, casing integrity testing. or casing cementing operations such that agency staff can witness the testing.

6 NYCRR § 560.6(c)(3), including proposed revision above, should apply to all oil and gas wells, not just to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(4) Hydrogen Sulfide

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(4) that requires the owner/operator to comply with unspecified "industry standards" when hydrogen sulfide (H_2S) is present.

Prior Comments and Response: Our 2012 Recommendations included a number of improved testing, monitoring and operating practices for hydrogen sulfide that were not included in the proposed regulations. NYSDEC responded only that H_2S must be reported as a non-routine incident. [Response 6179].

Recommendation: We support the requirement at 6 NYCRR § 560.6(c)(4) for additional precautions to be taken when H_2S is detected; however, we recommend that further requirements be added. Specifically, the owner/operator should be required to:

1. Follow American Petroleum Institute Recommended Practice 49 (API RP 49) for Drilling and Well Servicing Operations Involving Hydrogen Sulfide and API RP 55 for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide, to protect employees and the public or an equivalent or better standard.
2. Vent gas containing H_2S through a flare stack to combust the dangerous vapors.
3. Conduct initial H_2S testing at each well pad. Subsequent test frequency should be based on the results of initial testing; however, testing should be completed at least annually because H_2S levels can increase over time as gas fields age and sour.
4. Notify nearby neighbors, local authorities, and public facilities when H_2S is present and provide information on the safety and control measures that the operator will undertake to protect human health and safety.
5. Install audible alarms to alert the public to evacuate in cases where elevated H_2S levels are present.

6 NYCRR § 560.6(c)(4), including the proposed revisions above, should apply to all oil and gas wells, not just to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(5) Annular Disposal

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(5) that prohibits the "intentional" annular disposal of drill cuttings or fluid.

Prior Comments and Response: NYSDEC disagreed with Commenter 6181, who requested that the word "intentional" be added; yet, the regulation was revised to add the word, contrary to NYSDEC's intent. [Response 6181].

Recommendation: We support the requirement to prohibit annular disposal of drill cuttings or fluid at 6 NYCRR § 560.6(c)(5). We therefore agree with NYSDEC that the word "intentional" should not be included in the provision.

6 NYCRR § 560.6(c)(5) should be revised to delete the word "intentional," and the revised rule should apply to all oil and gas wells, not just to HVHF wells. Therefore, the rule, so revised, should also be included in Part 554.

6 NYCRR § 560.6(c)(7)-(8) Closed-Loop Tank Systems vs. Reserve Pits

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(7)-(8) that requires the owner/operator to use a closed-loop tank system instead of a reserve pit to manage drilling fluids and cuttings only for horizontal drilling in the Marcellus Shale (unless an acid rock drainage (ARD) mitigation plan for on-site burial is developed), and for any drilling that requires drill cuttings to be disposed off-site.

Prior Comments and Response: Our 2012 Recommendations requested that NYSDEC adopt regulations requiring closed-loop tank systems as best practice, instead of the use of temporary reserve pits to handle and store drill muds and cuttings, unless the operator demonstrates that closed-loop tank systems are not technically feasible. *See* Harvey Report Recommendations Nos. 43-45.

Commenters 6165 and 6168 also recommended closed-loop tank systems.

NYDEC did not respond to our comment or provide any technical analysis to show that closed-loop systems are not technically feasible. Instead, NYSDEC responded only that close-loop tank systems were studied in the RDSGEIS. [Responses 6165 and 6168].

Our 2012 Recommendations explained that the 2011 RDSGEIS recommends closed-loop tank systems as best practice only in some circumstances, but in other circumstances defaults to the use of reserve pits, without demonstrating that reserve pits are environmentally preferable.

The RDSGEIS requires a closed-loop tank system for horizontal drilling operations in the Marcellus Shale that do not have an acceptable ARD mitigation plan[28] for on-site cuttings burial; and drill cuttings that are coated with Synthetic-Based Muds (SBM) and Oil-Based Muds (OBM).

Appendix 10, Proposed Supplementary Permit Conditions for HVHF, Condition No. 56 requires the operator to provide NYSDEC with an ARD mitigation plan if NYSDEC requests the plan. However, there are no specific criteria established to define what constitutes an acceptable ARD mitigation plan.

The RDSGEIS proposal to permit reserve pits is internally inconsistent with the RDSGEIS' conclusion that closed-loop tank systems are environmentally preferable for the following reasons:

> *Depending on the configuration and design of a closed-loop tank system use of such a system can offer the following advantages:*

[28] 2011 NYSDEC, RDSGEIS, Page 7-67.

- *Eliminates the time and expense associated with reserve pit construction and reclamation;*
- *Reduces the surface disturbance associated with the well pad;*
- *Reduces the amount of water and mud additives required as a result of re-circulation of drilling mud;*
- *Lowers mud replacement costs by capturing and re-circulating drilling mud;*
- *Reduces the wastes associated with drilling by separating additional drilling mud from the cuttings; and*
- *Reduces expenses and truck traffic associated with transporting drilling waste due to the reduced volume of the waste.*[29]

Additionally, the 2011 RDSGEIS explains that the environmental risks of reserve pits include:

- **Pit leakage or failure;**
- **A greater intensity and duration of surface activities associated with well pads with multiple wells increases the potential for an accidental spill, pit leak, or pit failure;**
- Heightened concerns for on-site pits for handling drilling fluids in primary and principal aquifer areas, or are constructed on the filled portion of a cut-and-filled well pad.

Of even greater concern is the RDSGEIS' proposal to allow drill cuttings to be buried onsite in some cases. Marcellus Shale cuttings contain NORM and are coated with drilling muds, including Water-Based Mud (WBM). The proposed revisions to the NYCRR would require the reserve pit liner to be ripped and perforated as part of the onsite burial process; therefore, contaminated drill cuttings would be in direct contact with soils and surface waters.

While the RDSGEIS generally takes the position that WBM-coated cuttings can be stored in reserve pits and buried onsite, in some cases it allows waivers. It is not clear what additional limitations may be applied to WBM-coated drill-cuttings disposal. NYSDEC recognizes that onsite burial of chemical additives included in WBM may not be prudent. However, the RDSGEIS does not spell out criteria for determining what types of WBM-coated cuttings may and may not be stored and buried in reserve pits. The RDSGEIS proposes this decision be left to a later NYSDEC consultation process.

Additionally, it is inefficient from a logistics and energy use standpoint to construct a reserve pit for the temporary storage of drill cuttings and then remove this pit at a later time. It is substantially more efficient to use a closed-loop tank system to collect the drill cuttings, because the cuttings can be directly transported to a waste handling facility. The RDSGEIS agrees with the efficiencies gained through closed-loop tank systems, but incongruously does not recommend them in all cases.

Recommendation: We support the requirement for closed-loop tanks to be used instead of reserve pits at 6 NYCRR § 560.6(c)(7)-(8) to manage drilling fluids and cuttings; however, we recommend that this requirement apply to *all* substances and for *all* oil and gas wells in NYS, unless demonstrated to be technically infeasible.

[29] 2011 NYSDEC, RDSGEIS, Page 5-39.

If NYSDEC continues to reject our recommendation, at a minimum, 6 NYCRR § 560.6(c)(7) should clarify that closed-loop systems must be used for:

1. Drill cuttings that are coated with Synthetic-Based Muds (SBM) and Oil-Based Muds (OBM); and

2. Drill cuttings that are coated with Water-Based Muds, where NYSDEC has not verified that the chemical additives are safe and non-toxic to humans and the environment.

NYSDEC also should clarify what constitutes an acceptable ARD mitigation plan.

6 NYCRR § 560.6(c)(7)-(8), including the proposed revisions above, should apply to all oil and gas wells, and not just to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(9) Biocide Use

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(9) that limits biocide use to "biocides registered for use in New York."

Recommendation: We support the requirement at 6 NYCRR § 560.6(c)(9) that limits biocide use; however, the regulation should clearly reference the applicable list of registered biocides

6 NYCRR § 560.6(c)(5), including proposed revision above, should apply to all oil and gas wells that use biocides. Biocide use is not unique to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(10) Casing and Cementing - All Casing Strings

Revised Proposed Regulation: NYSDEC proposes a new regulation at 6 NYCRR § 560.6(c)(10) that requires: the owner/operator to follow its permit; mud to be circulated and conditioned prior to cementing; a spacer to be pumped; cement to be pumped to inhibit channeling; an 8-hour cement curing time; a casing thread compound and centralizers specified by the Department; cement mixtures to minimize its freewater content and contain a gas-blocking additive; and record keeping. The provision also prohibits welded connections.

Prior Comments and Response: Our 2012 Recommendations made extensive casing and cementing best technology and practice recommendations. *See* Harvey Report Recommendations Nos. [6-21]. Additionally, numerous other commenters requested casing and cementing improvements.

We appreciate the inclusion of a number of our recommended improvements, however, NYDEC did not respond to all of our recommendations. For the recommendations that were not included, NYSDEC did not provide any information to show that these best technology practices are not technically feasible.

Recommendation: We support the casing and cementing regulations proposed at 6 NYCRR § 560.6(c)(10). However, we recommend that the requirements be expanded to include all best technology and practice recommendations. 6 NYCRR § 560.6(c)(10) should require:

1. Use of compressed air or water based mud (with no toxic additives) when drilling through protected water zones.

2. Use of float valves and verification that they have held to prevent cement backflow in the drill string.

3. Installation of a cement sheath of at least 1-1/4".

4. Use of 25% excess cement, unless a caliper log is run to assess the hole shape and required cement volume. [NYSDEC agrees with the 25% standard, but allows a waiver without criteria for reducing the cement volume. We recommend a caliper log be run to more accurate estimate cement needs].

5. Cement free water separation that averages no more than six milliliters per 250 milliliters of tested cement. [NYSDEC agrees with the need to limit free water separation but did not set a standard; we recommend a minimum standard of 6ml/250ml].

6. Casing to be rotated and reciprocated while cementing to improve cement placement, if well conditions allow.

7. Cement must include additives in areas where CO_2 and H_2S, and other lithologic and physical conditions exist surrounding the wellbore to protect the casing from corrosion and the cement from subsequent deterioration and resist degradation by chemical and physical conditions anticipated in the well.

8. Implementation of lost circulation control procedures.

9. All potentially productive zones, zones capable of over-pressurizing the surface casing annulus, or corrosive zones be isolated and sealed off to the extent that such isolation is necessary to prevent vertical migration of fluids or gases behind the casing.[30]

10. Mud to be circulated and conditioned with a minimum of two hole volumes; adjusting drilling fluid rheology to optimize conditions for displacement of the drilling fluid and ensuring that the wellbore is static and that all gas flows are killed.

11. Casing to be hydrostatically pressure tested with an applied pressure that exceeds the maximum pressure to which the pipe will be subjected in the well, by at least 25%.

12. Casing used to conducting hydraulic fracturing operations shall meet new API casing standards, including API Spec 5CT, for compression, tension, collapse, and burst resistance. It must be designed to withstand the anticipated hydraulic fracturing pressure to which it will be subjected, production pressures, corrosive conditions and all other conditions that may be reasonably anticipated.

13. Casing used to isolate protected water must not be used as the production string in the well in which it is installed, and may not be perforated for purposes of conducting a hydraulic fracture treatment through it.

[30] *See* California Dep't of Conservation, Pre-Rulemaking Discussion Draft Hydraulic Fracturing Regulations at 2, http://www.conservation.ca.gov/dog/general_information/Documents/121712DiscussionDraftofHFRegs.pdf.

14. Reserve the agency's right to require industry to install additional cemented casing strings in wells, and repair defective casing or cementing, as deemed necessary for environmental and/or public safety reasons.

6 NYCRR Part 560.6(c)(10), including proposed revision above, should apply to all oil and gas wells. It is not unique to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(11)-(12) Surface Casing and Cementing

Revised Proposed Regulation: NYSDEC proposes new regulations at 6 NYCRR § 560.6(c)(11)-(12) that require: the owner/operator to follow its permit; surface casing to be set 75 below the base of potable water (determined by logging); cement to be placed by the pump and plug method using 25% excess cement and lost circulation material (unless a different amount required by the Department); the annulus to be completely cemented; notification prior to cementing; and where potable water is found below the surface casing seat, use of an external casing packer on intermediate casing to isolate the potable freshwater zones.

Prior Comments and Response: Our 2012 Recommendations made extensive casing and cementing best technology and practice recommendations for surface casing. *See* Harvey Report Recommendations Nos. 7-14. Additionally, numerous other commenters requested casing and cementing improvements.

We appreciate the inclusion of a number of our recommended improvements, however, NYDEC did not respond to all of our recommendations. For the recommendations that were not included, NYSDEC did not provide any information to show that these best technology practices are not technically feasible.

For example, NYSDEC uses a 75' surface casing setting depth below potable water, but does not provide a technical basis for this depth or explain why a 100' surface casing setting depth to increase groundwater protection and reduce risk of contamination is not preferred.

NYSDEC retains discretion to require a cement evaluation tool to examine surface casing cement quality, but does not make use of the tool mandatory, or explain the criteria the Department would use to decide whether to require such use.

Recommendation: We support the casing and cementing regulations proposed at 6 NYCRR § 560.6(c)(11)-(12). However, we recommend that the requirements be expanded to include all best technology and practice recommendations. 6 NYCRR § 560.6(c)(11)-(12) should be revised to add the following requirements:

1. Surface casing shall be set and cemented to a minimum depth of at least 100 feet below the base of the deepest strata containing protected groundwater, but above any hydrocarbon strata.

2. Surface casing shall be set deep enough and into a competent formation to ensure the BOP can contain any formation pressure that many be encountered when drilling the next section of the hole below the surface casing shoe.

3. If a shallow gas hazard is encountered, surface hole drilling shall stop and surface casing shall be set and cemented before drilling deeper. Any shallow gas hazards encountered while drilling shall be recorded and reported electronically to the Department and made available to other operators and potentially affected residents in the area.

4. Surface casing strings shall stand under pressure until the cement has reached a compressive strength of at least 500 psi in the zone of critical cement, before drilling out the cement plug or initiating a test. The cement mixture in the zone of critical cement shall have a 72-hour compressive strength of at least 1,200 psi.

5. If an intermediate casing is waived under 6 NYCRR § 560.6(c)(13) and the cement evaluation tool is not run on intermediate casing, a cement evaluation tool and temperature survey shall be run to verify cement placement and remedial cementing operations shall be completed before drilling deeper into the hole. [We agree with NYSDEC that a cement evaluation tool should be required only on the intermediate casing and not the surface casing and intermediate casing both, but we are concerned that in the case that the intermediate casing requirement is waived, that there be a mandatory requirement to run a cement evaluation tool on the surface casing so that there is a cement evaluation across the water protection string.]

6. A formation integrity test shall be completed to verify the integrity of the cement in the surface casing annulus at the surface casing shoe. The test shall be conducted after drilling out of the casing shoe, into at least 20 feet, but not more than 50 feet of new formation. The test results must demonstrate that the integrity of the casing shoe is sufficient to contain the anticipated wellbore pressures identified in the application for the Permit to Drill.

7. Surface casing shall be pressure tested to ensure it can hold the required working pressure of the BOP.

In addition, the term "potable freshwater" should be replaced with the term "protected groundwater," as is further explained in our comments.

6 NYCRR § 560.6(c)(11)-(12), including proposed revision above, should apply to all oil and gas wells, not just to HVHF wells; therefore, these improved requirements should also be included in Part 554.

6 NYCRR § 560.6(c)(13)-(15) Intermediate Casing and Cementing

Revised Proposed Regulation: NYSDEC proposes new regulations at 6 NYCRR § 560.6(c)(13)-(15) that require: the owner/operator to follow its permit; intermediate casing to be installed and run to the surface (with a waiver provision); cement to be placed by the pump and plug method using 25% excess cement and lost circulation material (unless a caliper log is run); the annulus to be completely cemented; notification prior to cementing; and running of a cement evaluation tool.

Prior Comments and Response: Our 2012 Recommendations made extensive casing and cementing best technology and practice recommendations for intermediate casing. *See* Harvey Report Recommendations Nos. 16-18. Additionally, numerous other commenters requested casing and cementing improvements.

We appreciate the inclusion of a number of our recommended improvements. NYSDEC admits:

> *In general, the Department agrees that the industry best practices referenced in the Harvey Report should be followed.*

NYSDEC nevertheless did not include all the Harvey Report recommendations. For the recommendations that were not included, NYSDEC provided no information to show that these best technology practices are not technically feasible.

Of primary concern, NYSDEC allows an intermediate casing waiver provision but does not establish criteria in regulation for making that determination. NYSDEC's Response to Comments lists some criteria that it envisions granting waivers:

> " . . .*without compromise to environmental protection. . .*" [Response 6192];
>
> if "*. . .environmental protection and public safety will not be compromised*;" [Response 6197];
>
> if the following conditions are met "*. . .deep-set surface casing; shallow total well depth; and absence of fluid and gas between the surface casing shoe and the target interval*." [Response 6197].

Recommendation: We support the casing and cementing regulations proposed at 6 NYCRR § 560.6(c)(13)-(15). However, we recommend that the requirements be expanded to include all best technology and practice recommendations. 6 NYCRR § 560.6(c)(13)-(15) should be revised to add the following requirements:

1. Where protected groundwater is found below the surface casing seat, intermediate casing shall be set a minimum of 100' below the base of protected groundwater to increase groundwater protection, to reduce risk of contamination, and to seal off anomalous pressure zones, lost circulation zones, and other drilling hazards.

2. Anomalous pressure zones, lost circulation zones, and other drilling hazards encountered while drilling the intermediate casing hole shall be recorded and reported electronically to the Department and made available to other operators and potentially affected residents in the area.

3. Casing string shall stand under pressure until the cement has reached a compressive strength of at least 500 psi in the zone of critical cement, before drilling out the cement plug or initiating a test, or disturbing the cement in any way. The cement mixture in the zone of critical cement shall have a 72-hour compressive strength of at least 1,200 psi.

4. Immediately after drilling out below the intermediate casing shoe, a formation pressure integrity test shall be performed to determine that formation integrity at the casing shoe is adequate to meet the maximum anticipated wellbore pressure at total depth. The formation pressure integrity test results should demonstrate that the integrity of the casing shoe is sufficient to contain the anticipated wellbore pressures identified in the application for the Permit to Drill; that no flow path exists to formations above the casing shoe; and that the casing shoe is competent to handle an influx of formation fluid or gas without breaking down.

NYSDEC should remove the waiver provision for HVHF well intermediate casing. If NYSDEC does not remove the waiver provision entirely, it should include criteria for granting the waiver that require the Department to produce a technical support document for each waiver that describes the technical basis for granting the waiver, explains why the waiver constitutes the best practice, and verifies the waiver will not compromise environmental protection or public safety.

6 NYCRR § 560.6(c)(13)-(15), including the proposed revisions above, should apply to all oil and gas wells where intermediate casing is run; therefore, these improved requirements should also be included in Part 554 and applied when intermediate casing is run on a case-by-case basis for oil and gas wells that do not meet the HVHF well definition.

6 NYCRR § 560.6(c)(16)-(17) Production Casing and Cementing

Revised Proposed Regulation: NYSDEC proposes new regulations at 6 NYCRR § 560.6(c)(16)-(17) that require: the owner/operator to follow its permit; production casing to be installed and run to the surface and cemented, if intermediate casing is waived; if intermediate casing is set and cemented, production casing must be set and cemented to tie into the intermediate casing by 500'; a waiver provision to reduce cementing requirements (with criteria for granting the waiver); and running of a cement evaluation tool.

Prior Comments and Response: Our 2012 Recommendations made extensive casing and cementing best technology and practice recommendations for production casing. We appreciate the inclusion of our recommended improvements.

Recommendation: We support the casing and cementing regulations proposed at 6 NYCRR § 560.6(c)(16)-(17). The recommendations listed above for the overall casing and cementing requirements at 6 NYCRR § 560.6(c)(10) should also apply to production casing and cementing.

6 NYCRR § 560.6(c)(20)-(21) Pressure Testing Prior to Hydraulic Fracturing

Revised Proposed Regulation: NYSDEC proposes two new requirements at 6 NYCRR § 560.6(c)(20)-(21) to pressure test prior to hydraulic fracturing. The proposed test procedure requires a pressure test of downhole and surface equipment at:

> *". . .the maximum anticipated treatment pressure for at least 30 minutes with less than a* ***10 percent pressure loss****"[emphasis added].*

The proposed regulation concludes that a successful pressure test is one that leaked at a rate of less than 10% over a period of 30 minutes.

While pressure readings may initially fluctuate during a pressure test (+/-10%) until the pressure is stabilized, a pressure test should not be determined to be successful if the pressure dropped at a rate of 10% over a 30 minute period. A continued pressure drop indicates a leak. Instead, the operator should ensure that the pressure stabilizes and holds constant for a 30 minute period.

Mechanical integrity tests should be run at 110% of the maximum anticipated treatment pressure to provide an additional safety margin.

NYS's proposed regulations do not require tubing strings to be tested or require any specific action after a failed pressure test.

