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This memorandum comments on issues in the Revised Draft Supplemental Generic Environmental Impact Statement (RDSGEIS) and accompanying documents that address the social and economic impacts of high volume hydraulic fracturing (HVHF) proposed for New York. In preparing this memorandum, the key documents reviewed include:

- The 2009 scope of work for the SGEIS,
- Comments prepared by AKRF and other technical experts on the 2009 draft SGEIS,
- A report prepared by Sammons, Dutton and Blankenship (2010) in response to comments on the 2009 draft SGEIS analysis of socio-economic impacts,
- The RDSGEIS issued in September 2011 and particularly sections addressing social and economic issues (6.8 and 6.12) and mitigation (7.0), and
- The Economic Assessment Report (EAR) prepared by Environment and Ecology LLC to accompany the RDSGEIS.

These comments also draw on my own research on input/output models and community impacts and on research that has been done on the social and economic impacts of natural gas drilling in shale gas plays across the U.S. Other documents cited in this memorandum are included in the reference list at the end of this memorandum.

HVHF describes a stage in the gas extraction process whereby large amounts of water, toxic chemicals, and sand are injected at high pressure to create fissures in low-permeability formations and thereby allow the release of gas. The process is capital intensive, and throughout its duration, it poses significant environmental risks. The New York State Department of Environmental Conservation (NYSDEC or the Department) is charged with identifying and evaluating the impacts of gas development using HVHF, including both the benefits and the costs that will be borne by the communities and counties where drilling will occur and its associated infrastructure will be built. Although NYSDEC has included more information on the social and economic impacts of gas development using HVHF in the RDSGEIS than it did in the 2009 draft, the RDSGEIS still does not effectively assess those impacts or provide appropriate mitigation strategies.

These comments are intended to assist the NYSDEC in identifying areas of social and economic impact that require additional or revised research or analysis in the SGEIS. Part I focuses on the socioeconomic impact analysis set forth in section 6.8 of the RDSGEIS, which adopts the assumptions utilized in the EAR and summarizes its more detailed description of anticipated benefits from HVHF gas development. Part I. A pays particular attention to the model employed in the EAR and its assumptions about how the exploratory, drilling, production, and resource depletion phases of development will occur, especially the uncertainties and risks associated with HVHF gas development. Part I.B comments on particular issues and areas of impact addressed in the RDSGEIS. Part II discusses issues pertaining to the distribution of economic benefits that are raised

by the EAR but not addressed in the RDSGEIS. Part III comments on mitigation for potentially significant social and economic impacts.

Overall, the RDSGEIS is poorly organized to assess social and economic impacts. Social and economic topics are discussed in several sections of the RDSGEIS and statements are made in some sections that are contradicted by evidence in others. The differences between the social and economic impacts of vertical and horizontal drilling are not addressed in a systematic way. Critical assumptions underlying the socioeconomic impact analysis were accepted from industry sources (IOGA NY) without independent verification.

Substantive concerns include the following:

1. The assessment of economic benefits (jobs and taxes) relies on questionable assumptions about the amount of gas extractable in the New York portion of the Marcellus Shale. The range of estimates for extractable gas appears to be skewed to the high end, producing an overestimation of economic benefits.

2. The model used to assess social and economic impacts presents natural gas development as a gradual, predictable process beginning with a "ramp-up" period and then proceeding through a regular pattern of well development over time. Experience from Western US shale plays demonstrates that volatility and unpredictability are intrinsic to natural gas extraction, as operating companies assess their commercial options from one shale play to another or within one shale play and allocate rigs to respond to those options. The model used in the RDSGEIS is misleading, giving the impression that communities in the drilling regions will experience economic disruption only once, during a ramp-up phase, rather than periodically, as operating companies repeatedly enter and leave the region. The problems with the model are then compounded, as projected impacts on population, jobs, and housing are predicated on one-time ramp-up and adjustment phases rather than on a process in which rigs may move in, move out, and move in again, in an unpredictable sequence. Because many of the negative social and economic impacts of HVHF gas extraction (such as housing shortages followed by excess supply) are a consequence of unpredictable development, the model used in the RDSGEIS cannot appropriately assess those impacts. The limitations of the model should be explained with reference to the literature that describes the irregular, unpredictable course of natural gas development, including rig movement among shale plays and the frequency of re-fracturing wells.

3. The RDSGEIS does not assess public costs associated with natural gas development. A fiscal impact analysis of the base costs to the state and localities that will occur with any amount of HVHF gas development is required along with an estimate of how costs will increase and cumulate as development expands. Although some of the potential community character and economic costs associated with the projected drilling scenarios are mentioned in the RDSGEIS, there is no attempt to quantify those costs to the state or localities either as part of the modeling process or separately.

4. The long-term economic consequences of HVHF for the regions where production occurs are not addressed despite a widely recognized literature indicating that such regions have poor economic outcomes when resource extraction ends.

5. Mitigation of enumerated negative social and economic impacts of HVHF is presumed to occur by means of phased development and regulation of the industry, but no evidence or information is provided to indicate how that would occur. For example, NYSDEC proposes to ask operators to identify inconsistencies with local zoning and other comprehensive land use planning, but there is no explanation of how the inconsistencies will be addressed in the permitting process or regulatory system. All mechanisms that will be relied on to address adverse social and economic impacts need to be defined and incorporated into enforceable mitigation measures.

I. NYSDEC's Socioeconomic Impact Analysis

A. The Unpredictability of Natural Gas Production and How It Is Treated in the RDSGEIS

Natural gas drilling is a speculative venture and the commercially extractable gas from any particular well is uncertain. Because of the speculative nature of the industry, there are significant economic risks associated with natural gas production. These risks are magnified by the costs involved in natural gas development, which uses capital-intensive technologies such as those engaged in hydraulic fracturing.

The industry is organized in such a way that these risks can be lessened. For example, a limited number of rigs are available nationally, and they are deployed among and within natural gas plays based on calculations of well productivity and commercial return. The drilling labor force is not fixed to a place but moves with the rigs based on operator company strategies. Work is carried out by contractors on a project-by-project basis to maximize flexibility and efficient deployment of the specialized skills needed.

Because of the speculative character of commercial development of natural gas plays, there are uncertainties in how any shale gas play or portion of a play will be developed. What this means in practical terms is that the regions where shale gas development occurs can experience considerable volatility in the timing of well development and in the scale of well development (in the total number of wells). This central feature of natural gas development has critical implications for the economies of natural gas development regions. As production fluctuates, they may experience short- and medium-term volatility in population, jobs, revenues, and housing vacancies (Best, 2009; Headwaters Economics, 2011; Jacquet, 2009; Sammons, Dutton and Blankenship, 2010).

The EAR recognizes both production volatility and price volatility in the gas industry. In describing national drilling activity, the authors report: "The number of active gas drilling rigs fluctuated substantially over the decade, with the number of rigs in the most active quarter being 2.35 times the number in the least active quarter." (EAR, 2-2) In New York, "the average wellhead price for natural gas remained at relatively low levels in the 1990s, generally increased thereafter, reaching a peak in 2008, and then fell sharply in 2009." (EAR, 3-12).

The EAR also briefly mentions the difficulties that the unpredictability and volatility of natural gas development presents for predicting social and economic impacts (e.g., EAR, 4-59, 4-111). The model used to project socioeconomic impacts ignores those issues, however, and assumes instead that the HVHF natural gas development in New York will have a different pattern than that typically and historically associated with such development. Rather than occurring in irregularly recurring waves (or "boom-bust

cycles"), development in New York is assumed to be steady and predictable. The EAR's projections concerning population, jobs, housing, and revenue are predicated on the assumption of a regular, predictable roll-out of the exploratory, drilling, and production phases of the natural gas development process.

