1259 Dryden Road
Ithaca, NY 14850
January 1, 2012

Attn: dSGEIS Comments
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233-6510

To Whom It May Concern:

I focused my review of the *Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program* (September 2011) on Chapter 4, Geology. This key chapter has major flaws which undermine the credibility of the rest of the document and any resulting regulations.

The fundamental problem is that this chapter avoids explicit discussion of fractures in the strata, especially deep strata. It uses old data to avoid obvious places where this discussion might be important, and attempts to argue away the possible consequences of these issues.

The 1992 GEIS acknowledges deformations, fractures, and porosity in its Chapter 5, Geology. In particular, it notes that "the faults, folds and associated fracture systems formed during the Appalachian Orogeny have been of primary importance in trapping oil and gas in the overlying Devonian strata."[1] These acknowledgments, however, are included primarily in the context of where to find oil and gas, not in regard to their effects on the environment or the health and safety of human, animal, and plant populations.

The Revised Draft SGEIS misses several opportunities to consider these issues. Section 4.5, Seismicity in NYS, uses a 1977 New York State Museum map, *Preliminary Brittle Structure Map of New York*, for Figure 4.13, Mapped Geologic Faults in New York State. More recent research by University of Buffalo Professor of Geology Robert D. Jacobi shows that that map is extremely incomplete. Finding that research is not difficult.[2] His maps[3] show far more faults and possible faults than the SGEIS, with faults crisscrossing western and central New York State in his Figure 5.

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[1] "Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (GEIS)", page 5-25

[2] See, for example, "Faults crisscross upstate NY," *http://www.buffalo.edu/ubreporter/archives/vol31/vol31n23/n2.html* .

[3] Jacobi, Robert D. "Basement faults and seismicity in the Appalachian Basin of New York State." *Tectonophysics* Volume 353, Issues 1-4, 23 August 2002, Pages 75-113.

While those faults may presently be seismically quiet, two centuries of data are not actually very much. The SGEIS downplays the magnitude 3.2 earthquake at the New Avoca Natural Gas Storage project, arguing that it was the result of injection processes very different from hydraulic fracturing. The DEC, however, has not been willing to share much of what it knows about that incident, releasing only a heavily redacted report.[4]

Faults are important not only for their seismic potential, but because they are places where layers share common breaks, places where liquids and especially gases can move far more easily than they can even through porous rock. The Revised Draft SGEIS does not mention these issues at all.

The Revised Draft SGEIS also omits any discussion of cleavages, folds, joints, and other fractures that are common to the Alleghany Plateau - common enough that the New York State Museum, in its *Geology of New York: A Simplified Account*, includes a section on them[5], provided by Terry Engelder of Pennsylvania State University. The Alleghanian Orogeny, according to Engelder, involved substantial change: "an original width of 200 km was shortened by 20 km." (133) He also mentions fractures created by the release of pressure when sediments eroded away, creating release joints, and more recently unloading joints created by cooling. (137)

In addition to joints on the surface that "may exceed 300 m in length in cliff faces", Engelder notes the presence of kimberlite in the Ithaca area because "some north-south joints in central and western New York became the passageways for magma that moved upward from the earth's mantle." (134-7)

These common geological features raise basic questions about the basic approach of the SGEIS, which appears to assume that all movement of material underground is contained to the area where active drilling, fracturing, and extraction is taking place. This leads to important discussion of well casings and setbacks, but also avoids mentioning possible problems further from the wellhead itself.

Section 4.7 of the Revised Draft SGEIS, "Naturally-Occurring Methane in New York State" brings these problems to a head. It points fingers for well-water contamination anywhere except drilling, and argues that the case is closed without providing any concrete data beyond the prior existence of methane in many geologic structures.

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[4] Orr, Steve. "Avoca earthquake info: Still deep underground", November 23, 2011, *http://blogs.democratandchronicle.com/520/?p=2328* and Orr, Steve. "Earthquake info under wraps – for a decade", November 28, 2011. *http://blogs.democratandchronicle.com/520/?p=2358*. Both published in the 520 weblog of the *Rochester Democrat and Chronicle*.