Recommendation: 6 NYCRR § 560.6(c)(20)-(21) should be revised to include these requirements:

4. Prior to conducting hydraulic fracturing operations in a well, mechanical integrity tests shall be run at 110% of the maximum anticipated treatment pressure. The test shall be run for a sufficient period of time to allow the pressure to stabilize at that required test pressure. Once the pressure stabilizes, the operator must monitor the pressure gauge to ensure the pressure remains stable for a full 30 minutes.

5. Mechanical integrity tests shall be conducted on casing strings and tubing strings planned for use in hydraulic fracturing treatments.

6. If a mechanical integrity test fails, the operator shall remedy the failure and repeat a pressure test until successful.

6 NYCRR § 560.6(c)(22) HVHF Design and Monitoring

Revised Proposed Regulation: NYSDEC's proposed regulation at 6 NYCRR § 560.6(c)(22) requires a HVHF treatment plan to be submitted to the Department 3 days prior to a HVHF operation. There is no Department review or approval of the HVHF treatment plan required.

As proposed, the HVHF treatment plan needs to include only a profile showing anticipated pressures and volumes of fluid for pumping the first stage and a description of the planned treatment interval for the well (*i.e.*, top and bottom of perforations expressed in both True Vertical Depth and True Measured Depth).

There is no requirement to model the HVHF treatment to ensure the job will not fracture out-of-zone; nor is there any follow-up on whether the job was successful or failed. More specifically, 6 NYCRR § 560.6(c)(22) does not require the owner/operator to: estimate the vertical and horizontal fracture length using a three-dimensional model; verify that HVHF design and actual implementation in the field match; and notify NYSDEC if the actual vertical and/or horizontal fracture length greatly exceeds the job design, such that risk may be present to the environment.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC require the owner/operator to: estimate the vertical and horizontal fracture length using a three-dimensional model; verify that HVHF design and actual implementation in the field match; and notify NYSDEC if the actual vertical and/or horizontal fracture length greatly exceeds the job design, such that risk may be present to the environment. Harvey Report Recommendations Nos. 32-36; Myers Report at 8-12.

NYSDEC responded that it did require a hydraulic fracture stimulation model to be run [Response 6194], but a search of the proposed regulation for the term "hydraulic fracture stimulation model" or even the term "model" shows no such requirement exists.

The 2012 Recommendations pointed out that because fracture treatments may be executed several thousand feet below the surface of the earth, and can only be indirectly observed, it is important for engineers to have a 3D model to guide design. California's proposed hydraulic fracturing regulations call for fracture radius analyses to verify that no fracturing fluids or hydrocarbons will migrate into a strata or zone that contains protected water and require operators to utilize modeling that will simulate the projected fracture height growth.[31] While 3D modeling is not an exact science, the model provides an engineer with an estimating method for predicting both horizontal and vertical fracture length. Data collected during drilling, well logging, coring, and other geophysical activities and HVHF implementation can be used to continuously improve the model quality and predictive capability.

[31] California Dep't of Conservation, Pre-Rulemaking Discussion Draft Hydraulic Fracturing Regulations at 3, http://www.conservation.ca.gov/dog/general_information/Documents/121712DiscussionDraftofHFRegs.pdf.

We explained that HVHF treatments in thin shale zones increase the risk of fracturing out-of-zone unless a very cautious approach is taken by tailoring the design to the geophysical properties of the shale, taking into account shale thickness, local stress conditions, compressibility, and rigidity. For example, Marcellus Shale thickness lessens substantially in western NYS to less than 75' for roughly one-third of the total anticipated development area.[32]

The RDSGEIS agreed that in new areas hydraulic fracture model development and design is important, citing recommendations from the Ground Water Protection Council and its consultant ICF. Yet, incongruously, the RDSGEIS concludes it is unnecessary for operators to be required do this work in NYS.

The RDSGEIS requires the operator to abide by only a 1000' vertical offset from protected aquifers and collect data during the HVHF job to evaluate whether the job was implemented as planned.[33]

Knowing whether a job was implemented as planned is helpful only if the initial design is protective of human health and environment. If the job is poorly planned, and is implemented as planned, that only proves that a poor job was actually implemented.

Instead, NYSDEC needs to first verify that the operator has engineered a HVHF treatment that is protective of human health and environment, and then, second, verify that the job was implemented to that protective standard. A rigorous engineering analysis is a critical design step. Proper design and monitoring of HVHF jobs is not only best practice from an environmental and human health perspective; it is also good business because it optimizes gas production and reduces hydraulic fracture treatment costs.

The RDSGEIS assumes that any HVHF job, no matter the volume, no matter the pressure, and no matter the shale thickness, will be safe, as long as it is conducted at a depth below 2,000'. Yet, the RDSGEIS lacks technical and scientific data to support the hypothesis that all HVHF treatments, regardless of design, at 2000' or deeper will be safe or identify a safe horizontal fracture length.

Recommendation: We support the 6 NYCRR § 560.6(c)(22) requirement for a treatment plan to be submitted to NYSDEC; however, the treatment plan should be substantially more robust, including a requirement for that plan to be developed using a 3D model and submitted to the Department for review and approval prior to commencing HVHF operations. It appears from NYSDEC Response 6194 that the Department intends to implement such a requirement, but the current text of the proposed regulation does not impose it.

More specifically, the regulation should require the owner/operator to:

1. Collect additional geophysical and reservoir data to support a reservoir simulation model;
2. Develop a high-quality 3D reservoir model(s) to safely design fracture treatments;
3. Maintain and run hydraulic fracture models prior to each fracture treatment to ensure that the fracture is contained in zone;
4. Estimate the maximum vertical and horizontal fracture propagation length for each well, and submit technical information (*e.g.* model output) with its application to support its computations;

[32] 2009 NYSDEC, DSGEIS, Figure 4.9.

[33] 2011 NYSDEC, RDSGEIS, Page 5-88.

5. Design the HVHF treatment to mitigate vertical propagation out-of-zone and prevent fractures from intersecting with existing improperly constructed and improperly abandoned wells and transmissive faults and fractures, which can provide pollutants a direct pathway to protected groundwater resources;
5. Collect and carefully analyze data from HVHF treatments to optimize future HVHF treatments;
6. Describe in its post-well completion report whether the predicted vertical and horizontal fracture propagation lengths were accurate, or note discrepancies;
7. Certify that the actual HVHF job was implemented safely, and fracture propagations did not intersect protected aquifers or nearby wells; and
8. Immediately notify NYSDEC if the actual vertical and/or horizontal fracture length greatly exceeds the job design, such that risk may be present to the environment.

6 NYCRR § 560.6(c)(23)-(24) Hydraulic Fracturing Fluid Chemical Limitations

Revised Proposed Regulation: NYSDEC proposes a regulation that limits the use of hydraulic fracturing fluids to those chemicals listed in an operator's approved permit [6 NYCRR § 560.6(c)(23)] and prohibits the use of diesel [6 NYCRR § 560.6(c)(24)].

As proposed, 6 NYCRR § 560.6(c)(23) is a meaningless regulation because it allows industry to propose any chemical it wants to use in hydraulic fracturing. As long as it is listed on the permit it can be used. The only exception is diesel.

Therefore, an owner/operator could use any chemical proposed in its permit application (except diesel), even if it is a carcinogen, highly toxic, or otherwise known to be harmful to human health or the environment.

While NYSDEC proposed regulation 6 NYCRR § 560.3(d)(1)(viii) requests industry to examine chemical additives that exhibit reduced aquatic toxicity and pose a lower risk, there is no mandatory requirement to use those chemicals and the NYCRR does not provide specific criteria for determining whether a reduction in toxicity offers an acceptable reduction in risk.

If an operator proposes a chemical additive that is known to impact the environment and be persistent if it remains in the environment, but the operator proposes no other alternative, or states that this is the only chemical that will be effective for its planned job, neither the RDSGEIS or the NYCRR prohibits the operator from using this chemical, even if it is harmful.

As proposed, the NYCRR would still allow the use of a highly toxic chemical, as long as it was slightly less toxic than the most toxic chemical available. This is not best practice. Best practice would be to use the chemical with the lowest impact and risk, not just a slightly improved risk. Best practice would also be for NYSDEC to develop a list of prohibited chemicals that pose an unacceptable risk to human health and the environment.

Although the percentage of hydraulic fracturing fluid that is composed of chemicals may be small—typically 0.5 to 2 percent of the total volume required for a Marcellus Shale hydraulic fracture stimulation—the absolute volume of chemicals used is very large. A typical Marcellus Shale well may require the use of more than five million gallons of freshwater for drilling and hydraulic fracturing. A five-million-gallon hydraulic fracture treatment would require approximately 25,000 to 100,000 gallons of hydraulic fracturing chemicals per well at a chemical additive dosage of 0.5 to 2 percent. Some of

these chemicals are toxic, including known or possible human carcinogens, chemicals regulated under the Safe Drinking Water Act due to their risks to human health, and chemicals regulated under the Clean Air Act as hazardous air pollutants.[34]

Prior Comment and Response: While we support NYSDEC's proposal to prohibit the use of diesel fuel as a hydraulic fluid treatment additive, NYSDEC does not propose to prohibit the use of any other specific hydraulic fracturing treatment chemicals as requested in our 2012 Recommendations. *See* Harvey Report at Recommendations Nos. 37-39; Miller Report Recommendation No. 8. We requested that NYSDEC:

> *Develop a list of prohibited fracture treatment additives based on the known list of chemicals currently used in hydraulic fracturing. The list of prohibited fracture treatment additives should apply to all hydraulic fracture treatments, not just HVHF treatments. NYSDEC should also develop a process to evaluate newly proposed hydraulic fracturing chemical additives to determine whether they should be added to the prohibited list. No chemical should be used until NYSDEC and/or the NYSDOH has assessed whether it is protective of human health and the environment, and has determined whether or not it warrants inclusion on the list of prohibited hydraulic fracturing chemical additives for NYS. The burden of proof should be on industry to demonstrate, via scientific and technical data and analysis, and risk assessment work, that the chemical is safe. Fracture treatment additive prohibitions should be included in the SGEIS as a mitigation measure and codified in the NYCRR.*
>
> *The NYSDEC should re-examine the additives used in hydraulic fracturing and conduct a much more detailed analysis of the risk of these compounds. Specifically, acrylamide and acrylonitrile, a carcinogenic and exclusively anthropogenic compound used in hydraulic fracturing, should be measured in flowback water, and an assessment made as to whether and/or how use of this compound should be permitted. The conclusions of such analysis should be included in the SGEIS as a mitigation measure and codified in the NYCRR.*

Other commenters also recommended that NYSDEC specifically prohibit the use of any substances that are known carcinogens, endocrine disruptors, or contain BTEX. [Comments 6118, 6120, 6202, 6121, and 6122].

NYSDEC agreed that diesel fuel should be prohibited because of its known human health hazards, but rejected all other recommendations to restrict the type of hydraulic fracturing chemicals use. [Responses 6118, 6120, 6202, 6121, and 6122].

Inconsistently, NYSDEC concludes that it make sense to prohibit diesel because of the human health hazards associated with using diesel (it is a known carcinogen), but rejects the idea of prohibiting other chemicals that are known to be hazardous to human health or the environment. NYSDEC does not respond to Dr. Miller's specific request to prohibit carcinogens such as acrylamide and acrylonitrile. It is inconsistent to prohibit one type of carcinogen and not another.

NYSDEC states, without scientific or technical justification, that:

[34] United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing, April 2011.

> *The Department does not agree that requiring additional assessments for each proposed fracturing fluid would measurably add to the protection of the public health or the environment.* [Response 6122].

.At the very least, new assessments should be prepared for chemicals not listed as proposed fracturing fluid constituents in the RDSGEIS. Manufacturers and processors of newly developed additives should be required to prove the safety of the additives before NYSDEC allows them to be used in fracturing treatments.

Refusing to impose any other chemical limitations, NYSDEC relies solely on prevention measures (*e.g.* setbacks, buffers, exclusion areas, secondary containment, etc.) to prevent hazardous chemicals from reaching humans or sensitive environmental receptors.

> *The approach taken in the proposed regulations and assumes that hydraulic fracturing fluid additives, if released into the environment, may pose some potential impact that depends on site-specific circumstances. Therefore, the requirements contained in the proposed regulations, Chapter 7 and Appendix 10 of the rdSGEIS, including setbacks, buffers, exclusion areas, secondary containment requirements, inspection and preventative maintenance protocols, and well construction requirements, are included as precautionary measures that are intended to reduce and/or prevent any releases and environmental and human exposures. This approach addresses a broader range of potential impacts than attempting to apply a toxicity or hazard characterization to any specific chemicals, since all chemicals are toxic at some exposure level. Regardless of additive composition, the potential impacts from the chemicals utilized in hydraulic fracturing are mitigated by the required design and operational controls to prevent releases and exposures. Therefore,* ***prohibiting specific chemicals or additives is not necessary****.* [Response 6121; emphasis added].

NYSDEC does not explain why a combination of prevention measures **and** chemical prohibitions is not a lower risk, more prudent approach.

Comment 6201 requested that NYSDEC periodically test hydraulic fracturing fluid used on actual stimulation jobs to ensure that the chemicals used are the same ones listed by industry in its disclosure. NYSDEC rejected the recommendation to audit the chemicals actually used. [Response 6201].

Recommendation: We support the prohibition on use of diesel at 6 NYCRR § 560.6(c)(24). We do not support NYSDEC's proposal at 6 NYCRR § 560.6(c)(23) to allow any other chemicals to be used in hydraulic fracturing it if is merely listed in a permit application. NYSDEC should do the following.

1. Develop a list of prohibited fracture treatment additives based on the known list of chemicals currently used in hydraulic fracturing. The list of prohibited fracture treatment additives should apply to all hydraulic fracture treatments, not just HVHF treatments.

2. Develop a process to evaluate newly proposed hydraulic fracturing chemical additives to determine whether they should be added to the prohibited list.

3. Require the burden of proof to be on industry to demonstrate, via scientific and technical data and analysis and risk assessment work, that any newly proposed hydraulic fracturing chemical is safe.

4. Prohibit any chemical from use in a hydraulic fracturing treatment until NYSDEC and/or the NYSDOH has assessed the industry's toxicity studies and other documentation concerning the impact of the chemical on human health and the environment and has determined whether or not it warrants inclusion on the list of prohibited hydraulic fracturing chemical additives for NYS.

5. Include fracture treatment additive prohibitions at 6 NYCRR § 560.6(c)(23).

6. Periodically test hydraulic fracturing fluid used on actual stimulation jobs to ensure that the chemicals used are the same ones allowed.

6 NYCRR § 560.6(c)(26) Secondary Containment

Revised Proposed Regulation: NYSDEC proposes secondary containment requirements at 6 NYCRR § 560.6(c)(26).

Recommendation: We support the proposed regulation at 6 NYCRR § 560.6(c)(26); however, the requirement should also state that secondary containment materials must be chemically resistant to deterioration and compatible with the materials stored. This will prevent chemical spills into secondary containment from leaking through the containment barrier.

6 NYCRR § 560.6(c)(26) Hydraulic Fracturing Operational Procedures

Revised Proposed Regulation: 6 NYCRR § 560.6(c)(26) proposes that a number of operational limitations, monitoring, and testing procedures be implemented during a hydraulic fracturing operation.

However, NYSDEC did not include any limitation on the depth where a HVHF job could commence.

Prior Comment and Response: Our 2012 Recommendations requested that NYSDEC justify its proposal to allow HVHF wells as long as they are conducted below 2,000' TVD and 1,000' below the base of potable water. Harvey Report Recommendation No. 35; Myers Report at 25. Our 2012 Recommendations pointed out that the 1,000' vertical offset proposed by ICF was not technically supported, and a horizontal buffer zone is also needed. We recommended that vertical and horizontal offsets be based on actual field data, 3D reservoir simulation modeling, and a peer-reviewed hydrological assessment and recommended these steps be taken to ensure aquifers are protected and nearby wellbore intersections are avoided.

The RDSGEIS did not provide technical justification for the proposed minimum 1,000' vertical offset, nor did it make a recommendation for a horizontal offset from existing wells. Instead, the RDSGEIS requires only that the operator abide by a 1000' vertical offset from protected aquifers and collect data during the HVHF job to evaluate whether the job was implemented as planned.[35] The RDSGEIS provided data, however, showing that HVHF treatments in the Marcellus Shale have propagated vertical fractures up to 1500' in length and that horizontal fractures can extend hundreds to thousands of feet. This data does not support the proposed buffers.

The RDSGEIS assumes that any HVHF job, no matter the volume, no matter the pressure, and no matter the shale thickness, will be safe as long as it is conducted at a depth below 2,000'. The RDSGEIS recommends that site-specific SEQRA reviews be limited to wells shallower than 2000' and within 1000'

[35] 2011 NYSDEC, RDSGEIS, Page 5-88.

of a protected aquifer.[36] The RDSGEIS lacks technical and scientific data to support the hypothesis that all HVHF treatments, regardless of design, at 2000' or deeper will be safe.

Neither the 2009 DSGEIS nor the 2011 RDSGEIS contained site-specific NYS Marcellus Shale hydraulic fracture model data to support NYSDEC's conclusion that a 1,000' vertical separation will be protective in all cases in NYS, especially where thinner, shallower shales are present. Furthermore, the RDSGEIS lacks data on vertical and horizontal fracture propagation in the Marcellus Shale at depths between 2000' and 5000' (depths at which NYSDEC proposes to permit HVHF).

The use of vertical offset limits to separate hydrocarbon recovery operations from protected aquifers must be scientifically and technical supported. While it is possible that a 1,000' vertical offset may be sufficiently protective, the RDSGEIS does not provide sufficient scientific data or technical examination to support this recommended threshold.

In addition to understanding the maximum vertical fracture propagation height, horizontal fracture propagation distance is an important consideration, especially when developing shallower shale zones. Fractures in shallower formations will tend to propagate on the horizontal plane. HVHF treatments should be designed to prevent fractures from intersecting with existing improperly constructed and improperly abandoned wells, and transmissive faults and fractures, which can provide pollutants a direct pathway to protected groundwater resources.

Recommendation: We support the proposed improvements at 6 NYCRR § 560.6(c)(26); however, these requirements should apply to all hydraulic fracture treatments, not just HVHF treatments, and therefore should also be included in Part 554.

Additionally, 6 NYCRR § 560.6(c)(26) should include a limitation on the depth where a HVHF job could commence. The regulation should include the following:

1. Initial HVHF treatments should be completed in the deepest, thickest sections of the Marcellus Shale (below 4,000'), maximizing the vertical separation from drinking water aquifers and maximizing data collection on overlying drinking water aquifers and geologic barriers that will limit fracture propagation, before development in shallower zones is permitted.
2. Initially, smaller fracture treatments should be used as tests. These treatments can be increased in size over time, if data support the conclusion that large fracture treatments can remain in zone.
3. Use data collected during drilling and HVHF treatments in the Marcellus Shale below 4,000' deep to populate an accurate field-calibrated 3D reservoir simulation model to examine whether HVHF treatments are likely to remain in zone at shallower and thinner intervals.
4. Revise the regulations at a later date to approve shallower HVHF treatments, if technical and scientifically supported.

6 NYCRR § 560.6(c)(27) Hydraulic Fracturing Flowback Handling

Revised Proposed Regulation: 6 NYCRR § 560.6(c)(27) proposes the use of close-loop tank systems for HVHF flowback. The regulation states that:

[36] 2011 NYSDEC, RDSGEIS, Page 7-59.

> *"Flowback water is prohibited from being directed to or stored in any on-site pit or impoundment."*

While the regulation prohibits hydraulic fracturing fluid impoundments "on-site," it is unclear whether or not this prohibits the use of centralized impoundments.

Prior Comments and Response: As explained in more detail in comments at 6 NYCRR § 750-3.11(f)(1) below, our 2012 Recommendations requested that centralized impoundments be prohibited because of the risk of surface and ground water contamination and because they are major sources of air pollution.

Recommendation: We support the proposed improvements at 6 NYCRR § 560.6(c)(27); however, we request that 6 NYCRR § 560.6(c)(27) be revised to clearly prohibit centralized waste impoundments in addition to waste impoundments on or near the well pad.

Additionally these requirements should apply to all hydraulic fracture treatments, not just HVHF treatments, and should also be included in Part 554.

6 NYCRR § 560.6(c)(28)–(29) Air Pollution Controls

Revised Proposed Regulation: 6 NYCRR § 560.6(c)(28)-(29) proposes the mandatory use of self-ignited flare systems and reduced emission completions ("green completions") during HVHF treatments.

Recommendation: We support the proposed improvements at 6 NYCRR § 560.6(c)(28)-(29); however, these requirements should apply to all hydraulic fracture treatments, not just HVHF treatments, and should also be included in Part 554.

6 NYCRR § 560.6(c)(26)(ix) Hydraulic Fracturing Report

Revised Proposed Regulation: NYSDEC's proposed regulation at 6 NYCRR § 560.6(c) requires a hydraulic fracturing report to be submitted.