The RDSGEIS mentions the uncertainty and variation in well productivity in sections not addressing socioeconomic impacts (RDSGEIS, 2-5, 2-62, 2-74, 4-17), but section 6.8 of the RDSGEIS ignores those facts and the evidence of unpredictability in the pace and scale (timing and total well development) of natural gas development from New York counties with vertical well development and from other shale plays. Instead, it reports results from the model used in the EAR to project social and economic impacts from HVHF, assuming a regular, incremental, and predictable pattern of well development and production over a 60-year period, both on a statewide basis in three defined regions and under two development scenarios (low and average). Like the EAR, the RDSGEIS neglects the implications of variable well productivity and commercial viability -- critical considerations that will affect the pace and scale of drilling as well as its geographic distribution.

A1. Uncertainties Regarding Well Productivity

The RDSGEIS and accompanying EAR do not meaningfully recognize a central category of uncertainties that will affect the pace and scale of drilling – the uncertainties surrounding well productivity. Instead, NYSDEC states with respect to the low and average development scenarios analyzed:

> Both development scenarios assume a consistent timeline for development and production. Development is assumed to occur for a period of 30 years, starting with a 10-year ramp-up period. The number of new wells constructed each year is assumed to reach the maximum in Year 10 and to continue at this level until Year 30, when all new well construction is assumed to end.

(RDSGEIS, 6-209; emphasis added)

This approach is one of the major weaknesses of the RDSGEIS because the assumptions of a 30-year well production cycle and a sub-regionally consistent roll-out of wells that will move through the drilling and production phases over 60 years are not supported by evidence from other shale plays. In fact, there is sufficient evidence of precipitous decline in well productivity and the costs of HVHF relative to ultimate recovery to raise questions about why the 30-year development/60-year productivity profile was adopted (Berman, 2010; Berman and Pittinger, 2011; Hughes, 2011; Urbina, 2011). In an analysis of shale gas wells across shale plays, Berman and Pittinger (2011) found thousands of wells that dropped below commercially viable production between 5 and 12 years after initial drilling. The average commercial life of these wells was 8 years. NYSDEC cannot use only data provided by IOGA to construct the roll-out model; rather, it should obtain evidence and data from independent sources who do not stand to benefit from the projection of long-term, predictable resource development.

Another example of questionable assumptions that likely over-estimate potential gas extraction from the New York portion of the Marcellus Shale is presented in Tables 4-3, 4-4 and 4-5 of the EAR. Although ultimate recovery figures are not presented in the

EAR, they can be calculated based on the yearly production projections presented in 4.1.3 and the number of wells projected in 4.1.2.

The well productivity projections used in the EAR are considerably higher than the well productivity results from existing shale plays found by Berman and Pittinger (2011) . In addition,calculations of well productivity over the 60 year period produce ultimate recovery figures for the New York portion of the shale play that, in the medium and high scenarios, exceed most scientific estimates of ultimate recovery While the 29 Tcf low scenario (for 60 years) does not exceed the geologist Terry Engelder's estimate for NYS, it does appear to significantly exceed the implied USGS estimate for New York, especially considering that, "The Marcellus fairway in New York is expected to have less formation thickness, and because there has not been horizontal Marcellus drilling to date in New York the reservoir characteristics and production performance are unknown. IOGA-NY expects lower average production rates in New York than in Pennsylvania." (RDSGEIS 5-139)

In addition, as pointed out by a group of economists commenting on the EAR assumptions and methods (Barth, Kokkelenberg and Mount, 2011), the range of estimates of productivity are so large as to be meaningless. For example, estimates for well productivity during the 23rd year of production range from 600 billion to 3.6 trillion cubic feet, a variation on the order of 600%. Accuracy in these estimates is critical to derived estimates of tax and employment effects. As it stands, the estimates used in the EAR are no better than bloated "guesstimates".

The RDSGEIS should be updated to reflect the Energy Information Administration's revised estimates of natural gas in the Marcellus shale based on the USGS studies.

The estimates of well productivity need to be revised to more accurately reflect expert opinion of anticipated well productivity in the New York portion of the Marcellus shale. The use of IOGA's estimates as a sole source undermines the credibility of the EAR and the RDSGEIS.

The uncertainties associated with productivity of extraction from the Utica shale should also be discussed if Utica shale wells are to be included in the SGEIS analysis. The projections of numbers of wells to be drilled include those for the Utica shale but there are significant uncertainties about the productivity of the play, the geographic variation in liquid content across the play, whether the well spacing and fracture treatment would resemble that for the Marcellus and the technologies that would be used in Utica shale development (Yost, 2011). These unknowns are significant and indicate that Utica shale development may proceed differently than Marcellus shale development and utilize different technologies.

The unspecified inclusion of well numbers and productivity figures from the Utica shale raises questions about the extrapolated employment, housing and tax implications that are attributed to Marcellus shale development.

The questions raised about long-term well productivity argue for modeling a shorter-term development and production cycle. These questions are further substantiated by the common practice of re-fracturing wells to increase pressure and productivity. If re-fracturing is practiced in New York Marcellus wells, communities will be repeatedly subjected to the environmental disruptions associated with heavy industry.

At the very least the competing evidence concerning well productivity and the cost of recovery should have been discussed in the RDSGEIS to qualify assumptions concerning the production cycle and estimated ultimate recovery.

A2. Impacts of the Uncertainties Associated with HVHF Gas Development

Evidence from Western shale plays indicates that the volatile pace and scale of natural gas development drives many environmental and social and economic impacts (Best, 2009; Jacquet, 2009; Headwaters Economics, 2010). Impacts directly affected by the pace and scale of drilling include:

1) labor force needs and behavior (How much of the workforce remains transient rather than becoming local? A local labor supply cannot develop if gas development is unpredictable.)
2) demands placed on public services, including health facilities, public safety, and schools (Can communities adapt over time or are there unpredictable rises and falls in demand?)
3) community character impacts from increases in traffic, noise, construction disruption, and the transient population (Do these increases roll out in a regular fashion with the expectation that disruptive "ramp-up" will end or are they unpredictable over a long period of time?)
4) impacts on rural industries, such as tourism (Can the scale of noise and traffic be predicted to occur only for a short period or are disruptive activities likely to recur over a longer period of time, for example, with re-fracturing of wells?)
5) housing demand and cost (Will there be a periodic housing shortages with homelessness and lack of affordable housing for people on fixed incomes potentially followed by excess housing supply and falling home values?)

To illustrate: As well pad construction begins in an area, jobs increase along with housing construction and business development. A transient population (in addition to transient industry workers) migrates to the area because of the prospect of jobs, increasing the demand for housing and services, including education and health. For a variety of reasons (price of natural gas, availability of higher value opportunities elsewhere, rig availability) natural gas development may drop off in the area within five-ten years of this initial "ramp-up." Evidence from gas plays in Western states indicates that this drop-off may be sudden. In the wake of this drop in production and the number of drilling rigs in the area, the transient population leaves and resident communities are left without jobs and revenue. Local governments may still be paying the public costs of ramping up to respond to the initial "boom." If conditions change (rigs become available, prices rise) the rigs may return to the area, causing another production "boom" with all its attendant costs. This pattern is described by Spelman (2009) and is associated with a reluctance of business (other than the gas industry) to invest in regions characterized by boom-bust economies.

A contemporary example of such reluctance is contributing to the housing crisis in the Williston North Dakota Bakken Shale development. According to interviews conducted there: "Developers have been slow to build more apartments, largely because they got stung by the region's last oil boom that went bust in the 1980s" (MacPherson, 2011).

