NEW YORK STATE ASSEMBLY

ASSEMBLY STANDING COMMITTEE ON ENVIORNMENTAL CONSERVATION

AND HEALTH

PUBLIC HEARING

HEALTH IMPACTS OF HYDRAULIC FRACTURING TECHNIQUES

Hamilton Hearing Room B

2nd Floor, Legislative Office Building

Albany, New York

Thursday, May 26, 2011

9:30 a.m. to 4:06 p.m.

COMMITTEE MEMBERS:

ASSEMBLY MEMBER ROBERT K. SWEENEY, Chair, Committee on Environmental Conservation

ASSEMBLY MEMBER RICHARD N. GOTTFRIED, Chair, Committee on Health

ASSEMBLY MEMBER MICHELLE SCHIMEL

ASSEMBLY MEMBER STEVE ENGLEBRIGHT

ASSEMBLY MEMBER THOMAS J. ABINANTI

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(The public hearing commenced at 9:40 a.m.)

ASSEMBLY MEMBER ROBERT K. SWEENEY, CHAIR, COMMITTEE ON ENVIORNMENTAL CONSERVATIONMALE VOICE: --is held concerning natural gas drilling, but be have assembled a panel of experts, health experts, in order to learn more about the potential health impacts of hydrofracking. As the CED works on the draft supplemental generic environmental statement and the New York grapples with the issue, it seems prudent to obtain additional information.

We’re also interested in obtaining more information, in part, because we have heard a number of anecdotal reports from individuals living near oil and gas wells who are suffering adverse health effects. Many of those reports have been accompanied by what we consider rather convincing evidence and some of those people actually may be here today and have provided written testimony that will be entered into the record and we thank them for that. I would like to remind those who are testifying to supply us and many of you already have with your written testimony that becomes a part of the official record. Anyone else who is interested subsequently in submitting written testimony to be part of the record may do so for a week from today.

I would strongly urge those who are testifying to not read us your testimony, we can do that ourselves. It is part of the official record. I would strongly urge you to try to summarize your testimony and then that leaves us a little more time for some questions, which we like to engage in.

I am pleased, today, to be joined--to be joined by Assemblyman Dick Gottfried, the chairman of the Assembly Health Committee. This is a joint assembly hearing of the Environmental Conservation and Health Committees. We've also been joined by Assemblyman Steve Englebright, and Assemblywoman Michelle Schimel, both from Long Island, both long-time interest in environmental issues and health issues.

Dick, anything you want to add? Mr.

Gottfried?

ASSEMBLY MEMBER RICHARD N. GOTTFRIED, CHAIR, COMMITTEE ON HEALTH: Well, I don't have a lot to add. There is actually a very long history of the health and Environmental Conservation Committees holding joint hearings on environmental issues that have significant health aspects to them, and vice versa, and this is clearly a pretty central and important environmental and health issue of New York, for the whole State, not only for the areas of the State where the hydrofracking drilling may take place, but because of the implications for the water supply, it potentially has enormous impact on large parts of the rest of the state as well. And so, this is an important topic, and I'm delighted to be here with Bob Sweeney on further exploring this.

MR. SWEENEY: Thank you. And we'll get started. The first person testifying is Dr. Sandra Steingraber, distinguished scholar in residence at Ithaca College.

DR. SANDRA STEINGRABER: Brought with me

a few audiovisual aids. Good morning. Chairman Sweeney, Chairman Gottfried, and Members of the Committee. Thank you for convening this hearing that is a topic of such concern to all of us in New York. Hydraulic fracturing relies on pressure, water, and high volumes of inherently toxic chemicals to shatter the bedrock beneath our feet and beneath our drinking water aquifers. And once shattered, the bedrock releases more than just bubbles of gas, the rock, itself, releases inherently toxic materials that have been bound together with the shale for millions of years. And as we in New York consider whether to permit or prohibit this form of energy extraction, I think it’s essential to consider the consequences to public health. Once shale is shattered, it cannot be unshattered. Once ground water is poisoned, it can’t be unpoinsoned. Some of the chemicals used in hydrofracking or liberated by it are carcinogens. Some of them are neurological poisons, with suspected links to learning deficits in children. Some are asthma triggers. And the radioactive chemicals actually bio-accumulate in milk, which is an issue for us here in the dairy state. Others are reproductive toxicants that can contribute to pregnancy loss. And, of course, cancer, miscarriage, learning disabilities, and asthma, are not only devastating disorders, they're expensive disorders. They add rocks to the pockets of our health care system and they cripple productivity.

A recent analysis just published in health affairs estimates we spend 76-billion a year just on health care for children due to their exposure to toxic chemicals and air pollutants. So it's right that we should ask if hydraulic fracturing brings with it involuntary environmental exposures, what we call toxic trespass that might increase our disease burden here in New York. So I applaud you for initiating this conversation. It feels to me that this is a historic moment.

My name is Sandra Steingraber. I'm the distinguished scholar in residence at Ithaca College. My Ph.D. is in Biology from the University of Michigan.

Now early on in my career as a biologist I had a profound personal experience that lead me to the work I do now, which is focused on an understanding of how the accumulative impacts of multiple environmental exposures to toxic chemicals create risks for human health.

At the age of 20 I was diagnosed with bladder cancer, which turns out to be a quintessential environmental cancer with well-established links to chemical exposures. And questions about my possible environmental exposures were actually posed to me by my own diagnosing physician while I was lying in a hospital bed exhaling anesthesia, and these questions led me, years later, to return to my hometown in Illinois and investigate the alleged cancer cluster there.

Among other things I discovered that my hometown drinking water wells contained dry cleaning fluid. And that was a surprise, because the underlying geology of the area should not have allowed toxic contamination to happen. But there it was and with that discovery I came to appreciate how little we really know about the unmapped subterranean landscape beneath our feet, which has intimate unseen connections to the world aboveground. It turns out it’s not just an inert lump of rock down there.

My investigations into the environmental links of cancer became a topic of my book, Living Downstream, which was released last year as a documentary film. I’ve published two books on pediatric environmental health and most recent of which is, Raising Elijah, Protecting Children in the Age of Environmental Crisis. The book’s final chapter addresses potential health threats of hydraulic fracturing and I’m please to describe some of the results of my research with you.

So I’m going to in a very quick way going to overview with you threats from exposures that come to us from air and then from water, and then from food, and I’d be happy to take your questions. Because breathing is our most ecological act, we actually inhale a pint of atmosphere with every breath with take. I’ll start with air.

Air pollution is an inevitable consequence of hydrofracking. It’s not a risk. It’s not the outcome of an accident that may or may not happen. Compromised air quality is a certainty with hydrofracking. With 77,000 wells envisioned for Upstate New York, each one of which requires a 1,000 truck, trips, 1,000 times 77,000 equals a number that has six zeros after it, which makes for a prodigious amount of diesel exhaust. And, of course, in condition to endless fleets of 18-wheelers, gas production requires generators, pumps, drill rigs, condensers and compressors. All these things run on diesel. At the same time the wellhead themselves vent volatile chemicals, benzene and toluene, these are also highly toxic and they actually combine with combusting products to create smog. And we actually know a lot about smog. This kind of air pollution is lethal. It contains ultra fine particles, soot, ozone, and the carcinogen benzo-a-pyrene. In adults, these pollutants are linked to bladder, lung, and breast cancers, stroke, diabetes, and premature death. And in children, they are linked to premature birth, asthma, cognitive deficits, and stunted lung development. And they have come with a very high price tag. Premature birth is the leading cause of disability in the US. It carries with it a $26-billion price tag and asthma and $18-billion price tag. And, of course, the pollution doesn't stay in the gas catch. It can travel up to 200 miles, so children in Albany will be affected, children in New York City will be affected. And in places where no one is benefiting financially from land leases.

Water pollution is also an issue and each one of us in this room is 65-percent water by weight. We all enjoy an exquisite communion not only with the atmosphere, but with the water cycle as well.

We know that there are many documented cases of surface and groundwater contamination with compounds associated with gas extraction, including the carcinogen benzene. But because hydraulic fracturing has been granted, the environmental equivalent of diplomatic immunity, enjoying special exceptions from our Federal statutes, it’s difficult for those of us in the research community to quantify what the public health effects are. We lack knowledge about the behavior of ground water and we also lack knowledge about the trade—because of trade secrets we don’t know what chemicals to test for.

We do not, from a study released earlier this month, that drinking water wells near gas extraction sites in Pennsylvania and New York have on average 17 times higher methane levels than wells located outside the gas patch. We don’t know what the health effects of drinking and inhaling methane are, for pregnant women, for children, or for anyone. Not because we’ve done the studies and there is no evidence for harm, but because we’ve never done the studies. We do know that when you chlorinate water that contains carbon based contaminates, you create disinfections by-products called trihalomethanes. One example is chloroform, and these, in fact, are carcinogens linked to both bladder and colon cancers. Can methane serve as a raw material for the creation of trihalomethanes? To my knowledge, we in a scientific community don’t yet have an answer to that question. Shouldn’t we answer it before we proceed with hydrofracking?

So I brought with me here a jar of water from my kitchen tap in the village of Trumansburg. And this water comes from municipal well sunk into a groundwater aquifer near Pie Eagle Lake (phonetic). Everyday I pour this water into glasses and hand them to my children and they take a drink, before they get on the bus, and everyday this water becomes their blood plasma. It becomes their tears. It becomes their cerebral spinal fluid that surrounds their brain. And according to the annual drinking water quality report for this water, in my village, it contains some trihalomethanes from the chlorination process, and it also contains nitrates, which are probably a result of all the farming we do near the well, and there are presence in this jar, all by itself is not a call for alarm, it’s all within the legal limits, but it is a sign that our municipal water, as so much water in New York, comes from an unconfined aquifer that's vulnerable to chemical contamination. Already this water has fertilizer in it. And if the presence of the fertilizer shows us that there exists hidden connections between the surface of the earth and the watery vaults of groundwater deep beneath our feet. What would happen to this water if the fields that surround my village, many of which are already leased to the gas industry become a stating ground for fossil fuel extraction? In Tompkins County, where I live, 40-percent of all land acreage is leased to the gas drillers. This is not a hydrological experiment I am interested in running.

I've also brought with me a loaf of bread and a bag of flour. Both of these are made from heirloom wheat and rye that is grown in my home county and milled right in my village. This is called farmer grown flour and this is the bread that my local baker made out of this flour. You can find similar loaves of artisonal bread made from the same flour in Brooklyn bakeries. It’s part of our economy in Upstate New York to bake bread. And this particular loaf is actually created by a baker named Stefen Senders of the Wide Awake Bakers in Mecklenburg, New York. And Baker Senders asked me to submit this loaf to you as his personal testimony to the assembly today. So this loaf of bread is the testimony of a baker. And it comes with the following message. And this is what Stefen says. Please tell the assembly that bread is mostly water. The flour and yeast in this bread are just a matrix to make water stand up. I can’t bake bread without a source of clean water. He also told me that the flours who grew the organic wheat to make his flour are surrounded by leased land. He believes the whole farm to table enterprise is threatened by fracking. And Stefen and his farmer suppliers have reason to feel concerned organic farms who raise food near fracking operations are facing potential boycotts and will lose their certification if their crops and animals are chemically contaminated. This is a public health issue. I argue that it is.

Actually, Upstate New York is a national hot spot for organic agriculture. Cows, wheat fields, vineyards, maple syrup, and apple orchards, all of this is part of our public health system. They're part of a healthy food chain. And each of those crops requires clean water. They're all affected badly by exposure to air pollution. So to conclude, I hope that these hearings are the beginning of an essential conversation and as current incarnations, the New York State Department of Environmental conservations draft supplemental environmental impact statement in which the future of hydraulic fracturing hangs considers neither health consequences nor the cumulative impact of numerous hazards that gas drilling has brought to our doors. The human health impacts of fracking can't be understood by looking at one chemical by itself, not looking at one river at a time, nor by looking at one well pad in isolation. We all know that it's not just the last straw that breaks the backs of camels. So I urge the

Assembly to look at all the straws, employing the new tools of accumulative impact assessment to do to. And until that work is complete, I believe the benefit of the doubt goes to New York's children, water, cows, and wheat fields, and not to the things that threaten it. Thank you.

MR. SWEENEY: Thank you very much. You started out talking about air pollution, so let's take that first. Can you talk a little more about the air pollutants that are produced at the wellheads, and also, I'm a little curious how you think that might impact New York's areas of ozone non-attainment?

DR. STEINGRABER: Well the data we have from Utah and Wyoming shows that even in areas with no traffic flow and where the baseline is pristine air quality, that hydrofracking alone can create ozone levels that are above legal attainment. Ozone is not a chemical that's generated by diesel trucks or by the wellheads, rather, ozone is a triangle box that is created when volatile organic compounds, which are waft up from the wellhead, such as toluene, benzene and ziolenes, mixed with the nitric oxides from the diesel exhaust from the compressors and generators and the trucks. And so, when sunlight hits these things a chemical reaction happens and you get ozone. Now ozone is a powerful cellular poison and it’s linked to inflammation. It’s not a carcinogen but it appears to make metastases to lungs more likely. So in other words, if you have breast cancer, let’s say, and you’re breathing a lot of lung—air pollution, your lungs are inflamed in such a way that cancer cells are more likely to set up shot there and form a metastasis.