Recommendation: We support the requirement for a hydraulic fracturing report to be submitted; however, we recommend that the entire report be submitted to NYSDEC (not just a synopsis) and that the report include the following information, in addition to the information NYSDEC proposes:

1. Total hydraulic fracturing fluid and proppant volumes used in the well.
2. Type and volume of base fluid used in the hydraulic fracturing treatment.
3. Type and volume of all chemicals added to the base fluid and used in the hydraulic fracturing treatment.
4. Maximum surface treating pressure observed during the hydraulic fracturing treatment, and annulus pressure and surface casing pressure.
5. A copy of the contractor's hydraulic fracturing treatment field ticket.

6 NYCRR § 560.6(c)(26)(ix), including the proposed revision above, should apply to all oil and gas wells that hydraulically fractured, not just to HVHF wells; therefore, these improved requirements should be included in Part 554.

6 NYCRR § 560.7 (a) Waste Removal Timing

Revised Proposed Regulation: NYSDEC proposes a requirement to remove waste from the well pad within 45 days 6 NYCRR § 560.7(a).

Recommendation: We support the 45-day timeline for waste removal proposed at 6 NYCRR § 560.7(a); however, this requirement should apply to all oil and gas wells and all hydraulic fracture treatments, not just HVHF treatments, and should be included in Part 554.

6 NYCRR § 560.7(c) and (g) On-site Burial of Cuttings

Revised Proposed Regulation: NYSDEC proposes a requirement at 6 NYCRR § 560.7(c) to prohibit onsite burial of drill cuttings contaminated with oil-based muds or polymer-based muds containing mineral oil lubricants, except that some Marcellus Shale cuttings may be buried pursuant to 6 NYCRR § 560.7(g).

Prior Comments and Response: Our 2012 Recommendations requested that onsite burial of cutting be prohibited. If allowed by NYSDEC, we recommended that burial be limited to cuttings that do not contain NORM and are not coated with drill muds containing mercury, heavy metals, and other chemical additives and that NYCRR be expanded to provide specific instruction on how to properly dispose of contaminated drill cuttings. Harvey Report Recommendations No. 44, 82, and 83.

Recommendation: We support the proposed requirement set forth at 6 NYCRR § 560.7(c) to prohibit onsite burial of drill cuttings contaminated with oil-based muds or polymer-based muds containing mineral oil lubricants. However, we recommend that NSYDEC specifically prohibit onsite cuttings burial if the cuttings contain NORM or mercury. We do not support any onsite burial of Marcellus Shale cuttings because they contain NORM.

6 NYCRR § 560.7(c) should include specific instruction on how to properly dispose of contaminated drill cuttings.

These requirements should apply to all oil and gas wells and all hydraulic fracture treatments, not just HVHF treatments, and should be included in Part 554.

6 NYCRR § 560.7(i) and (k) Flowback, Soil, and Equipment Testing for NORM

Revised Proposed Regulation: NYSDEC proposes a requirement at 6 NYCRR § 560.7(i) and (k) to test flowback, soils, and equipment for NORM at the well pad. However, the testing requirements do not include testing for polonium or instructions on how to properly treat and dispose of waste containing NORM.

Prior Comments and Response: Our 2012 Recommendations requested NORM testing and testing for polonium, and instructions on how to properly treat and dispose of waste containing NORM. Miller Report Recommendations No. 1-5, and 7-8; Harvey Report Recommendations No. 73-78.

Recommendations: We support the proposed requirements at 6 NYCRR § 560.7(i) and (k) for NORM testing; however, the requirements should be expanded to include the following:

1. Provide specific treatment and disposal instructions for flowback, soil, and equipment contaminated with NORM.

2. All components of the gross alpha radioactivity should be identified.
3. Test for polonium.
4. Specify the analytical test methods required.
5. Specify the frequency for equipment testing (instead of just saying a schedule prescribed by the Department).
6. Explicitly state that land and road spreading of waste containing NORM is prohibited.

This requirement should apply to all oil and gas wells and all hydraulic fracture treatments, not just HVHF treatments, and should be included in Part 554.

6 NYCRR § 560.7(l) Reclamation Plans

Revised Proposed Regulation: NYSDEC proposes site reclamation requirements at 6 NYCRR § 560.7(l). However, the reclamation plan requirements have no criteria specified other than the requirement to submit a plan (on an unspecified timeline) with unspecified contents, to be approved by the Department (using unspecified approval criteria) at a date (unknown). There is no timeline set for when partial or final reclamation is required and no definition provided as to the difference between partial and final reclamation.

Recommendation: We support the requirement at 6 NYCRR § 560.7 (l) for a reclamation plan to be submitted and approved by NYSDEC; however, the plan submittal timing, contents, and approval criteria should be clearly stated; the terms "partial" and "final reclamation" should be defined; and the timeframe for completion should be specified.

These requirement should apply to all oil and gas wells and all hydraulic fracture treatments, not just HVHF treatments, and should be included in Part 554.

The information required to be submitted to the Department pursuant to 6 NYCRR § 560.7 should be made publicly available on NYSDEC.

6 NYCRR § 750-3.2(b)(19) Definition of Formation Fluids

Revised Proposed Regulation: NYSDEC added a new definition for "formation fluids" in the 2011 proposed regulations. There is no revision proposed in this subsection.

NYSDEC's current regulations define formation fluids as:

> *6 NYCRR § 750-3.2(b)(19): Formation fluids means fluids in a liquid or gaseous physical state, present within the pore spaces, fractures, faults, caverns, or any other spaces of formations, whether or not naturally occurring or injected therein.*

Prior Comment and Response: Comment 5769 recommended deleting this definition, because the term did not appear in the 2011 proposed regulations. NYSDEC declined to delete it because the regulations now do use the term. Because the Revised Proposed Regulations do use the term, it is important that NYSDEC get the definition correct.

Recommendation: 6 NYCRR § 750-3.2(b)(19) should be revised to read: "Formation fluids means fluids in a liquid state or containing dissolved gases, present within the pore spaces, fractures, faults, caverns, or any other spaces of formations, whether or not naturally occurring or injected therein."

6 NYCRR § 750-3.2(b)(21) Definition of Fresh Water Supply

Revised Proposed Regulation: NYSDEC added a new definition for "fresh water supply" at 6 NYCRR § 750-3.2(b)(21).

> *6 NYCRR § 750-3.2(b)(21): Fresh water supply means those groundwaters having a chloride concentration equal to or less than 250 mg/l or a total dissolved solids concentration equal to or less than 1,000 mg/l.*

Prior Comment and Response: NYSDEC's proposed addition to the NYCRR did not respond to the comments in the Myers Report and the Harvey Report recommending that NYSDEC adopt the EPA standard for an Underground Source of Drinking Water (USDW) when defining fresh water supplies. [Myers Report at 4-6; Harvey Report at 12-14.] In addition to NYSDEC's proposal to protect fresh water including groundwater having a chloride concentration equal to or less than 250 mg/l or a total dissolved solids concentration equal to or less than 1,000 mg/l, Harvey recommended that the protected groundwater standard be expanded to include all water also protected under the federal USDW program, up to and including a 10,000 ppm TSD threshold. [Harvey Report at 14, Recommendation No. 5.] Harvey explained that NYSDEC's proposed definition of fresh water did not include water with less than 10,000 ppm TDS but greater than 1,000 ppm TDS, meaning that NYS's proposed regulations would not protect waters that could qualify as USDWs under the Safe Drinking Water Act.[37] Harvey also recommended that the USDW standard be used as a minimum threshold to be consistent with federal law, and that NYSDEC should propose more protective standards for New York State if needed to protect the State's future water supply needs if the threshold is found insufficient. [Harvey Report at 13-14, Recommendation Nos. 3-5.]

In addition, the use of two different terms for fresh water, "fresh water supply" in 6 NYCRR § 750-3.2(b)(21), and "potable fresh water" in 6 NYCRR § 550.3(au), is confusing. Although they are in separate regulatory parts, it is inconsistent to use two different terms which are defined by virtually the same standard: waters with a chloride concentration equal to or less than 250 mg/l or a total dissolved solids concentration equal to or less than 1,000 mg/l.

Recommendation: The definition of "fresh water supply" in subsection 750-3.2(b)(21) should adopt the definition that we have proposed for 6 NYCRR § 550.3(au). The new definition should provide: "'Protected groundwater' shall mean potable fresh water and all underground sources of drinking water, as defined in 40 CFR §§ 144.3, 146.4." All instances of "fresh water supply" in 6 NYCRR § 750-3 should be revised accordingly.

[37] 40 CFR §§ 144.3, 146.4.

6 NYCRR § 750-3.3(a)(1) Setbacks from Unfiltered Drinking Water Supplies within Which HVHF Well Pads Are Prohibited

Revised Proposed Regulation: 6 NYCRR § 750-3.3(a)(1) prohibits well pads for HVHF operations within 4,000' of, and including, an unfiltered surface drinking water supply watershed and states that no SPDES permits will be issued authorizing well pads for HVHF operations or discharges in that buffer area.

Prior Comment and Response: NYSDEC did not adequately address Comment 3837, which recommended that the regulations clarify whether HVHF activities will be prohibited underneath the watershed as well as on the surface. In its response, NYSDEC clarified that the setback in 6 NYCRR § 750-3.3(a)(1) applies to well pads at the surface only and does not prohibit HVHF subsurface activities under either the 4,000' buffer area or the drinking water supply watersheds themselves. NYSDEC did not acknowledge the concern that 4,000' buffers may not prevent migration of contaminants underneath unfiltered drinking water supply watersheds, particularly when the well site and associated activities (as opposed to the well pad *per se*) may still lie within 4,000' and subsurface HVHF activities may occur within 4,000'. Permitting drilling underneath unfiltered drinking water supplies significantly threatens the New York City watershed, and such a threat may cause EPA to retract its filtration avoidance determination.

Recommendation: NYSDEC should revise 6 NYCRR § 750-3.3(a)(1) to prohibit all surface and subsurface HVHF activities within 4,000' of, and including, an unfiltered surface drinking water supply and to require operators to analyze the local hydrogeology to demonstrate that the groundwater divide would not allow transport of contaminants into any unfiltered surface water supply watershed from activities proposed within one mile of the 4,000' setback.

6 NYCRR § 750-3.3(a)(2) Setbacks from Primary Aquifers within Which HVHF Well Pads Are Prohibited

Revised Proposed Regulation: 6 NYCRR § 750-3.3(a)(2) prohibits well pads for HVHF operations within 500' of, and including, a primary aquifer and states that no SPDES permits will be issued authorizing well pads for HVHF operations or discharges in that buffer area.

Prior Comment and Response: NYSDEC did not address comments in the Myers Report recommending that wells be set back at least 4,000' from primary aquifers, which is the same as the regulated distance proposed by NYSDEC around unfiltered surface drinking water supply watersheds. [Myers Report at 23-24.] If the groundwater in the bedrock connects with the aquifer, the potential exists for rapid transport of contaminants from a spill through fractures to the aquifer. Since the risk to primary aquifers is the same as to unfiltered drinking water supply watersheds - the contamination of sources of public water supply - setbacks around primary aquifers should be the same as those around unfiltered, surface public water supplies.

In Response 2453, NYSDEC states that the proposed setbacks are meant to "conservatively add an additional layer of protection to [] water resources from significant adverse impacts from potential surface spills or other releases" and that "the magnitude of the setback should also reflect the magnitude of the potential risk and the potential harm." 500' setbacks around primary aquifers do not satisfy these goals. In addition, NYSDEC provides no scientific or technical justification for the adequacy of 500' setbacks.

Recommendation: NYSDEC should revise 6 NYCRR § 750-3.3(a)(2) to increase setbacks around primary aquifers to at least 4,000'.

6 NYCRR § 750-3.3(a)(3) Prohibition of HVHF Well Pads within 100-year Floodplains

Revised Proposed Regulation: 6 NYCRR § 750-3.3(a)(3) prohibits well pads for HVHF operations within 100-year floodplains and states that no SPDES permits will be issued authorizing well pads for HVHF operations or discharges in those floodplains.

Prior Comment and Response: As noted in our 2012 Recommendations, prohibiting HVHF operations within 100-year floodplains is insufficient. For wells that might operate for 30 years, there is a 26% chance of a 100-year flood occurring during the period the well would be operated. [Myers Report at 24; Knowlton Report at 2-3.] Instead, HVHF activities should be prohibited within 500-year floodplains and the regulations should specify approved sources for floodplain information and location. In Response 6131, NYSDEC rejected this contention, asserting that a prohibition within 100-year floodplains is adequately protective of potential flooding impacts. NYSDEC does not, however, provide any scientific or technical justification responding to the concerns outlined in the Myers and Knowlton Reports. In addition, NYSDEC does not acknowledge its concession in the RDSGEIS that although the Federal Emergency Management Agency (FEMA) is currently updating Flood Insurance Rate Maps (FIRMs) in several high-flood areas in the state. Increased frequency and magnitude of flooding due to the advent of extreme precipitation events and an overall increase in average precipitation has raised concerns regarding the reliability of existing FIRMs in the Susquehanna and Delaware River basins.[38] NYSDEC does not address this concern in Response 6131, stating only that "FEMA Floodplain Insurance Rate Maps are one source of information discussed [in the RDSGEIS]."

Although Response 6131 states that 6 NYCRR § 560.3 has been revised to provide a notice period during which local officials can inform NYSDEC of site-specific issues, this does not afford sufficient protection to floodplains. First, this provision has not been incorporated into Part 750 regulations governing SPDES permits. Second, "the opportunity to mention areas outside the 100-year floodplain that are known to be susceptible to flooding and where the Department should consider mitigation measures" is inadequate. [Response 6131.] This regulatory approach improperly relies on local officials to put NYSDEC on notice of the potential flood risk to drilling outside 100-year floodplains and assumes that local officials have knowledge of such risks.

The Myers Technical Memorandum, attached as Appendix A, points out that floodplain mapping is required by FEMA for primary waterway channels. A watershed consists of smaller drainages and wetlands that are not included in FIRMS and these control the flow and contribute substantial amounts of the sediment produced in floods. The Myers Technical Memorandum advises that runoff and erosion from hill slope areas can present a risk of contamination should gas development occur there. Of particular importance is the finding stated in this Memorandum that climate variability and landscape management at small scales has the most effect on flow pathways. Much of the landscape in the New York portions of the Delaware River and Susquehanna River basins, including the Catskills, is characterized by small subwatersheds that do not tip the threshold requirement for FEMA mapping. Without mapping the floodplains for these small drainages, increased flood flows, erosion and stream channel changes, and pollution from gas activities is a greater risk and can greatly impair efforts downstream to control flood flows.

[38] 2011 NYSDEC, RDSGEIS, Page 2-33.

Appendix A addresses additional comments on the inadequacy of the prohibition of HVHF operations in 100-year floodplains in 6 NYCRR § 750-3.3(a)(3).

Recommendation: NYSDEC should revise 6 NYCRR § 750-3.3(a)(3) to prohibit HVHF operations and the issuance of SPDES permits for activity or discharge within 500-year floodplains. NYSDEC also should revise 6 NYCRR § 750-3.3(a)(3) to require the mapping of the floodplain for smaller drainage areas that do not require FIRMs under FEMA; the maps should be produced by the applicant based on the presence of riparian soils through standard soil testing analysis.

6 NYCRR § 750-3.3(a)(4) Setbacks from Public Drinking Water Sources within Which HVHF Well Pads Are Prohibited

Revised Proposed Regulation: 6 NYCRR § 750-3.3(a)(4) prohibits well pads for HVHF operations within 2,000' of any public drinking water supply well, reservoir, natural lake, man-made impoundment, or spring, and states that no SPDES permits will be issued authorizing well pads for HVHF operations or discharges within those buffer areas.

Prior Comment and Response: NYSDEC did not address comments in the Myers Report recommending that wells be set back at least 4,000' from public drinking water sources, which is the same as the regulated distance proposed by NYSDEC around unfiltered surface drinking water supply watersheds and our recommended distance from both principal and primary aquifers. [Myers Report at 23-24.] In addition, the Myers Report recommended that HVHF operators be required to identify the capture zone for flow to the well and identify the five-year transport distance contour. [Myers Report at 24.] If the public drinking water supply well could draw contaminants from a spill at a gas well site, that gas well should not be sited in that location.

Recommendation: NYSDEC should revise 6 NYCRR § 750-3.3(a)(4) to increase setbacks around public drinking water supply wells, reservoirs, natural lakes, man-made impoundments, and springs to at least 4,000', and should require operators to identify the capture zone for flow to the well, as well as the five-year transport distance contour. If these data show that the drinking water well could draw contaminants from a spill at the gas well, then the well pad should be prohibited within the capture zone.

6 NYCRR § 750-3.3(a)(5) Setbacks around Public Drinking Water Supply Intakes within Which HVHF Well Pads Are Prohibited

Revised Proposed Regulation: NYSDEC revised 6 NYCRR § 750-3.3(a)(5) to prohibit well pads for HVHF operations within 2,000' around a public drinking water supply intake in flowing water, with an additional prohibition of 1,000' on each side of the main flowing waterbody and any upstream tributary to that waterbody for a distance of one mile from the public drinking water supply intake, and to state that no SPDES permits will be issued authorizing well pads for HVHF operations or discharges in those buffer areas.

Prior Comment and Response: Although we support explicit setbacks around waterbodies and tributaries that feed into public drinking water supplies, there are significant problems with the revised 6 NYCRR § 750-3.3(a)(5) language.

First, the protection around public drinking water supply intakes in flowing water should be 4,000' to sufficiently protect these resources. This is consistent with our 2012 Recommendations and current

recommendations of 4,000' buffers around primary and principal aquifers. [LBG Report at 7; Harvey Report at 136, Recommendation No. 68.] Public water supplies and primary and principal aquifers should all be afforded the same level of protection. NYSDEC did not respond to our 2012 Recommendations suggesting this setback increase.

Second, the prohibition on HVHF operations within 1,000' on either side of main flowing waterbodies and their upstream tributaries for a distance of one mile from public drinking water supply intakes does not afford sufficient protection to those public drinking water supplies. Numerous perennial and intermittent streams lead to public drinking water supplies, but are outside the one-mile buffer around the water supply intake. These tributaries beyond one mile do not receive the protection of 6 NYCRR § 750-3.3(a)(5) and instead fall under 6 NYCRR § 750-3.11(d), which allows HVHF operations near perennial and intermittent streams over a mile from the public drinking water supply intake within a 300' buffer, as long as the HVHF operator obtains an individual SPDES permit instead of an HVHF general permit (GP). These revisions reduce protections afforded under the 2011 proposed regulations, in which subparagraph 750-3.3(b)(4) contained explicit prohibitions on HVHF operations within 2,000' of *any* public water supply intake, and subparagraph 750-3.21(f)(4) included an additional 500' buffer within which an individual SPDES permit was required for the entire remaining length of streams tributary to surface public drinking water supplies. The reduced buffer area is insufficient to protect both the tributaries that lead to public drinking water supplies and the terminal drinking water supplies themselves. NYSDEC has provided no scientific evidence or reasoned explanation justifying the reduction in setback distance for perennial and intermittent streams more than a mile from public water supply intakes from 500' to 300' or showing that such a reduced buffer is sufficient to protect these waterbodies or the public drinking water supplies that they feed.

Third, the draft SPDES General Permit for Stormwater Discharges is inconsistent with the current proposed regulations. It does not contain a provision for the prohibition of HVHF within 2,000' of a public drinking water supply intake or the additional prohibition of 1,000'on each side of the main waterbody and any upstream tributary to that water body for a distance of one mile from the public drinking water supply intake. NYSDEC should revise the draft SPDES General Permit for Stormwater Discharges to reflect its final setback regulations.

Recommendation: NYSDEC should increase setbacks around public drinking water supply intakes in all main flowing waterbodies to at least 4,000', while retaining the 1,000' setback on each side of the main waterbody and any upstream tributary within a mile of the intake. For upstream tributaries more than a mile from the intake, NYSDEC should reinstate a 500' setback. This setback should be provided for in 6 NYCRR § 750-3.3(a)(5), however, not in 6 NYCRR § 750-3.11(d). In addition, the draft SPDES General Permit for Stormwater Discharges must be revised to reflect NYSDEC's final setback regulations.

6 NYCRR § 750-3.3(a)(6) Setbacks from Private Water Supplies within which HVHF Well Pads Are Prohibited

Revised Proposed Regulation: NYSDEC revised 6 NYCRR § 750-3.3(a)(6) to prohibit well pads for HVHF operations within 500' of private water wells, domestic use springs, and water supplies for crops or livestock and to state that no SPDES permits will be issued authorizing well pads for HVHF operations or discharges within those buffer areas.

Prior Comment and Response: NYSDEC did not acknowledge or respond to our 2012 Recommendations requesting that NYSDEC establish 4,000' setbacks around private drinking water

supplies. [LBG Report at 7; Harvey Report at 136, Recommendation No. 68.] It is unclear why unfiltered drinking water supplies and public water supplies should be afforded a higher level of protection than private wells. All public and private drinking water supplies should have equivalent setbacks. NYSDEC also did not adequately address comments in the Myers Report and Harvey Report objecting to any provision allowing private water well owners to waive setbacks around their wells, which has been deleted from 6 NYCRR Part 750 and added to 6 NYCRR § 560.4(c) as an NYSDEC variance with landowner consent. [Myers Report at 24; Harvey Report at 132, Recommendation No. 64.] Authorizing NYSDEC to grant a variance to setback requirements permitting drilling near private water sources endangers public health and safety. Instead of analyzing these risks, NYSDEC simply stated in Response 4405 that it does not agree that allowing landowners to permit drilling near private wells endangers water quality, and that protections in the RDSGEIS and the ECL will adequately protect water sources and the environment. NYSDEC has not, however, provided any scientific or technical justification for its conclusion.