This volatile pattern is dramatically different from the scenario presented in the EAR and RDSGEIS. There, communities are assumed to be impacted by a boom only once (during "ramp-up") and are gradually able to adjust to natural gas drilling. Many of the economic benefits that the RDSGEIS and EAR associate with natural gas development are predicated on this gradual, regular development scenario. For example, the RDSGEIS assumes that as the industry "matures" in the region, local residents will be trained and hired for drilling jobs. If, as has been the case with vertical drilling in New York State and in the Western US shale plays, development follows a more irregular pattern, then the higher paid technical jobs are less likely to evolve into stable local employment. In addition, the jobs in ancillary industries (retail and services) are likely to disappear and reappear as rigs leave and re-enter the region at unpredictable intervals.

A3. Hot Spots, Socio-Economic Impacts, and Public Costs

In contrast with the model used in the RDSGEIS, natural gas development does not resemble a "manufacturing" process. Some wells will have long production phases; others will have dramatic declines in productivity after a relatively short period. Well productivity may be uniformly low across a region, or there may be long-term well productivity in particular "hot-spots." The question of how many wells will exhibit long-term productivity and where they will be located is unknown before exploratory drilling takes place and, even then, well productivity will be unpredictable.

The RDSGEIS admits that its socioeconomic analysis is based on average well productivity (RDSGEIS, 6-210), but the production process in natural gas (pace and scale) is not effectively captured using averages. The uncertainties in the geographic extent of drilling and the potential for intensive development in "hot spots" have implications for social and economic impacts. For example, if drilling is concentrated in particular locations rather than rolled out uniformly across sub-regions of the landscape for 60 years (as is modeled in the RDSGEIS and EAR), wealth effects and tax revenues also will be concentrated in particular localities. The social and economic costs of spatially concentrated drilling, however, will be experienced across a much wider geographic area, because public services will be required in areas without HVHF development (and therefore not receiving tax revenues from drilling) but close enough to serve the transient population associated with the industry. There is no attempt to address this likely unbalanced distribution of impacts in the RDSGEIS.

Contrary to the contention that the regularized development model "does not significantly affect the socioeconomic analysis" (RDSGEIS, 6-209), smoothing out the unpredictability and unevenness of development in fact covers up many of its negative cumulative social and economic impacts, for example, localized truck traffic or impacts on public services. The RDSGEIS admits that steady, constant well construction is "unlikely" (*id.*), but it fails to analyze the implications of this admission and offers no description of evaluation of the adverse impacts of temporally and spatially uneven development.

Finally, the RDSGEIS does not sufficiently model the resource depletion phase of the exploration, drilling, production, and resource depletion cycle and its implications for local and regional economies. Figure 6.13 (RDSGEIS, 6-215) shows the drop in direct and indirect employment following resource depletion. This depiction needs to be accompanied by analyses of how the resource depletion phase will be reflected in royalty payments and tax revenues.

A4. Socioeconomic Impact Analysis Can Accommodate the Uncertain Pace and Scale of Gas Development

It is difficult to model the unpredictable pace and scale of natural gas production, but that difficulty is no excuse for ignoring adverse social and economic impacts of the industry. Those impacts have been documented in relation to the phases of production and resource depletion, recognizing company strategies that produce economic volatility in the resource extraction regions (Jacquet, 2009; Kelsey, 2009; Sammons, Dutton and Blankenship, 2010).[1] If the impacts of volatility are to be mitigated, their prevalence in natural gas extraction regions needs to acknowledged in the SGEIS.

The precautionary principle indicates that, in cases where it is not possible to model specific cause-effect relationships (such as the relationship between well development and public costs), but where there is evidence of potential adverse impacts, those impacts should be recognized and documented. This approach is illustrated in the approach taken by Sammons, Dutton and Blankenship (2010) in the report commissioned by NYSERDA to describe socioeconomic impacts that can be anticipated with HVHF. NYSDEC needs to quantify known social and economic costs even if their occurrence cannot be synchronized with their scenario model of development. This quantification can be accomplished through examination of comparable cases of impact, a standard method used in fiscal impact analysis (Kotval and Mullin, 2006).

B. NYSDEC's Analysis of Specific Socioeconomic Impacts: Model Assumptions and the Use of Representative Regions

The RDSGEIS, presents only a fraction of the material contained in the EAR and acknowledges: "A more detailed discussion of the potential impacts, as well as the assumptions used to estimate the impacts, is provided in the Economic Assessment Report, which is available as an addendum to this RDSGEIS" (RDSGEIS, 6-207). In this section (B) of my comments I begin with questions and concerns regarding the assumptions underlying the model used to project impacts of HVHF in New York State. These comments focus particularly on the use of representative regions to project impacts throughout New York State, including those for Utica shale gas drilling.

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[1] From Sammons, Dutton and Blankenship (2010):

> Several recent studies address (social and economic) aspects of natural gas development in the western U.S. They include the *Northwest Colorado Socioeconomic Analysis and Forecasts* prepared for the Associated Governments of Northwest Colorado and the *Sublette County Socioeconomic Impact Study: Phase I Final Report* and *Phase II Final Report,* prepared for the Sublette County, Wyoming Board of County Commissioners. A third report, the *ExxonMobil Piceance Development Project Environmental Assessment - Socioeconomic Technical Report,* prepared by the authors for the U.S. Bureau of Land Management White River Field Office, assesses potential effects of a specific natural gas project in the context of ongoing large scale natural gas development in northeastern Colorado. A more recent journal article, *Energy Boomtowns & Natural Gas: Implications for Marcellus Shale Local Governments & Rural Communities,* published by the Northeast Regional Center for Rural Development, describes a model for impact assessment, presents a case study describing Sublette County's experience with large scale natural gas development and discusses some possible implications for Marcellus Shale development.

In section C I comment on RDSGEIS section 6.8, which assesses specific social and economic impacts anticipated with HVHF natural gas drilling.

B 1. The Use of Representative Regions

The EAR and RDSGEIS define three representative regions for the socioeconomic analysis, with Region A representing counties accounting for a high percentage of overall well development, Region B representing counties with about half the development of Region A, and Region C representing counties not expected to have much production but with a history of drilling. In the RDSGEIS, characteristics from Region C are used to make assumptions about socioeconomic impacts in other New York State regions where drilling may occur. For example, tourism impacts are assumed to be minimal for all regions based on the continued presence of a tourism industry in Region C.

The use of a set of Southern Tier counties to represent counties in New York that may experience HVHF shale gas drilling (EAR 6-217) raises concerns about the representativeness of these counties. The EAR and DECNYS need to provide evidence (in industrial composition, growth rates, and population composition) supporting the assumption that these counties are "representative" of all the counties that may experience drilling.

The EAR indicates that it addresses "local" impacts but there is no analysis below the county scale. Analysis of differential economic impacts in urban and rural areas, for example, is critical to understanding the total economic impact picture For example, counties in Region A in the EAR scenario analysis include both urban areas such as the Binghamton MSA and rural areas where tourism and agriculture are the primary industries. Urban areas will garner more expenditures from natural gas drilling in the region but are also likely to have negative impacts in the form of increased crime and demand for health services (because of their location in the urban areas). Rural areas will experience intense impacts on their small rural communities, including demand for housing and increases in road damage as well as potential negative effects on agriculture and tourism. These local impacts and how the distribution of costs and benefits will be distributed need to be assessed separately.

B 2. The Use of a RIMS Input-Output Model to Assess Social and Economic Impacts

A central component of the EAR consists of a Regional Industrial Multiplier System (RIMS) model developed by The Bureau of Economic Analysis (RIMS or The Regional Industrial Multiplier System). The purpose of the model is to deduce direct and indirect economic impacts of new expenditures in a region. This type of model is very limited in the types of impacts it can assess. It is typically used to estimate some economic impacts but is not useful to assess the wide range of social impacts that have been identified as occurring with HVHF shale gas drilling. So, for example, the model can be used to derive population increases and then, to crudely extrapolate potential housing demand. It cannot tell policy makers anything about the impact of housing demand on different population segments or on community character, both of which are social impacts.