Ozone also stunts lung development in children, in addition to triggering asthma. So when you’re exposed to ozone in either infancy or early childhood, while your lungs are still developing, you actually grow a smaller set of lungs than if you would otherwise. And research in some of our major cities shows that this could actually interfere with, let’s say, athletic performance in adolescence. So you end up growing a smaller set of lungs and that can compromise your repertory ability for life. So these are the things that we're now worried about with Wyoming and Utah's air in places where we had no air quality problems.

By contrast, we have ozone alerts every summer here in Upstate New York. So we're not starting with the baseline of pristine air. We are at the tailpipe end of some of the coal burning power plants in Ohio Valley. We have a lot of traffic. And so, we already struggle with air attainment standards. And so, the kind of density of fracking that would come, which is pretty much required, because the bubbles of gas under the shale are so disbursed that to do fracking, it's kind of a shock in operation. You have to have a lot of wells, and all of these require a thousand different trucks and so the air pollution is going to be an inevitable consequence.

We know that you can measure diesel exhaust in umbilical blood and some of the best research that we have coming out of Columbia University shows that the higher the levels of diesel exhaust exposure prenataly, the higher the rise for pre-term birth, which is the leading cause of disability in this nature, and the higher the risk for cognitive deficits. So given that we already spent a quarter of our public school dollars on special education, why would we invite to New York a form of extreme energy extraction that extinguishes the IQ points of our children and simply adds a burden to our educational schools and to our medical systems at a time when we are struggling as a State so much financially that we’ve just had to cut medical and education in the State of New York, rather than increasing the need for more medicine and a need for more special ed, if we invest in the kinds of sustainable economic development that would clean up our air and rely on renewables, then we would have less need for public education, and special ed. We’d have less need for emergency room visits for asthmatic children.

MR. SWEENEY: You mentioned Wyoming, was there not a study that was released recently indicating that the air quality in parts of

Wyoming is comparable, in terms of ozone, to that of Los Angeles--

DR. STEINGRABER: That’s right.

MR. SWEENEY: --and attributable to drilling?

DR. STEINGRABER: That’s right. Because in that part of Wyoming, there’s no other industrial activity. There are not a lot of highways, and so what began as some of the most pristine air in the nation, after shale gas extraction came to that community, the amounts of ozone in the air were comparable to what we see in some of our highly polluted cities, such as Los Angeles. In Los Angeles we’ve already done the studies showing that children who breathe ozone at those levels have health effects. So we can predict that in Wyoming we will see some of the health effects in those children that we might—that we have already documented in Los Angeles. My concern is a biologist for the children of New York is that we would achieve ozone unattainment far more rapidly than even Wyoming, because we’ve already got ozone problems already. And these are very expensive problems to solve and as the mother of an asthmatic child, myself, I can tell you that it’s a very parent-intensive experience to have a child who can’t breath. I, myself, was offered a position, a wonderful job, heading up a graduate program at Iowa State University. And when I went out to do the interview, because of my son, I had to read the data on the local air quality data there. I was surprised to discover that Ames, Iowa actually has serious air quality problems because of an old municipal waste incinerator that also serves as that city’s power generator. There is also a coal burning power plant on campus. So that when I did my interview there and my husband was actually also offered a job there, we brought out family out to look into buying a house and while I was there and my son began to have asthmatic symptoms. So I came back to Ithaca, New York and when his symptoms disappeared he could breath again, I went down to Cayuga Lake, near where I live, I looked out over this beautiful landscape, near where I live, and I said to myself, no amount of, you know, retirement benefits, and academic prestige makes up for my child not being able to breath. So I turned down that job and embedded my roots here in Upstate New York only to now be faced with, surrounded by land that's all leased to the gas drillers and it's only the moratorium that the Assembly and the Governor has provided me as a mother that stands between me and repertory harm to my child. Already, I've seen my neighbors talking about leaving the area. I received from my own readers I received email saying if fracking is coming, maybe I won't retire in Ithaca after all. Maybe we should leave before we can't—by buyer can't get a mortgage for the house. And so, I see signs already of an exodus from Upstate New York. Surely, good people leaving and with all of their tax dollars and their willingness to pay for schools cannot be part of sustainable economic growth in Upstate New York.

MR. SWEENEY: Why do you think we know so little about the health impacts and methane?

DR. STEINGRABER: Because methane has never been a big issue in water before. So there’s been no need to study it. We don’t know of large numbers of people don’t drink high amounts of methane in water. Methane is not sort of a natural contaminate of water. It only comes when you do something, you disturb the subterranean landscape in such a way that it’s released from those geological - - so we’ve seen it in some cases, associated with coal, but the widespread hydrofracking would raises the possibility that we would bring methane to drinking water, not just of a few wells here and there, but methane in our public drinking water, which, unlike private wells, is chlorinated. And so we have, as far as I know, there is no data on what happens to methane and chlorine when they’re mixed together. As a biologist, I intend to seek out this information. I wrote a lot in my book, Living Downstream, about this infection byproducts, because they are linked to bladder and colon cancers. And the EPA has moved to lower trihalomethanes, recognizing they’re a much bigger threat to human cancer than previously appreciated. And so this is created, already, a problem in Ithaca to bring our trihalomethanes to lower those levels, because you don't, of course, want to raise the risk of exposing people to communicable diseases by not chlorinating the water sufficiently, but the more carbon you add to water, when you do chlorinate it, the more trihalomethanes you get. So I have no data to offer you about what happens when methane and chlorine combine. That's a topic I plan to seek out. But surely, until we have an answer to that question, maybe we should hit the pause button here.

MR. SWEENEY: Do you expect that the EPA's study, due out sometime next year, will address any of these issues?

DR. STEINGRABER: I was very distressed that the EPA study, which originally was supposed to consider the health effects caused by air pollution has now decided not to investigate air. Because that is—we have more data on that. We can make better predictions on that. And surely it would help us if we looked at air, it would help us understand, okay, methane extraction offers us this amount of economic development, but if the cost to human health it is considerable, then suddenly, that doesn't look like such a good investment, after all. I would like to have those numbers. How many more asthma cases, how many more bladder and colon cases, how many more breast cancer cases, how many more pre-term births caused by predictions about the degradation of our air.

Also, this is an issue for New York City, because New York City, like Los Angeles has a lot of emissions. The reason New York City isn't in the situation that Los Angeles is in is because it's not surrounded by mountains so that the fresh clean air of Upstate New York blows through New York City and pushes that—all those emissions out to sea. What happens if we degrade our Upstate air to resemble New York City air, will the City of New York, itself, get no relief from its own ozone emissions and so forth? So these are huge issues that the EPA study has not and is not going to be addressing. I do hope the EPA's study will shed some light on ground water. Although, again, it's not comprehensive, so, for example, the Marcellus shale is quite radio active. This represents elements left over from these ancient mountains that used to be where the Catskills are now, when those mountains eroded into the shallow sea of what which once covered this area, those elements, including uranium and stadiums, other radio active isotopes bound themselves up together with the shale and those bubbles of methane, which represent the dead bodies of all the creatures that lived in this ocean, and when you shatter it, and bring those bubbles up, you also bring up radio active isotopes with the flow back fluid and with the cutting muds, which are being dumped in various places, and so the dumping of the hazardous waste created from hydrofracking, which is not classified as hazardous waste, but certainly is, my knowledge is that that's not a focus of the EPA's study, but that omission also concerns me. So there's the EPA study will, I think, offer us some good information about what risks we might be—our ground water might be faced with, but there are other risks that I am equally concerned about that are outside the focus of that study.

MR. SWEENEY: Well, you mentioned the need for additional studies. So what should those studies be, and could you priorities?

DR. STEINGRABER: I would certainly priorities the study of where the hazardous waste is going. We know that some of it is going into our landfills, and we know that, for example, right now toxic flowback from wells in Pennsylvania are heading up Route 13 and being dumped in the New York City of Auburn, and there are downstream communities that are being impacted. So we need study of those things. I'm also very interested in what happens to New York's dairy industry, which is, I think, highly vulnerable, we're a big dairy state. It's a $2-billion industry. And cow's milk bio-accumulates especially radio active isotopes, along with some of the other heavy metals that are found in fracking. So when you've got wells going up on pastures near where cows are grazing, how does that work? I mean, if all that would have to happen is, you know, one study ten years from now showing that our milk is radioactive and who is going to trust the milk from New York cows. And so I think—and we've already seen from the disaster in Japan that radiation from Japan has made it all the way to California cow's milk in Vermont, so the dumping of radio active waste products in our landfills possibly spills that affect pasture land and organic dairies in New York. As a mom of children who relies on organic milk that I buy from my local farmers, I have concern about that.

MR. SWEENEY: Thank you.

MR. GOTTFRIED: You know, hydrofracking gas drilling has been going on and going on in parts of New York State for decades as I understand it. If I'm correct, it has been essentially vertical drilling and what is contemplated now, I gather, is drilling that would go down and then for great distances horizontally. Are the issues that you have raised applicable as much to the long-standing practice of vertical drilling, as well as the horizontal? Is it a different—if there are differences, is it just differences of scale or of substance as well?

DR. STEINGRABER: It's both. The differences of scale would mean that vertical drilling, which, of course, began here in New York State in the 19th Century. We were the first state to do, you know, drill for natural gas. That relied on natural gas that was generated and moved through geological - - and got trapped in big bubbles. So we could kind of put a big straw straight down and up came the gas. So that was sort of our grandparents' gas drills. Now we've run through most of that gas. So to get gas out of shale where it's disbursed as kind of a petrified fizz of champagne bubbles, if you will horizontal drilling as opposed to go down and then turn the drill sideways and go about a mile or so and then detonate, but with explosives, that shale, and then force, under very high pressure, chemicalized water to release the bubbles, and so the chemicals that are used in horizontal hydrofracking are different from what was used in previous kinds of drilling. Even drills that relied on fracturing, so we are introducing new chemicals to New York that haven’t been used before in drilling, so that is a novel thing. But the accumulative impacts part of my message that because each one of these wells isn’t going to hit this sort of goldmine of gas it relies on little bubbles coming out here and there, it’s the density of wells that’s going to be very different. We will industrialize the entire landscaping. 77,000 wells, each well pad several acres big, we’re fragmenting habitat, we’re compressing soil, we raise the risk for flood control problem. And, of course, there are many other public health problem that I’m concerned about that I haven’t addressed. One of them is light at night, which we not have evidence is linked for breast cancer, and, of course, noise pollution, which is considerable with fracking, there’s some new data out of Europe showing that this is more than just a nuisance, it's actually related to stroke and cardiac risk, and hearing loss and things like that. So there are many public health problems that come with a horizontal fracking that we have not seen so far with vertical drilling. That being said, I am alarmed at the amount of vertical drilling that's going on in the southern tear, even now. And I'm hearing anecdotes from people who live there that their well water is being affected by vertical drilling. Now what I learned in graduate school is that the plural to anecdote is not data, right? So we don't—I don't know as a biologist whether or not vertical drilling is posing serious risks to our water. But I don't think anyone knows. I don't think anyone is looking at this. And again, that needs to be looked at very closely.

MR. SWEENEY: Thank you.

ASSEMBLY WOMAN MICHELLE SCHIMEL: Good morning. Did I turn it on? It's on. Okay. Thank you for your testimony. I just have a short question. In term of—one thing that caught my eye, and I'm familiar with this, the fact that, I guess you could say, the clean water act that the hydrofracking fluids are so-called exempted from that, and I wanted to focus on the air pollution concerns that you had brought up because, one thing that I have been reading of late is the quantification of the air quality problem, that it hasn't really been focused on, and I'm wondering is there a possibility, or should there be a possibility, of future modeling of quantifying the air quality impacts. Because you had said, now, that you're able to get a finger, a pulse, if you will on that. Is that something that should be considered? And then I'll get to my next question--

DR. STEINGRABER: Yeah. I think it should be—

MS. SCHIMEL: --as to why.

DR. STEINGRABER: --and I think it could be if, because there are new tools through what's now being called accumulative impact assessment that would allow us to do that. And I would encourage an approach that would include the emissions that we're already getting from

Pennsylvania. All right. So, for example, last summer we had more ozone alert days in Tompkins Count, New York than I have ever seen in all the years that I have lived here. Is that because of ozone coming out from 60 miles south where fracking is going on at breakneck speed? As far as I know, no one is looking into that. So our air quality may already be affected by what's happening just across the border in Pennsylvania. We need to know that before we decide to bring 77,000 wells to New York, because the accumulative impact is not just from the wells in New York, but because of the way the prevailing wind blows from the southwest the wind follows the Appalachian Mountains, all the fracking air pollutants from Pennsylvania are also being inhaled by all of us here in New York.

MS. SCHMIMEL: Well, that gets back to your other statement with regard to the clean water act. And talking about the clean air act, we have responsibilities to meet thresholds because of mandates, if you will from the Federal government and we have, we're a responsive state implementation plans, and I’m wondering how will that affect our future modeling, if you will, to meet the clean water act, which is, say, mandate that the state, each state in the country had to follow and is there any thought that you have in terms of you think there could be exemptions to the clean water act, have you heard anything like that?

DR. STEINGRABER: I haven’t.