Recommendation: NYSDEC should revise 6 NYCRR § 750-3.3(a)(6) to increase setbacks around private water wells, domestic use springs, and water supplies for crops or livestock to at least 4,000'. NYSDEC should remove the provision referencing the variance exception from 6 NYCRR § 750-3.3(a)(6), and should amend 6 NYCRR § 560.4(c) to remove the provision authorizing NYSDEC to grant a variance to setback requirements with the written consent of landowners and tenants, essentially permitting well owners to waive setbacks around private water supplies that may have connections to other private water wells.

6 NYCRR § 750-3.3(b) Measuring Setbacks

Revised Proposed Regulation: 6 NYCRR § 750-3.3(b) requires all setbacks in subparagraph 750-3.3(a) to be measured from the closest edge of the HVHF well pad.

Prior Comment and Response: NYSDEC did not adequately respond to our 2012 Recommendations requesting that NYSDEC require all setbacks to be measured from the edge of the well site, which, according to the definition in 6 NYCRR § 750-3.2(52), includes the contiguous disturbed area and ancillary facilities around the well pad. Our 2012 Recommendations also stated that NYSDEC should require all wells on the well site to be centered on the well pad and set back at least 100' from the pad edge to maximize setbacks from sensitive receptors. [Harvey Report at 137, Recommendation No. 72.] In Response 6136, NYSDEC did not explain why setbacks, which "are designed to provide an added level of protection from potential surface spills from a well pad," must therefore be "measured from the closest edge of the well pad instead of the drill site."

Recommendation: NYSDEC should specify that setbacks are measured from the edge of the well site, as defined in proposed 6 NYCRR §750-3.2(52). Wells should be centered on the well pad and set back at least 100' from the pad edge to maximize well setbacks from sensitive receptors.

6 NYCRR § 750-3.5(b) and (c) Exception to the Requirement for a SPDES Permit

Revised Proposed Regulation: 6 NYCRR § 750-3.5(b) permits NYSDEC to allow HVHF operations without the requirement of a SPDES permit when the Department determines that injection into a HVHF well will not result in degradation to ground or surface water resources. 6 NYCRR § 750-3.5(c) provides that NYSDEC may base that determination primarily on the requirement that the top of the target fracture

zone is deeper than 2,000' below the ground surface and deeper than 1,000' below the base of a known fresh water supply.

6 NYCRR § 750-3.1 states that all HVHF operations, meaning all wells that will fracture their target formation by injecting more than 300,000 gallons of HVHF fluid under pressure into the formation, as defined in 6 NYCRR § 750-3.2(b)(22), require a SPDES permit. However, section 750-3.5(b) exempts HVHF injections for well stimulation from the SPDES permit requirement if they satisfy four conditions, the most important of which is a Department determination, set forth at 6 NYCRR § 750-3.5(b)(2), "that such injection will not result in the degradation of ground or surface water resources." NYSDEC is authorized by the proposed Part 750 regulations to base its no-degradation determination on compliance with the separation requirements set forth in subsection 740-3.5(c)(1).

Prior Comment and Response: NYSDEC has ignored our 2012 Recommendations expressing concern that NYSDEC, in both the RDSGEIS and its proposed regulations, continues to insist that HVHF operations below 2,000' are safe because New York State does not have any drinking water supplies below 850', even though the RDSGEIS does not show that NYSDEC has examined the availability of drinking water resources below 850'. [Harvey Report at 13.] In fact, the RDSGEIS itself states that potable water is found deeper than 850'.[39] In addition, NYSDEC's assumption that there are no drinking water supplies below 850' does not take into account that under the federal definition of a USDW, drinking water can exist at depths below 850'.

NYSDEC also ignored all of the comments provided in the Myers Report regarding the potential for upward movement of contaminants. Myers concluded that hydraulic fracturing could result in movement of fluids from the Marcellus formation approximately 4,920' (1500 meters) below the surface to shallow groundwater in less than 10 years, if the proper conditions manifest.[40] [Myers Report, Appendix B at 58-60.] (This is further addressed in a peer-reviewed report by Myers published in the publication *Groundwater*.[41]) In addition, NYSDEC should be considering new geochemical evidence found in Pennsylvania that links the Marcellus formation brine to shallow aquifers,[42] as well as recent research

[39] 2011 NYSDEC, RDSGEIS, Page 2-23.

[40] The appendix to the Myers Report since has been published in the journal *Ground Water*. *See* Myers, T. (2012) Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers. *Ground Water*. DOI: 10.1111/j.1745-6584.2012.00933.x.

[41] Myers, Tom, (2012) Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers, *Groundwater*: 1-11.

[42] Warner, N.R., Jackson, R.B., Darrah, T.H., Osborn, S.G., Down, A., Zhao, K., White, A., and Vengosh, A. (2012) Geochemical Evidence for Possible Natural Migration of Marcellus Formation Brine to Shallow Aquifers in Pennsylvania. *Proceedings of the National Academy of Sciences* 109(30): 11961-11966. Warner et al. stated in their abstract that"[w]e present geochemical evidence from northeastern Pennsylvania showing that pathways, unrelated to recent drilling activities, exist in some locations between deep underlying formations and shallow drinking water aquifers." *Id.* at 11961. It is important to note that these pathways exist even without hydraulic fracturing and potential out-of-formation fracturing or other means of activating existing faults. In their final paragraphs, they state that "the coincidence of elevated salinity in shallow groundwater with a geochemical signature similar to produced water from the Marcellus formation suggests that these areas could be a greater risk of contamination from shale gas development because of a preexisting network of cross-formational pathways that has enhanced hydraulic connectivity to deeper geological formations." *Id.* at 11965.

which concludes that vertical movement of fluids from the Marcellus formation to shallow groundwater is possible.[43] These three studies are evidence that it is not proper to conclude that fracking below 2,000'below the ground surface will not pollute shallow groundwater. In addition, EPA is currently examining evidence and completing models of the potential for vertical movement of hydraulic fracturing fluid or formation fluid to near-surface aquifers.[44] While the subject of potential vertical flow from the Marcellus formation remains controversial, NYSDEC has no scientific basis for its assumption, embodied in regulation, that hydraulic fracturing will not degrade groundwater if it occurs deeper than 2000' and at least 1000' below fresh water supplies.

Comments 6136, 4027, 5788, 5826, 5845, and 6968 address this depth limit in various ways, but NYSDEC does not defend its depth choice either against comments that it is too stringent or not stringent enough. Moreover, NYSDEC has not provided a scientific basis to justify linking its SPDES permit exception for HVHF injections to one specified fracture zone separation requirement for all wells in the Marcellus and Utica shale plays.

Recommendation: NYSDEC should amend 6 NYCRR § 750-3.5(b) to require individual SPDES permits for most HVHF operations. In addition, NYSDEC should set standards in 6 NYCRR § 750-3.5 that require an operator to maintain a mandatory vertical buffer and to provide the Department with scientific and technical analyses verifying that the vertical buffer is adequately protective. This analysis should include a survey for nearby faults and an examination of upward vertical gradients.[45] NYSDEC should amend 6 NYCRR § 750-3.5(c) to include requirements for the operator to demonstrate either that there are no faults within a mile of the well bore or that there is no vertical gradient. Absent such a showing, the SPDES permit exception provided for in subsection 750-3.5(c) would not be applicable. Specifically, NYSDEC should revise 6 NYCRR § 750-3.5(c) to say:

> *750-3.5(c) At a minimum, in order for the department to make a determination that the injection will not result in the degradation of ground or surface water resources pursuant to paragraph 750-3.5(b)(2) of this Part:*
>
> *(1) the top of the target fracture zone, at any point along any part of the proposed length of the wellbore, for HVHF must be deeper than 2,000 feet below the ground surface and must be deeper than 1,000 feet below the base of a known freshwater supply; and*
>
> *(2) the operator must show with reasonable certainty that:*
> *(i) there are no fault or fracture zones within 5280 feet (one mile) of the well bore, including the horizontal well bore, that could allow vertical transport of fluids; or*
> *(ii) there is not an upward vertical gradient which could cause an upward movement of fluids at any zone above the target formation; and*

[43] Rozell, D.J., and Reaven, S.J. (2012) Water Pollution Risk Associated with Natural Gas Extraction from the Marcellus Shale, *Risk Analysis* 32(8): 1382-1393. Rozell and Reaven estimated that an expected value of approximately 7,000 cubic feet (200 cubic meters) of contaminated fluid would be released from specific gas wells into local waters. *Id.* at 1389.

[44] EPA's Study of Hydraulic Fracturing Resources and Its Potential Impact on Drinking Water Resources, U.S. EPA, http://www.epa.gov/hfstudy/index.html (last updated Jan. 10, 2013).

[45] See the Myers Report for discussion of both vertical gradients and faults, and the need to map both.

(3) the owner or operator must have measures in place to ensure compliance with the requirements of paragraphs 750-3.7(k)(1), (2), (3), (4), (6), and (7) of this Part and subdivisions 750-3.7(l), (m), and (n) of this Part.

6 NYCRR § 750-3.6(d) and § 750-3.7(k)(4) Fluid Disposal Plan

Revised Proposed Regulation: 6 NYCRR §§ 750-3.6(d) and 750-3.7(k)(4) require the operator to develop and submit a fluid disposal plan.

While we approve of NYSDEC requiring each operator to develop a plan for disposal of wastewater prior to commencing HVHF operations, the "wastewater disposal plan" is not properly defined anywhere in the regulations. Requirements for an "approvable" plan are similarly absent. Previous draft regulation section 750-3.12(b) outlined requirements for disposal plans and offered guidelines for disposal options that operators may identify in their plans. This provision has been inexplicably removed from the regulations, leaving no definition or guidelines for fluid disposal plans.

Additionally, the fluid disposal plan does not address all wastes from HVHF operations, some of which will include solid wastes with the same chemicals and radioactive materials as the fluid wastes.

Recommendation: NYSDEC should include in its regulations requirements for disposal options and specifically identify the necessary components of an "approvable" fluid disposal plan. NYSDEC should also require an approvable disposal plan which addresses all other wastes from HVHF operations, including drill cuttings and muds. These plans should be made publicly available on NYSDEC's website.

6 NYCRR §§ 750-3.7(l), 750-3.12(b), and 750-3.12(e) Naturally Occurring Radioactive Materials

Revised Proposed Regulation: NYSDEC has removed all mention of NORM from 6 NYCRR § 750-3.7(l) and § 750-3.12(b) and (e). Language requiring testing of water recovered after HVHF operations and of soil from the surrounding site has been moved to 6 NYCRR § 560.7(i).

Prior Comment and Response: We support mandatory testing for NORM of flowback water and production brine recovered during and after HVHF operations, as well as nearby soils, prior to removal from the site. NYSDEC, however, has not adequately addressed comments in the Miller Report, which recommended that NYSDEC specifically address treatment and management methods for waste with high levels of NORM in the SGEIS and codify these mitigation measures in regulation. [Miller Report at 1115.]

In Response 3904, NYSDEC stated that 6 NYCRR § 730-3 includes disposal requirements for various types of HVHF wastewater, including characterizing the waste and identifying its chemical concentration. This response overlooks the fact that NYSDEC has neither set a standard for safe levels for NORM in the flowback water, production brine, or soil, nor established handling and disposal requirements for fluid waste with high levels of NORM. NYSDEC's Response 3441, intended to address all comments regarding fluid disposal plans, also does not address these issues. Response 3441 only outlines the requirements for a fluid disposal plan codified in the proposed regulations. It does not respond to our concerns about high NORM levels or explain why these concerns have been ignored.

Recommendation: NYSDEC should revise its proposed Part 750 regulations to establish a standard for safe levels of NORM and require that any fluids produced during or after the HVHF process that do not to meet that standard be treated as radioactive waste under New York's Hazardous Waste Management regulations.

6 NYCRR § 750-3.7(o) Dedicated Groundwater Monitoring Plan

Revised Proposed Regulation: NYSDEC proposed a new requirement at 6 NYCRR § 750-3.7(o):

> *6 NYCRR § 750-3.7(o): The department **may** require that an approvable groundwater monitoring program be developed and implemented [emphasis added].*

The use of the term "may" in this regulation allows NYSDEC to require monitoring with dedicated monitoring wells, but does not explicitly mandate that the Department must do so. What qualifies as "an approvable groundwater monitoring program" also has not been specified. It is unclear whether the well and spring sampling required under 6 NYCRR § 560.5(d), standing alone, would satisfy the requirements of this provision in instances that the department chooses to require a groundwater monitoring program.

Prior Comment and Response: NYSDEC refers to groundwater monitoring at several points in its responses to comments. For example, NYSDEC incorrectly claims that "the revised regulations at 6 NYCRR 750-3 require an approvable groundwater monitoring program be developed and implemented." [Response 3784.] This program is not mandatory but instead is optional under the current Revised Proposed Regulations.

In Response 6146, NYSDEC references the requirement as providing the opportunity for it to consider hydrogeology and potential contaminant transport. The problem is that the regulations do not prescribe how the operator should develop that information, which renders these optional monitoring requirements ineffective for protecting aquifers.

In our 2012 Recommendations, we requested groundwater monitoring, as set forth in the Myers Report at 17-18:

- *The operator should prepare a conceptual flow path model for groundwater and contaminant transport from the drill pad to and through nearby aquifers.*
- *As part of the conceptual model, the operator should estimate the distance that a contaminant would travel from the well pad in various time periods, including one month, six months, one year, and five years.*
- *Dedicated groundwater monitoring wells should be reasonably located along and perpendicular to the projected flow path out to the five -year travel distance. At a minimum, there should be a transect of monitoring wells/piezometers at the one -month travel distance from t important receptors, meaning wells or discharge points such as springs or streams.*
- *Monitor wells should span the surface aquifer and piezometers should have multiport sampling capabilities for twenty foot intervals at the top of the saturated zone and every 100 feet to the bottom of the freshwater zone. This will help establish vertical concentration and hydraulic gradients.*

- *The monitoring system should be established to establish [i.e., collect] baseline data including seasonal variability for at least one year prior to drilling and [hydraulic fracturing].*

NYSDEC did not respond to these comments. Additionally, the Myers Report at pages 18-19 recommended that NYSDEC establish a plan to monitor potential transport of contaminants from the shale or very deep in the well bore to the surface:

> *Monitoring transport from the deep shale is more difficult because a substantial flux of contaminants could be released from most anywhere in the fractured shale as a result of oil and gas development. Time intervals for transport could be more than 100 years, but fractures could decrease the time frame to as short a time as a few years. Fracture zones therefore could be monitored, but if they are known the industry should avoid [hydraulic fracturing] near them, both to avoid vertical transport and induced seismicity. It is therefore reasonable to require a dedicated monitoring well in the middle of each well pad wherever there is an upward flow gradient.*
>
> - *Industry should establish a multiport piezometer system from the shale to the bottom of the freshwater zone in the center of all well pads.*
> - *The industry should provide the funding to maintain the piezometers system for at least 100 years beyond the end of gas production, to account for the long potential travel times.*

NYSDEC did not respond to these recommendations.

The need for monitoring using dedicated monitoring wells has become more widely accepted. The National Groundwater Association has taken a position in favor of dedicated monitoring wells: "Integrated groundwater monitoring programs using dedicated wells at both the regional and local scale should be developed to establish baseline conditions, and to determine long-term trends in both water quality and quantity in active oil and gas producing areas."[46] Dedicated monitoring wells established prior to development can partially obviate the need for monitoring water supply wells, in addition to avoiding the problems with using production wells for monitoring purposes. The purpose of monitoring is to minimize the chance that aquifers are contaminated to avoid the significant cost of remediation and replacement of water resources once they are degraded, and to identify possible problems and potential movement of contaminants before they reach the water supply so that any problems can be addressed before the supply actually becomes contaminated.

A primary reason to require monitoring prior to operations is to establish a baseline water quality for the zones where development will occur. Failure to collect baseline data is often a reason to dispute the results of monitoring or sampling that indicates that development has caused observed degradation. For example, EPA has been unable to rule out that methane had existed in domestic wells prior to gas well development at Pavillion,, WY.[47]

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[46] National Groundwater Association, (NGWA), Hydraulic Fracturing: Meeting the Nation's Energy Needs While Protecting Groundwater Resources, Position Paper, November 2011.

[47] DiGiulio, D..C, Wilkin, R.T., Miller, C. and Oberly, G., (2011) DRAFT: Investigation of Ground Water Contamination near Pavillion, Wyoming. U.S. Environmental Protection Agency, Office of Research and Development, Ada, OK. A lack of baseline data for water wells in Pennsylvania was the reason Davies was able to

NYSDEC's proposed requirement for one baseline sample from wells up to a mile from the site will not establish the seasonal variability for many constituents; it will be useful only for chemicals for which presence/absence is the primary monitoring issue. The U.S. Department of Energy recommended that operators collect baseline data prior to well development. Their reasons include "establishing facts and verifying contamination claims."[48]

The layout of the dedicated monitoring wells should include consideration of the likely travel pathways for contaminants. The operator should submit a conceptual model of the flow pathways so that the monitoring wells are located near the centerline of the likely pathways, accounting for gradient and geologic formations including faults and fractures.

Just as the spatial layout of a monitoring system should be designed to minimize the chance that a plume could pass without being detected, it is important to sample all of the geologic layers through which a contaminant could pass. Each transmissive formation must be screened separately so that samples are representative of only a specific layer. Because a leak could occur anywhere along the borehole or from the horizontal portion within the target formation, all of the formations should be monitored. This is necessary if the source of the leak is to be determined. It is also necessary to target remediation efforts to the aquifer volume actually contaminated. Practicality and cost may limit the monitoring to the formation layers within the freshwater aquifer zone, however.

The monitoring well system must be sampled frequently enough after development to minimize the chance that a plume will pass between sampling events. Monitoring times should consider contaminant travel times:

> Dependent on groundwater conditions and the nature of the release, contaminant occurrence in drinking water supplies **may lag, by months or years**, oil and gas well installation and hydraulic fracturing. Monitoring, financial responsibility, and liability provisions related to oil and gas development should be cognizant of the actual travel times observed in natural hydrologic systems.[49]

A temporary leak that does not disperse as it moves with the groundwater flow may pass a site in just a few days whereas a continuous leak may cause a slow increase in concentration occasionally diluted by natural recharge. Even once stopped, a substance that leaked for several years may appear in monitoring

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disagree with the findings of Osborn et al., even though Osborn et al. documented that water wells nearer the hydraulically fractured wells had significantly higher gas concentrations. Baseline data collection would have decreased the disagreements as to whether gas development had degraded these wells. *Compare* Davies, R.J. (2011) Methane contamination of drinking water caused by hydraulic fracturing remains unproven. Proceedings of the National Academy of Sciences USA 108:E871; Osborn SG, Vengosh A, Warner NR, Jackson RB (2011) Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing. Proceedings of the National Academy of Sciences pnas:1100682108.

[48] US Department of Energy (USDOE) (2011) Secretary of Energy Advisory Board. Shale Gas Production Subcommittee. Second Ninety-Day Report – November 18, 2011, at 7; US Department of Energy (USDOE) (2011) Secretary of Energy Advisory Board, Shale Gas Production Subcommittee, Ninety-Day Report – August 11, 2011.

[49] National Groundwater Association, (NGWA), Hydraulic Fracturing: Meeting the Nation's Energy Needs While Protecting Groundwater Resources, Position Paper, November 2011 (emphasis added).

systems for decades due to variable transport rates.[50] A quarterly sampling frequency is acceptable only if transport calculations show that it is unlikely that contamination from a spill could pass the monitoring well between sampling events. There also should be a plan to increase sampling frequency if a parameter of interest begins to increase or exceed standards. Additionally, monitoring wells should include continuous sampling of specific conductivity, pH, and water level so that the time frames associated with recharge events and the potential short-term leak can be recorded and considered.

Recommendation: The dedicated groundwater monitoring plan recommended below is in addition to the spring and well sampling as specified in 6 NYCRR § 560.5(d), as amended by our recommendations on that section. NYSDEC should revise 6 NYCRR § 750-3.7(o) as follows:

> *For each well pad, the Department shall require that the operator to develop a groundwater monitoring program that meets the following objectives:*
> *(1) Provide for monitoring each aquifer layer from the ground surface through the freshwater zone to at least one aquifer below the zone of freshwater.*
> *(2) Monitor contaminant flow along the most likely flow pathway downgradient from the well pad. At least two downgradient wells with the capacity to sample from each of the zones specified in (1) shall be constructed.*
> *(3) At least one upgradient well shall be constructed in the zones specified in (1).*
> *(4) The monitoring program shall be established long enough before oil or gas development to provide for determining a baseline, as described in (5).*
> *(5) Monitoring of the established wells shall occur quarterly for a year prior to development on the well pad.*
> *(6) Monitoring shall continue quarterly for at least two years after the last well is established at the well pad. Subsequent to that period, sampling should occur annually and continue for at least five years after the final well on the pad has been abandoned properly.*
> *(7) If at any time one or more of the parameters being monitored increases or otherwise changes more than would be expected from the baseline sampling, the sampling frequency shall be increased.*
> *(8) Notify potentially affected nearby residents and all water end users immediately of any potential contamination of their water supplies.*
> *(9) Require implantation of a monitoring plan consistent with the requirements of 6 NYCRR § 650.2(d) [amended pursuant to our recommendations on that subsection].*

In addition, NYSDEC should adopt the recommendations in our comments provided above on 6 NYCRR § 750-3.7(o) and previously recommended by the Myers Report.