A model of this type is completely dependent on the assumptions about the source of expenditures in the region. For example, in the case of HVHF, the creators of the model have to make assumptions about where the labor force hired in the drilling phase will spend the money they earn -- in the drilling region or in their home states? These assumptions are critical to the model results and should be available to anyone who wants to analyze the accuracy of the model.

This type of model is useful for comparing different types of investments and for examining inter-industry linkages but it has a significant drawback as the central model for the RDSGEIS analysis of socioeconomic impacts, because it can measure economic benefits only. The results of this kind of model will always be positive because the model begins with the inflow of expenditures in the region. If the modelers had examined new expenditures flowing into the region's tourism or agricultural sectors, those, too, would be positive. The model provided in the RDSEIS does not allow us to assess opportunity costs, that is to compare the economic impacts of shale gas drilling with potential increased investments and expenditures in other industries. Because the RIMS input-output model and the associated scenario approach cannot address the costs of HVHF, the model does not provide information on impacts that require mitigation. The reasons for using this approach rather than one that addresses costs as well as benefits needs to be laid out in the SGEIS.

The presentation of the model results in the EAR is neither useful nor informative. Much of the text is devoted to tables presenting mechanical calculations. These tables should have been relegated to an appendix and the body of the report used to lay out and support the assumptions that underlie the calculations.

In December 2011, the consulting firm that developed the EAR was asked to evaluate costs associated with HVHF in New York State. Given the inadequacies of the EAR model and the significance of local and state costs to decisions about shale gas drilling in the state, there should be an opportunity for public review and comment on the revised EAR findings regarding costs before the SGEIS is published.

C. NYSDEC Analysis of Selected Social and Economic Impacts

In this section (C) I comment on RDSGEIS section 6.8, which assesses a set of selective impacts among the many social and economic impacts anticipated with HVHF natural gas drilling. These include: (1) economy and employment, (2) population, (3) housing, (4) government revenue and expenditure, and (5) environmental justice. I conclude this section with comments on material presented in the EAR that is not discussed in section 6.8 but which is relevant to the RDSGEIS findings regarding social and economic impacts.

C1. Economy and Employment

Because of the project-based nature of the drilling phase of natural gas production (rigs and crews move from one place to another and activities are carried out at each well) and its capital intensity (labor is a small portion of total production costs) the oil and gas industry is not likely to be a major source of jobs in New York (Jacquet, 2009). Although the industry points to years of drilling experience in New York, the oil and gas industry employed only 362 people in New York State in 2009 (0.01% of the state's total employment) (EAR, 3-7). 43% of those workers (157) were employed in Region C, the region where vertical natural gas drilling is most significant in New York. Wages for these workers composed 0.04% of the wages in the two-county region (EAR 3-31), with almost 4,000 active gas wells (EAR 3-31).

The employment multiplier projected for New York State (2.1766) is exceptionally high, especially for investment from a capital-intensive industry. (A 2.0 multiplier is considered generous by most regional economic analysts.) This attests to a need to make the assumptions underlying the model transparent. For example, do the creators of the model assume that expenditures on real estate development resulting from the HVHF drilling will accrue disproportionately to New York state firms? If so, why?

Finally, the employment figures presented in Table 4-8 are "full–time-equivalent" (FTE) jobs. They are a composite of part-time and full-time jobs that might be developed from the 410 job activities associated with constructing and drilling a well and from the subsequent production phase. These may not be new jobs but existing jobs required to sustain industry activity. They also do not correspond with what the ordinary person thinks of as a job – a person employed full-time to carry out certain tasks. The emerging information on actual employment created in Pennsylvania in conjunction with Marcellus drilling shows much smaller numbers than the input-output models projected. Because unrealistic and overly optimistic assumptions made in constructing the models may overstate economic benefits, assumptions underlying this RIMS model need to be available for scrutiny.

Finally, the EAR does not provide sufficient context for evaluating the employment impact of HVHF in the state. Projected employment in HVHF should be compared with that in other New York industries, including tourism, to place the numbers in perspective. Projected increases in employment in these other industries should be provided to enable comparison and to estimate costs and benefits of permitting HVHF.

Having described in detail the modeled economic and employment growth from the gas industry, the RDSGEIS then mentions the potential adverse impacts on existing industries in the regions where natural gas development will occur. In a bare two paragraphs, the RDSGEIS admits:

> Conversely, some industries in the regional economies may contract as a result of the proposed natural gas development. Negative externalities associated with the natural gas drilling and production could have a negative impact on some industries such as tourism and agriculture. Negative changes to the amenities and aesthetics in an area could have some effect on the number of tourists that visit a region, and thereby impact the tourism industry. However, as shown by the tourism statistics provided for Region C, Cattaraugus and Chautauqua Counties still have healthy tourism sectors despite having more than 3,900 active natural gas wells in the region.

> Similarly, agricultural production in the heavily developed regions may experience some decline as productive agricultural land is taken out of use and is developed by the natural gas industry.

(RDSGEIS, 6-230)

In contrast with the pages of projected benefits from gas development, the RDSGEIS offers no detailed description and no quantitative analysis of the effects of HVHF on existing industries and the associated impact on the State of New York's economy. This omission is particularly important for the counties defined in the EAR as "representative" because industries, including agriculture and tourism, are significant employers in those counties and are important to the overall economy of the State. There is no analysis of how the "crowding out" of existing industries may impact the regional or statewide economy or of the implications of the loss of industrial diversity to the long-term prospects for regional economic sustainability. The inadequate assessment of the impacts on existing industries in the region that will be affected by HVHF drilling is problematic not only because the state does not have adequate information to assess costs and benefits of HVHF gas development but because negative impacts on industries such as tourism and agriculture, including dairies and wineries, will contravene other state investments intended to support those industries. Given the importance of these industries in the state and regional economy, the evidence that they will be negatively affected by HVHF should be analyzed in detail and quantified when possible.

Tourism. Nearly 674,000 New York jobs were sustained by tourism activity last year with total income of $26.5 billion. 7.9% of New York State employment is sustained by tourism, either directly or indirectly. New York State tourism generated $6.5 billion in state and local taxes in 2010.

Tourism in the Southern Tier counties includes a wide range of activities, from visits to the Corning Glass Museum to hiking, hunting, and fishing in the rural areas. The Southern Tier Central (STC) Planning District, which includes one "fairway" county, Chemung (in Region A in the RDSGEIS analysis), has published a study indicating that:

> In 2008, visitors spent more than $239 million in the STC region across a diverse range of sectors. The tourism and travel sector accounted for 3,335 direct jobs and nearly $66 million in labor income in the STC region that year. When indirect and induced employment is considered, the tourism sector was responsible for 4,691 jobs and $113.5 million in labor income. In addition, the travel and tourism sector generated nearly $16 million in state taxes and $15 million in local taxes, for a total of almost $31 million in tax revenue -- a tax benefit of $1,181 per household.
>
> (Rumbach, 2011, page 1)

Tourism is thus a significant contributor to the counties in New York potentially impacted by HVHF. The tourist opportunities and activities also contribute to the quality of life of local residents and attract companies in other sectors, such as manufacturing. The RDSGEIS makes no effort to quantify the value of tourism that may be adversely affected by gas development but rather dismisses any impacts as insignificant.

NYSDEC's use of Chautauqua and Cattaraugus Counties as the basis for contending that tourism will not be significantly impacted in New York is not persuasive. First, the evidence offered for the judgment that those counties have "healthy tourism sectors" (RDSGEIS, 6-231) consists of nothing more than the statement that: "In 2009 wages earned by persons employed in the travel and tourism sector in Chautauqua and Cattaraugus counties (Region C) were approximately $77.5 million, or about 3.0% of all wages earned in Region C" (NYSDOL 2009b*)* (see Table 3-37)." (EAR 3-27) Without a comparison over time with similar counties without natural gas development, it is impossible to determine whether shale gas drilling has negatively impacted the tourism sector.