MS. SCHIMEL: That would be pretty scary, but I--

DR. STEINGRABER: I think the Federal statutes, the clean water act, the clean air act, safe drinking water act, these are good laws. They certainly allow those of us in the research community to design studies. So the safe drinking water act would require the identity of chemicals used in fracking. Right now we don’t have that. So people like me can’t ask—can’t answer questions from the public like, well, could these symptoms, you know, be related to what’s in my water. We don’t even know what to test for in the water, because we don’t know what chemicals were used. So the secrecy that surrounds fracking puts a veil of silence and secrecy around the process and it doesn't allow the science to go forward, if nothing else. And, of course, as a bladder cancer patient, I have another perspective on all this. This jar of water, I actually drank from recently, my last check up was abnormal. And so my urologist asked me to come in for some more scans and I was required to drink a whole quart of water before having the scan, so out of this jar I drank the quart of water and went in and watched the interior of my body, you know, like a nova show special up on the big screen and I'm still waiting for the results of those pathology reports. Later on on that same day after I took the backless, blue cotton gown off, I still had my jar of water with me. I went to the Cornell Law School and entered into a debate with a member of the gas industry over the issue of hydrofracking. And I talked to him about my experience that this morning with this water and the fact that it already contains, well, that people like me have higher vulnerability than the general population. And, perhaps, need more protection from drinking water contaminants and who is looking out for my rights as a bladder cancer patient and who is looking out for my children for whom this becomes their blood plasma. And the response I got was that from the other panel members was that our energy policy needed to be based on science, not on emotion. And so I find frustrating the call to look first before we take action as an emotional call, in fact, the precautionary principal is an honest scientific response, because it’s an admission by the scientific community that we don’t know everything about the underlying geology of the world we walk in and we, therefore, have to be careful. Have the opportunity to talk about cancer in the environment to the European union in December at the European parliament and talked about fracking in that forum and I found that members of parliament there were far more likely to understand that precaution should come first and the science should come next, and then action is the last thing to happen. On this side of the Atlantic seems that action happens first, and then our science is always trying to play catch up for these unintended human experiments that we create. Sometimes with devastating consequences.

MS. SCHIMEL: Well, I just wanted to, in conclusion to what you said, we are, I believe, New York State, am I right, is a non-attainment State in terms of our clean, the clean air act. We have to make compensation and as a legislator we're always looking for solutions to be able— because a lot of times it's financial. In order to get Federal aid, we have to show progress and so to we went after congestion pricing when I first got here in the assembly to become and attainment State, if you will. And that was roundly defeated. But I supported congestion pricing. So ironically, as we look to solutions to mitigate our air quality, that balance has to be there, as you had so wonderfully put forth, the unintended consequences, are we going to be back here a few years later figuring out means, like congestion pricing to offset the impacts of legislation we had done prior to, because we have mandates that we have to follow from the Federal government with regards to water and in this case the clean air act.

DR. STEINGRABER: Well, that's very true. And the American Lung Association has done a wonderful job compiling the data that we do have available on our non-attainment areas and so their brand new report is available now online. It's interactive. So you can click on the icon showing New York and read everything about all the metrics we have available to us now about our air quality, in terms of particulates, in terms of ozone, and so forth. And realizing that that will be our baseline on top of which we will add these other things. And we should be able to model this, you know, what will happen when these—when all these fleets of 18-wheelers come in and things like that. On the ground, as a person who lives in a community that surrounded by leased land, what I'm hearing is, you know, not conversations about ozone, but I'm hearing as the mother of a 12-year old daughter, conversations, you know, with other soccer moms to the effect of, wait a minute, I'm supposed to teach my teenage children how to drive on rural roads in icy weather with 18-wheelers hauling hasmat (phonetic), how does that work? So those kind of light bulbs going on above people's heads, because we're already seeing frac (phonetic) trucks as they move up to Auburn carrying waste. Our roads are already being congested, and people are thinking of leaving. I mean, I really want to give you that message strongly. And these are good people with Ph.D.s, and they have the money and the resources to go elsewhere. They've chosen to live in Upstate New York because the quality of life that it offers. It's a good place to raise children. It has clean air and clean water. It has culture, it has nature, it has organic food, it's a wonderful place to raise a family. But there are other wonderful places that don't involve the Marcellus shale and there are many people who become environmental refugees and simply choose to leave.

MS. SCHIMEL: Thank you.

DR. STEINGRABER: I have promised this farmer I would deliver his testimony, so I'm going to keep my promise.

MR. GOTTFRIED: I hope he's not a registered lobbyist, because then we can't accept the bread.

[Laugher]

ASSEMBLY MEMBER STEVE ENGLEBRIGHT: Dr. Steingraber--

MR. GOTTFRIED: This is going to distract us for the rest of the day, you know.

DR. STEINGRABER: It's two-day old bread. I've been on the road for a while.

[Laughter]

MR. ENGLEBRIGHT: Dr. Steingraber, the part of your testimony that really caught my attention centered on your statement regarding methane in drinking water. And you referenced the paper by Osborne and others, the researchers at Duke University. I read that paper recently. It rocked me backwards. I found it to be a meaningful contribution and one of the first efforts made by reputable scientists to look at the question that you rightly raise about the impact of methane in drinking water. And you have indicated that you have methane in water and then chlorinated can create problems and I just--

DR. STEINGRABER: I don't actually know it can. I raise it as a question. Can it.

MR. ENGLEBRIGHT: You raise it as a question. The Osborne study you point out here on average there is an indication that methane occurs on average 17 times more frequently than in non-drilling neighborhoods. If I remember correctly, it's up to more than 60 times. So the 17 is an understatement.

DR. STEINGRABER: That's right.

MR. ENGLEBRIGHT: And this seems to me is a meaningful area of investigation. I have a question. There is a common daily activity that most homemakers do, which is, they wash their clothes, and they use bleach, and we've seen, you know, in recent films done on this that very often there's a lot of methane in tap water. Do you see the possibility that simply washing one's clothes in a neighborhood that is subjected to a lot of drilling may expose—may cause this potential pathway of creation of trihalomethanes?

DR. STEINGRABER: Well, that's an excellent question and there's, you know, one can write a discretion on that topic. I don't think we have an answer for that. And, again, it's one of many unanswered questions. I would hate for us to shatter the bedrock under our feet, bringing methane up into our drinking water only to find out ten to 20 years from now that it is a health hazard, or that it does combine with bleach or detergent or chlorine to create something hazardous. Science simply has no answers for us. I was distressed to see that as a result of the publication of the Duke study, which is one of two now, only two scientific studies on hydrofracking published in the - - review medical literature, the other being the study that shows that hydrofracking is—has a carbon footprint, at least on par with burning coal, and maybe worse, that was published recently by my colleague, Tony Angrafia

Environmental Conservation & Health, 5-26-2011 (phonetic), and Bob Howard at Cornell University. So that paper and this paper from the Duke team on methane are the only two scientific papers we have, and the Howard/Angrafia paper, the authors clearly admit that the data that—the industry itself that provided them was poor, but they did the best they can with it, and there are many unanswered questions. The Duke team intended the study to be a pilot project as a hypothesis generating exercise. What it did show to us is that the methane in the water of the people's wells, we know that it's thermogenic methane, it actually comes up from the Marcellus, because they were able to do molecular fingerprinting, so it's not methane from some other surface source, so that was kind of the brilliant experimental design of that study offers to us. But, you know, it's easier for me as a scientist to say, to all for more research, and, of course, we do need more research. But let's do the research first and keep people out of harms way until we get the results of that research. So the biologist in me wants to see more and better data. The mother in me and the cancer patient in me wants to keep us safe while that data is being generated.

MR. ENGELBRIGHT: I think you caution regarding the proper sequence is very, very important and I hope we all remember precaution first, science next, then action. That’s the proper sequence. Thank you for that wonderful thought. And thank you for your wonderful testimony.

DR. STEINGRABER: Thank you very much.

MR. SWEENEY: Thank you very much. Next we’ll hear from Dr. Adam Law, Endocrinologist, Physicians, Scientists and Engineers for Healthy Energy. Welcome.

DR. ADAM LAW: Thank you. Good morning, Chairman Sweeney, and Gottfried, and members of the Committee. Thank you for inviting me today. I open with a resolution passed by The Counsel of the Medical Society of the State of New York on December the 9th, 2010.

MR. GOTTFRIED: Excuse me. Could you pull the microphone a little closer? Thank you.

DR. LAW: Resolved, that the Medical Society of the State of New York supports a moratorium on natural gas extraction using high volume hydraulic fracturing in New York State until valid information is available to evaluate the process for it's potential effects on human health and the environment.

Hydraulic fracturing shorthand for high volume slick-water, hydraulic fracturing from long horizontal well legs has significant effects on human health. From my perspective as a physician and an endocrinologist practicing in the Finger Lakes Region of New York State, I would like to make three points. First, that there are not high quality studies in the medical literature addressing the health effects of hydraulic fracturing and I propose a much more active role for the New York State Department of Health in fostering quality research in this area. Second, classic toxicology does not adequately describe the entire risk to health from hydraulic fracturing. As an endocrine disruption represents an emerging potential hazard arising from exposure to specific chemicals or mixtures at extremely low concentrations. Third, as the effects of hydraulic fracturing on health are not adequately studied and there is sufficient reason for concern, New York State should continue it’s cautionary approach by extending the current moratorium. There are more than ten years of experience in hydraulic fracturing in other states, and as I speak, there have been no peer-reviewed publications in the scientific or medical literature addressing it’s affect on human health. Madelon Finkel, Professor of Public Health at Weill Cornell College and I co-authored the first peer-reviewed commentary on hydraulic fracturing and health in a high impact medical journal. This is published in this month’s addition of the American Journal of Public Health entitled, The Rush to Drill For Natural Gas, a Public Health Cautionary Tale, submitted as part of my testimony.

During research for this article and also in subsequent systematic evidence based literature search, my co-author and I have not uncovered a single high quality study on the effects of this process on health. There are a number of small surveys and state sponsored investigations but these have been posted or archived on websites and are not submitted to the standard scientific peer-review process. There is increasing evidence of leaks, spills, pollution, waste management practices and industrial accidents surrounding the hydraulic fracturing process. Demonstrating this is beyond the scope of this public hearing. We also know that there are many well-characterized toxins added to the hydraulic fracturing fluid. Despite this, communities states the EPA and even congress are unable to obtain a comprehensive - - of the identity of chemicals used in the hydraulic fracturing process. A gap explained by energy companies as a concern for competitive advantage. With the Energy Policy Act of 2005, Congress explicitly precluded the EPA from regulating most aspects of hydraulic fracturing, including any requirement to disclose the substances being injected underground. Researchers and policy makers are forced to play a guessing game to identify these chemicals from the materials safety data sheets, gas drillers are mandated to produce in case of industrial accidents. Unfortunately, the MSDS contained proprietary names and although we can be fairly certain about the identities of many of the chemicals from this kind of time wasting analysis, we cannot infer the unique chemical identities of many others.

From the perspectives of a physician committed to evidence based medicine, this situation is deeply troubling. Over the last decade when hydraulic fracturing has come into substantial use in other states, there has been increasing anecdotal evidence of human harm. I remind you, as a practicing physician, the doctor/patient encounter is based precisely upon anecdotal evidence. We term this type of evidence the patient history. I simply cannot dismiss the stories of people living in close proximity to this industrial process.

For public health researchers, this kind of data is the equivalent of a canary in the mind, warning us there is a problem we need to study systematically. Thus, in the short-term, there are a long list of medical conditions, here are some commonly found in a single survey in one town. Sinus problems, throat irritation, allergies, weakness and fatigue, eye irritation, nasal irritation, joint pain, muscle aches and pains, breathing difficulties, vision impairments, severe headaches, et cetera. This is alongside the effects of noise, industrial odor and light pollution, all significant stresses in rural communities where people have often chosen to live to be away from these more characteristically urban problems. In the medium term, there are the well-established toxic effects of chemicals and the chemical additives to hydraulic fracturing fluid and also in the flow back and produced waters. These can affect many organ systems, including, liver, digestive, pulmonary, and nervous systems. Others transcend bodily system in effect in unifunction or are linked to cancer. In addition to toxins, there are naturally occurring nuclear materials in the drilling waste and produce fluid.

In the long-term, research has focused on greenhouse gas methane at the center of this process. A recent life-cycle analysis has demonstrated the purposeful and inadvertent leakage of methane into the air, as a potent greenhouse gas alone, makes the hydraulic fracturing process at least as damaging to climate as tradition use of coal as fossil fuel.

The contribution of hydraulic fracturing to climate change has an impact on human health. In addition, in a draught afflicted world, water depletion by both contamination and removal of large volumes of fresh water from the hydrological cycle has a very significant negative health implication.

My opinion and that of public health researchers I’ve consulted, we need to conduct well-designed epidemiologic studies on the health effects of unconventional drillings. These studies should include particular at-risk populations such as pregnant women, children, workers, in addition to those living in proximity to hydraulic fracturing. This should include a variety of epidemiological study designs including cross-sectional, longitudinal ecological, case control, and prospective cohort studies. I suggest the New York State Department of Health should take a lead in fostering and funding such a research program, studying the fairly extensive experience of other states where hydraulic fracturing is currently underway. This research should be published in peer-review journals so it can come to the attention and under the scrutiny of other investigators and to the attention of policy makers.

I am a clinical endocrinologist and my patients present with diseases of hormones and their organs including diabetes, mellitus, infertility, thyroid cancer, pituitary disease, and adrenal disease. My introduction to the health concerns about hydraulic fracturing came from patients asking me how this technology would affect the hormone system in the body. The term endocrine disruption was coined in 1992 in response to the recognition that exposure to minute concentrations of specific chemicals and mixtures, particularly at critical points of the development, can result in profound damage in widespread groups of organisms including humans.