6 NYCRR § 750-3.8 Monitoring Requirements in HVHF SPDES Permits

Revised Proposed Regulation: NYSDEC has revised 6 NYCRR § 750-3.8(b)-(e) to require HVHF operators to keep on-site records of stormwater discharge, water usage, chemical additives used in the

[50] Ridley, M. and MacQueen, D., (2005) Cost-effective Sampling of Groundwater Monitoring Wells: A Data Review and Well Frequency Evaluation. In Proceedings: American Society of Civil Engineers, Anchorage AK, May 15 through May 19, 2005; Johnson, P., Lundegard, P. and Liu, Z., (2006) Source zone natural attenuation at petroleum hydrocarbon spill sites – 1: Site-specific assessment approach. Ground Water Monitoring and Remediation 26(4): 82-92.

HVHF process, flowback and production brine, and wastewater, to be furnished to NYSDEC on request. NYSDEC has removed from 6 NYCRR § 750-3 the monthly compilations provision, previously found in subparagraph 750-3.13(g), which required operators to compile monthly and daily total volumes of flowback water, production brine, and sanitary wastewater collected and transported off-site from the well pad, as well as analytical results for any flowback water samples taken. In addition, the monitoring requirements do not require reporting of the recorded data to NYSDEC.

Prior Comment and Response: NYSDEC ignored our 2012 Recommendations, which stated that there should be periodic filings with NYSDEC of the on-site records so that the public can monitor compliance and systematic academic studies can be undertaken. [Myers Report at 28.] It is insufficient just to record the categories of data identified in the regulation without reporting them to the Department. We also recommended that these periodic filings be compiled electronically for ease of submission and public access.

Comment 7006 recommended making reports documenting quantities of water and their sources available to the public on a website using GIS technology. In Response 5880, NYSDEC asserted that the regulations at 6 NYCRR § 750-3 include an "appropriate level" of monitoring requirements. This Response is inadequate to address concerns about regulatory compliance and public access to the records.

Further, in Response 5953, NYSDEC stated that all documents it receives under section 750-3.8 would be available to the public, subject to the limitations of the Freedom of Information Law (FOIL). NYSDEC refused to require that records be available online. Instead, it stated that the "draft HVHF GP requires that 'The NOI, SWPPP and inspection reports required by the general permit are public documents that the owner or operator must make available for review and copying by any person within five (5) business (sic) of the owner or operator receiving a written request by any such person to review the NOI, SWPPP or inspection reports. Copying . . . will be done at the requester's expense.'" This Response, however, overlooks the fact that on-site monitoring records are submitted to NYSDEC only upon its request. The public is therefore unable to access records that NYSDEC does not request and cannot easily access even those records that it does. Even if NYSDEC does request certain monitoring records, the public would need to be aware that NYSDEC possesses the documents and submit a FOIL request each time they wished to view monitoring data. It is unacceptable to ask the public to chase down a private owner or operator to obtain public records. NYSDEC also does not even set a limit on the cost the owner or operator could charge to copy the records. Contrary to the Department's proposal, this information should be readily available to the public at no cost without special request. Pennsylvania posts semiannual discharge reports on its website,[51] as do other states. There is no reason that New York should not utilize the same procedure.

We further disapprove of the removal of the monthly compilations provision in previous section 750-3.13(g). NYSDEC should continue to require these compilations and allow the public to monitor the transport of all sanitary and non-domestic wastewater produced on-site and shipped off-site.

Recommendation: NYSDEC should reinsert the monthly compilation requirement in 6 NYCRR § 750-3.8(c)(6), and include a requirement that all operators must post the filings each month on a publicly accessible website maintained by NYSDEC. NYSDEC also should require monthly electronic public filings of all records required by 6 NYCRR § 750-3.8. In addition, NYSDEC should require the operator

[51] Electronic Discharge Monitoring (eDMR) System, PADEP, http://www.portal.state.pa.us/portal/server.pt/community/edmr/17879 (last visited Jan. 11, 2013).

to report monitoring well data collected during the hydraulic fracturing operation. 6 NYCRR § 750-3.8(c) should be modified to require the HVHF SWPPP to include provisions to monitor, record and submit to the department the average and maximum injection pressure for each HVHF stage and the results from the monitoring of changes in water level, EC, and turbidity, during each HVHF stage at the dedicated groundwater monitoring wells. Records should be submitted to the department and made public on a GIS site.

6 NYCRR § 750-3.8(c)(2) Monitoring Requirements in HVHF SPDES Permits

Revised Proposed Regulation: Newly proposed section 6 NYCRR § 750-3.8(c)(2) requires the HVHF General Permit to include a Stormwater Pollution Plan that includes provisions to monitor and record the "volume of all recycled wastewater." However, the draft SPDES General Permit for Stormwater Discharges from HVHF is silent on the issue of recycled wastewater.

Recommendation: NYSDEC should amend the SPDES General Permit Part IX.A., "General SWPPP Requirements," to include provisions to monitor and record the volume of all recycled wastewater so that it is consistent with the requirements of this subsection.

6 NYCRR § 750-3.11(d) Setbacks from Principal Aquifers, Perennial or Intermittent Streams, Storm Drains, Lakes or Ponds within which HVHF Operations Cannot Be Authorized by a HVHF General Permit

Revised Proposed Regulation: 6 NYCRR § 750-3.11(d) prohibits HVHF GPs from authorizing HVHF operations sited within 500' from principal aquifers, and within 300' from wetlands and perennial or intermittent streams, storms drains, lakes, or ponds, and instead requires authorization under an individual SPDES permit.

Prior Comment and Response: Although NYSDEC accepted our 2012 Recommendations to increase setbacks around wetlands and around perennial or intermittent streams, storm drains, lakes, or ponds, NYSDEC did not adequately address our additional recommendation to further increase setbacks around principal aquifers, as well as streams, storm drains, lakes, and ponds. In Response 3785, NYSDEC provided its justification for preventing HVHF operations within 500' of principal aquifers from obtaining coverage under an HVHF SPDES GP, as opposed to prohibiting all HVHF operations within 500' of principal aquifers. NYSDEC stated that this distinction stems from the fact that principal aquifers do not serve major municipal water supply systems and therefore serve fewer individuals than primary aquifers. [Response 3785.] This Response, however, does not provide any scientific or technical justification for a 500'setback, which is inadequate to protect actual or potential public drinking water supplies. Principal aquifers are a productive water source and contamination from HVHF fluid or flowback could render them unusable. Furthermore, the differential protection the proposed regulations provide for primary and principal aquifers ignores the connections between surface and groundwater. Wells near principal aquifers should be subject to the same setback as wells near primary aquifers, since the only difference between a primary and principal aquifer is the number of people currently using the aquifer. All public and private drinking water sources should be subject to the same setback of at least 4,000'.

NYSDEC also ignored our 2012 Recommendation to increase setbacks around perennial or intermittent streams, storm drains, lakes, and ponds to 660'. [LBG Report at 7; Harvey Report at 136, Recommendation No. 68.] NYSDEC did not respond to our recommendation and provided no scientific

or technical justification for reducing its previously proposed setback from 500' to 300'. In addition, this requirement conflicts with the 50' setback around "any public stream, river, or other body of water" provided for in current 6 NYCRR § 553.2. In response to comments on the resulting confusion about which setbacks would be applied to lakes, ponds, and perennial or intermittent streams and rivers, NYSDEC's Response 5895 states that duplication and consistency has been addressed, but there is no proposed revision to 6 NYCRR § 553.2. It is our recommendation that there should be consistent setback requirements applied to all drilling operations in the state.

Furthermore, NYSDEC did not adequately respond to our 2012 Recommendations requesting that NYSDEC require all setbacks to be measured from the edge of the well site, as defined in proposed 6 NYCRR §750-3.2(52), which includes the contiguous disturbed area and ancillary facilities around the well pad. [Harvey Report at 137, Recommendation No. 72.]

Our 2012 Recommendations also stated that NYSDEC should require all wells on the well site to be centered on the well pad and set back at least 100' from the pad edge to maximize setbacks from sensitive receptors. [Harvey Report at 137, Recommendation No. 72.] In Response 6136, NYSDEC did not explain why setbacks, which "are designed to provide an added level of protection from potential surface spills from a well pad," must therefore be "measured from the closest edge of the well pad instead of the drill site."

In addition, the current draft SPDES General Permit for Stormwater Discharges is inconsistent with NYSDEC's Revised Proposed Regulations. The current draft SPDES General Permit authorizes to HVHF operations over 100' from wetlands, even though 6 NYCRR § 750-3.11(d) requires an individual SPDES permit for such operations within 300' of wetlands. Similarly, the current draft SPDES General Permit authorizes HVHF operations over 150' from perennial or intermittent streams, even though 6 NYCRR § 750-3.11(d) requires an individual SPDES permit for such operations within 300' of these waterbodies. NYSDEC should revise the draft SPDES General Permit for Stormwater Discharges to reflect its final setback regulations.

Recommendation: NYSDEC should increase the buffer around principal aquifers to at least 4,000'. This setback should however be provided for in 6 NYCRR § 750-3.3(a)(5), not in 6 NYCRR § 750-3.11(d). In addition, NYSDEC should increase the buffer in which an individual SPDES permit is required around perennial or intermittent streams that are not tributary to a water supply, as well as storm drains, lakes, and ponds, to at least 660'. At a bare minimum, the buffer in which a SPDES permit is required should be restored to the 500'provided for in the 2011 proposed regulations. Moreover, it should revise 6 NYCRR §§ 750-3.11(d) and 553.2 to provide consistent requirements that are protective of water resources and that apply to all drilling operations in the state. NYSDEC should clarify that setbacks are measured from the edge of the well site. Wells should be centered on the well pad and should be set back at least 100'from the pad edge to improve protection of sensitive receptors. Finally, NYSDEC should revise the draft SPDES General Permit for Stormwater Discharges to reflect its final setback regulations.

6 NYCRR § 750-3.11(f)(1) Centralized Flowback Impoundments

Revised Proposed Regulation: 6 NYCRR § 750-3.11(f)(1) provides that construction and use of a centralized flowback impoundment are activities ineligible for coverage under an HVHF general permit and require authorization under an individual SPDES permit.

Prior Comment and Response: NYSDEC ignored our 2012 Recommendations commenting on the use of centralized flowback impoundments and requesting their prohibition. [Harvey Report at 103. Recommendation No. 46.] NYSDEC's response barely addresses the use of centralized flowback impoundments at all. Comments 4025, 4034, 5909, 6864, and 6964 all requested that NYSDEC prohibit the use of centralized flowback impoundments. NYSDEC's brief responses to these comments state only that before permitting, NYSDEC will perform a site-specific SEQRA review subject to public participation requirements and possible mitigation measures. [Response 5909.] Such a response ignores the hazards posed by centralized flowback impoundments, which are a significant source of air pollution, particularly hazardous air pollutants, as well as increased risk of spills and resulting contamination of surface waters. These hazards are so great, individually and cumulatively, that they should be fully considered by NYSDEC now instead of when individual HVHF operator applies an authorization for such use, on a site-by-site basis.

Centralized flowback impoundments have been used in Pennsylvania and other states and the impact on human health and the environment is reasonably foreseeable. The potential impacts of this practice are too significant to defer analysis until future site-specific review under SEQRA, as NYSDEC asserts in Response 5909. In addition, addressing impacts on a case-by-case basis forgoes uniform standards, prevents analysis of cumulative impacts, does not provide industry with consistency, and invites inconsistencies between regions and permit administrators.

Recommendation: NYSDEC should amend the NYCRR to prohibit the use of centralized impoundments, both at the well site and away from the well site. If NYSDEC declines to ban centralized flowback impoundments, NYSDEC should prepare a new draft RDSGEIS, or a draft supplement to the RDSGEIS, that includes a full analysis of the potentially significant adverse impacts of centralized flowback impoundments and make this draft available for public comment. Mitigation measures to address the potential significant impacts on human health and the environment identified must be included in both a final SGEIS and codified in final regulations.

6 NYCRR § 750-3.12(c) Requirements for Acceptance, Treatment, and Disposal of HVHF wastewater at POTWs

Revised Proposed Regulation: 6 NYCRR § 750-3.12(c) sets forth proposed requirements for acceptance of HVHF wastewater at publicly owned treatment works (POTWs).

We do not believe that HVHF wastewater should be permitted to be accepted, treated or disposed of at POTWs.[52]

Recommendation: 6 NYCRR § 750-3.12(c) should be removed and replaced with a prohibition on acceptance, treatment, or disposal of HVHF wastewater at POTWs.

[52] Our rationales for disallowing treatment of HVHF wastewater at POTWs are set forth in this report: Van Briesen, J. and Hammer, R. (2012), In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater (NRDC).

6 NYCRR § 750-3.12(c)(6) and § 750-3.12(e) Disposal of Radioactive Waste

Revised Proposed Regulation: 6 NYCRR §§ 750-3.12(c)(6) and (e) allow NORM to be disposed of at low level radioactive waste facilities, if transport and disposal complies with 6 NYCRR §§ 360, 364, 380, 381, and 750-2.8(e).

Prior Comment and Response: We agree that the residuals from wastewater treatment or recycling, which may contain NORM, should be subject to regulations for the disposal of radioactive wastes. However, all other radioactive waste in New York is subject to 6 NYCRR § 382 and § 383.

Recommendation: NYSDEC should require the disposal of residuals from wastewater treatment to be subject to 6 NYCRR § 382 and § 383.

6 NYCRR § 750-3.12(d) Effluent Limitations Guidelines

Revised Proposed Regulation: NYSDEC revised 6 NYCRR § 750-3.12(d), which now lists requirements for offsite acceptance, treatment, recycling, and disposal of HVHF wastewater at privately owned industrial wastewater treatment facilities.

We disapprove of the absence of effluent limitations guidelines (ELGs) in revised Part 750-3.12(d). All industrial wastewater treatment plants should at a minimum comply with all federal effluent limitations guidelines for centralized waste treatment point sources under 40 CFR Part 437. In Pennsylvania, EPA requires wastewater treatment plants to comply with Part 437. NYSDEC should conduct a further analysis and consider imposition of the ELGs set forth in 25 Pa. Code § 95.10(b)(3)(iii)-(vi).

Recommendation: : NYSDEC should amend Part 750-3.12(d) to require all privately owned industrial wastewater treatment facilities to comply with all federal Part 437 effluent limitations guidelines and, as determined appropriate, with the guidelines set forth in 25 Pa. Code § 95.10(b)(3)(iii)-(vi).

6 NYCRR § 750-3.12(d)(2)(iii) Treatability Analyses at Privately Owned Industrial Wastewater Treatment Facilities

Revised Proposed Regulation: NYSDEC revised 6 NYCRR § 750-3.12(d)(2)(iii) to require that treatability analyses at privately owned industrial wastewater treatment facilities include "a representative assay of the concentrations or chemicals constituents present, as well as other parameters that may be present in the HVHF wastewater."

We approve of this change from previously proposed subparagraphs 750-3.12(d)(2)(ii)(a) and (iii)(a)(2), which required treatability analyses to analyze only "HVHF chemicals" and "expected effluent concentrations of all HVHF specific parameters." A "representative assay" will include not only the chemicals used in HVHF processes but also the chemicals in the waste, including those mobilized by subsurface HVHF operations.

Recommendation: The results of the representative assay should be made publicly available on NYSDEC's website.

6 NYCRR § 750-3.12(f) Requirements for Deep Well Injection of HVHF Wastewater

Proposed Revised Regulation: NYSDEC has proposed a completely new subsection that sets forth the requirements for the state permitting of deep well injection of HVHF wastewater.

6 NYCRR § 750-3.12 (f) Requirements for deep well injection of HVHF wastewater:

(1) HVHF wastewater may be accepted only by a deep well injection facility that has a valid SPDES permit and is permitted by the department to accept HVHF wastewater.

(2) The owner or operator of the disposal well must obtain a permit, or a modification to an existing permit, under the EPA Underground Injection Control (UIC) program for disposal wells prior to applying for a SPDES permit, or a modification to an existing SPDES permit, in accordance with this subpart and subpart 750-1.

(3) The SPDES permit application for a new deep well injection facility or modification of an existing deep well injection facility SPDES permit to accept HVHF wastewater must include the following:

(i) each source of HVHF wastewater and the identity of each HVHF well owner or operator;

(ii) the total volume of HVHF wastewater from each source of HVHF wastewater, and the proposed rate of introduction into the disposal well;

(iii) for each identified source of HVHF wastewater, a representative assay of the concentrations of chemical constituents present, as well as other parameters that may be present in the HVHF wastewater;

(iv) geotechnical information regarding the ability of the disposal stratum to accept and retain the injected fluid, including an estimate of available capacity;

(v) a water quality analysis of the receiving stratum for chemical constituents present, as well as other parameters that may be present in the HVHF wastewater; and

(vi) injection well construction and operational control information showing that the well meets the applicable EPA UIC injection well standards as promulgated under 40 CFR Parts 144-148 and sections 1423 and 1425 of the Safe Drinking Water Act.

(4) The SPDES permit application for an existing deep well injection facility that has already been approved to accept HVHF wastewater, but wishes to accept another source of HVHF wastewater must include the items listed in paragraph 750-3.12 (f)(3).

(5) In addition to the requirements of the EPA UIC program, the department may propose appropriate monitoring, recording and reporting requirements and effluent limitations in the SPDES permit, including:

(i) effluent limitations, pursuant to Parts 701-706 of this Title for chemical constituents present, as well as other parameters that may be present in the HVHF wastewater;

(ii) the proposed well construction and operation program; and

(iii) installation of upgradient and downgradient monitoring wells and a monitoring program with periodic monitoring for chemical constituents present, as well as other parameters that may be present in the HVHF wastewater.

Prior Comment and Response: No specific comments requested that NYSDEC establish a deep well injection program for HVHF.

The RDSGEIS listed deep well injection as a viable disposable option at p. 6-59, but other sections discuss the process only briefly and in regard to the potential for inducing earthquakes.[53] The brief discussion in RSDGEIS is insufficient and does not discuss the requirements or the ramifications of implementing regulations. At present, the NYSDEC lists only six deep injection wells for the disposal of brine associated with oil and gas production.[54] New York State apparently has little experience with deep well injection for the disposal of flowback fluids or production brine. Therefore, it is not appropriate for the State to issue special regulations without a detailed analysis in an SGEIS.

Recommendation: NYSDEC should withdraw all of the 6 NYCRR § 750-3.12(f) regulations until they are analyzed in a new draft SGEIS, or a new draft supplement to the RDSGEIS. That SGEIS should, among other things, examine the geology in the areas expected to be targeted and discuss whether it is appropriate. To be appropriate, a receiving formation would have to have sufficient storage capability and be sufficiently permeable to accept the injection. The formation also would have to have a sufficient capstone, which should not be the Marcellus formation because fracturing that formation will change its hydrogeology. While future site-specific study may provide more detailed information, NYSDEC should discuss what is known about the potential formations to give the public an understanding of where underground injection disposal could occur. In addition, the Department should evaluate the prevalence of abandoned wells which could provide pathways for injected waste to reach the ground surface or shallow aquifers.

In its study, NYSDEC should examine how permeability affects how fast fluids can enter formations and how much fluid can be injected underground without causing excessive pressure. NYSDEC should determine which geochemical parameters should be tested for in the HVHF wastewater, and should specify water quality standards for formation waters in any stratum proposed for receipt of injected wastewaters, because, following injection, those waters will not be useable for other purposes without substantial remediation or treatment. The analysis should also include an assessment of whether the injected fluid, as specified in proposed 6 NYCRR § 750-3.12(f)(3)(iii), would react with formation fluid either to seal the pores or to create a different constituent that could be more hazardous if it were not contained in the formation. In addition, NYSDEC should study flow layers near the base of injection wells as well as methods to identify and properly plug any abandoned wells in the area in which the deep well injection facility is proposed.

[53] 2011 NYSDEC, RDSGEIS, Pages 5-131, 5-132.

[54] Brine Disposal Well Summary, NYSDEC, http://www.dec.ny.gov/energy/29856.html (last visited January 11, 2013).