The contention that those counties represent a tourism success story is contradicted by data presented in the EAR, which shows that from 2007 to 2009, Region C tourism employment declined 17%, and wages declined 13% (EAR, 3-28). While a portion of this decline might be attributable to the recession, there is no justification for describing waning tourism in the region as "healthy."

The EAR also conflates access to private recreational land for purposes of hiking, hunting, and fishing with the success of commercial tourism businesses. The relationship between personal recreational opportunities and natural gas development is presented as one of personal trade-offs in terms of land use. The negative impacts on the options of non-land owning recreationists are mentioned but not addressed. (EAR 4.58)

There is growing evidence regarding negative effects of shale gas drilling on tourism in the counties where shale gas drilling takes place (Rumbach, 2011).

> Evidence from other shale plays in the Western U.S. indicates that natural habitat tourism (whether hunting, fishing, birding or hiking) may be disrupted for long periods of time and in some cases where infrastructure, such as compressor plants and pipelines, disrupts habitats, may be permanently altered.

(Sammons, Dutton and Blankenship, 2010) Negative impacts derive not only from the loss of habitat for outdoor sports but also from the "crowding out" of tourism activities (because of increasing prices in the drilling region and the loss of hotel spaces to gas industry workers) and from the impact of regional industrialization on the tourism brand. For example, tourism centers in Upstate New York, such as the Finger Lakes wineries, may experience losses when tourists looking for a rural retreat find themselves driving through an industrial region with heavy truck traffic and shift their allegiance to quieter and more accessible vacation spots. In addition, the RDSGEIS does not assess the impacts on tourism from degradation of historical and cultural assets.

Rumbach's assessment of HVHF on tourism is that:

> ….individual impacts are unlikely to have serious and long-term consequences, but without mitigation, cumulatively they could do substantial damage to the tourism sector. Examples of such impacts include strains on the available supply and pricing of hotel/motel rooms, shortfalls in the collection of room (occupancy) taxes, visual impacts (including wells, drilling pads, compressor stations, equipment depots,

> etc.), vastly increased truck and vehicle traffic, potential degradation of waterways, forests and open space, and strains on the labor supply that the tourism sector draws from. All told, the region's ability to attract tourists could be damaged in the long-term if the perception of the region as an industrial landscape outlasts the employment and monetary benefits of gas drilling.

(Ibid, page 2) The RDSGEIS fails, however, to address the long-term costs associated with displacing business in existing industries, such as tourism, that provide economic diversity in the regional economy and thus increase its prospects for sustainability.

Agriculture. Potential negative impacts on agricultural production and land use are noted but their impact is not assessed nor are any mitigation measures indicated. (RDSGEIS 6-231) There is no analysis of whether and how HVHF will affect sub-sectors of agriculture, such as dairy farming, which are of key importance in the New York economy.

Recent evidence from Pennsylvania indicates that agriculture and particularly dairy farming may be significantly affected by drilling activity. For example: "(Bradford) county's dairy herd has decreased over the last decade from 30,000 head in 2002 to just under 20,000 head today. Another 15 dairies have been sold since the beginning of the year (2011.)" (Tomes 2011). Although evidence from Pennsylvania is anecdotal, there is sufficient information to indicate that one of New York's major industries will be negatively affected by HVHF gas drilling.

Dairy farms are decreasing both because some farmers have another source of income and because costs for dairy farmers are going up as a consequence of the impact of the drilling economy in the county. For example, competition for truck drivers is raising cost for dairy farmers to transport their milk to processors. In addition to the impacts on the dairy farms themselves, the infrastructure that supports dairy farming in Bradford County is being affected. For example, an agricultural equipment dealer in the County has gone out of business because of an inability to hire and retain a workforce (Tomes, 2011).

There are also land use impacts affecting farmers, including impacts not only from the well pads but also from the ancillary industrial facilities, such as "laydown yards" (operations and storage sites), pipelines, and compressor stations. (Tomes 2011).

The American Farmland Trust (2011) has submitted comments on the RDSGEIS that summarize its expert assessment of the impact on agricultural production in New York State:

> …the DEC's analysis of the impacts of drilling and hydraulic fracturing to agricultural land is inadequate and encourages specific analysis of the likely impacts of such activities to agricultural land resources. The SGEIS analysis should consider the scale of farmland likely to be converted by both direct drilling activities and the off-site drilling support services and other types of residential and commercial development that is anticipated as a result of natural gas drilling. In addition, it should consider the impacts of such activities to agricultural land values and on the ability of

New York farmers to maintain their competitiveness in a global economy.

Upstate New York is currently experiencing resurgence in its food processing industry, and the State Agricultural and Markets Program has a stated policy of encouraging more dairy production in the state. In July 2011, the State of New York provided $16 million in incentives to a dairy processing company in Chenango County in Central New York. According to a statement by Governor Cuomo: "Agro Farma's expansion in Chenango County will create hundreds of new jobs and increase the demand for milk from New York dairy farms," (Press release available at: http://www.governor.ny.gov/press/07212011DairyProductsCompany)

The support from New York's Empire State Development Corporation reflects the significance of this industry to the regional and state economy. Milk and other dairy products account for more than half the total value of agricultural products sold in New York State, accounting in $2.2 billion in receipts in 2010. According to the US Department of Agriculture, New York ranks third in the US in production and sale of dairy products. Certainly the size and importance of this industry to the New York economy warrants a full analysis of how production and producers will be impacted by HVHF.

Instead, the RDSGEIS lacks an economic assessment of how temporary and long-term agricultural costs and productivity will be affected by HVHF development. This assessment should include labor costs (from competition for truckers, for example) and impacts on specialty agricultural producers, such as organic farmers. New York State has the fourth largest number of organic farms in the U.S.

The Finger Lakes wineries, combining agriculture and tourism and an important subset of New York industries, may also be affected by HVHF in Upstate New York. New York State ranks third nationally in grape production. Tourists visiting the wineries may not want to drive through industrial development and its associated truck traffic in order the reach the wineries even if the wineries are not locally impacted by the drilling process. Given the importance of this industry to the Upstate New York "brand" and the investment of State resources to build the industry, the SGEIS needs to separately address the impacts on this industry and develop mitigation policies to address any negative impacts.

Manufacturing. Finally, the RDSGEIS and the EAR focus exclusively on impacts on agriculture and tourism because the use of land for those industries potentially competes with use of land for gas development. Focusing on that competition may make sense for the largely rural representative regions defined in the EAR, but it does not make sense for representative regions with more diversified economies, including substantial manufacturing. A report by the New York State Comptroller's office in 2010 shows that the Southern Tier has 14% of the Upstate manufacturing. Manufacturing should be included in the assessment of impacts on existing industries, because of its significance in Region A and because gas development will affect the labor supply and industry wage rates in counties where manufacturing plays a significant role in the economy.

C2. Population

The RDSGEIS and EAR do not address population impacts on community services, such as schools and health, but only population as it relates to employment and the labor market. The EAR assumes that, for the first 30 years, the population increases in

counties that "host" natural gas drilling will be modest. It notes, for example:

> [A]ctual population impacts may also be less than what is described in the following section because currently unemployed or underemployed local workers could be hired to fill some of the construction and production positions, thereby, reducing the total in-migration to the region.

(EAR 4-59)

By focusing only on population changes directly related to gas industry employment, the RDSGEIS avoids addressing the potential for long-term population decline beyond the loss of industry workers. Many areas with significant natural gas drilling lose population over time. That has been the case with Chautauqua and Cattaraugus counties (Region C) in New York. There was no attempt to look at actual population trends in such counties and whether they reflect a decline in economic diversity that makes population levels less sustainable. An analysis of the long-term population trends in shale gas drilling counties in the US is necessary to determine the impact of HVHF on New York counties. A projection based on labor demand is not sufficient.