Paradoxically, because of the molecular mechanisms endocrine disrupting chemicals interact with hormone receptors, they're often much more potent at lower concentrations and do not show the classic toxin dose-response curve. The Endocrine Disruption Exchange has identified many potential endocrine disrupting chemicals in the hydraulic fracturing fluid. To this extensive list, others need to be added that emerge in the produced fluid from the shale.

We need to know more about the chemicals introduced into the environment during hydraulic fracturing. I propose New York State require the energy companies, the drilling companies, and their chemical suppliers to provide the DEC and interested researchers the unique chemical abstract services registry numbers for all potential and proposed hydraulic fracturing chemicals so we can identify and regulate the use of endocrine disrupting chemicals in hydraulic fracturing fluid.

We also should study the presence of endocrine disrupting chemicals in the produced waters, volatile gas emissions, and solid waste deriving from Marcellus shale itself.

My third point is the need for further caution. As a physician, I work within the bounds of a complex system of medical ethics. Two precepts come to mind in this discussion of hydraulic fracturing in its health impact. First, do no harm, and informed consent.

Hydraulic fracturing in this context appears to me to be like a large misconceived experiment in which unspecified toxins are being introduced in an unpredictable fashion to human subjects without any systematic or scientific attempt to establish or quantify it’s effects on human health and well being. In many cases this is done without adequate informed consent of citizens. With economic projections of trillions of dollars of revenue from the sales of natural gas, I think there should be no shortage of resources to design a top flight research program. I suggest the caution displayed by New York State in establishing a moratorium against unconventional gas drilling as wise, and I recommend that this should be extended until we have thoroughly studied the implications for public health. Thank you.

MR. SWEENEY: Thank you very much. Let me ask you, we are certainly aware of many people who live near drilling and who have medical conditions that have developed since drilling began where they are, and who certainly believe that their medical conditions are attributable to, or are a result of the drilling. On the other side, the drillers say, well, there's no evidence of this. They may have a medical condition. Maybe they do, maybe they don't, but who knows where it comes from. Is it possible in your view, either now or with the proper studies to be able to separate out and identify that, yes, this person has a medical condition and that medical condition is attributable to some aspect of drilling? And what kind of studies do we need to be undertaking to help us make determinations like that?

DR. LAW: This question is one that is occupying the minds of variety of public health experts and epidemiologists at the moment. Madelon Finkel who is the co-author of the article, which I mentioned, Roxanne Witter (phonetic), who works in the University of Colorado School of Public Health, and various others are all talking together about putting a conference together in the next six or nine months to address this very issue. What are the best study designs we can use given a large range of types of studies that are available in epidemiology to answer these questions well. I've spoken to the NIEHS, which is the environmental branch of the NIH and they strongly support that we should put together a conference of interested parties to discuss how to design properly studies to answer these very specific questions. They think that this is an area they

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would very much like to fund in the future in terms of research studies. They think that we need to put our right foot forward. If we design the studies incorrectly, we will get either erroneous answers or no answers at all. And there will be the problem of having put large amounts of money in the wrong direction. So the answer is that the science of epidemiology does have the tools. Each area to which this series of techniques are applied has its own unique characteristics. Each database you use has its own problems. So I do believe these are answerable questions as a physician and scientist, I think that that's the job of what we do. We have to create answerable questions and we need to be able to address this. Now some of the health effects, which we just discussed, in which have been—which arise from surveys we can enumerate a list of what are the potential problems. Having said that, as you say, it's very difficult to establish if that is above the background. So we have to design studies to tease that out. In addition, many people smoke

cigarettes, for example, and many of the toxins in cigarettes are also found in some of the polluted air and polluted water. So one has to design studies so that you can tease these effects apart, and they've got to be large enough and powered enough to be able to make meaningful epidemiological inferences. And that cannot be done unless you have a large research program. This is something that cannot be done by a sort of mom and pop approach of individual universities, which is why I have been helping to facilitating groups of epidemiologists with an interest in this, and bio-statisticians and other individuals to look at this as a group so that we can actually propose the scale of studies, which will actually address this question.

MR. SWEENEY: You talk about the use of chemical identifiers in fracking fluids. How would that work and what information would that provide that would be useful?

DR. LAW: I'm not quite clear about what you're asking here. The--

MR. SWEENEY: Chemical abstract services

registry numbers.

DR. LAW: Oh, yes. The truth of the matter is that when we were concerned about smoking and its danger or dangers of health, we were dealing with cigarette smoke, which is a mixture of hundreds, if not thousands of substances. We were able to find a link using epidemiological studies between smoking, lung cancer, and a dozen different illnesses including bladder cancer as it may—as it happens. Without necessarily studying each of these chemicals on their own. Hydraulic fracturing is like a bunch of different brands of cigarettes, in a way, each of which has—if each shale has its own signature as to what's going to be found in the produced waters, but I do think that one can study this in aggregate. Where this falls down is really in asking specific hypostasis, as to well, if we left this out of the mix, would it be safer, and without the industry supplying us candidly with the unique identifiers of these chemicals so that we can actually know what they're putting in, there's no way we can go back to the lab and say, well, is this an endocrine disrupter? What happens if this is used in experimental animals? Does it have any effect? Does it cause cancer? Whatever. We can't do those sorts of biological possibility studies, which are not really epidemiological studies, those are more basic science studies, but they do need to happen, as I discussed within the component of my talk, which addresses endocrine disruption. Because these are effects which can occur decades later and I see today in my patients, for example, patients whose mother's took diethyl festal when they were pregnant, I still see their daughters and sons today who are coming to me with the problems to their health. So we're talking about things which are not only things that affect people immediately, but they affect the next generation and some of them may even be transgenerational.

MR. SWEENEY: Thank you.

MR. GOTTFRIED: A couple of questions. One question I directed to the previous witness as well, do you—is there a difference in substance or degree between the concerns you would have about the, I don’t know, conventional long-standing practice of vertical drilling with hydraulic fracturing, versus the new practice of long horizontal drilling? Is it a difference in— is it a qualitative difference or a difference of degree or not a difference?

DR. LAW: Well, I first have to state that I am not an engineer, so I don’t know all of the differences between the two processes, but I do know as the previous speaker said, that a different tool bag of chemicals are being used and the scale certainly is very much larger, in addition, the potential for contamination of the environment is greater because the horizontal legs are so much longer. So I think that probably the answer is all of the above. But as I say, I’m not an expert on the subject.

MR. GOTTFRIED: Your observation about hydraulic fracturing, essentially withdrawing a large volume of fresh water from the ecological system and burying it deep underground, can you give us a sense of scale involved annually? I mean, if there were widespread hydraulic fracturing in New York State, annually, would that be the amount of water consumed by a small village, or half of Brooklyn, or Texas?

DR. LAW: Well, to tell you, I try to put a scale on it within my own town of the City of Ithaca for a single hydraulic fracture of one of those horizontal legs is the equivalent use of a whole City of Ithaca for one day. That's how much is used for one of them. Remember, there are multiple legs and--

MR. GOTTFRIED: One of those four how--

DR. LAW: Yes. One of those would be about in a three to five-million gallons, which is about the - - --

MR. GOTTFRIED: For what period of time?

DR. LAW: --school or city.

MR. GOTTFRIED: I mean, the one well that you're referring to, over what period of time?

DR. LAW: Just a single fracking episode. It requires an enormous amount of water, from what I understand. And having said that, I think that, you know, in aggregate, one of the things about New York State is that our most valuable resource, natural resources, is actually water. It’s not natural gas. And if you look around at the world at the moment, I think a lot of people realize that. And I worry greatly about what we may do to this very, very precious resource that we cannot renew once it is damaged.

MR. GOTTFRIED: The endocrine disruption process that you referred to, why, I mean, I can easily understand why very small concentrations of a chemical would cause major disruption, small causes can cause large effects, does anyone know why larger concentrations do not produce larger effects? Is it--and do larger concentrations produce a smaller effect?

DR. LAW: Well, the endocrine system is very complex and the way in which the specific proteins called receptors work and it is such that in some cases when you add more of a stimulator or a blocker to the receptor, it actually down-regulates it. It switches that receptor off. And it does so by a number of mechanisms, one of which can be the receptors are simply recycled back into the cell. It switches them off. And we use that. I mean, patients, for example with prostate cancer who need to have no androgens, testosterone in their system, we give them a huge dose of a hormone called lupron, which, in small doses would stimulate the production of the hormones that lead to testosterone production. But when you give him a large amount, it switches it off altogether. So we actually are using this very property of endocrine disruptors in our clinical practice.

MR. GOTTFRIED: Thank you. And what is the endocrine disruption exchange?

DR. LAW: This is an organization which was founded by Theo Colborn (phonetic), who is an environmental scientist, which has created databases of endocrine disruptors which are characterized in general, but specifically because she lives in the county close to a lot of hydraulic fracturing to the chemicals involved in this process. It’s a non-profit organization and they, at the moment, have impressed their first publication looking at the range of chemicals, which they've identified from material safety data sheets. This shows, and it's really quite compelling data. They started off with three hundred and—sorry—it's 944 products named like optically, you know, whatever you call it, identified 632 chemicals and found the unique identities of 353. And when they looked in the literature toxnet (phonetic), popnet (phonetic), and other places, 37-percent of these chemicals were shown to have some reference in the literature to an endocrine property. Now that does not mean that these are all endocrine disruptors. Maybe only a small portion, but what it raises is a concern that we haven't got, yet, a decent set of assays by which to identify which of these chemicals actually are endocrine disruptors. The EPA has now set up a protocol for this very purpose. But it's not a swift process, and it's not a cheap process. But I do think that here we have a finite number of chemicals we don't know the identities of many of them, which one could put though these types of assays and at least rule out those which appear to be bad offenders. And I think we have the technology to do this right now. And I think that this is a project that needs to happen.

MR. GOTTFRIED: Thank you.

MR. ENGLEBRIGHT: Thank you for your wonderful testimony, Dr. Law. We've heard from two - - scientists right at the top of this hearing and I want to congratulate the two chairs for bringing you to be able to share this information with us all. I am very concerned about many of the parts of your testimony. Let me just first just say, though, that you've helped frame and context a couple of important things. One is particularly poignant in which you state that hydraulic fracturing appears to be a large misconceived experiment in which unspecified toxins are being introduced in an unpredictable fashion to human subjects without any systematic or scientific attempt to establish or quantify its impacts on human health and well being. That framing of concept, I think, if very important. So even if that was the only thing you said when you came here, I think that was a meaningful contribution, but you said much more than that. The Energy Policy Act of 2005 you said that researchers as a consequence of the limitations placed on information data gathering, research, this is to quote you, research and policy makers are forced to play a guessing game to identify chemicals from the material safety data sheets, the gas drillers are mandated to produce, unfortunately, the MSDS is contain proprietary names and although we can be fairly certain of the identities of many chemicals of this kind of time-wasting analysis, we cannot infer any chemical identities of many others. This 2005, then, this is my words, this appears to me to be an intentional blinding action on the part of policy makers in 2005 so that we would not be able to have scientists really have the chance to look at things, accurately. And that’s most unfortunate as you pointed out. What do you think we should do as policy makers and lawmakers to attempt to open the eyes and restore the sight and clear vision of what we’re dealing with?

What policy changes need to happen to enable scientists to do what they're supposed to do for our society?

DR. LAW: Well, I think that this is a self-defeating business strategy by the energy industry, which is a hostage to fortune for them. I think that they've tried, in many different ways, to wriggle around this issue and in some senses have been a bit disingenuous. For example, Helen Burton (phonetic) put up a website about what fluids—what are found in fracking fluids in Pennsylvania and in some other states. At the very bottom of the list, there's a chemical, which is called water, and they give it the chemical abstract services number. But, of course, they're highly selective and they have not been cooperative with the EPA in answering a subpoena to divulge what they're actually adding to the fluids. Other energy companies have come together and they say about 80-percent of them have to disclose what the chemicals are, but they've reserved the right to exclude those which give them a proprietary advantage. So we know from the track record at this point that there's not going to be a voluntary submission of this data and therefore this has to become the absolute prerequisite to considering the introduction of hydraulic fracturing to any new area or anywhere, for that matter. Unfortunately, as far as I understand it, you know, the Federal government do not look like they're rapidly going to do this. I know that there are a number of acts, which are going through congress at the moment to try and at least restore these provisions to the safe drinking water act, which is what took them away. And I think that that's probably the best route. But I think that each state has the right to say, sorry, we don't want your technology here if you're not going to be candid with us.

MR. ENGLEBRIGHT: Well said. Simple question. Shouldn't the industry pay for some of the costs of this research?

DR. LAW: Absolutely. And, in fact, in these various - - of the precautionary principle, it suggests that those people who are going to profit from these technologies should contribute to the understanding of the possible pitfalls and, of course, this should be done in a openhanded fashion. I think it would not be good for them to do what you might call advocacy based science where they say, well, we've got our team of scientists and we give them a lot of money and look, hey, this is very safe. I'll even drink the water coming from this. I think that that kind of approach will not work. I think that this needs to be money, which is given to independent bodies, which can then distribute it to reputable scientists who've applied with peer-reviewed grant submissions.

MR. ENGLEBRIGHT: Bad theater is not what we need, good science is what we need.

DR. LAW: Exactly.

MR. ENGLEBRIGHT: Thank you for your testimony.

MS. SCHIMEL: Thank you, Dr. Law, for your testimony. I just wanted to make three comments. Not necessarily questions, but if you can call it questions, by all means, answer it.