Recommended Addition to 6 NYCRR § 750 to Address Stormwater Impacts on Stream Crossings

Prior Comment and Response: Neither the proposed regulations nor the draft SPDES HVHF GP address surface impacts associated with stream crossings by access roads and pipelines. In our 2012 Recommendations, we commented on how stream crossings and associated water quality impacts have not been fully addressed by the RDSGEIS and are specifically not included in the draft SPDES HVHF GP. [Adams & Sitler Report at 5-6.]We also recommended that NYSDEC codify regulations to control and mitigate these adverse impacts. NYSDEC has not responded to these concerns. Currently, it is unclear how many stream crossings may be anticipated and how significantly these crossings will impact water quality and aquatic systems. NYSDEC should place in regulation requirements that address stream crossings to ensure that proposed crossings are constructed and maintained properly and do not impact water quality.

Recommendation: NYSDEC should develop robust regulations establishing requirements to address surface impacts associated with stream crossings. NYSDEC should prepare a new draft SGEIS, or a draft supplement to the RDSGEIS, that includes estimates of the anticipated extent of road crossings of streams and wetlands, an evaluation of the potential environmental impacts of these crossings, individually and cumulatively, and avoidance and mitigation measures that can be incorporated into the proposed regulations. In addition, NYSDEC should revise Part IV, *Contents of the Construction SWPPP*, of the SPDES HVHF GP to include a defined documentation process that requires the applicant to reduce the number and extent of stream crossings. This documentation process also should include mapping requirements and narrative that documents the need for each stream crossing, as well as explanation as to why any individual stream crossing cannot be reduced or combined.

Recommended Addition to 6 NYCRR § 750 to Address Stormwater Discharges from Related Infrastructure

Prior Comment and Response: Neither the regulations nor the draft SPDES HVHF GP that addresses stormwater discharges contained any provisions related to gathering lines, compressor stations, or compressor station access roads. NYSDEC has not addressed our 2012 Recommendations, which suggested that the SPDES HVHF GP and the required SWPPP address construction and stormwater discharges related to gathering lines, compressor stations, and compressor station access roads, or clarify how these discharges will be addressed under another permit, and that the RDSGEIS provide a process for regulation and mitigation of land disturbances associated with these construction activities. [Adams & Sitler Report at 5-6.] We also recommended that NYSDEC provide for control and mitigation of these disturbances in proposed regulations. These requirements must be codified in regulation even if included in the SPDES HVHF GP or other permits to ensure that HVHF infrastructure is properly constructed and maintained without adversely affecting water quality.

Recommendation: NYSDEC should develop robust regulations that address stormwater discharges related to gathering lines, compressor stations, and compressor station access roads. NYSDEC should prepare a new draft SGEIS, or a draft supplement to the RDSGEIS, that includes consideration of the anticipated disturbance and well pad density on a watershed basis, proximity to streams and anticipated stream crossings, and potential individual and cumulative effects on stream health. The new draft RDSGEIS or draft supplement to the RDSGEIS also should include a process for regulation and mitigation of land disturbances associated with these construction activities. In addition, NYSDEC should revise the SPDES HVHF GP and the required construction SWPPP to include construction and

stormwater discharges related to gathering lines, compressor stations, and compressor station access roads, or clarify how these discharges will be addressed under another permit.

Other Regulatory Gaps - RCRA Waste Exemption

Revised Proposed Regulation: NYSDEC does not propose to remove the exemption of gas development wastes from the definition of hazardous wastes pursuant to 6 NYCRR § 371.1(e)(2)(v) ("The following solid wastes are not hazardous wastes: [. . .] drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy"). This is so despite the fact that, under the Environmental Conservation Law's expansive definition, these wastes may "pose a substantial hazard to human health and the environment." ECL § 27-0901(3)(b).

Under the federal Resource Conservation and Recovery Act ("RCRA"), New York State has the authority to adopt definitions and regulations of hazardous waste that are more stringent than the federal standards. By its express terms, RCRA establishes a floor rather than a ceiling. RCRA provides that "[n]othing in [the statute] shall be construed to prohibit any State or political subdivision thereof from imposing any requirements, including those for site selection, which are more stringent than those imposed by [the federal program]."[55] Courts have regularly held that it is squarely within the states' authority under RCRA to "adopt regulations more stringent than those imposed by the federal government."[56]

Defining liquid and solid wastes from gas development operations as hazardous waste, and subjecting them to hazardous waste regulation, is necessary to protect the health and welfare of the citizens of New York. Hydraulic fracturing wastewater and solid wastes can be highly dangerous and thus their regulation presents significant environmental benefit. Common additives used in hydraulic fracturing and found in flowback and other development wastewaters include: surfactants, friction reducing chemicals, biocides, scale inhibitors, polymers, cross linkers, pH control agents, gel breakers, clay control agents, and propping agents. Many of these additives contain chemicals that are known or potential carcinogens, as are some of the contaminants mobilized from the formation during fracturing.[57] Analysis of flowback water from Pennsylvania and West Virginia, for example, found the known carcinogen benzene present in nearly half of all flowback water and at average concentrations nearly *one hundred times* the maximum acceptable containment level established by USEPA.[58] This alone is highly dangerous to human health. According to the Occupational Safety and Health Administration, "[r]epeated or prolonged exposure to benzene, even at relatively low concentrations, may result in various blood disorders, ranging from anemia to leukemia, an irreversible, fatal disease."[59] Further, the true extent of the risk associated with flowback water is still unknown as many of the compounds found in fracturing fluids (and thus returned in wastewater) are not publically disclosed because they are currently protected as trade secrets.[60]

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[55] 42 U.S.C. § 6929 (2013).

[56] *Nat'l Elect. Mfrs. Ass'n v. Sorrell,* 272 F.3d 104, 113 (2d Cir. 2001). *See also Old Bridge Chems., Inc. v. N. J. Dept. of Envtl. Prot.*, 965 F.2d 1287, 1296 (3d Cir. 1992); *N. Haven Planning & Zoning Comm'n v. Upjohn Co.*, 753 F. Supp. 423, 429 (D. Conn. 1990), *aff'd,* 921 F.2d 27 (2d Cir. 1990).

[57] Natural Res. Defense Council, Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy 9 (2010) [hereinafter "NRDC Petition"], *available at* http://docs.nrdc.org/energy/files/ene_10091301a.pdf.

[58] *Id.* at 9–10; *see also* N.Y. Dep't of Envtl. Conservation, Draft SGEIS 5-104 (2009).

[59] U.S. Dep't of Labor Occupational Safety & Health Admin., *Substance safety data sheet, Benzene*, Occupational Safety and Health Admin., *available at* http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10043.

[60] NRDC Petition at 10.

Prior Comment and Response: NYSDEC's response to Comment 3833—requesting that the hazardous waste exemption for gas production wastes be eliminated—asserts that "[t]he proposed regulations and permits provide provisions to prevent significant adverse impacts from mismanagement of high-volume hydraulic fracturing wastes." [Response 3833]. NYSDEC offers "secondary containment for flowback fluids and standby vacuum trucks," "setback requirements," the permitting of transporters, a "Waste Tracking Form," and SPDES requirements as examples. These represent a piecemeal approach to the problem and do not compare to the ECL's comprehensive 'cradle to grave' regulation of hazardous waste.[61]

Moreover, the newly added requirements for waste characterization prior to disposal in underground injection wells pursuant to revised proposed 6 NYCRR 750-3.12(f)(iii) would, by operation of the federal Commerce Clause, be restricted to wells located in New York State. This means that there would be no correlative requirement for waste characterization for wastewater destined for disposal in underground injection wells outside of New York, or for any other means of disposal of liquid or solid wastes within the state. There is no justification for this unequal treatment. All wastes destined for disposal—whether inside or without New York—should be characterized to determine their hazardousness. Removing the hazardous waste exemption in 6 NYCRR §371.1(e)(2)(v) would accomplish this end.

NYSDEC also asserts that "[r]egulating high-volume hydraulic fracturing wastes as hazardous wastes would unnecessarily increase the cost of regulation with little, if any, additional environmental benefit." [Response 3833]. DEC adduces no evidence that treating flowback water as hazardous waste will significantly increase the costs of regulation. On the contrary, the trend in the last 20 years of oil and gas development has been towards new waste management technologies and practices that are both safer and less costly than their predecessors.[62] These include new waste disposal technologies,[63] new waste reduction technologies,[64] and new substitutes for toxic materials.[65] There is no evidence that any additional regulatory costs would be unnecessarily excessive, especially given the known and unknown health risks posed by hydraulic fracturing wastes.

Finally, NYSDEC asserts that regulating flowback water as hazardous waste "would [] likely eliminate the recycling of flowback water." This fear is unfounded. Since 2008, USEPA regulations implementing RCRA have promoted recycling of hazardous waste by establishing conditions whereby recycled hazardous waste may be exempt from regulation as solid waste under RCRA. Therefore, NYSDEC can define gas wastes as hazardous, and still promote recycling, without running afoul of RCRA.

Recommendation: NYSDEC should remove the exemption of gas development wastes from the definition of hazardous wastes pursuant to 6 NYCRR § 371.1(e)(2)(v).

Other Regulatory Gaps – RDSGEIS Mitigation Not Included In Regulation

Revised Proposed Regulation: The revised proposed regulations do not include a number of RDSGEIS mitigation measures.

[61] *See generally* ECL §§ 27-0101–17-0109, 27-0301–27-0307, 27-0900–27-0926, 27-1101–27-1115 (2013).

[62] NRDC Petition at 32.

[63] *Id.* at 32–34.

[64] *Id.* at 34–36.

[65] *Id.* at 36–37.

Recommendation: NYSDEC regulations should be revised to include all the RDSGEIS mitigation measures, including, but not limited to the following:

Requirements found in Proposed Supplementary Permit Conditions for HVHF that are not found in NYCRR as listed below:

1. A visual impacts mitigation plan consistent with the SGEIS.

2. A greenhouse gas ("GHG") emissions impact mitigation plan consistent with the SGEIS.

3. A Department-approved transportation plan that does not provide relief from any local requirements authorized by or enacted pursuant to the New York State Vehicle and Traffic Law.

4. Water well analysis must be performed by an ELAP-certified laboratory.

5. Access roads must be placed as far away from unleased property. (The proposed NYCRR requires access roads to be placed back from water resources, inhabited private dwellings and places of assembly, but not unleased property).

6. Authorization under the Department's General Permit for Stormwater Discharges Associated with High-Volume Hydraulic Fracturing ("HVHF GP") must be obtained prior to any disturbance at the site.

7. Surface water and stormwater runoff must be diverted away from the pit.

8. A copy of the SWPPP must be available on-site and available to Department inspectors while HVHF GP coverage is in effect. HVHF GP coverage may be terminated upon the plugging and abandonment of all wells on the well pad in accordance with Department-issued permits.

9. Two feet of freeboard must be maintained at all times for any on-site pit.

10. Lighting and noise mitigation measures as deemed necessary by the Department may be required at any time.

11. A system for recording, documenting and retaining the results of all pressure tests and inspections conducted during drilling and/or completion operations. The results must be available to the Department at the well site during the corresponding operation, and to the Department upon request at any time during the period up to and including five years after the well is permanently plugged and abandoned under a Department permit. If the well is located on a multi-well pad, all pressure testing records must be maintained and made available during the period up to and including five years after the last well on the pad is permanently plugged and abandoned under a Department permit. The record for each pressure test, at a minimum, must identify the equipment or casing being tested, the date of the test, the minimum and maximum test pressures in psig, the test medium (*e.g.*, water, brine, mud, air, nitrogen) including its density, test duration, and the results of the test including any pressure drop;

12. Consultation with the Department's Division of Materials Management ("DMM") is requires prior to disposal of any cuttings associated with water-based mud drilling and pit liner associated with water-based mud drilling where the water-based mud contains chemical additives. Any sampling and analysis directed by DMM must be by an ELAP Certified Laboratory.

13. The operator must follow applicable best management practices ("BMPs") for reducing direct impacts at individual well pads described in Section 7.4.1.1 of the SGEIS.

14. The operator must fully implement the Invasive Species Management Plan described in the approved application materials.

15. The operator must follow applicable best management practices ("BMPs") for reducing the potential for transfer and introduction of invasive species described in Section 7.4.2.2 of the SGEIS.

16. Periodic radiation surveys must be conducted at specified time intervals during the production phase for Marcellus wells. All surveys must be conducted in accordance with NYSDOH protocols.

17. Diesel fuel used in drilling and completion equipment engines will be limited to Ultra Low Sulfur Fuel ("ULSF") with a maximum sulfur content of 15 ppm.

18. There will not be any simultaneous operations of the drilling and completion equipment engines at the single well pad.

19. The maximum number of wells to be drilled and completed annually or during any consecutive 12 -month period at a single pad will be limited to four.

20. The emissions of benzene at any glycol dehydrator to be used at the well pad will be limited to one ton/year as determined by calculations with the GRI-GlyCalc program. If wet gas is encountered, then the dehydrator will have a minimum stack height of 30 feet (9.1m) and will be equipped with a control devise to limit the benzene emissions to 1 Tpy.

21. Condensate tanks used at the well pad shall be equipped with vapor recovery systems to minimize fugitive VOC emissions.

22. During the flowback phase, the venting of gas from each well pad will be limited to a maximum of 5 MMscf during any consecutive 12 -month period. If "sour" gas is encountered with detected H2S emissions, the height at which the gas will be vented will be a minimum of 30 feet (9.1m).

23. During the flowback phase, flaring of gas at each well pad will be limited to a maximum of 120 MMscf during any consecutive 12 -month period.

24. Wellhead compressor will be equipped with NSCR controls.

25. No uncertified (*i.e.*, EPA Tier 0) drilling or completion equipment engines will be used for any activity at the well sites.

26. The drilling engines and drilling air compressors will be limited to EPA Tier 2 or newer equipment. If Tier 1 drilling equipment is to be used, these will be equipped with both particulate traps (CRDPF) and SCR controls. During operations, this equipment will be positioned as close to the center of the well pad as practicable. If industry deviates from the control requirements or proposes alternate mitigation and/or control measures to demonstrate ambient standard compliance, site specific information will be provided to the Department for review and concurrence.

27. The completion equipment engines will be limited to EPA Tier 2 or newer equipment.

28. Particulate traps will be required for all Tier 2 engines. SCR control will be required on all completion equipment engines regardless of the emission Tier. During operations, this equipment will be positioned as close to the center of the well pad as practicable. If industry deviates from this requirement or proposes mitigation and/or alternate control measures to demonstrate ambient standard compliance, site specific information will be provided to the Department for review and concurrence.

29. Monitoring and Reporting. Passby flows must be maintained instantaneously. Determinations of allowable removal rates will be made based on comparisons with instantaneous flow data.

a. Description of Gage Types.

Tier I - Gage data in this category is collected by the permitee immediately downstream of the water withdrawal location using streamflow gage equipment capable of accurately measuring instantaneous flow rates as approved at the discretion of the Department.

Tier II - Gage data in this category is obtained from acceptable USGS gages that must be located at a point in the same watershed where the drainage area at the gage is from 0.5x to 2.0x the size of the drainage area as measured at the withdrawal point. The catchment area must not have altered flows unless the instantaneous flow measurements can take into account the alterations.

Tier III - Gage data in this category is obtained from USGS gages that are either outside the acceptable distance within the same watershed or are in adjacent watersheds that possess similar basin characteristics. The use of these "surrogate" watersheds are the most inaccurate account of stream flow and should be used only as approved at the discretion of the Department.

b. All streamflow records used in determining the instantaneous passby flow rates should be measured to the nearest 0.1 cfs at 15-minute increments. Water withdrawal rates must be reported as instantaneous measurements to the nearest 0.1 cfs at 5-minute increments. Reporting is required annually to Department in Microsoft Excel or similar electronic spreadsheet/database formats.

c. Violations and Suspension of Operations. Water withdrawal operations will be suspended immediately upon determination that the required passby flow has not been maintained. The Department has the right to modify passby flow requirements if water quality standards are not being met within a watercourse as the result of a water withdrawal. Failure to submit annual reports, filing of inaccurate reports on water withdrawals, and continuing to withdraw water after a determination that the required passby flow has not been maintained, are all considered separate violations of this permit and the Environmental Conservation Law Article 71-1305(2).

30. Operators developing well sites in Forest and Grassland Focus Areas that involve disturbance in a contiguous forest patch of 150 acres or more in size or in a contiguous grassland patch of 30 acres or more in size must:

a. Implement mitigation measures identified as part of the Department-approved ecological assessment;

b. Monitor the effects of disturbance as active development proceeds and for a minimum of two years following well completion; and

c. Practice adaptive management as previously unknown effects are documented

Appendix A

TECHNICAL MEMORANDUM

Changes in the 100-Year Floodplain in Areas Potentially Affected by Hydraulic Fracturing

January 8, 2012

Prepared for: Catskill Mountainkeeper
Delaware Riverkeeper Network
Earthjustice
Natural Resources Defense Council, New York
Riverkeeper

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SUMMARY

The New York State Department of Environmental Conservation ("NYSDEC") has proposed that high volume hydraulic fracturing ("HVHF") operations be disallowed within designated 100-year floodplains. The floodplain will be as designated on a Flood Insurance Rate Map as developed by the Federal Emergency Management Agency ("FEMA"). Many FEMA maps are out-dated and may not accurately describe likely current and future flooding events in the areas proposed for HVHF development. Flooding of HVHF facilities, including well pads and waste storage facilities, could present a significant risk of contamination to surface and groundwater. Using the FEMA 100-year floodplains is therefore inadequately protective. A more conservative and protective approach would be to instead preclude HVHF development within 500-year floodplains, which likely better represent the areas that are at real risk of flooding.

Even before considering the effects that climate change has on the current maps, the maps contain much undisclosed uncertainty because of inaccuracies in estimating the design flood, usually the 100-year or 500-year return interval flood, inaccuracies in measuring the stream sections over which the hydraulic calculations will be completed, and various modeling assumptions. Beyond these sources of uncertainty, climate change will likely result in larger and more frequent storms, such as the recent Tropical Storms Lee and Irene and Hurricane Sandy,

with more intense rainfall which will increase flooding, runoff and change the stream plan and profile by causing erosion and sedimentation. Today's 100-year flood may occur much more frequently in the future with global warming and the 100-year flood may be a much larger event. It is very possible that floodplains will change substantially and likely become larger. In the Northeastern United States, and particularly in the Susquehanna and Delaware River watersheds, precipitation has increased over the past century and will increase over the next century. Flood flows are projected to continue to increase.

It is therefore likely that many of the FEMA floodplain maps substantially underestimate the actual 100-year floodplain. That underestimation is likely to become greater with time as global warming increases flood flow rates. Utilizing them as the basis for establishing boundaries for restricting gas development facilities is taking a substantial risk that facilities will in fact be subject to significant flooding events. Developing regulations for potentially polluting facilities that will exist for the next fifty years or longer without properly considering climate change exposes New Yorkers to unnecessary and avoidable risks.

Society will, of necessity, adapt to climate change because it is occurring and will likely become worse. Adapting to climate change impacts that cannot be prevented will require adaptive management over all aspects of society. Knowingly placing facilities that could be sources for substantial contamination in outdated 100-year floodplains is the opposite of the type of future planning needed for climate change adaptation. The NYSDEC should amend its proposed regulations to disallow HVHF operations within 500-year floodplains; this would help account for the uncertainties in floodplain mapping, observed changes in flood flow rates, and projected changes in floods in the future due to climate change.

INTRODUCTION

The NYSDEC has proposed that HVHF operations be disallowed within designated 100-year floodplains (proposed 6 NYCRR §560.4(a)(4) and §750-3.3(a)(3)). The floodplain would be as designated on a Flood Insurance Rate Map as developed by FEMA (6 NYCRR § 750-3.2(b)(1)). Appendix 1 in NYSDEC (2011) lists the available FEMA maps for different areas as affected by proposed HVHF operations. Some of these floodplain maps are up to 36 years old.

Hurricane Sandy, which occurred in late October 2012, has refocused attention on the damages which can be caused by natural disasters, including floods. Sandy was the largest hurricane by area affected at one time ever recorded in the Atlantic Basin and brought tropical storm force winds to more of the Atlantic Coast than any other storm in history. Tropical Storm Lee occurred just after Hurricane Irene in September 2011 and caused the worst flooding in at least 40 years in parts of northcentral Pennsylvania, in the middle of the Pennsylvania Marcellus Shale gas play, and in the Catskill Mountains and across southern New York where the State is proposing to allow hydraulic fracturing. While no given event can be blamed on climate change, Sandy and Lee are certainly examples of the types of tropical storm events to be expected in the future. Tropical storms are only one type of flood-producing event that could be increased by global warming.

In addition to changing climate and flooding, there are many reasons why floodplain maps may understate by large amounts the actual 100-year floodplain (Bales and Wagner 2009; Smemoe et

al 2009; Merwade et al 2008). It is also likely that climate change will increase the size of floods affecting river channels. Flood risk analysis with climate change suggests that up to 20% of the world's population could eventually be affected by increased flooding (Kleinen and Petschel-Held 2007). Flood flows and frequency have increased in some areas targeted for gas development since the floodplain maps were prepared, including the Delaware River Basin (Brandes and Kucz 2007).

This technical memorandum briefly reviews the development of FEMA floodplain maps and discusses their sources of uncertainty. It also discusses trends in flood flows over the 20th century, and before, as well as future projections as to how floodplains may be affected by climate change. Because flooding also happens outside of floodplains, it considers the roll of geomorphic change caused by global warming in the overall targeted watershed.