The RDSGEIS assumes a gradual (rather than disruptive) integration of the unemployed population in the region and of transient workers into the labor force required in the industry. Experience from other states, however, contradicts the assumption of easy integration of the resident workforce and of newcomers to the regional labor force. "In areas of Pennsylvania where Marcellus shale drilling activity is occurring, it has been difficult at times to accommodate the influx of new workers." (Kelsey 2011) The potential for a low-skilled, transient workforce to migrate into the area is not considered although there is evidence from Western shale plays that this occurs, and is particularly likely with high national unemployment rates.

> [B)ecause labor markets are imperfect, and the availability of a relatively large number of jobs may result in an influx of job seekers, some of whom lack necessary skills and qualifications and may be relatively indigent. To the extent that indigent job seekers are unable to find jobs or do not have resources to secure housing and transportation to work; they can become a burden for local human service agencies. This situation can be exacerbated by weak economic conditions in other parts of the state or country.

(Sammons, Dutton and Blankenship (2010): page 13)

The RDSGEIS cannot just ignore this evidence of adverse economic impacts.

C3. Housing and Property Values

The potential impacts on the housing supply, housing costs, and housing financing are inadequately addressed in the EAR. The report assumes that the current housing stock would be used to house any workers who move to the production region on a "permanent" (more than one year) basis. (EAR, 4-107 (concluding "the impact on the supply of permanent housing units would be negligible at the statewide level during the production phase"). Given the quality and age of the housing stock in the region,

evidence from Pennsylvania indicates that it is likely that there will be a demand for new single-family housing (Kolb and Williamson, 2011). This new housing stock will create new and additional construction jobs, increasing population pressure, accelerating the "boomtown" phenomenon. This housing may also contribute to sprawl around urban population centers such as Binghamton. When drilling ceases, either or temporarily or permanently, the value of this new housing is likely to plummet (Best, 2009).

With respect to temporary housing, the EAR (EAR 4-111) admits:

> "In areas of Pennsylvania where Marcellus shale drilling activity is occurring, it has been difficult at times to accommodate the influx of new workers (Kelsey 2011). There have been reports of large increases in rent in Bradford County, Pennsylvania, as a result of the influx of out-of-area workers (Lowenstein 2010). There have also been "frequent reports" of landlords not renewing leases with existing tenants in anticipation of leasing at higher rates to incoming workers, and reports of an increased demand for motel and hotel rooms, increased demand at RV camp sites, and increases in home sales (Kelsey 2011). Such localized increases in the demand for housing have raised concerns about the difficulties caused for existing local, low-income residents to afford housing (Kelsey 2011)."

If communities add substantial temporary, short-term housing or single-family housing to accommodate development-phase workers, surplus capacity may exist in all these types of units after development is completed. Based on evidence from other shale gas plays, this impact is likely (Best, 2009; Sammons, Dutton and Blankenship, 2010).

The EAR (EAR, 4-111) also acknowledges the potential impact of the volatility of the production cycle on the housing market and property values:

> The demand for housing, both temporary and permanent, would be expected to change over time. The demand for housing would be the greatest in the period during which the wells in an areas are being developed, and demand would decline thereafter. This would create the possibility of an excess supply of such housing after the well development period (Kelsey 2011). If well development in a region occurs in some areas earlier than in others, then housing shortages and surpluses may occur at the same time in different areas within the same region.
>
> The natural gas market can be volatile, with large swings in well development activity. Downswings may cause periods of temporary housing surplus, while up-swings may exacerbate housing shortages within the regions.

<u>The social and economic impacts of unpredictable shortfalls in housing followed by periods in which there is an excess supply are not addressed.</u> A recent study of the impact of HVHF in Pennsylvania indicates that impacts on the housing supply are significant, especially for people at the economic margins. (Williamson and Kolb, 2011) These impacts pose environmental justice concerns and require mitigation strategies.

With respect to property value, the EAR authors found that having a well on a property was associated with a 22% reduction in the value of the property; that having a well within 550 feet of a property increased its value; and that having a well located between 551 feet and 2,600 feet from a property had a negative impact on a property's value. Thus,

> …not all properties in the region would increase in value, as residential properties located in close proximity to the new gas wells would likely see some downward pressure on price. This downward pressure would be particularly acute for residential properties that do not own the subsurface mineral rights (EAR, 4-114).

The EAR authors attributed the positive impact on property values of having a well located within 550 feet of a property to the prevention of further gas well development in that area due to a spacing order and setback conditions that prevented well drilling close to existing wells.

The assertion in the EAR that property owners in the drilling region would see an overall increase in property values is based on increased demand and economic activity. Evidence from Pennsylvania and from Western Shale plays indicates that this demand may not occur in the county or locality where the drilling is occurring (Patton et al, 2010).

The assumption of recovering property values after the completion of HVHF does not take into account the potential for re-fracturing of wells to increase their productivity or the effects of waves of development in which drilling moves into an area. The prospect of industrial activity is what drives down investment in regions open to boom-bust development and also negatively impacts property values (Spelman, 2009). A more definitive analysis of impacts of on property values, including mortgage availability, in regions affected by drilling is needed.

C 4. Government Revenues and Expenditures

The RDSGEIS assumes, based on the RIMS model, that economic benefits from HVHF, presumably including benefits to revenue, will be substantial, but there is no fiscal impact analysis or cost-benefit analysis to substantiate that assumption. A fiscal impact analysis is required, given that:

(1) Many purchases by drilling companies are tax exempt. (EAR 4-116)

(2) Costs to the State that will reduce tax revenues are not calculated. For an example of this problem, see the discussion of rail infrastructure in the RDSGEIS section on transportation impacts. The provision of tax rebates to railroad companies and to industry facilities represent lost revenue to the State and the locality. The EAR admits that in addition to tax benefits, "such as expensing, depletion, and depreciation deductions," which reduce taxable income, "New York State offers an investment tax credit (ITC) that could substantially reduce most, if not all, of the net income generated by these energy development companies." (EAR 4-115 to 4-116)

(3) Substantial negative fiscal impacts are detailed in the EAR:

> High-volume hydraulic fracturing operations would also result in some

> significant negative fiscal impacts on the state. The increased truck traffic required to deliver equipment, supplies, and water and sand to the well sites would increase the rate of deterioration of the state's road system. Additional capital outlays would be required to maintain the same level of service on these roads for their projected useful life. Depending on the exact location of well pads, the state may also be required to upgrade roads and interchanges under its jurisdiction in order to handle the additional truck traffic. The potential increase in accidents and potential additional hazardous materials spills resulting from the increased truck traffic also would require additional expenditures. Finally, approval of transportation plans/permits would place additional administrative costs on the New York State Department of Transportation. (EAR, 4-116)

There are now numerous studies available to calculate road damage, and the counties in the "fairway" in New York State have undertaken baseline studies that would enable accurate calculation of the costs of road damage. (Randall, 2011) There is plenty of expertise available in the state to draw on, including Cornell Local Roads program, which has completed a thorough analysis of the kind of damage and what it would cost to repair. This knowledge regarding public costs and fiscal impacts should be reflected in the SGEIS (Ibid.).