I find as the state policymaker your testimony particularly compelling for it’s irony and a positive irony. Number one, one of the things that is transparency aspect of it as someone who is a state lawmaker who is constantly scrutinized for transparency in the way we do government and we’re constantly, in terms of the press, in terms of our public opinion that transparency aspect, which is so important to what we do, that irony that comes out, you know, from the industry perspective is very compelling. Also, I want to cite what Chairman Sweeney talks about finding the cause of linkage. I mean, I think that’s the excuse that’s given that we cannot find the definitive cause of linkage in terms of the technology to the medical health implications, which I find, you can never definitively in other aspects of policy can you ever really definitively find out. That is the great mystery of life. You cannot. But there is the assurance that based on common knowledge and science that we can find that cause of linkage and I think it’s very important to what you said. But the most important thing to me and the line that you have in here, which really stands out at a policymaker is one of the things that I look at, and I’m trying to be fair-minded, and I look forward to hearing the testimony from the industry, is, you know, why are we doing this. And as a policymaker, it’s national security concerns, freeing ourselves from foreign oil dependence, which is certainly very much a hallmark of what it stands for. But you bring up a very interesting point, which is not been I haven’t heard before about, in a drought afflicted world, in terms of national security, it’s not just oil and gas, it’s also water. And we’re starting to see that, particularly in Africa. Particularly in China. Particularly in Israel, and the Middle East. And that so goes the neighborhood. In other words, we are a global economy. We are who we are, and our security concerns will, I believe, some day rest more with water than it does with oil and gas.

DR. LAW: New York State is the Saudi Arabia of water.

MS. SCHIMEL: Thank you. So as a policymaker, one of the concerns that I have is, and as you point out, help people, but also, you must not do harm. But does our policy, the ends, I hope always justify the means. And I am—has not been—that's what I'm hoping to get today in going forward. Does the ends, which is freeing ourselves from dependency and allowing the consumptions to continue in security, does it justify the means? Are we setting ourselves up for more policy concerns that we will have to, once again, address decades to come, and that's the irony of what your statement brought to me and I thank you for that to bring to the public domain. Thank you. Is that a question?

MR. ENGLEBRIGHT: Thank you very much Doctor.

MR. SWEENEY: Next we will hear from Dr. Kevin Chatham-Stephens, Pediatric Environmental Health Fellow Mount Sinai School of Medicine.

DR. KEVIN CHATHAM-STEPHENS: Good morning.

MR. SWEENEY: Welcome, Doctor.

DR. CHATHAM-STEPHENS: Thank you Chairman and Committee Members for inviting me here today. Like you said, my name is Kevin Chatham-Stephens, and I am a pediatrician completing an environmental health research fellowship at Mount Sinai under the supervision of Dr. Phil Landrigan and Dr. Myron Galvez (phonetic) two leaders in the field of environmental pediatrics. As a pediatrician I'm really—(clears throat)—excuse me—as a pediatrician, I'm really focused on the environmental determinants of children's health. I'm here to advocate for the inclusion of children's health in our society's current discussion regarding natural gas extraction.

I was actually quite pleased to see that I am not only the sole pediatrician in this list of ten individuals, there are two pediatricians as well as two endocrinologists, a toxicologist, psychiatrist, in addition to all the Ph.D.s. So I think you guys did a fantastic job of getting a diverse group out of ten individuals, including individuals from the Public Health field and from industry, which I think in this complicated topic is definitely needed.

So we know that children differ fundamentally from adults in multiple ways, which places them at a higher risk of exposure to toxic chemicals. In medical school, we are constantly reminded of these differences with the statement, children are not little adults. And I know that might seem obvious, but for decades in the field of toxicology and medicine, those differences weren't really fully realized. And I'll just go through some of the reasons why they are different. On a pound-per-pound of body weight comparison, children actually consume more food and water than adults, which can result in them consuming relatively higher amounts of pesticides from food, or lead from drinking water. Due to their faster breathing rate, their lungs may be exposed to air pollutants to a greater degree than adults. In addition, the detoxification process in infants and children are oftentimes immature compared to adults. And perhaps most importantly, the fetus, infant, and child each proceed through crucial, highly programmed developmental stages. Each of which is uniquely vulnerable to disruption by a variety of toxics.

And, unfortunately, history is littered with examples of toxic substances being used or liberated without sufficient knowledge of their safety profile and long-term health effects. Lead, for example, was used for decades in paint and in gasoline before its permanent, negative impact on development and cognition in children was understood. If you look at the history of mercury it proceeds in a similar fashion and it's also very well known as a potentate or a toxicant. Our children and society, overall, continue to pay the price for these toxic substances with reduced IQ, impaired attention, and poor reading skills. Understanding these historical examples and the unique vulnerability of the fetus and child to environmental toxic exposures helps frame the discussion regarding public—(clears throat)—excuse me—regarding potential health impacts from natural gas extraction.

So from my standpoint, there seems to be four major potential routes of exposure, potential routes of threat to our health from natural gas extraction. And they are, potential contamination from drinking water, potential increased local air pollution, potential increase noise pollution, and then potentially mental health effects, as well. I think the first two have been covered quite well by the previous two speakers, so I'll truncate my testimony on those two topics and focus on the last.

So just to begin with the establishment of clean unpolluted, easily accessible drinking water was a public health victory that resulted in significant reductions in morbidity and mortality. Natural gas extraction from the drilling process to the hydraulic fracturing and management of wastewater presents a potential threat to this significant achievement. Recent investigations have begun to confirm the anecdotal reports of the private drinking water well contamination in addition to the Osborne study, that was just mentioned, in December of last year the US EPA concluded that elevated methane levels in two private drinking water wells in Parker County, Texas were due, at least, in part, to nearby natural gas drilling.

And as children consume relatively larger amounts of water and have a longer life expectancy than adults, they may be more vulnerable to toxic exposures from drinking water. And I echo the precious speakers when I say that systematic, post-spectrum studies are needed to adequately address this issue.

So moving on to local air pollution. Due to multiple factors including their faster breathing rates, ongoing lunch maturation, and higher prevalence of asthma, children are uniquely susceptible to increases in air pollution. Over the past several decades, the prevalence of asthma in children has steadily increased. Many for the reasons that we don't fully understand at this point. Since found level ozone and many of the products of diesel fuel combustion had been linked to asthmas, respiratory symptoms, and various other health effects the impact of potentially exposing more children to these air pollutants should be examined.

So now, like I mentioned, I kind of shortened my testimony on those two subjects. Now I’ll talk about two that I don’t think have gotten as much publicity as they should. So I’ll start off with noise pollution. While historically not studied to the degree as air pollution or environmental toxicants, the impact of noise pollution has recently become a focus of many researcher and public health authorities. The World Health Organization labels noise pollution as, quote, not only an environmental nuisance, but also a threat to public health, end quote. The WHO estimates that approximately one million healthy life years are lost each year in Western Europe due to noise and traffic, while other research has shown that airport noise, adversely affects academic performance in children. With drilling occurring relatively close to houses and schools in certain parts of the country, such as Texas and Pennsylvania, the potential for increased noise level should be addressed also in a systematic fashion.

So regarding mental health effects. Research has shown that children and adolescence are at risk for mental health disorders, such as PTSD, anxiety, and depression, following a variety of disasters, including shooting sprees, terrorist attacks, and natural events such as hurricanes or tornadoes. Therefore, the potential impact of explosions and spills on children's mental health should be addressed and adequate supports be provided in the unfortunate scenario in such a disaster. Many families that I've talked to also endure stress and anxiety regarding the uncertainty surrounding natural gas extraction, especially the concern of drinking water contamination and changes to their local communities.

To be comprehensive, any prospective health study that's done on this issue should include assessments of mental health and quality of life. So whether it is water contamination, increased air noise pollution, or mental health effects, children are uniquely susceptible to health threats in their environment. More vigorous research into the impact of hydraulic fracturing has been urged by a variety of groups, while the ongoing EPA study of the life cycle of water through the process of natural gas extraction will address one potential route of exposure, additional studies are needed for a comprehensive evaluation of air pollution, noise pollution, and mental health effects. It is imperative that the health effects of pregnant women, infants, and children are adequately studies in order to weigh the potential benefits and risks from natural gas extraction. Thank you.

MR. SWEENEY: Thank you very much, Doctor. So clearly you’re saying these are areas that we need to be concerned about, but also areas with regard to hydraulic fracturing that we don’t know enough about.

DR. CHATHAM-STEPHENS: Correct.

MR. SWEENEY: And therefore the need for additional studies. What kinds of studies? How long would these kinds of studies take to complete?

DR. CHATHAM-STEPHENS: Those are--

MR. SWEENEY: What should we be—how should we be going about this?

DR. CHATHAM-STEPHENS: Sure. It’s a fantastic question. I think it’s been addresses somewhat by the two previous speakers. There are a variety of epidemiological studies that can be performed, kind of the gold standard are your prospect of longitudinal cohort studies where you have a community, for example, you have a community before any natural gas extraction is going to occur. You start studying them beforehand, all right. Because all the criticism of all that’s being done right now with hydraulic fracturing is that we don’t have any baseline data. Right? So if you have water that’s contaminated the industry will say, what some public health people would say is you don’t know exactly where that contamination came from, because you don’t have baseline data. So you need to start optimally in a community before there's any natural gas extraction going on. And so, you get your baseline data at that point, and then you study the community in a longitude fashion. So you do it before any extraction occurs, during extraction, and then afterwards as well. So the unfortunate or the drawbacks in those types of studies are obvious, they're obviously quite long, so those are years. The EPA portion, the study of the EPA portion looking at water, they say they're official results will be back until 2014 in some aspects of the study. So the prospective studies are long and they're also quite expensive to some degree.

MR. SWEENEY: Well, the during and after part of those studies infers that there would be drilling that would proceed and then we would study the results of that, which is a little different, than, I think, cautionary principles that some others have talked about this morning, which would argue in favor of don't do it unless you know exactly what you're getting into first.

DR. CHATHAM-STEPHENS: Sure. And I think in different parts of the country you may be able to do different types of studies, because there are certain parts of the country where this is going to proceed regardless of what public health authorities have to say, I believe. Here in New York, we have, fortunately, we have the opportunity, perhaps, to use precautionary principle and study things first and get information from a variety of sources, before we proceed, but in other parts of the country, they're still doing this quite regularly. So that might be one instance where you could go into a community and start studying that before it's done and you continue to do it afterwards.

MR. SWEENEY: Well, do you know of any studies that you would considered to be valid scientific or medical studies that exist now that examine—have examined these issues and produced a report, conclusion or any sort?

DR. CHATHAM-STEPHENS: Not that I know. Exactly like Dr. Law mentioned, you know, they did the systematic literature, they would be looking for specific papers and what you'll find is stuff like the Osborne paper, which was fantastic, you'll find Theo Colburn's paper from the endocrine destruction exchange, but none of those you're looking at necessarily human health effects. So they're definitely a piece of the puzzle, they're trying to show that there is some exposure to a variety of chemicals, but the next step will, obviously, be to link that exposure to human health effects. And that's, oftentimes, most difficult link to complete in the epidemiological study.

MR. SWEENEY: Do we need to separate out studies on children and studies on adults, or are there things that we can extrapolate from, let's say, a study of children with regards to adults or vice versa?

DR. CHATHAM-STEPHENS: So I think a lot of times it is difficult to get a child data for a variety of reasons, often times, our families are quite reluctant to have their children involved in studies, even if it is kind of epidemiological data driven study. And they're just not as many families that are willing to participate in studies like these. So oftentimes what is done is that you do get the adult data and you extrapolate it down to children. The thing that you have to keep in mind, though, is that children are, like I mentioned are more susceptible toward a variety of toxins, so, a level of chemical X, the safe level many be lower in children than it is in adults. And so you have to take into account those fundamental differences between children and adults.

MR. SWEENEY: Let me ask you a question similar to what I asked someone previously, which is, in those families where there are medical conditions that the families attribute to living in close proximity to drilling, after the fact, now that these medical conditions exist, is there a way to figure out whether they are attributable to hydrofracking that’s going on, or not?

DR. CHATHAM-STEPHENS: Sure. I think theoretically it is. Like Dr. Law mentioned, it will be somewhat difficult to kind of tease out all of the determinants of health. So we know that people’s health are influenced by a wide variety of factors. And we have been able to show that community level studies are important, so if you look at a study looking at the Atlanta Olympics, what they did is they studies ozone layer levels, like the previous doctors mentioned, ground level ozone levels, so they study them beforehand, during the Olympics, and afterwards. Because what Atlanta tired to do is they tried to clean up their air and encourage people to use public transportation, not drive, that kind of stuff. What they saw is that when the ozone level dropped during the Olympics asthma emissions, asthma visits dropped as well. And so they correlated quite well. And so that's just one example of being able to do community level research without going to individual families and discussing it with them. So I think it is possible, but like Dr. Law mentioned, I think it's going to take a bunch of epidemiologists and public health authorities to get together and design these studies.

MR. SWEENEY: Thank you.

MR. GOTTFRIED: I don't have any questions, I just want to ask you to give my best to Dr. Landrigan and you're very lucky to be working with him. He's someone we've relied on for advice and support on many, many issues.

MR. ENGLEBRIGHT: Please, I just want to echo what Chairman Gottfried just said. Please extend my hello to Dr. Landrigan. Thank you.

DR. CHATHAM-STEPHENS: Thank you.