FEMA FLOODPLAIN MAPPING

FEMA is the federal authority that establishes 100-year floodplains, generally for flood insurance purposes. Many other governmental entities, including the NYSDEC in its proposed HVHF regulations, use FEMA maps to establish floodplain areas in which certain development is precluded. If the maps are inaccurate (Merwade et al. 2008), or if they are out-of-date due to increased flood flows, regulations based on them may not achieve their intended goals.

A floodplain map for a given return interval flow is a map of all of the riparian terrain that would be underwater while a river passes at that flow rate. A return interval is the average amount of time that would pass between floods exceeding a given flow rate; a 100-year flood is often used for development purposes. In general terms, a floodplain is determined as follows (adapted from Merwade et al. (2008)):

1. Estimate a design flow (*e.g.* 100-year flow) using a calibrated hydrologic model with precipitation input or through statistical analysis.
2. Determine cross-sections in the river being mapped; this is done by surveying the river, by using digital elevation models, or by manually estimating cross-sections from a map.
3. Use a hydraulics model to estimate water surface elevations for the given flow and cross-sections.
4. Plot the water surface elevations on a base topographic map. The land underneath the plotted water surface elevations is the floodplain.

Smemoe et al. (2007) show that there is so much uncertainty around the use of a single line to designate the flood plain that they recommend that resource managers use a probabilistic estimate. Uncertainty in the final map is due to uncertainty in all of the many factors that go into making the map; climate change can affect the first two items above the most. The following discussion is based on Bales and Wagner (2009), Merwade et al. (2008), and Smemoe et al. (2007).

The design flow is uncertain because of the estimation methods. The best data is a flood flow record at the site of interest. A rule of thumb is that there should be about twice as many years of record as in the design storm, meaning that 200 years is really necessary to have an accurate

prediction for a 100-year event. Adding paleoflood data, or estimates of flows that occurred prior to recorded data, to the database can increase the precision of long-return-interval flood estimates (England et al. 2003, Stedinger and Cohn 1986). Flood frequency analysis is based on fitting the flood data to a probability distribution, but there are uncertainties associated with the fitting methodology. If there are no observations at the site, meaning the site is not a gaging station, which is usually the case, the design flood is usually based on a regression analysis of sites in the area. Statistical estimates using probabilistic estimates add much uncertainty to the estimate. Additionally, the unavoidable fact is that the watersheds used to develop the regression relationship have different size, geology, soils, topography, and rainfall distributions, and therefore cannot truly be considered to have been drawn from the same population of floods.

Climate change may increase the frequency and magnitude of floods from a watershed, thus rendering any database used for estimation or for developing the regression equation non-stationary (Milly et al 2008); this means that the average and/or variance of the flood flows may change. It essentially means that the population of floods that controls the probability distribution describing future flood events has changed from the population used to establish today's estimate of a given return interval flood.

An alternative method is to use hydrologic modeling, usually rainfall runoff modeling. This is a model in which the input is precipitation and output is a flow rate or hydrograph. The model parameters, or state variables, are used to represent watershed characteristics, infiltration, and antecedent conditions. Precipitation dynamics are the intensity and duration of the storm and antecedent conditions are the wetness of the soil prior to the design storm. In addition to the problems with estimating these parameters, the big assumption is that the return interval of the computed flow equals the return interval of the input storm precipitation. Obvious problems with this assumption include the antecedent conditions being the same and the within-storm precipitation distribution being appropriate (not necessarily spaced to give the maximum runoff). In the Northeast, these items could be seasonally dependent, so seasonal considerations may also apply.

The cross-sections used for floodplain mapping could also change due to global warming. Large floods could erode the banks or place sediment in ways that could change substantially the channel and surrounding terraces (Stinchcomb et al. 2012). Hydraulic analyses would yield a different water surface elevation dependent on the changed channel for the same flow.

Two other sources of uncertainty are not directly climate-related. The first is the accuracy with which the cross-sections can be determined; this uncertainty will decrease with improved mapping and surveying techniques. The second is the assumption that the flow is steady through the length of river being analyzed. In reality, it is rare for a river to have a level water surface all the way across its cross-section and it is also rare that the flow rate is exactly the same at all points along a river reach.

Actual floodplain maps show the difference between those completed 30 years or more ago and those more recently completed. Figures 1 through 3 are created from FEMA floodplain maps along the Susquehanna River in Broome County in 1981 and along the Delaware River and a tributary in 2011, respectively. More recent maps (Figures 2 and 3) show more detail. A

noticeable difference between the 100-year and 500-year floodplains is that the 500-year may just be a little wider than the 100-year but also that it fills in areas that may be above the water level in the 100-year flood. The restriction from developing gas wells within the 100-year floodplain would allow gas wells in the areas within the floodplain boundaries that are just higher than the water level. During the 500-year flood, most of the areas within the 100-year floodplain are filled in with water and the general boundary is spread horizontally a little further. The tributary in Figure 1 clearly meanders within the 500-year floodplain but some of the terraces on the meander bends are actually above the 100-year but within the 500-year floodplain. In Pennsylvania, operators have even developed Marcellus Shale gas wells within the existing 100-year floodplains (Figure 4). There is clearly a need to restrict development near the streams.

HISTORIC TREND IN FLOODS

The Northeast has had several significant climate trends over the 20th century (Barron 2001).

- The area has been prone to natural disasters related to weather and climate, including floods, droughts, heat, and severe storms.
- Temperature along the coast has increased about 4° F over the century.
- Precipitation has also increased up to 20% over the century, with an increase in the extremes.
- The amount of the region experiencing drought at any given time has increased.
- The period between the first and last dates with snow on the ground has decreased by 7 days over the last 50 years.

The back-to-back Irene and Lee storms and the three major floods in the Delaware River Basin in a 22 month period between 2004 and 2006 (September 2004, April 2005, and June 2006) are examples of the area being prone to more flood disasters, which have become worse over large basins. Very large floods, in excess of 100-year return intervals, from the largest basins have increased through the 20th century (Milly et al 2002). Paleoflood data on the Susquehanna River has shown that larger floods have occurred in the past than were observed at the gage near Harrisburg (England et al. 2003).

Table 1 shows the flood flows recorded at four stream gages with long records and how those flows compare with computed 100-year flows (Brandes and Kucz 2007; Schopp and Firda 2008) at those gages. At three of the four gages—Riegelsville, Belvidere, and Port Jervis—two of the recent floods exceeded the 100-year flood computed with flow records up to 1985. Using flow data through 2006, the 100-year flood is higher than the 2004 through 2006 flows. Six of the highest seven floods in 300 years have occurred in the past century (Schopp and Firda 2008) and three floods that have occurred from 2004 through 2006 were in the top five floods since 1903 at the four gages listed in Table 1. Estimated 100-year floods on the Delaware River have increased by from 15 to 20 percent since the FEMA flood maps were prepared in 1985 (Brandes and Kucz 2007) (Table 1). The 50- and 25-year floods increased by 12 and 9 percent, respectively. Consequent increases in the stage at the gaging stations ranged from 1.4 to 3.3 feet, dependent on the station. This is substantial evidence that flood flows are increasing in the past ten or more years and also in the past 60 years.

Table 1: floods recorded in 2004, 2005, and 2006 at four stream gages along the Delaware River and estimated 100-year and 500-year flood flows for those gages. Peak flow data obtained from http://nwis.waterdata.usgs.gov/usa/nwis/peak/, accessed 1/5/13.

Gage***	Riegelsville	Belvidere	Port Jervis	Barryville
2004	216,000	184,000	151,000	112,000
2005	262,000	226,000	166,000	118,000
2006	254,000	225,000	189,000	151,000
1985 100-year Flood*	232,444	208,167	165,239	125,743
2006 100-year Flood*	267,568	242,821	189,129	152,014
2006 500-year Flood **	358,000	334,000	273,000	188,000

* - Brandes and Kucz 2007

** - Schopp and Firda 2008

***: Riegelsville, #01457500

Belvidere, gage #01446500

Port Jervis, gage # 01434000

Barryville, gage #01428500

Computed 500-year flood flows are from 19 to 31% higher than the 100-year flood flows. The difference in the computed floodplain depends on the shape of the valley and river channel. As noted in the discussion above about Figures 1 through 3, in a canyon, the depth and flow velocity would increase substantially but the width of the channel would not appear substantially wider on the map. In a broad flat valley, the water level may rise only a few feet between the 100-year and 500-year flows but substantially spread further across the valley. This additional flooding could inundate wells that have been constructed between the 100-year and 500-year floodplains.

In the Catskill Mountains, regional annual mean air temperature increased significantly by 0.6°C per 50 years over the 20th century (Burns et al 2007). The greatest increases and largest number of significant upward trends at different stations were in daily minimum air temperature. Daily maximum air temperature showed the greatest increase during February through April, whereas daily minimum air temperature showed the greatest increase during May through September. Regional mean precipitation increased by 5.4 inches in 50 years, nearly double that of the regional mean increase in runoff. Regional mean potential evapotranspiration increased by 0.7

inches in 50 years, about one-seventh that of the increase in precipitation amount. The increased evaporation prevented the runoff from increasing commensurately with the increase in precipitation (Burns et al. 2007). Peak snowmelt generally shifted from early April at the beginning of the record to late March at the end of the record, consistent with a decreasing trend in April runoff and an increasing trend in maximum March air temperature. The supply of water to reservoirs therefore increases earlier in the year.

In contrast, Zhu and Day (2005) found that base flow, total streamflow, and runoff had decreased at various stations across Pennsylvania, with only a weak linkage to changes in climate. They attributed the contrasting results to unmeasured watershed factors, such as urbanization or forestry. Zhu and Day (2005) did not analyze peak flows so their study does not contradict other studies documenting higher floods.

The general increase in floods and flood flows in the Northeast, particularly, in the Catskills region and northeastern Pennsylvania probably corresponds to the increase in extreme precipitation and storm intensity that has been observed through the 20th century (Trenberth 1999). The processes that can lead to more intense storms include increased moisture content of the atmosphere or advective moisture flux into the storm cell. Evaporation from the surface within a cell may increase but the added moisture is miniscule compared to the amount of water in the atmosphere. In some watersheds, however, other land use changes may have affected the flows; this includes primarily the increased urbanization of the watershed or changes in forest cover, which can magnify the impacts of increased rainfall in ways that make it very difficult to ascertain the precise cause of increased flooding (Zhu and Day 2005, Schreider et al. 2000).

CLIMATE CHANGE AND THE FUTURE TREND IN FLOODS

Projections of changes in climate in the Northeast for the next century include the following, which suggest more change in precipitation than in temperatures (Barron 2001):

- The area has among the lowest rate of projected future warming.
- Winter minimum temperatures are likely to increase the most, with model-projected increases ranging from 4° to 5° F with up to 9° F increases expected near the coast.
- Daily maximum temperatures will change the least, but the largest change will occur near the coast.
- Projected precipitation increases range from none to about 25% over the century.
- Precipitation variability will also increase.
- Model guidance is poorest, or most variable, for scenarios concerning changes in the frequency and intensity of winter storms.

Global warming enhances precipitation because much of the radiation reflected back to the earth by greenhouse gases warms the surface and increases evaporation, which increases the water vapor content of the atmosphere (Trenberth 1999). The warmer atmosphere can also hold more moisture which should lead to increased extreme rainfall events (Trenberth 1999, Karl et al. 1995). Because precipitation rates exceed evaporation rates by many times, the upper limit to

potential rainfall rates depends on the amount of moisture in the atmosphere at the beginning of the storm and the total amount depends on how much can be transported into the storm cell (Trenberth 1999).

In the Delaware River Basin, projections into the future suggest that annual runoff will increase at one and a half to two times the rate of precipitation, temperature dependent (Frei et al 2002). If temperature increases with no change in precipitation, runoff may decrease about 6% for every degree Celsius of temperature increase (Frei et al. 2002); this estimate essentially confirms the much older estimate of McCabe and Ayers (1989) that runoff would be reduced by 9 to 25% for a 2 to 4 degree Celsius increase in temperature with constant precipitation. The agreement between forecasts should increase the confidence in those forecasts.

Most flood predictions assume that climate is stationary, meaning that the statistics of storm depths, including the average and standard deviation, remain constant with time. However, both paleo studies and climate change predictions show that climate is anything but stationary (Milly et al. 2008; Knox and Kundewicz 1999). Small changes in the statistical distribution of storms in a basin can lead to large changes in the predicted response (Knox and Kundewicz 1999), at least until the watershed and ecosystems have adapted to the new climate regimes (Eagleson 1982, Bull 1991). In the Northeast, there are a variety of conditions which can lead to extreme flooding (Barron 2001):

- Rapid melting of snow due to warming after a big storm.
- Spring snow melt following heavy winter snowfall.
- Heavy rainfall on frozen ground that limits percolation and drainage.
- Major summer thunderstorm systems.
- Major precipitation event associated with tropical cyclones.

Global warming enhances all of these processes, in large part due to enhanced advective moisture transport from the nearby oceans. Both the Atlantic and Gulf of Mexico are prolific moisture producers in the Northeast; moisture can flow from the Gulf over 1000 kilometers in a day so that increased evaporation there due to warmer sea temperatures vastly increases the moisture source to the Northeast.

A watershed's response to increased extreme events depends on how the watershed has evolved due to the warming climate and overall increased precipitation (Blöschl et al. 2007). For example, a watershed that has had its forest cover increase and thicken due to increased annual precipitation may not respond differently to an extreme event than it would have previously. If the frequency of that extreme event has increased, however, the subsequent higher amounts of runoff, erosion, and sediment transport may change the floodplain considerably and lower the return interval associated with a given flow rate. In other words, today's 100-year flood may be the 20-year flow in 2050 and the stream channel may be similarly adjusting.

Winter flooding can increase in places because warmer temperatures lead to more moisture and more rain events. Snowstorms that occur at warmer temperatures may be heavier also because of increased moisture. Rain-on-snow events could become more frequent and intensify flooding (Trenberth 1999). As noted, storms on frozen ground can have more runoff for a given amount

of precipitation, which can occur due to a period of freezing temperatures followed by an influx of warm air. This is particularly possible in the Northeast because many storms already occur near the freezing threshold (Burakowski and Wake undated).

Knutson et al (2010) summarized both statistical studies and forward-looking model studies in an attempt to determine the long-term changes expected in tropical cyclones. They estimated that the frequency of tropical cyclones with global warming will actually decrease by from 6 to 34 percent due to an increase in midlevel wind that causes shear and prevents cyclone formation. However, cyclone intensity, and therefore the number of category 3 to 5 storms, will increase. They also predict the amount of rainfall associated with cyclones, especially in the center 100 kilometers, is likely to increase by 20%.

Although it is mostly outside of the New York Marcellus Shale area, coastal flooding will increase even more due to sea level rise and other global warming effects on the ocean. Current 100-year high water marks will be exceeded at least once every 30 years by 2050 (Kirshen et al 2008). In New York City, projected sea level rise is 15, 20, and 21 cm for scenarios of low, medium, and high rates of continued carbon emissions (Yin et al 2009). Because the oceans control the downstream base levels in large rivers, sea level increases will affect flood levels upstream including possibly into areas potentially affected by HVHF.

The general consensus therefore is that flood flows will increase with global warming in the Northeast, including those areas targeted for HVHF in New York. The rate of increase may also exceed the rate that the stream channels can adjust to pass the flows. Additionally, near-floodplain developments may prevent the channel from expanding as necessary. Industrial facilities, such as HVHF wells or waste storage facilities, may feature contaminant sources that could overflow and/or be washed away by the increased flooding, presenting a significant risk of contamination to surface and groundwater supplies.

WATERSHED PROCESSES

Floodplain mapping includes only the primary channels through a valley. Watersheds, consisting of smaller drainages and wetlands, control the flow and much of the sediment that a watershed produces in most floods. Also, being outside the mapped floodplains, the runoff and erosion that occur on a hillslope can present a risk of contamination from any gas development facilities. It is at small scales that climate variability and landscape management most affect the flow pathways from a watershed (Blöschl et al. 2007).

Climate change alters the thresholds for change at a watershed scale (Bull 1991). Floods cause erosion and headcuts to form. A headcut is a point where severe erosion causes a small cliff or waterfalls to form in the profile of the stream; usually the headcut will move rapidly upstream which effectively rejuvenates the watersheds. A rejuvenating watershed is one in which the bases of the streams are rapidly changing due to erosion. As floods currently characterized as extreme become more frequent, the ability of a watershed to pass a given flow decreases. Once a given flow exceeds a threshold along a given drainage, a headcut may form and start moving up through the watershed causing widespread rejuvenation. Extreme sedimentation or channel movement may occur. Flooding and erosion could affect facilities constructed near these drainages.

Rejuvenating watersheds also have more landslides, which can affect landscapes away from the floodplains. Landscapes are more prone to small landslides during long-duration moderate or high intensity rainfall event because the landslides occur after rainfall infiltration can fill the soil and allow it to move (Jacobson et al. 1989). Once an area has had a large storm with substantial soil movement, it may take a long time until the area can fail again (Jacobsen et al. 1989).

There is a feedback loop among climate change, flooding, and wetlands in small watersheds as well (Pitchford et al. 2012). The wetlands mitigate flooding until global warming destroys the wetlands. Wetland vulnerability to climate change depends extensively on their position in the watershed (Winter 2000). The most vulnerable wetlands are in mountainous or other upland areas because they tend to depend on runoff (Winter 2000). In this context the wetlands decrease flooding and the water storage essentially maintains wetland function. If storm intensity increases, hillslope erosion will cause sediment to reach the wetlands which, with time, will decrease their capacity to hold runoff. Increased temperatures may lower the wetland water and nearby groundwater level more quickly, thereby making more storage available for floods, at least until the wetland fills with sediment. Groundwater typically supports the wetlands nearest the streams (Winter 2000). If global warming decreases stream base flows or recharge to the floodplain, wetland plants could die and decrease the cohesive strength of the stream channel thereby rendering them more easily eroded. Erosion of the stream channel, in turn, changes the morphology of the stream, moving the floodplain boundaries.

DISCUSSION AND CONCLUSION

This memorandum discusses numerous factors of climate change and floods that indicate that existing floodplain maps probably substantially underestimate the area that will be affected by 100-year floods both presently and in the future, and therefore do not provide an appropriate basis for delineating areas in which HVHF facilities should be precluded. In some areas, the floodplain maps are over 30 years old and flood records since that time have shown that the FEMA design flows are too small. Without even considering climate change, the maps are uncertain because of the inaccuracies in estimating the design flood, inaccuracies in measuring the stream sections over which the hydraulic calculations will be completed, and various modeling assumptions. If climate change results in more intense rainfall and runoff or changes the stream cross-sections substantially it is very possible that the floodplains will change substantially. To decrease the risk, NYSDEC should not allow HVHF facilities within the 500-year rather than the 100-year floodplain. As shown on Figures 1 through 3, using the 500-year floodplain may primarily prevent gas wells from being located on high ground that would be surrounded by water during the 100-year flood flow.

In the Northeastern United States, and particularly in the Susquehanna and Delaware River watersheds, increased precipitation has been measured over the past century and is projected to further increase over the next century. Most likely the future increases will take the form of greater intensity of rare storms, including hurricanes. As storms become larger and affect larger areas, more of a given watershed may become affected. Larger floods may not be due to substantial increases in runoff per area for small to mid-size watersheds but rather could be due to larger storms producing similar runoff from larger areas which combine to create larger events at downstream locations (Milly et al. 2002).

Using out-of-date FEMA floodplain maps as the basis for regulating the location of HVHF facilities is not minimizing risk because those maps are likely based on a population of rainfall/runoff data that no longer applies due to changing climate. The insurance industry, one of the most conservative businesses in existence (Adger et al. 2005), has begun to adapt to climate change because their bottom-line depends on it (Weiss 2012, Adger et al. 2005). There can really be no better indicator of increased risk due to natural disasters, including flooding and hurricanes, than interest by the insurance companies.

Permitting polluting industrial facilities to be developed in areas that have the potential to flood, *i.e.*, existing 100-year floodplains, and thus could be sources for substantial contamination, is the opposite of the type of future planning needed for appropriate climate change planning and adaptation. Utilizing the 500-year floodplains as the basis for HVHF regulation is more conservative and provides a more appropriate level of protection. This will help account for the uncertainties in floodplain mapping, observed changes in floods, including many recent floods that have exceeded the currently-mapped 100-year flood, and projected changes in floods in the future due to climate change.