The EAR also recognizes:

> Additional environmental monitoring, oversight, and permitting costs would also accrue to the state. In order to protect human health and the environment, New York State would be required to spend substantial funds to review permit applications; to ensure that permit requirements were met, safe drilling techniques were used, and the best available management plans were followed; and to provide enforcement against violations. In addition, the state would experience administrative costs associated with the review of well permit applications and leasing requirements and enforcement of regulations and permit restrictions. All of these factors could result in significant added costs for the New York State government.
>
> The New York State Department of Health would also incur additional costs due to the need to provide additional technical support and oversight services to local governments that would monitor water quality in local drinking water wells. (EAR 4-116)
>
> In addition to the positive fiscal impacts discussed above, local governments would also experience some significant negative fiscal impacts as a result of the development of natural gas reserves in the low-permeability shale. As described in previous sections, the use of high-volume hydraulic-fracturing drilling techniques would increase the demand for governmental services and thus increase the total expenditures of local government entities. Additional road construction, improvement, and repair expenditures would be required as a result of the increased truck traffic that would occur. Additional expenditures on emergency services such as fire, police, and first aid would be expected as a result of the increased traffic and construction and production

> activities. Also, additional expenditures on public water supply systems may be required. Finally, if substantial immigration occurs in the region as a result of high-volume hydraulic fracturing operations, local governments would be required to increase expenditures on other services, such as education, housing, health and welfare, recreation, and solid waste management to serve the additional population. (EAR 4-138).

The RDSGEIS mentions public costs associated with the increased demand for community social services, police and fire departments, first responders, schools, etc. but makes no attempt to calculate the costs and consider them in the context of a fiscal impact assessment. Experience in other shale gas plays demonstrates that these costs are likely:

> Natural gas development and production-related activities and the incremental population associated with those activities will generate demand for the full range of local government facilities and services and for some state government services. For example, during exploration and moderate stages of development, demand is usually limited to law enforcement, emergency response, emergency medical and road and highway maintenance and traffic control. Traffic, vehicle and industrial accidents and issues associated with a single-status, predominately working-age male workforce are the primary drivers associated with emergency response and law enforcement increases. Because many workers are temporary, and do not have local general purpose health care providers, they commonly use hospital emergency rooms for what would be otherwise be routine health care visits.

(Sammons, Dutton and Blankenship, 2010, page 19) These costs may occur even if the amount of commercially extractable natural gas does not reach projected levels. They need to be calculated both in terms of the baseline costs that are likely to occur with any drilling activity and in relation to varying levels of drilling activity.

Addressing the variability is important because the distinct community character impacts attributable to large-scale development have been identified and documented in other shale plays[2]: For example:

> …some areas that experience large scale development have reported substantial increases in a variety of crime and social problems including alcohol and drug-related offenses, traffic offenses, disturbances, assaults and domestic conflicts. Although some increases in crime and social problems would be anticipated to accompany any increase in population, some researchers have also attributed the increased levels of crime and social problems to the temporary and transient nature of the workforce

[2] *See* Sublette County Socioeconomic Impact Study Phase I Final Report. Ecosystem Research Group. January 2008. Pages 54 – 58 and Index Crimes, Arrests, and Incidents in Sublette County 1995 to 2004: Trends and Forecasts. Prepared by J. Jacquet. Sublette County, Wyoming. April 2005, *available at:* http://www.sublettewyo.com/DocumentView.aspx?DID=351. Local Social Disruption and Western Energy Development: A Critical Review. Wilkinson et.al. Pacific Sociological Review Volume 25. July 1982. *Available at:* http://www.sublettewyo.com/archives/42/Local_Social_Disruption__Critical_Review_Response_and_Commentary[1].pdf.

> and their living conditions. There has been some debate in the social impact assessment literature about whether or not crime and other adverse social indicators increase at higher rates in communities experiencing large-scale development than average rates for all communities. But the implications are clear that increases in crime and social problems are likely with large-scale development, even if they are proportionate to the increase in the numbers of people working and living in affected communities.

(Sammons, Dutton, and Blankenship, 2010)

Given the scale of development being projected, the SGEIS needs to address the thresholds for community costs and adaptation to the impacts related to population increase or demand for services (administrative, school, health, public safety). Evidence from Pennsylvania indicates that ability to adapt to these community social and economic impacts is critical to short-term and long-term community well-being (Kolb and Williamson, 2011; Kelsey, 2010, 2011).

(4) Costs will vary with the nature of population increases driven by the permitting of HVHF. For example, indigent job seekers unable to find jobs and without resources to secure housing or transportation to work can become a burden for local human service agencies. This situation may be exacerbated by weak economic conditions in other parts of the state or country.

An example of this phenomenon is documented in a study carried out by Guthrie Hospital/Troy Community Hospital in Bradford County, Pennsylvania, where impacts from HVHF in the county have significantly increased demand for health services. (Covey 2010) The hospital is treating a new non-English speaking clientele and has had to hire translators. They have also had to purchase new equipment and have experienced a significantly increased demand on their emergency room services. The new demand affects not only the bottom line of providers but also the availability of and access to health care for residents of the region in which drilling is occurring.

(5) There is no analysis of the expected lag between immediate costs and anticipated revenues. This lag may be 2-3 years, during which communities will be faced with significant public service costs.

(6) To understand how natural gas drilling has fiscally impacted Region C, where most wells are located and where wells have increased, a tax profile over time needs to be presented, not one for a single year.

C 5. Environmental Justice Impacts

A section on Environmental Justice, included at the end section 6.8 of the RDSGEIS, notes that well permits are currently exempt from screening under NYSDEC Commissioner Policy 29, Environmental Justice and Permitting (CP-29). (RDSGEIS, 6-263) NYSDEC suggests that a drilling permit applicant could, “when necessary,” conduct a GIS analysis to identify potential environmental justice areas. The RDSGEIS should set forth criteria to determine when such an analysis would be “necessary” and should include the requirement in standard permit conditions or regulations. Moreover, given the known housing impacts of gas development on low-income populations, efforts

to mitigate significant adverse environmental justice impacts must include not only the "additional community outreach activities" required in the RDSGEIS but also substantive measures to prevent dislocation and homelessness.

II. Additional Economic Impacts indicated in the EAR But Not Addressed in the SGEIS

The RDSGEIS presents only a fraction of the material contained in the EAR and acknowledges: "A more detailed discussion of the potential impacts, as well as the assumptions used to estimate the impacts, is provided in the Economic Assessment Report, which is available as an addendum to this SGEIS." (RDSGEIS, 6-207). This section comments on material presented in the EAR that is not discussed in section 6.8 but which is relevant to the RDSGEIS findings regarding social and economic impacts

A. The Distribution of Impacts of HVHF in New York State

The socioeconomic impact analysis should systematically describe the geographic distribution of impacts. In New York, as is explained below, the creation of high-paying jobs as a result of expenditures in industries outside the extraction industry is likely to occur outside the production region. This is important because regions where natural resource extraction takes place (and especially rural regions with little economic diversity) have been found to end up with poorer economies at the end of the resource extraction process (Best, 2009; Sammons, Dutton and Balnkenship, 2010). Mitigation measures need to address long-term costs to the rural counties where extraction will be concentrated.

The EAR calculates the impact of a $1 million increase in the final demand in the output of the oil and gas extraction industry on the value of the output of other industries in New York State. (EAR, 3-6) The EAR then makes a series of statements concerning where the economic benefits of HVHF are expected to occur. For example,

> The proposed use of high-volume hydraulic fracturing would have a significant, positive impact on employment in New York State as a whole and in the affected communities. However, the distribution of these positive employment impacts would not be evenly distributed throughout the state or even throughout the areas where low-permeability shale is located. Many geological and economic factors would interact to determine the exact locations where wells would be drilled. The location of productive wells would determine the distribution of impacts. (EAR 4-46)

The location of wells is, however, only one factor affecting the distribution of economic impacts in New York State. Many wells are drilled in rural areas with no or very limited commercial services near-by. If that is the case then the economic impacts (in the form of expenditures by drillers and companies) will not occur close to the drilling site. Some will occur in centers – perhaps across a municipal or county line – where there are stores and restaurants that the drilling company employees use for meals and supplies. Some economic impacts will occur in far away places, such as New York City, where the drilling company can buy specialized services, such as tax accounting and legal services, to meet their business needs.