MR. SWEENEY: Thank you very much. Next we will hear from two people testifying together. Uni Blake, environmental toxicologist, Independent Oil and Gas Association of New York, and Dr. Scott Cline, geologist and petroleum engineer, Independent Oil and Gas Association of New York. And I believe you have a presentation— a PowerPoint presentation.

DR. UNI BLAKE: Yes.

MR. SWEENEY: Okay.

DR. BLAKE: We have some technical difficulties, so.

MR. SWEENEY: Okay.

DR. BLAKE: I think I'll just go ahead and proceed.

MR. SWEENEY: Sure.

DR. BLAKE: So, Chairman Gottfried, Chairman Sweeney, and distinguished Members of the Assembly. I want to thank you for this opportunity to come before you and talk to you about the health effects. As you know, my name is Uni Blake and I'm please to be here to offer some comments and see how I can help you. I'm here because of my training as a toxicologist and environmental scientist. I have been working at building and applying regulatory processes to a number of industries, which include the oil and gas industry. And this has entailed me to work directly with some of the regulatory agencies, the EPA, the FDA and as well as our own DEC. So that being said, I would like to help you address the question of how best to review the potential health effects of the fracturing techniques used in the oil and gas industry. I believe the how is why I'm here.

After listening to some of the public statements and reviewing some of the discussions in the media and attending a lot of the different meetings, I noticed that there was one thing that was obviously missing, and that's a discussion about what is called exposure pathways. There has been a lot of information made available about the toxicity of the chemicals. I'm not going to get into that. I'm just going to dwell mostly on how these chemicals could potentially enter a person and affect their health. So I think what's every important, what I really need to reiterate is the pathways need to exist. And they need to be completed before any type of health effect can occur.

So the Agency of Toxic Substances and Disease Registry and which is part of the CDC, and the US EPA use pathway analyses for chemicals that have the potential to have negative effects on people. So they do this when they're performing public health assessments or risk assessments. Results from these assessments are important in establishing how the industry can go about mitigating different processes and conditions, specifically, to protect human health.

So, again, the key is containment.

Properly contained chemicals cannot create any changes in our health. I'll just draw up there like a loose example the gasoline in our tank is a very, you know, potentate toxic chemicals, but as long as it's well contained in the petroleum tank, we don't really worry about it. So I think the key here is containment. But what brings us here today is what I call those surprises that occur and these are those incidents. These incidents are usually related to human error or mechanical failure such as leaky valves or hoses, or incidents involving the transportation of the fluids. So doing these particular assessments can help provide the qualitative and quantitative results that people have been asking and talking about.

Since there's no environmental contamination data in New York State related to hydraulic fracturing because there have been no such instances, an assessment of the potential health effects relies on data obtained from environmental modeling studies and data from other States where similar activities have been taking place. As a risk assessment, you design a conceptual model and you use statistical tools to use you to model for these surprise scenarios and in these particular scenarios, incorporate all the physical, chemical, and biological changes that could potentially occur to the chemicals once they're released into the environment.

So just a little brief up on what an exposure pathway analysis is. It's basically a way to connect the dots from the source all the way to the health effect. So the first element is the presence of the source. We all know that there is a source of chemicals here, and Dr. Cline will talk about more the potential source from the reservoir. I'm mainly going to focus on problems that potentially could occur on the surface.

The second element would be the availability of the media to transport the contaminants. This refers to the groundwater, the soil, the sediment, the surface water, the air, and the food chain. So successful transportation through these medias is determined by, again, the chemical, the physical, and biological processes that occur in this media, which is referred to as a fate and transport. These processes can result in complete degradation, dissolution, or dissipation of the chemicals, making them biologically unavailable for exposure.

The third element of the pathway analysis is the point of contact, which means that people have to come in contact with these chemicals. And example of a contact point that we have discussed here today is a presence of a drinking water well where a family may draw their ground water for drinking.

And the fourth element of the exposure pathway is the contaminants will enter the body either by inhaling, ingesting, or injecting, which I hope, nobody would do, or through dermal contact, such as inhaling dust particles, drinking the contaminated water or physically touching contaminated soil.

And the fifth element is the presence of a population. One of the reasons we are having this discussion is because I believe that the drilling moved from more rural areas where there was—where the fifth element was missing. So when you do a model exposure pathway, all these five elements have to be met for you to say that a pathway is completed. If one thing is lacking then the pathway is not completed. For example, if you have a contaminated well and nobody drinks out of it, then the pathway is not completed and we will not have any negative or adverse health effects related to that particular pathway. And so when we modeled the different pathways, we found that there were some that were completed and some of them can be eliminated through, again, containment. The use of closed loop systems can eliminate some of the pathways, which means if we do not use open pits and we contain all the flowback fluid in a container, then that inhalation pathway ceases to exist.

The use of setbacks, if the well pad sits far away enough from the local residents, then that particular pathway will not exist. Then also the use of physical barriers, you know, we talk about animals, you know, walking into the pits, you know, just trying to block the physical person from physically getting close to whatever problem it is and then in an event of an accidental spill, the DEC has a department where they deal with the spill response program, which is designed to protect the public and, you know, people's safety. And also just something simple as re-routing the traffic. If you don't run the trucks through where you have a susceptible population then you're not dealing with the issues related to the emissions and the dust particles on the intense smaller level.

So, again, as I said in the event of a completed pathway, the next step of an accessor would be to do a risk assessment or a potential health evaluation. The risk assessment establishes quantitative values. For the concentrations that would be ingested or inhaled by the local residence, these calculated values are then compared to standard environmental health with those based comparison values and these values have been used for a long time.

They include drinking water, standard levels, they include some of the ambient air standard levels, so once you compare the calculated or predicted values with these, then you can determine whether, you know, there's a risk for cancer, or there's a risk for non-cancer, or on the different chemicals have raised concern. So a health evaluation on the air emissions also would include a literary review of health effects related to workers in the oil and gas industry, a review was conducted and it did not reveal any signs of chronic illnesses that were related to workers exposed at the well sites. Even when they did the review of workers who were exposed to levels of benzene working and so the inference is since the workers who were exposed to these high concentrations for longer periods of time it is expected that the local residents and the people who belong to the more sensitive populations, subpopulations with lower actual exposure durations were not expected to develop the chronic illnesses. So using setbacks in some of the industries' best practices, are designed to minimize some of these pathways.

Health effects associated with hydraulic fracturing related water treatment, we have discussed this a lot at our level. As far as the wastewater goes, New York State through the DEC have a very stringent program through the national program as well. So waste water treatment of flowback guidelines are outlined by the DEC and only certain wastewater treatment plans are allowed to handle frac flowback water and they're expected to meet pre-treatment standards.

And then the health effects associated with the emissions, I briefly mentioned that. On May 6th of this year the Pennsylvania Department of Environmental Protection released a study where they stated that there are no health effects associated with the natural gas activities in the north central region of the commonwealth. This region produces dry gas, which is similar to the type of gas that we expect here. And by dry gas, I believe be mean that you don't have a lot of the other compounds besides the methane and the gas, you know, that are worrisome.

One of the previous presenters talked about doing air modeling and the DEC did do an air model study. It's in the draft supplement. The results of the modeling showed that potential air emissions exposures can be eliminated by using proper setbacks and containing frac flowback fluids. Health effects associated with drinking water, again, this is all a part of the health evaluation.

Gastem USA, which is a exploratory company down in—operating in Otsego County. I work as a technical consultant for them. We have collected over 50 different sites of water quality as a baseline from private wells and surface waters and we did this around a vertically fractured well in the county. The sampling started in 2008, the well was fractured in 2009 and we're still continuing collecting watering samples to date. We haven't noticed any significant changes in the water quality barring seasonal fluctuations. And I'm not sure if you're aware that this particular well was a part of the Duke's study that Osborne did, Steve Osborne and Abner did. There was methane detected prior to the fracturing of the well. Actually, we have seen about 20-percent of the water wells in the county do have methane in them in detectable levels and after the hydraulic fracturing that was done, we did not notice any change in the amounts of methane that was in the wells. So I just wanted to throw that in there.

So I'm going back to what they did out is Garfield County in Colorado. They did a community health risk assessment and what they noted was they did not notice that there was going to be a health crisis associated with the industry. And as we know, there's a lot of activity going on in Garfield County. So what they put at the end of their report was the use of best practices can reduce risk and more data is required and I do acknowledge the fact that we do need more data to connect the dots. Somebody had raised the point that if you have somebody that's sick and there's a well going by, we do need more data to try and find where the relationship is. And so in summary, and just to reiterate, the key to protecting the human health is containment and regulation. Modeled health assessments and risk assessments have been evaluated based on recreating potential viable pathways and affirming whether these links exist or they do not exist, if chemicals can be contained, then pathways can be eliminated and human health protected. However, there is the factor of human error and mechanical failure and there is the potential that incidents will happen. But through risk assessment modeling, it is expected that due to setbacks which will help natural attenuation, which is what happens to the water as it moves through the ground and dissipation, the dilution and a hose of other biological, physical, and chemical processes involved during the transport of the chemicals, concentrations that are available at the point of contact will not be significant enough to elicit an adverse acute health effect. Thank you for the opportunity.

MR. SWEENEY: Dr. Cline, would you like to - - this morning and then we'll have—okay.

DR. SCOTT CLINE: Chairman Sweeney, Chairman Gottfried, distinguished Members of the Legislature. The Independent Oil and Gas Association appreciates this opportunity to share our perspectives on the health and facts of hydraulic fracturing from natural gas wells. My name is Scott Cline. I hold a Bachelor's Degree in geological science from PennState, both Master's and Ph.D. in petroleum engineering. I'm with the University of Oklahoma. I began my career in 1976 as a geophysicist for Gulf Oil, which is now part of Chevron and then worked for over 25 years in the oil and gas industry as geophysicist, geologist, petroleum engineer, and later as senior manager of several oil and gas companies based in Huston, Oklahoma City. I currently reside in the Finger Lakes region of New York. I was extensively involved in the early implementation and development of horizontal drilling, especially in Oklahoma. And my research interest and publications primarily concentrate on horizontal drilling and naturally fractured reservoirs, fluid flows and forced media reservoirs simulation, as well as gas reserve analysis.

Most recently, I served as subject matter expert for the EPA hearings in Arlington Virginia on well construction, hydraulic fracturing and fluid flow and forced media and I also helped the Quebec’s office in public hearings and the environment and helping them to design regulations similar to what we’re doing here in New York. Neither fracture stimulation nor the production to produce water back to the surface to the well boar poses a risk of fluid migration to sources of underground drinking water. There is some risk of exposure pathway in case of large surface spills that are not contained to the lined drilling pad, but not from the subsurface operations.

The fracture stimulated production zone is typically a mile or below more below the underground source of drinking water, which I’ll refer to as USDW for brevity. Approximately 30, plus or minus, ten-percent of the fracture fluids are recovered over the life of the well. And directed per proposed regulations in New York into tanks at the surface. Within the first few weeks to months following fracture stimulation, the remaining 70-percent, plus or minus, ten-percent of the fluid is imbibed into the large surface area of the fractures and locked effectively into place with the - - brine by capillary forces for geologic time. Even if that fluid could move within the subsurface, which it cannot, the fluid is separated from the USDW by thousands of feet of numerous - - layers of strata and neither a permeability path nor a pressure gradient to move it exists. Permeability sustained pressure gradient and the availability of fluid are all required or fluids will not move in the subsurface. The fracture stimulation, which lasts only a matter of hours to days for each fracture stage, after which the pressure gradient is reversed and flow to the well boar begins. The well boar thus becomes a pressure sink, the lowest pressure point and that any available gas and fluids then move to that pressure sink and up to the surface to the well boar that had triple or often quadruple redundant layers of steel casing and cement, plus tubing to protect the USDW. The naturally occurring Marcellus fracturing joints that were created naturally, millions of years ago during the gas generation phase do not extend above the Marcellus. The Marcellus is, in essence both the source and reservoir in a closed petroleum system. Over time, even these natural fractures became partially mineralized and disconnected. The object of the fracture stimulation is thus to reconnect them and thus allowing the gas to flow to the well boar more effectively. When these natural fractures are subsequently hydraulic fracture stimulated in horizontal wells, the wells typically, as I mentioned exhibit good gas production but poor fluid recovery. The relative contribution of the fluid entrapment are fluid leak off into the fracture face.

I supplied a white paper to you as a secondary aide that has some visual aides in here that might be useful in visualizing this that I presented at the EPA hearings.

Additionally, absorption of water to the hydrophilic clays, the material in the shale wants to capture some of that water. Narrow fracture branches also trap the fluid by stranding capillary forces and fluid also drops to the bottom of the propped packs by gravity and the gas flows preferentially above it.

In addition to fluid retention mechanisms the fracture pressures, which could, potentially, drive fluid from the target shale formation through toward an aquifer are only applied, as I mentioned, for a short period of time, for which flow is reversed. Even if the water was not trapped, and could be moved, the developed shale formations separated by thousands of feet of an impermeable laminated - - required—would require decades if not centuries to move that water to the surface. Instead, the formation experience is continually decreasing in well pressure during production and eventually there’s no energy even available to move fluid to the low permeable shale and not even to the well itself, eventually.