[5] Engelder, Terry. "Deformation of 'Undeformed' Rocks: Structures in the Alleghany Plateau", pages 132-137 in Isachsen, Y. W., et al. *Geology of New York: A Simplified Account, 2nd Edition*. (Albany: New York State Education Department, 2000)

Yes, methane occurs naturally in many of the strata below this part of New York State. Yes, that methane sometimes causes problems for well water, and might do so whether or not any additional gas wells are drilled in New York State. However, this section makes no effort whatsoever to determine whether gas drilling (of any variety) could be a contributing factor to such disruptions beyond the creation of the well hole itself. The statement "The migration of methane can contaminate well water supplies if well construction practices designed to prevent gas migration are not adhered to" (4-38) is true but incomplete.

The section's handling of "the Duke study"[6] is probably its worst moment. It cites the study, then says absolutely nothing about the paper's conclusions except to note one series of data from wells in New York State. Amid complaints that the study itself used too small a sample size, the dSGEIS's approach of reducing the sample size further to draw convenient conclusions is a very strange and irresponsible response.

The study's actual conclusions deserve further exploration and may well change the regulatory framework described in this document. They found substantial increases in the methane content of shallow well water within one kilometer of active shale-drilling options, and while the concentrations were highest closest to the wells, they continued to be very high within roughly that one kilometer circle.

In asking how this result is possible, they offer three possibilities:

1. fluid migration, which they consider unlikely in these cases;

2. well casing leaks, which the SGEIS addresses;

3. "increasing the connectivity of the fracture system" and the enlargement of "the extensive fracture systems reported for these formations"

Point 3 is the most difficult point, the one that this section carefully avoids. It is the hardest to regulate, requiring substantially more research than is provided in this document to determine the extent of fractures. They point out that while it is difficult for liquids to migrate quickly, the "relatively common phenomenon of rapid vertical transport of gases (Rn, CH4, and CO2) from depth to the surface" remains a threat.

Gas transport may threaten more than water supplies. Section 4.6 of the Revised Draft SGEIS, "Naturally Occurring Radioactive Materials (NORM) in Marcellus Shale" examines radioactive materials exposed by the drilling and fracking processes, but assumes that they will emerge only through the well itself, as cuttings or flowback water. Radon is mentioned once in the Revised Draft SGEIS, on page 6-206, in a discussion of

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[6] Osborn, Stephen G., et al."Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing", in *PNAS Early Edition*, at http://www.pnas.org/cgi/doi/10.1073/pnas.1100682108.

the dangers of radium. The possibility of methane from these depths reaching the surface substantially increases the risk of radon migration. As Etiope, et al. put it[7],

> The amount of noble gases, such as helium and radon, occurring in the subsurface is many orders of magnitude too small (orders of ppm of He and of 10−10 ppm of Rn) to form a macroscopic quantity of gas which can react to pressure gradients and flow autonomously by advection. For such gases the advective movement must be referenced to a "carrier gas" (e.g. CO2, CH4, N2) able to form large domains that can carry the rare gas. (190)
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> These gas flows are precisely those which may serve as fast carriers for radon... it is evident that a small gas flow significantly increases the radon transport to shallow depths. (193)

Unfortunately, ignoring these possibilities limits the effectiveness of all of the remaining proposed regulation.

I would ask the DEC to reconsider issuing regulations for hydrofracking operations until you have taken the time to study these questions and determined how best to handle problems that are difficult to regulate, rather than ignoring them in favor of addressing the ones that seem easiest to control.

Thank you,

Simon St.Laurent
Town of Dryden

[7] Etiope, G. and Martinelli, G. "Migration of carrier and trace gases in the geosphere: an overview," in *Physics of the Earth and Planetary Interiors* 129 (2002) 185–204.