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Attn: Scope Comments
Bureau of Oil & Gas Regulation
NYSDEC Division of Mineral Resources
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To the SGEIS Team:

I applaud Governor Paterson's and your decision to re-examine New York State's Generic Environmental Impact Statement (GEIS) on the Oil, Gas and Solution Mining Regulatory Program in anticipation of producers' herculean efforts to extract natural gas from low-permeability sources like the Marcellus and Utica shales that underlie my home (and, most likely, yours as well). My purpose in writing to you is to help strengthen the supplemental GEIS in two ways: discussing potential impacts of new activities or technologies, and pointing out assumptions made in the 1992 GEIS that I suggest should be verified, modified or abandoned as available evidence may direct.

I appreciate the opportunity to contribute to this public discourse. My major point of view is that of a chemist / biochemist with over twenty-seven years of government, industrial and academic experience. My comments are indexed to numbered sections of your draft scoping document:

2.1.2 Hydraulic Fracturing. The draft scope document alludes to the recent "slick water" fracturing technology favored by horizontal well producers in other states, but no assurance is offered that this technology will actually be favored here. It may not be unreasonable to suppose that conventional additives such as guar gum (gelling agent) or borax (cross-linker)[1] would add no new impacts applied to horizontal drilling, but I strongly recommend prohibition of diesel fuel use for drilling or stimulation. In this context, I'd like to point out that additives like dimethylformamide, propargyl alcohol and thiourea[2] (corrosion inhibitors), ammonium bisulfite (oxygen scavenger) and citric acid (iron stabilizer)[1] would still be needed for slick water stimulations. However, the amounts used would be vastly greater than for vertical wells, simply because the fluid volumes involved are so

much greater. Combine this consideration with the increased amounts of material left unrecovered from horizontal wells – about half of the total injected[2] , and the implied assumption that conventional fracturing additives will contribute no significant additional impacts to those dealt with in Ch. 9 of the GEIS appears difficult to justify.

Concerning the "slick water" technology, my review of industry trade journals and patents points to one dominant class of compounds, quaternary ammonium salts, as probable multi-functional additives. One set of options would be cationic polymers produced from *N,N*-dimethylaminoethyl methacrylate (DMAEM), dimethylaminoethyl acrylate (DMAEA) and related organic salts (several patents). These monomers are extremely toxic, especially to the central nervous system[3]. Moreover, the amount of hydrochloric acid needed to drive their polymerization results in a lower underground pH than that produced by conventional acid pre-treatments[1]: a major step backward with respect to environmental conservation. I realize that government agencies need to avoid regulating the state of the art, but conditions under which acrylates could be safely used as surfactants / flocculents / scale inhibitors / biocides in horizontal wells are difficult to imagine. However, this has not prevented their use, probably because they are less expensive than other slick water agents.

A different quaternary ammonium compound is probably a better alternative: erucyl bis(2-hydroxyethyl)methyl ammonium chloride (EHMAC), a viscoelastic surfactant / flocculant / scale inhibitor / biocide. Used as a 50% solution in 2-propanol[4], this agent appears to be only mildly toxic. However, sodium salicylate would be required as an additional stabilizer at the expected temperatures, and common brine formulations use calcium chloride – with an obvious intent of disposing of recovered fluid on roadways for ice control. I submit that the toxicity of this reagent mixture has not been sufficiently evaluated for its safety in any concentration to be left in our storm drains and roadside ditches.

Finally, I take issue with the statement on page 11 that "the fluid used for slick water fracturing is typically comprised (*sic*) of more than 99% fresh water"; it is <u>very</u> <u>misleading</u>. From 2 to 8 % of slick water fluid is composed of organic chemical additives[4]. Another 4 to 6% is inorganic salt[4], and proppant comprises from 1 to over 30%[1]. The truth is, in practically <u>no</u> instance that I could find is fracturing fluid *anywhere near* 99% fresh water.

2.1.2.1 Fluid Handling at the Well Site. Whether tanks or lined pits are used to manage flowback fluids, the high pressures associated with deep wells and incredible abrasiveness of these salt- and sand-laden fluids will pose major challenges to their control. Certainly, dikes should continue to

be required around all storage tanks. In addition, the use of proppants which are less abrasive than sand, such as low-density ceramic or plastic beads (which are also easier to suspend in fracturing fluid)[5] could possibly be encouraged by regulators.