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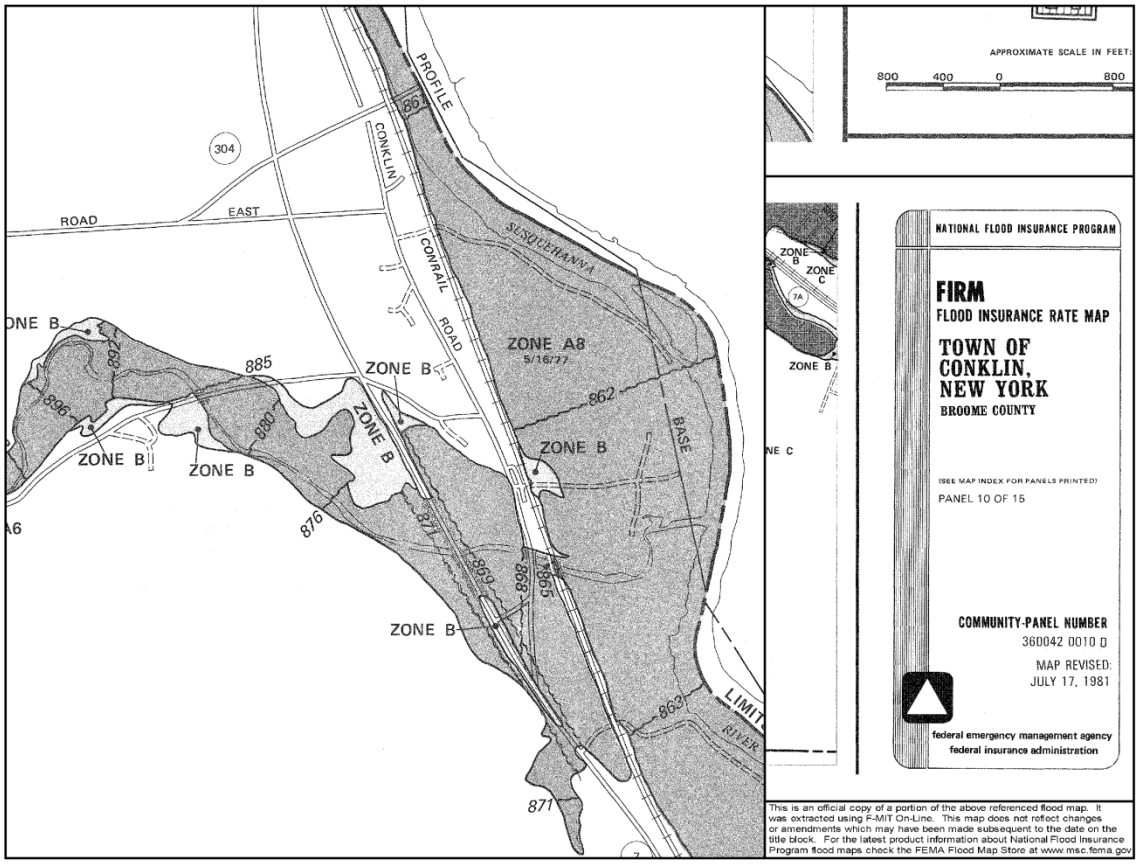

Figure 1: FEMA Floodplain Map, Conklin, NY. Zone B is the area between the 100-year and 500-year flood lines.

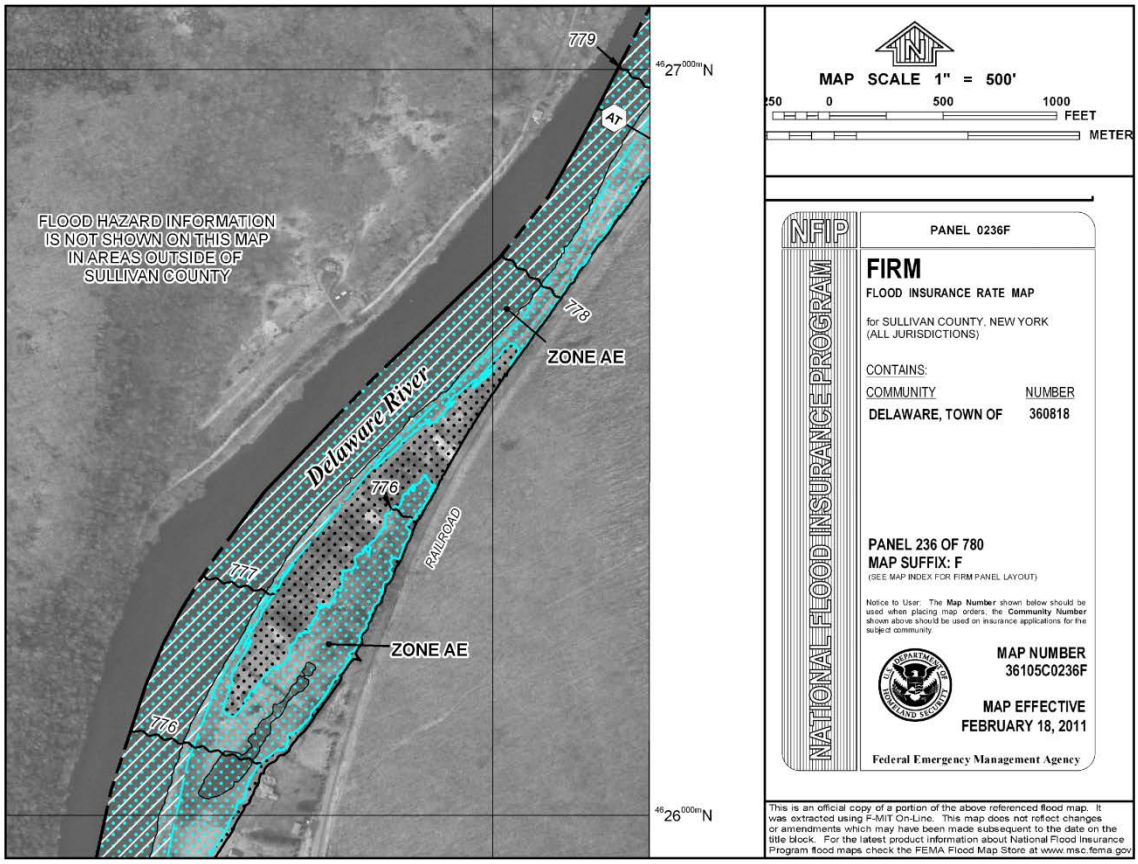

Figure 2: FEMA Floodplain Map, Delaware, NY. Blue dots represent the 100-year floodplain and the black dots represent the 500-year floodplain. The cross-hatch is the flood channel which is the area where no encroachment is allowed because it would change the floodplain.

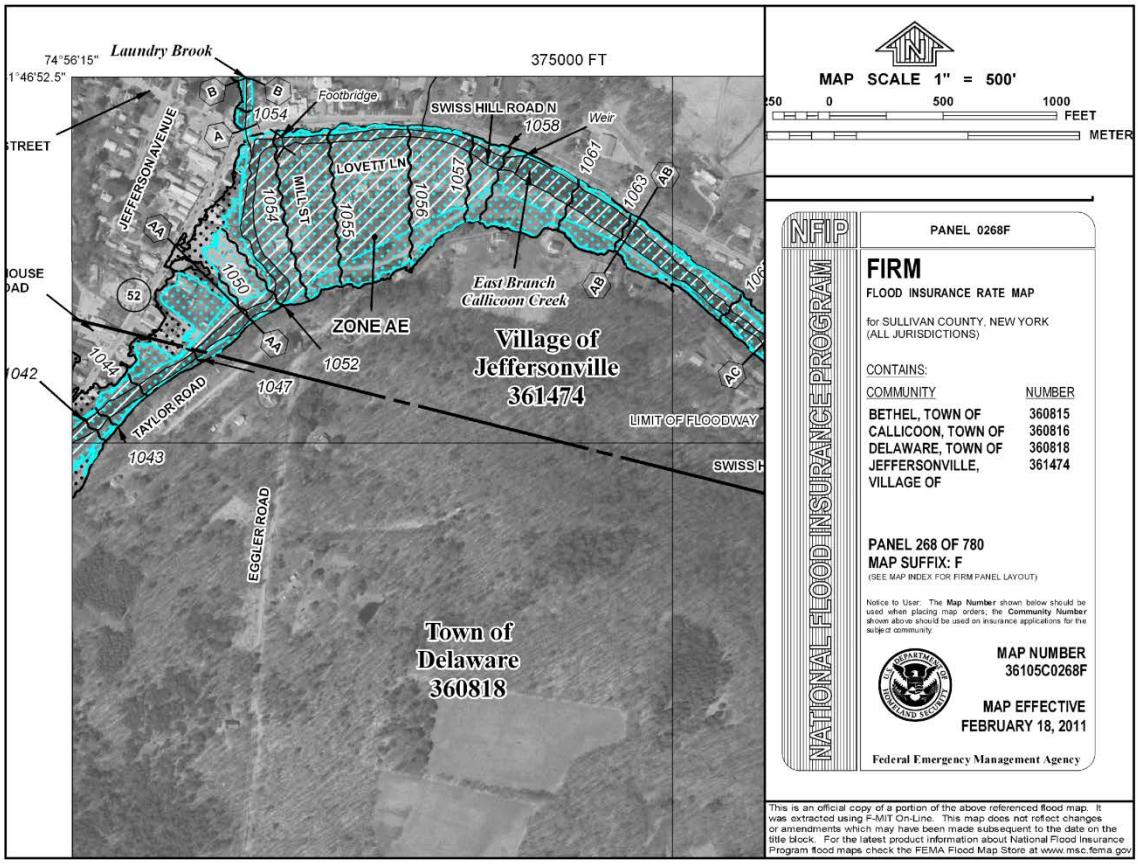

Figure 3: FEMA Floodplain Map, Sullivan County, NY. Blue dots represent the 100-year floodplain and the black dots represent the 500-year floodplain. The cross-hatch is the flood channel which is the area where no encroachment is allowed because it would change the floodplain.

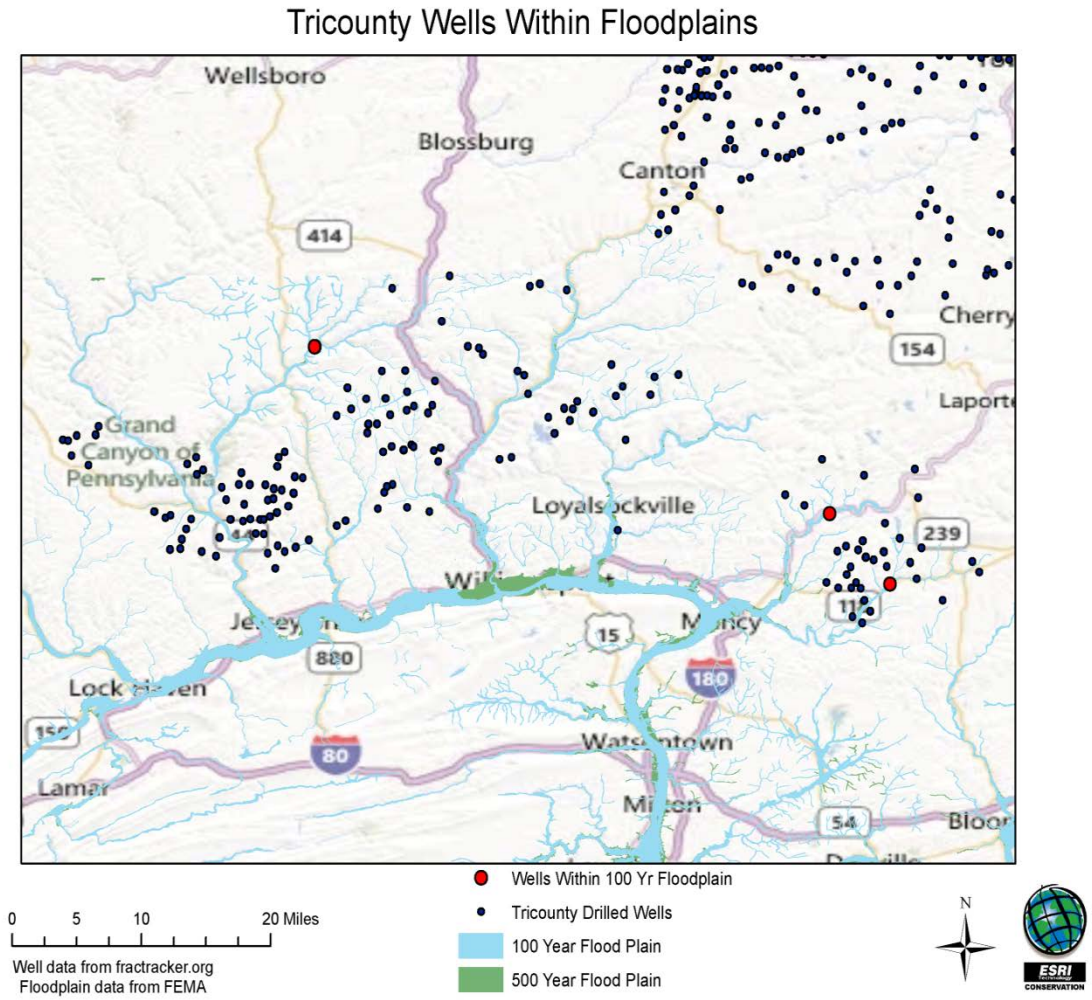

Figure 4: Map of Marcellus Shale Wells and FEMA Floodplain Maps for Bradford, Lycoming, and Sullivan Counties, Pennsylvania. Prepared by Avi Allison, Earthjustice.

Appendix B: Comparison of Term Definitions Between Proposed Regulation
6 NYCRR § 750-3.2(b) and the SPDES General Permit for Stormwater Discharges from HVHF

§ 750-3.2(b)	HVHF SPDES General Permit
Casing means pipe, typically made of steel, placed in the drilled hole of a well of an oil and gas well.	**Casing** means steel pipe placed in a well.
Closed-loop tank system means a pitless drilling system where all drilling fluids and cuttings are contained at the surface within piping, separation equipment and tanks.	**Closed-loop drilling system** means a pitless drilling system where all drilling fluids and cuttings are contained at the surface within piping, separation equipment and tanks.
Construction Phase means the phase between commencement of surface soil disturbance associated with the construction of access roads, well pads, and other appurtenances and Construction Phase Completion.	**Construction Phase** means the construction of access roads, wellpad, and other appurtenances.
Construction SWPPP means the stand-alone stormwater pollution prevention plan that includes best management practices and other requirements to control the pollution of stormwater during both construction of the well site and post-construction at the well site.	**Construction SWPPP** means the stand alone stormwater pollution prevention plan that includes best management practices and other requirements to control the pollution of stormwater during construction and post-construction.
Cuttings or samples means chips of rock cut by the drill bit and brought to the surface by the drilling fluid.	**Cuttings or samples** means chips of rock cut by the drill bit and brought to the surface by the drilling fluid. They indicate to the wellsite workers what kind of rocks are being penetrated and can also indicate the presence of oil or gas.

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6 NYCRR § 750-3.2(b) and the SPDES General Permit for Stormwater Discharges from HVHF

§ 750-3.2(b)	HVHF SPDES General Permit
Drilling fluid means mud, water, brine, or other fluid, including air, pumped down the drill string which acts as a lubricant and coolant for the drill bit and is used to carry rock cuttings back up the wellbore. It may also be used for pressure control in the wellbore and to drive a mud motor and bit for directional drilling.	**Drilling fluid** means mud, water, or air pumped down the drill string which acts as a lubricant for the bit and is used to carry rock cuttings back up the wellbore. It is also used for pressure control in the wellbore.
Final stabilization means all soil disturbance activities have ceased and a uniform, perennial vegetative cover with a density of at least eighty (80) percent has been established or other equivalent stabilization measures, such as sod, permanent landscape mulches, rock rip-rap or washed/crushed stone, have been applied on all disturbed areas that are not covered by permanent structures, concrete or pavement.	**Final stabilization** means all soil disturbance activities have ceased and a uniform, perennial vegetative cover with a density of eighty (80) percent has been established or other equivalent stabilization measures.
Flowback means liquids and solids produced during initial completion and clean up of the well or clean up of a well following re-fracture or workover of a well.	**Flowback** means return of fluids, used in the stimulation process, to the surface.
Freeboard means the distance between the maximum water surface elevation anticipated in design and the top of retaining banks or structures. Freeboard is provided to prevent overtopping due to unforeseen conditions.	**Freeboard** means the height above the recorded high-water mark of a structure designed to hold water. In the case of pits, freeboard is the extra depth left unused to prevent any chance of overflow.

Appendix B: Comparison of Term Definitions Between Proposed Regulation
6 NYCRR § 750-3.2(b) and the SPDES General Permit for Stormwater Discharges from HVHF

§ 750-3.2(b)	HVHF SPDES General Permit
High-Volume Hydraulic Fracturing Phase (HVHF Phase) means the phase following Construction Phase Completion and through completion of Partial Site Reclamation. This phase includes well drilling, high-volume hydraulic fracturing, and on-site handling and treatment of HVHF wastewater produced until all wells planned for that well pad have been completed.	**High-Volume Hydraulic Fracturing Phase (HVHF Phase)** means 1) the phase between the construction project completion and the Production Phase; and 2) any subsequent restimulation event. This includes well drilling, high-volume hydraulic fracturing, well stimulation and on-site handling and treatment of return flow.
HVHF general permit means a SPDES permit issued pursuant to section 750-3.11 of this Part.	**HVHF general permit** means a SPDES permit issued pursuant to section 750-3.21 of this Part.
HVHF SPDES permit means an individual SPDES permit for HVHF operations (individual HVHF SPDES permit) or an HVHF general permit.	**HVHF SPDES permit** means an individual or general SPDES permit for HVHF activities.
HVHF SWPPP means the stand-alone stormwater pollution prevention plan required by a SPDES permit that includes structural and non-structural best management practices and other activity-specific requirements to control the pollution of stormwater during the HVHF Phase and the Production Phase.	**HVHF SWPPP** means the stormwater pollution prevention plan required by a SPDES permit that includes structural and non-structural best management practices and other requirements to control the pollution of stormwater during the HVHF Phase and the Production Phase.

Appendix B: Comparison of Term Definitions Between Proposed Regulation
6 NYCRR § 750-3.2(b) and the SPDES General Permit for Stormwater Discharges from HVHF

§ **750-3.2(b)**	**HVHF SPDES General Permit**
Hydraulic fracturing means the act of pumping hydraulic fracturing fluid and a proppant into a formation to increase its permeability.	**Hydraulic fracturing** means the injection of fluids under pressure into a well in order to induce fractures in the target formation. Proppant which may be injected with the fluid holds the fractures open when the fluid is withdrawn. The procedure increases permeability of the rock near the wellbore and improves production.
Partial site reclamation means (a) when all of the equipment, materials and BMPs associated with the HVHF Phase have been removed, (b) surface disturbances not associated with production activities have been scarified or ripped to alleviate compaction prior to replacement of topsoil, and (c) all the disturbed areas have been stabilized after topsoil replacement, in accordance with the Partial Site Reclamation Plan submitted pursuant to Part 560.3(a)(17) of this Title, as adopted on XX, 20XX. Partial reclamation and final reclamation of any well pad and access road must be done in conformance with the plans approved by the department.	**Partial site reclamation** has occurred after all planned wells at the well pad have been completed and a Department inspector verifies that the drilling/fracturing equipment has been removed; pits used for those operations have been reclaimed and surface disturbances not associated with production activities have been scarified or ripped to alleviate compaction prior to replacement of topsoil. Reclaimed areas must be seeded and mulched after topsoil replacement and vegetative cover reestablished that will ultimately return the site to pre-construction conditions.
Plugged and abandoned (plug and abandon) means the permanent abandonment of a well bore including the placing of all bridges, plugs and fluids therein.	**Plugged and abandoned (plug and abandon)** means to permanently close a well with cement plugs.

Appendix B: Comparison of Term Definitions Between Proposed Regulation
6 NYCRR § 750-3.2(b) and the SPDES General Permit for Stormwater Discharges from HVHF

§ 750-3.2(b)	HVHF SPDES General Permit
Proppant means a material such as sand or ceramic particles that is carried in suspension by the fracturing fluid and that serves to keep the induced fractures open when fracturing fluid is withdrawn after a fracture treatment.	**Proppant** means a granular substance (sand grains, aluminum pellets, or other materials) that is carried in suspension by the fracturing fluid and that serves to keep the cracks open when fracturing fluid is withdrawn after a fracture treatment.
Reserve pit means a lined, mud pit in which a supply of drilling fluid has been stored, or a waste pit, usually an excavated pit.	**Reserve pit** means a mud pit in which a supply of drilling fluid has been stored, or a waste pit, usually an excavated pit. It may be lined to prevent soil contamination.
Storage means the holding of a material, container or equipment at a well site.	**Storage** means the holding of a material, container or equipment at a site, not including the amount of material brought to the site for immediate use.
Temporary stabilization means that exposed soil has been covered with material(s) to prevent the exposed soil from eroding. The materials can include, but are not limited to, mulch, seed and mulch, and erosion control mats (e.g. jute twisted yarn, excelsior wood fiber mats).	**Temporary stabilization** means that exposed soil has been covered with material(s) as set forth in the technical standard, New York Standards and Specifications for Erosion and Sediment Control, to prevent the exposed soil from eroding. The materials can include, but are not limited to, mulch, seed and mulch, and erosion control mats (e.g. jute twisted yarn, excelsior wood fiber mats).
Watershed means the region drained by, or contributing water to, a stream, lake, or other body of water.	**Watershed** means an area of land that drains into a body of water, such as a river, lake, reservoir, estuary, sea or ocean.