Even though gas production is directed to the well boar during production, it’s certainly prudent to examine the potential height of fractures that are created by hydraulic fracturing. While the mechanisms that limit the vertical fracture height have been widely discussed and investigated, observed in laboratory and field testing, direct evidence is also available showing the limited extent of vertical fracture propagation. This is done through micro sized macro monitoring and testing, which gives us essentially a subsurface picture of the height of the fracture stimulation. This was recently illustrated in the literature where an extensive micro sized data base in the Marcellus formation and also one was done in the Barrnet, showed the vertical separation between the highest vertical extent of the - - fractures to the shallow ground water sources, indicating that fracture stimulation was not creating fractures anywhere near, except thousands of feet still separating the stimulated zone from the ground water. I provided that in my additional paper here, too.

In fact, in addition to this, vertical fracture propagation at depths of less than 3,000 feet is not even possible. As natural - - stress fields tend to rotate the fracture propagation from vertical to horizontal depths of less than 3,000 feet. In other words, the fractures begin to rotate horizontally, they cannot be created vertically, and they go along the bedding flanks.

In addition to that, DEC regulations as proposed do not allow high volume fracture stimulations at depths at less than 2,000 feet without site specific review.

In any event, reduced fractures do not extend far above the target zone and the injected water that does not return to the surface through production is trapped by the combination of capillary geomechanical - - stranding and absorption mechanisms, which render most of the injected water immobile. Thus, once the stimulation pressures, lasting as I mentioned only a matter of hours, are released fluid flow is directed to the well boar and up to the surface to the production - - . The purpose of the well casing design is to effectively hydraulic the isolate the deeply buried formations from the near surface. This is accomplished through a redundant, triple to quadruple system of overlapping steel casing cemented entirely to the surface. New York's regulations require cementing the casing all the way to the surface, the perforations at the very bottom of the well boar where the gas is entering the well boar is the only pathway for the fluid and migration of the gas. It wants to find the lowest pressure path to the surface. It's not going to go around the casing. Even if there was a crack in the cement, which there would not be, because we test it both mechanically and through sonic log testing? It would still preferentially want to go up that center string of casing where the perforations exposed the formation.

There is no basic difference in well construction actually between vertical and horizontal wells. After drilling over a million onshore wells in the US, there are still no confirmed cases of groundwater contamination from hydraulic fracturing in the producing zone. It is true that methane had migrated into groundwater sources occasionally. However, it is important to note that it is not from the stimulated zones of the shale target zones. The methane - - is rather a result of mere surface sources of methane, naturally occurring. They're in close proximity to the groundwater sources. This statement is also well confirmed by the Department of Environmental Protection and Pennsylvania that confirm the methane that was found in the wells of Dimmick was not coming from the Marcellus. These incidents can be prevented and if necessary remediated with existing technologies and a good knowledge of the shallow geologic conditions. In fact, proposed regulations would have mitigated these publicized events.

In summary, the water that remains in the formation that is trapped effectively for geologic time with no mechanism to move from the deeply buried formations, the gas and fluids that do not remain trapped in the formation flow to the well boar, pressure sink and safely to production facilities at the surface. The surface is where the attention to preventing spills and processing water should be concentrated. I'm confident the current industry best practices, existing technology, and DEC regulations will ensure that this happens. The Independent Oil and Gas Association of New York appreciates this opportunity to share our thoughts as well as myself, and I truly believe that we can balance the interest of the environment with the ability to safely develop these resources in New York. Thank you.

MR. SWEENEY: Thank you. We've been joined by Assemblymen Abinanti from Westchester County. I hardly know where to begin. I will make the general observation of both of the testimonies that you have presented, that they are limited an narrowly directed to specific things, which I would guess are the aspects of this that you want to talk about, while not talking about enormous areas of hydrofracking that are important and relevant and that other people who have testified today have talked about. So I'd like to question that, if we could take one at a time. Dr. Cline, you note in your testimony an involvement, I guess with the Quebec office of hearings on oil and gas regulations in Quebec?

DR. CLINE: Yes.

MR. SWEENEY: So I assume, therefore, you are aware that Quebec has recently abandoned any further hydrofracking in the province?

DR. CLINE: They have still not finished their regulations, yet.

MR. SWEENEY: They've announced a ban.

DR. CLINE: That's the same situation as here until they have been able to develop the regulations.

MR. SWEENEY: Well, they permitted 31 wells and then they decided they would be better off abandoning it. Is that what—can you shed any light on that?

DR. BLAKE: They did allow exploratory drilling, they took the approach that they wanted to define how large and the extent of the resource. There was never any intent in that to do developmental drilling. It was entirely to see to assess the extent of the resource pending developing final regulations for full scale development, which is in process at this moment.

MR. SWEENEY: I will ask the same question of both of you that I asked of others, which is, are either of you of any peer-review studies on the health impacts of hydrofracking?

DR. BLAKE: I am not aware of any studies that have been don. Like I said, there is a need for data because, like you said, this is a new process and to be able to connect dots, we do need that data.

MR. SWEENEY: Dr. Cline?

DR. CLINE: The health effects of hydraulic fracturing are obviously, as I mentioned multifaceted. I'm talking about the subsurface operations and whether or not there is a pathway of those fluids to the groundwater sources. And there is—it's well documented in the literature. A lot of which I gave as references in my white paper, including the EPA's own 2004 study showing that there is no risk to fracture fluids to the groundwater sources from the deeply buried underground source target zones.

MR. SWEENEY: Well, that's, that's, that's—

DR. CLINE: You're talking about a broad range of things from air to surface operations and that is not what we're here to testify about. We're trying to narrow it down to put away the concept that there is a risk from the actual fracture stimulation and subsurface. And to try to focus your attentions to surface operations.

MR. SWEENEY: I understand that's what you're trying to d, and I infer from your answer that you're not aware of any peer-review scientific studies that have been published either on health impacts - - --

DR. CLINE: Whether there have been peer-reviewed or not, I don't know, but there are many studies that have been in the literature on this subject and many of which I've referenced.

MR. SWEENEY: On the subject of health impacts, or on the subject of groundwater contamination?

DR. CLINE: Showing that there is no pathway of any of the substances to the groundwater, which would certainly imply that there are no health impacts if there is not a pathway to exposure.

MR. SWEENEY: Okay. So the short answer is no, you're not aware of any? I want to go back to one where you talk about methane and the fact that any methane that may result in water or elsewhere coming up to the surface is not coming from the fracturing that's taking place down below, that there's no pathway, as you referred to it, from a mile down to the surface for the methane, is that reasonably accurate?

MR. CLINE: That's correct. The methane, as I mentioned, such as a Dimmick was fingerprinted with carbon isotope fingerprinting as being a source from theromogenic shale as opposed to biogenic, but it was sourced from a shallower shale.

MR. SWEENEY: But does it mean that it is impossible that the hydrofracking activity that is taking place down below could not in some way form or fashion cause the methane that is about it to be released?

DR. CLINE: No. It's not really. There's not a direct pathway. It's not related to the production zone in the subsurface because, again, we have over a mile column of cement and casing separating the two and as I mentioned, the perforations in the casing--

MR. SWEENEY: Methane doesn't have to come from the casing or the piping, the methane comes from the rock formation. And if you're hydrofracking below it, which is an industrial activity that has an impact, is intended to have an impact on the shale around it, could it not have an impact on the methane that is above it that causes that methane to be released even if there isn't a direct line or connection?

DR. CLINE: No. Because we are not

creating any fracture past that far from the target zone as I mentioned from micro sized testing and our reservoir modeling we know that the fractures that are created through hydraulic fracturing only extend a few hundred feet above the Marcellus formation itself. Whereas the methane that is occasionally gotten into groundwater sources is coming from just a few first hundred feet below the surface. Close proximity and sometimes, very often naturally occurring in the water sources. There is no connection between the fracturing and those shallow zones.

MR. SWEENEY: Ms. Blake, you offer up several studies or assessments to support your contention that there are, I assume, to support a contention that there are not health effects associated with either air emissions or drinking water wells. For example, in your testimony, Gastem USA collected water samples from a site, various sites around a vertically fractured well in Onsego County. And found no problem. Are you suggesting, therefore, that the testing of a single vertically fractured well is representative of all wells and would be representative of all horizontally fractured wells?

DR. BLAKE: No. I'm not suggesting that. I was—I referred to that particular well site because it's one I'm familiar with and we do have data showing that baseline study can be done. I did present that particular topic of developing water quality, monitoring program at the EPA technical workshop, the first one on chemical analysis. There is a lot of discussion about doing baseline studies and the industries moving towards establishing programs to do baseline studies for that simple reason. I am not suggesting that it's either way, so.

MR. SWEENEY: So it's not representative? We shouldn't take it as being representative? You're not offering this as being representative of all wells in all cases?

DR. BLAKE: No. Like I said, I believe that water monitoring studies should be done.

MR. SWEENEY: You then follow that with

a reference to a study that I'm not familiar with in Garfield County, Colorado, that there is not a health crisis associates with oil and gas activities in the county. Saying there is not a health crisis is a far cry from saying there are not health problems. Does this study say that there are not health problems in Garfield County, Colorado?

DR. BLAKE: The study did mention that there was some problems to do with emissions related to benzene when they did the risk assessment. I am recommend—like I said, the key for my presentation is containment, benzene, some of the benzene did come off the open pits that they have and if New York moves towards closed contained fractful - - pits then that will lower the benzene emissions from the well site and diminish some of those concerns.

MR. SWEENEY: So then this study did indicate there are some health problems?

DR. BLAKE: They did indicate--

MR. SWEENEY: While saying there is not a health crisis?

DR. BLAKE: They did indicate through their risk assessments based on the levels of benzene in the air that there could be a higher risk of having a health effect related to benzene, the closer you were to the well pad and that's why I reiterated. I said, if we focus on moving towards contained systems, then that particular pathway will be eliminated. There's a lot of discussion in our state about Colorado and about Pennsylvania, but I see New York State as being a very environmental forward-looking state, as far as the regulations go and using a lot of those problems that they face, we can see how to better—how we do it in this state and the regulations already cover a lot of that. There was an air model study as a part of the GEIS supplemented to the GIS and they did mention that very very topic about using setbacks to lower some of those risks.

MR. SWEENEY: You make reference to air emissions also and in particular an air modeling done, I assume that's with the New York State.

DR. BLAKE: Yes.

MR. SWEENEY: And also a study released in Pennsylvania. We've heard some discussion from others who have testified today about air emissions and the various sources of air emissions from drilling which would include truck traffic, generators, not just what comes out of the well. But from a variety of other sources. Did this study in Pennsylvania take into account all of those various sources of air pollution?

DR. BLAKE: I believe they set up the equipment at different sites, which include some of the sources you've mentioned.

MR. SWEENEY: Did they also then monitor all the trucks coming in and out of the various sites? And did they monitor the generators as well as whatever is coming out of the well? And all of the other equipment that's associated that otherwise wouldn't be there?

DR. BLAKE: When they did their study, I believe it was a comprehensive study, they included all that in it. And they were really adamant to say that it was not a chronic study, it was a short impact study. So it just dealt with accurate toxicity and that--

MR. SWEENEY: We would—we would appreciate receiving a copy of that study.

DR. BLAKE: Okay.

MR. SWEENEY: Certainly, what we have heard from others this morning and in what we know of air pollution and sources of air pollution and what commonsense tells us would be that thousands of trucks a day and portable generators as well as all of the other equipment that otherwise wouldn’t be there is going to be producing some sources of air pollution and air pollution problems that didn’t previously exist in this location. So we certainly would like to take a look at that study that you referred to.

DR. BLAKE: Okay. We will make it available to you.

MR. SWEENEY: Thank you. Your—the remainder of your testimony certainly where you start off in talking about fluids, seems to focus on, you know, is there a pathway, is there a source and, you know, if fluids don’t escape, if there isn’t a direct contact, then there can’t be a problem. What about all of the wastewater that is removed and some of which is currently being taken places in New York State, which because of Federal and State regulations is not being tested for any chemicals or radiation, or anything else before it is disposed of, and what about all of the other waste that is being trucked some of it into New York State right now that is not being tested because Federal and State regulations don’t require that it be tested and that it’s being disposed of in landfills and in other places in New York State? Is that not a potential pathway for harmful substances to reach both human contact as well as groundwater and air pollution?

DR. BLAKE: Are you talking specifically about the transport from the well site to the--

MR. SWEENEY: I’m talking about the transportation itself. I’m talking about the substances that are being transported.

DR. BLAKE: It is--

MR. SWEENEY: It’s self evident that all of that additional truck traffic is going to produce problems also. But I'm more concerned about what's in the trucks and where it ends up.

DR. BLAKE: Okay. What—I believe what I said was containment is a key. So if it does say in the truck then it's not going to be an issue. But I did model in the event if a truck carrying, maybe 6,000 gallons of frac - - based on the concentrations of the particular flowback that came out of the - - well in Maryland that if it happened to have an incident and lose its cargo in the Susquehanna, I did model that and the numbers showed a very minimal impact on the water quality within the Susquehanna River.

MR. SWEENEY: I'm not even talking about accidents, I'm talking about what's being done deliberately.

DR. BLAKE: Wastewater treatment?

MR. SWEENEY: I'm talking about wastewater--

DR. BLAKE: Okay.