2.1.2.2 Fluid Removal from Well Site and Ultimate Disposition of Returned Fluids. The idea of reusing or recycling drilling and fracturing flowback fluids makes a lot of sense, since those fluids are always handled as hazardous wastes. However, such recycling, if it is found to be technically feasible, will readily be adopted by producers as a major cost saving advance. Therefore, I recommend permitting the practice rather than requiring it.

I think that requiring producers to develop and report specific disposal plans is a very good idea, particularly if their plans include municipal waste treatment plants. In addition, I view keeping the DEC and local officials appraised of waste treatment options as an important corollary to this kind of regulation.

2.1.4 Natural Gas Production. I'd like to stridently caution that diffusers should never be used to concentrate the contents of pits prior to their reclamation, as has been done in other states. The aerosols produced have been convincingly implicated in inhalation injuries to livestock[6].

2.1.5 Well Plugging. In these times of financial insecurity and wild market fluctuations, I strongly recommend requiring that all operators be bonded.

In addition, I recommend treating pipes and equipment that are removed from wellbores as hazardous materials unless and until they are proven otherwise.

2.1.6 Well Density. I know it's the law of the land, but I am NOT HAPPY with compulsory inclusion, especially with the standard for mineral rights leasing as low as 60% of the extracted subterranean area.

Now, for anyone who lives or works nearby, the prospect of adjusting to multiple horizontal wells being drilled from a single pad is grim. But my greatest concern is with management of accidents or spills that occur at such a site. The sustained, intensive wear on infrastructure in the vicinity poses grave risks for compromised culverts, weakened bridges, degraded road surfaces, and other impediments to emergency service vehicles that may need access. These conditions themselves may precipitate accidents, possibly involving trucks hauling hazardous materials. The eventual benefit of fewer overall well pads may come at a high price indeed.

3.0 Geology. I am encouraged that you plan to evaluate Marcellus shale for naturally occurring radioactive materials (NORM), since the 1990 study referred to in the 1992 GEIS and its follow-up 1999 study[7] did not include a single sample from the Marcellus formation. From evidence reported in 2004[8], Marcellus shale is known to be significantly radioactive. Further, testing of homes in and near Marcellus, New York (site of the black shale outcropping from which this formation derives its name) revealed radon levels from 3½ to 7 times the state average: levels well above the EPA action limit[9]. Therefore, some elevated levels of NORMs should be expected for horizontal drilling operations. I urge you to evaluate the results of your current studies by Nuclear Regulatory Commission standards that call for exposure levels as low as reasonably achievable (ALARA), rather than by comparison to the extraordinary radiation levels associated with North Sea oil and gas extraction, as alluded to in the study[7] cited on p. 17 of the scoping document. Similar studies have not been carried out on Utica shales, and they should be. Further, effluents from all Marcellus and Utica shale wellbores should be monitored for radiation and the results should be documented as routine procedures.

I am alarmed at the large number of potential well site leases already signed in northern Otsego County. As mentioned above, Marcellus shale surfaces in Marcellus and along a line roughly traced by U.S. Route 20 eastward through Cherry Valley and on to Schenectady. Recent geological reports indicate that the formation dips to only 2000 feet beneath Otsego and Canadarago Lakes, and thence to approximately 3000 feet under Oneonta. Utica shale lies an average of 600 feet below Marcellus[10]. With cracks stimulated by hydraulic fracturing extending over 2000 feet[1], the assumed margin for groundwater safety that was attributed to the great depth and multiple impermeable rock layers lying between Marcellus and Utica shales and the surface breaks down in mid- to northern reaches of our county – and our neighbors as well. Their nearness to subsurface aquifers makes <u>any</u> <u>kind</u> of stimulation unsafe in view of hydrofracturing's unpredictability[11]. This siting issue was not included in Ch. 8 of the 1992 GEIS, and I strongly urge you to address it in the supplement.

4.1 Noise, Visual and Air Quality Impacts. In contrast with your scoping document's focus on well pad activities and appearances, I predict that the greatest visual impacts from horizontal drilling and high-pressure fracturing operations will arise from degraded roads, culverts and bridges in the areas of operation. Oil and gas producers typically repair roads *after* extraction operations are completed – if at all[12]. In view of the paucity of local legal frameworks for interacting with heavy industry, transportation problems will probably persist for years or decades, not weeks. Air quality impacts from the same sources should also be expected to persist, barring some miracle

of State intervention to rebuild local infrastructure. These specific concerns are essentially not addressed in Ch. 15 or 16 of the 1992 GEIS, or in this section of the supplement scoping document.