This potentially broad distribution of economic impacts is reflected in the multipliers reported in the EAR as follows:

> As anticipated, the direct effect employment multiplier for the State of New York (2.1766) was substantially larger than the multipliers for the individual regions, which had direct-effect employment multipliers of 1.4977 in Region A, 1.3272 in Region B, and 1.4357 in Region C (USBEA 2011a, 2011b, 2011c, 2011d).

(EAR 4-19) These multipliers are affected by purchases by the gas drillers from other industries in the economy. In this case, the RIMS model used in the EAR indicates that three largest industries in which purchases will be made (and additional employment created) are (1) real estate and rental; (2) professional, scientific, and technical services; and (3) management of companies). We can anticipate that purchases from these industries would have a strong effect in New York State as a whole because these industries have a strong presence in New York State.

What the multipliers also tell us, however, is that the jobs indirectly created by purchases of goods and services by the natural gas developers are not likely to be located in the counties where HVHF occurs. Multipliers tell us how strong the industry is in a region or state. Higher multipliers indicate that those businesses that the oil and gas industry is likely to purchase goods and services from are present. Lower multipliers indicate a small industry presence and thus, a lower likelihood of purchases in that geographic area. So, for example, a natural gas development company would employ professional services as a consequence of expanding drilling in Chautauqua County but is likely to go to New York City to purchase those services because they are more likely to be available in New York City. Companies providing professional services in New York City are more likely to stay there rather than move to the Southern Tier because they have more opportunities to attract diverse industries to their specialized services in New York City than in Elmira or Jamestown.

If the EAR seeks to project the impact of expenditures on the regions in the state likely to be affected by HVHF gas development, it needs to disaggregate these impacts to show what proportion of the impacts in the three largest sectors (real estate and rental; professional, scientific, and technical services; and management of companies) is actually likely to occur in the representative regions. Although the authors assert that as the natural gas industry grows, more of the suppliers would locate to the representative regions and less of the indirect and induced economic impacts would leave the regions, no evidence is presented to substantiate this assumption. This assumption contravenes economic knowledge about agglomeration economies and company location behavior, which indicates that specialized services will remain in higher order centers (like New York City) and not re-locate to counties, especially rural counties, where drilling is occurring. The more likely outcome is indicated by a study of the impact of gas drilling on Western State economies, which found that natural gas drilling may have positive fiscal impacts at the state level but negative fiscal impacts for the regions in which it occurs (Headwaters Economics 2011).

B. The Distribution of Economic Impacts in New York Versus Those in Other States

Nationally, Texas and Oklahoma are the major beneficiaries of natural gas development wherever production takes place in the United States. According to *Mine K. Yücel and Jackson Thies of* the Dallas Federal Reserve (2011): "An increase in oil and gas production **anywhere** benefits the state (of Texas) and its energy sector, which provides oilfield machinery and energy services to the rest of the world." See also subsection C, below. Nevertheless, because of its capital intensity, natural gas drilling does not have a large employment impact, even in Texas. Gas development thus plays a minor role in the economies of even these resource extraction states.

C. The Distribution of Highly-Skilled Jobs

Petroleum engineers are listed as one of the most common occupations in the oil and gas industry. (EAR 3-8, Table 3-10) The occupational employment statistics geographical analysis of this occupation indicates that the states with the highest employment in this occupation are Texas, Oklahoma, and Louisiana. In 2010, the total US employment of petroleum engineers was 28,210, of which 15,510 were employed in Texas, and 10,380 of those worked in the Houston metropolitan area. Thus, even in Texas, the employment in this occupation is concentrated in the Houston metropolitan area, not in the drilling areas.

The likely distribution of highly paid occupations is demonstrated in Bureau of Labor Statistics Occupational Employment Statistics Data on one of the most numerically significant skilled occupations that of petroleum engineer. According to the BLS, (BLS, 2010) only a fraction of petroleum engineers (in the hundreds) are employed in US non-metropolitan areas. This data, too, suggests that the rural areas of New York that are likely to experience the most intensive gas development will not see an increase in highly skilled and highly paid jobs in petroleum engineering.

III. Mitigation Measures

A. Mitigation Measures Should Address Potential Impacts Related to Volatility in the Pace and Scale of Drilling

The mitigation chapter of the RDSGEIS implies that negative impacts will be mitigated through the permitting process and a secondary level of review triggered by the operator's identification of inconsistencies with comprehensive land use plans. There are currently no requirements to mitigate adverse socioeconomic impacts in this process. Any measures identified are only advisory.

Mitigation measures should be developed following a model used in Western U.S. drilling regions, where operating company plans for exploration and development in a county or counties are submitted to county planning offices for review of cumulative impacts and mitigation (for example truck traffic routing) (Headwaters Economics, 2011). This assessment is completed for National Environmental Policy Act compliance when development proceeds on public lands.

Because the RDSGEIS acknowledges that the pace and scale of development are difficult to ascertain until exploration and production begin to proceed, it is critical that a

permit and regional Plan of Development (POD) review process be set up that alerts local officials to the need for long term planning for land use, schools, public safety and public health. The POD, outlining the pace, scale, and general location in which development will occur enables local government to anticipate and develop strategies to mitigate cumulative impacts (Sammons, Dutton and Blankenship 2010). The near-term projections of development activity should include all secondary facilities (e.g., water extraction, waste disposal, pipeline construction) in the area to be affected
A POD would allow communities in that region to prepare for the disruption and negotiate the least disruptive and damaging development plan.

Another mechanism for reducing the unpredictability and uncertainty of natural gas production at the regional scale is being developed by the Nature Conservancy with pilot projects in the Western States and planned in Pennsylvania. See Kiesecker et al, 2010. Their objective is a science-based, landscape-scale approach to Marcellus gas development that will secure measurable conservation outcomes while enhancing industry's ability to operate in an environmentally sensitive and cost-efficient manner. To be enforceable, this cooperative approach, based on a partnership between the operating company and local public officials, needs to be codified in a binding agreement. Partnerships of this sort may be useful, but they cannot serve as mitigation for significant adverse socioeconomic impacts, unless they are mandatory.

B. Monitoring Reports Projecting Industry Development Plans Should Be Prepared by the State in Cooperation with Industry and Filed Semiannually

As development activities begin and progress, the information provided in initial projections should be confirmed or revised on a semiannual basis. Information provided in the semiannual assessment and projection should include: (1) employment for each activity; (2) identification and location of contractors; (3) demographic characteristics and residence of employees who will be working in the region. This information is critical to forecasting and meeting housing and service demands.

C. Mitigation Should Address Housing and Urban Development Impacts, Including Sprawl and Excess Substandard Housing

Evidence from Pennsylvania and Western shale plays indicates the likelihood of negative impacts on the quality of the temporary and permanent housing stock, a high rate of homelessness for extensive periods, and displacement of low income people from affordable housing Given the presence of small cities in the region, mitigation measures should include assistance to cities in the affected region to encourage new housing development in already-developed urban areas and the development of temporary housing that could be transformed to other uses once the influx of transient workers resides. Mitigation measures should also address the impacts of the loss of affordable housing units in the region.

D. Mitigation Should Address Long-Term Social and Economic Impacts

The RDSGEIS and the EAR describe significant adverse social and economic impacts, such as those produced by the volatility of natural gas development on the housing market of regions where development occurs. No mitigation strategies are recommended to alleviate long-term costs that are reasonably assumed to be

associated with natural resource development, including HVHF development. Mitigation strategies directed at these long-term costs to the affected regions need to be developed and described in the SGEIS. Mitigation strategies also need to be developed to address the resource depletion phase of the exploration, drilling, development and resource depletion process. In this phase, population and jobs leave the region and tax revenues may be insufficient to pay for the capital investments made to serve the population influx during the drilling and production phases of development. Mitigation strategies should include policies to prevent negative impacts on existing industries, including agriculture, tourism and manufacturing.

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