4.2.1 Water Withdrawals. Alternatives to fresh water use, such as water treatment plant effluents and cooling water might be welcomed by producers, but unused water from these sources would clearly not be suitable for disposal in our fresh water bodies. I urge stringent measures to prevent transmission of chemicals or organisms from one water body to another.

Successful use of saline aquifer fluids would depend substantially on the sophistication of chemists involved on-site in drilling and hydrofracturing operations. Therefore, I recommend case-by-case review of saline withdrawal for these purposes.

My greatest concern with water draw-downs has to do with their cumulative effects on water tables. As ground water subsides and is then recharged, the likelihood of circulating drilling fluids, fracturing fluids and other toxic wastes trapped in not-so-distant rock layers up into drinking water sources is multiplied with respect to relatively more stable water tables[2]. I found this issue addressed rather unconvincingly in the 1992 GEIS in the form of theoretical models for ground water movement (Appendix 3). In the absence of empirical data, I think that no conclusions (such as “poses no risk”) should be drawn with respect to such a momentous consideration.

4.2.3 Surface Water Quality. Chapters 9 and 10 of the 1992 GEIS deal with control of erosion in the vicinity of well pads, but do not discuss more widely scattered problems with byway culverts and bridges. As mentioned above, I view these as likely trouble spots with respect to visual and air quality, and certainly anticipate erosion-related surface water quality issues as well. Unfortunately, baseline values for aquatic chemistry or organisms, whether birds, fish, amphibians, reeds or benthic macroinvertebrates, are not to my knowledge available for most of our subwatersheds, and cannot realistically be generated in a time frame of months. Even so, I urge you to broaden the scope of your review to the wide-ranging problems of overtaxed infrastructure and the burdens they will impose on our surface waters.

4.8 Community Character. Not to negate the potential benefits of natural gas extraction in our region, I believe that you may have underestimated the deleterious influences of a large number of non-local workers (we don’t have major human resources in extraction industries here), increased illicit drug use and availability, and concomitant increased demands on law enforcement and medical professionals, which are widely reported in locales

where the scale of extraction proposed here has already taken place[13]. These influences should by no means be expected to resolve in a time frame of weeks or months. One mechanism the DEC might employ to prevent this looming descent into mayhem would be to coordinate the pace of well permits with police, judiciary and medical services, to limit their extra workloads to manageable levels.

5.1 Public and Local Government Participation. With participation of local government limited to regulating use of roadways and municipal water services, many of our town and village authorities appear to be poorly equipped for balancing the needs and interests of natural gas producers and local citizens. No comprehensive development plans are in place, nearly no byways have been evaluated for weight and other traffic limitations, few local ordinances exist to regulate bonding or cooperative agreements between townships and corporations, and our county representatives appear to be locked in the paralysis of analysis. Regionally, we're just not ready for the heavy industry of natural gas extraction from the Marcellus formation.

I sojourned for several years in the great State of West Virginia and grew to truly appreciate the unique culture there. Practically every local person I met possessed detailed knowledge of coal mining, and many individuals were employed by that industry. However, the benefits of their personal knowledge and private income failed to compensate for the regional destruction of communities, ecosystems and infrastructure. They learned too late how to manage an aggressive extraction industry without ruining some of their most precious assets, and they're still paying for their early mistakes today.

Amid the eager anticipation of bold new developments in our region that may have potential to rejuvenate our economy, increase our energy self-sufficiency and raise the national profile of Central New York, I am compelled to plead for a measured, deliberate plan of action that begins with a temporary (at least one year) moratorium on the Marcellus and Utica shale plays. However, this should not be viewed as a time for inaction, but rather, as an opportunity for citizens, state and local officials to collaborate on a course toward hosting the natural gas extraction industry more safely and effectively than has ever been done before. If you will choose such a course, no bells will ring and no reporters will notice, because they are much more attracted to calamity than to sanity. However, if you rush unduly into this scale of industry, we'll have plenty of excitement here, international exposure and a name for ourselves – but not one we would choose. They'll call us the New Appalachia.

Thank you for your attention.

Respectfully submitted,

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