MR. SWEENEY: --that is coming up out of the wells and then it's being trucked to plants, it's not being tested for what's in it. It's being treated, quote, unquote, in plants that don't have the capacity to treat the items that are most likely in it, and then it's being discharged, probably into surface bodies of water. The same thing is true for the solid substances that are being disposed of. Which, because of Federal and State regulations is not tested by anybody, it's not tested by the companies, because they are not required to test it. It's not tested by the landfills where it's being dumped, because they're not required to test it. They're happy to take it. They get paid to take it. They take it, they dump it. Nobody knows what's in it. It is, in my opinion, a virtual certainty that there's a lot of very nasty stuff in it. But nobody is testing for that. What is going to end up in our—it is in our environment. It's going to end up in the groundwater. It's going to end up in the surface water. And it's my understanding in Pennsylvania, I mean, because the flowback water—I mean, forget all the other noxious stuff that's in it, but it's so salty that when it was dumped into the rivers after being treated because it's not treated for salt at these plants they just push it through the plant, they're not taking out the salt that they had to stop doing it because the utility companies downstream their equipment was corroding from all the salt.

DR. BLAKE: I could speak what—through experience what we did over there in Oneonta County. We did test the flowback water. We had to test it before it was submitted to the water town treatment plant because he had to be aware of what was in it and see how it would impact his permit, his SPDS required permit if he would go over his limits on his - - or not and so the DEC and the EPA did require that waste water to be treated. And I believe it's within the best interest, I mean, the best practices that I work on instituting within the industry it is, know what's in that wastewater and ensure that it does get treated. And so in order for him to receive that wastewater, he had to know what was in it and there was a big questions about the bio-sides that were in the wastewater, if is would have an impact on his sludge treatment procedure and he did run some toxicity tests and I do have that data, and I will gladly make it available to you to go over, to see exactly what was required by the DEC before that water was treated in water town and what they had to go through in order for that water to be released.

MR. SWEENEY: Is that kind of testing taking place in all places now? Is it taking place in Pennsylvania before it's shipped to New York or anyplace else, in all case?

DR. BLAKE: I'm not sure how they do it in Pennsylvania, because I know the plant that Dr. Conrad Volts (phonetic) talked about the Josephine plant in his paper was kind of grandfathered into some clause where they didn't have to do pretreatment standards. The only wastewater treatment plants that could accept wastewater would be those involved of the National Pretreatment Program, which means that plants that accept industrial waste. And they have the treatment capacity to handle the wastewater from the industry, which means they are able to treat it through the different steps of the process. Now the plant down in Josephine, Pennsylvania that Dr. Volts referred to did not have any pretreatment program. From my understanding.

MR. SWEENEY: So your understanding would be that that kind of testing is not taking places in all cases now in other places in the country?

DR. BLAKE: In other places, in Pennsylvania, you mean?

MR. SWEENEY: Or elsewhere.

DR. BLAKE: I don't have the answer to that. I can find it for you. But I know within New York State as a part of their Speedies (phonetic) program you have to have pretreatment program to accept industrial waste. And before you accept a new—before you accept new water, you have to prove or do what they do a headwork analysis, which means you need to know what's in that waste before you accept it. And so even within the draft supplement, they do talk about it and they do list the different wastewater treatment plants that are in New York State that do have pretreatment programs in place.

MR. SWEENEY: And does that also apply to the solids? The rocks and the other items that are disposed of in landfills?

DR. BLAKE: That one I'm not aware of, I know about wastewater treatment, so we can find out and make the information available to you.

MR. SWEENEY: I can address that, if you'd like, sure, up to the limited extend. It's not my expertise, but I am a little bit familiar with the Shumong (phonetic) County and Stuban (phonetic) County landfill operations that are accepting drill cuttings. Those are landfills that are modern landfills, lime landfills and they did have a study done looking at the composition of samples of the Marcellus and what the effect would be of landfill and the DEC also took their own samples and did their own analysis, both came to the conclusion that they felt it was safe to landfill it. And I don't have—I have read the study and I know there are people that have other opinions about that, but both DEC and the counties head commission—or the landfill operator had commission studies that gave scientific backup to their claim that it was not hazardous and they are monitoring the radio activity level of the cuttings that come into the landfill continually.

MALE VOICE: Well, neither Federal nor State law requires it, are they testing every load that comes in to determine what's in it? Not just for radioactivity, but for all of the other things that can be in it, too?

MR. SWEENEY: I don't have knowledge of that, but—thank you.

MR. GOTTFRIED: A few questions. Ms. Blake, you said that one of the ways to make hydrofracking nonpolluting you referred to rerouting truck traffic off streets and routes where susceptible population live. I think if we passed a law that said you can hydrofrack anywhere in the State of New York that you want as long as your trucks don't go on a route through areas where susceptible populations live we will have effectively banned hydrofracking from the State of New York. How do you run a hydrofracking operation in New York State without running the trucks on route where susceptible populations live?

DR. BLAKE: That's a good one. I was referring to the local level—I am a parent, and I do have five kids that I raise over there in the town of Maryland and just like everybody else I do have concerns and I feel that if in terms of susceptible population I think in terms of a local school, this is why I feel that local, you know, have that ability to over their - - agreements and things like that to run the trucks in the less populated areas or less, you know, whatever they feel that the local level would be sufficient. I guess is my best way to answer that. So.

MR. GOTTFRIED: Well, I think it would be just about impossible to do hydrofracking in the Marcellus shale in this state if you were doing so on the condition that your trucks don't go on routes where susceptible populations live. If either of you could comment on this, the 2005

Federal legislation prohibiting EPA from regulating hydrofracking is it—am I correct in assuming that you're industry lobbied for that legislation or at least supported it? And that in the intervening years has not tried to persuade congress to repeal it? Yes?

DR. CLINE: It's for either one of us?

MR. GOTTFRIED: Yes.

DR. CLINE: I can—you know, I was not involved in that process, but I can comment on what my understanding of it. That was—you have to understand, that was right on the heels of the 2004 EPA study that was conducted that came to the conclusion, very convincingly, forcefully, that hydraulic fracturing did not pose a risk to the underground sources of drinking water. But that--

MR. GOTTFRIED: Congress, Congress doesn't ordinarily, on its own, get the idea to prohibit EPA from regulating something just because a study found that that's something was not an environmental hazard. They usually, you know, just say, okay, if it's not a hazard, you know, we'll assume you're going to work on something else. I mean, frankly it defies imagination to think that that legislation didn't get enacted without the strong advocacy of the oil and gas industry. I mean--

DR. CLINE: There were people--

MR. GOTTFRIED: --Congress didn't just wake up one morning and say, you know, I think we'll prohibit EPA from regulating hydrofracking and we haven't heard from the oil and gas industry, but we're going to prohibit this regulation anyway. I mean, that's not what happened.

DR. CLINE: I think they found that it was unnecessary because there was no pathway migration from the subsurface to the shallow--

MR. GOTTFRIED: No. I didn't ask--

DR. CLINE: And I don't know anything about the lobbying--

MR. GOTTFRIED: --you what their thinking was--

DR. CLINE: I'm--

MR. GOTTFRIED: --I asked did the

industry advocate for that prohibition and has the industry in the intervening years said, you know, that prohibition is really inappropriate. We welcome this scrutiny of EPA. We would welcome the opportunity to defend our industry. We would welcome appropriate regulation because we read testimony that says that hydrofracking is safe if there are appropriate things in place and we would welcome federal regulations that would make sure that appropriate things are in place. Has your industry taken that position with congress?

DR. CLINE: I don’t have any knowledge of that. I’m a scientist engineer. I’m not involved in the political process.

MR. GOTTFRIED: I see. And so you haven’t—I assume you must read a lot about the topic. Neither one of you has happened to notice an article in a trade association journal that says oil and gas industry trying to get congress to remove this prohibition so that we can be appropriately regulated? You haven’t read any such articles, have you? This line of questioning is pretty silly, isn't it? I mean, we all know the answer to the questions that I'm asking.

DR. CLINE: From a scientific standpoint it is not necessary, in my opinion.

MR. GOTTFRIED: Because scientifically we should just rely on the industry to regulate itself? And that's because the history of the oil industry is that it does such a wonderful job of regulating itself and making sure that nothing can go wrong? You're experience as a scientist tells you that—tells you that about that industry?

DR. CLINE: Every step of the process is regulated by either a State or Federal agency. Just because the actual hydraulic fracturing portion of that step was accepted from EPA control does not in any way mean that it is not regulated? States regulate Federal government regulates air, water, so you're talking about a very narrow part of the process and that process is highly regulated by state agencies.

MR. GOTTFRIED: But EPA does not

regulate hydrofracking and your industry works very hard, I'm quite confident to protect itself from being regulated by EPA, an agency that has a whole lot more resources to do research and a whole lot more legal tools than most State regulatory agencies. And your industry works darn hard to make sure that EPA doesn't require any of the kinds of protections and mitigating measures that the two of you have testified about. Right?

DR. CLINE: I believe the states regulatory agencies are far better equipped to regulate hydraulic fracturing than the EPA. They do not have the expertise or the personnel in that area. Geologically conditions are variable from state to state and the local enforcement regulatory agencies I think are far better equipped to do that regulation.

MR. GOTTFRIED: Okay. Now earlier you were testifying about how the methane was getting into the water at one of the drilling sites didn't come from the hydraulic fracturing, is it your belief that it was just a freak coincidence?

DR. CLINE: In that particular incidence, it was a combination of a human error and local geologic conditions in an area that was new to drilling.

MR. GOTTFRIED: So it was a result of the drilling? It was a result of unique geological features and human error?

DR. CLINE: We can get meth--

MR. GOTTFRIED: And will there be-will there be hydraulic fracturing wells in New York where you can assure us that there are no unique geological features and no human error?

DR. CLINE: Nobody can be 100-percent certain but in 30 years of drilling in New York, as I mentioned, the shallow section of the hole is no different vertically or horizontal drilling wells. We have only had one case of methane migration in over 10,000 wells in New York. We have the regulatory and technical specifications that prevent these things. Which I included as cementing completed to the surface and not allowing - - more pressure build up to errors that contributed to that, and as industry has understood the local geological conditions there in Pennsylvania, I believe they have feel that they solved that problem through running a 2500 foot section of intermediate pipe which was necessary in that particular geological condition. When you do drill into a new area, you may encounter some unique things like that that have to—your practice will have to accommodate. That’s just the nature of any industry. We do learn and I think the industry is very vigilant and when there is an instance, they shut down, they evaluate, they come up with a solution.

MR. GOTTFRIED: Now when you drill way, way down, thousands of feet and then miles horizontally, if you hit a unique geological feature that somehow creates hazard that miraculously some of these molecules that we’ve been told in extremely minute quantities can cause significant endocrine damage, so if there is one of these unique geological features, three-quarters of a mile down and several miles horizontally, A, how are we going to know—how are you going to know, that that unique feature way out there in the earth's underground exists, and if somehow miraculously you know that there is this crack or whatever, that's going to enable the chemicals to migrate, what are you going to do about it?

DR. CLINE: First of all, when we drill down vertically, we go to our target zone, that's the known zone. We go horizontally within that zone. It's not--

MR. GOTTFRIED: When you say known zone, you don't mean known in the sense that people have been there before and looked around, you mean, you know, what zone you're going to?

DR. CLINE: We also know because we use measurement while drilling techniques where we are in real time evaluating the properties of the rock, being transmitted electronically to the surface being interpreted, we know very precisely where that well is going, what the formation is in, what the characteristics of that formation are. And as I mentioned, once we have perforated and flowing that well back all flow is directed to the well boar pressure sink. It does not have a pressure gradient or a way to move anywhere else. It wants to go to the lowest pressure, which is to the well boar and to the surface.

MR. GOTTFRIED: Although, in the methane in the water case, we were talking earlier, some combination of unique geological features and human error resulted in methane in the drinking water and when it’s a few miles horizontally out, and the unique geological feature may not be right there where your sensors are, what’s our protection?

DR. CLINE: In the case of the shallow zones, the critical difference here is that those shallow zones do not have a path to the well boar. They’re behind the casing. So that if there is insufficient cemented cement, it would migrate behind the casing in the cement. Where as in the production zone, we have the pathway to the well boar and it goes up inside the well boar. That’s the critical difference.

MR. GOTTFRIED: So the chemicals that are shot down the well miles horizontally all get sort of pushed back into the well boar and come back up the surface? All of it?

DR. CLINE: Approximately 70-percent of the fluid remains in the formation and 30-percent returns to the surface over the life of the well.

MR. GOTTFRIED: Oh, so--

DR. CLINE: Most of that--

MR. GOTTFRIED: So the point about the pressure of the well boar bringing the water and the chemicals back applies to 30-percent of the water? 70-percent of the water stays down there so that if there's—and the chemicals, so that if there is a unique geological feature, like a crack that you none of us knows about or ever will, 70-percent of the chemicals are down there where that crack is.

DR. CLINE: No. It doesn't quite work that way. It's described in my paper in detail. The water leaks into the fracture face that's create and the volume that is left behind only is enough to imbibe itself into the first few inches because the surface area of the fracture is so large. Once that is imbibed by the pressure, the fracture stimulation, the - - roads are so minute and so torturous that what we call capillary forces hold that water behind and only the gas can flow preferentially. It’s a concept of relative permeability in capillary forces trapping that water for geologic time. It cannot move, and even if it did, there—even if there was a crack as you say, once the well produces the flow pattern will be to the lower pressure. You would have a hydro static pressure of the entire fluid column, naturally from the surface down to that exerting downward pressure and so naturally the only pressure direction could be toward the well boar.

MR. GOTTFRIED: If a liquid is being drawn by capillary action, yes, if the thin thing that is drawing the water comes to an end, maybe the water gets stuck at the end of that capillary. But if it doesn’t end, if it keeps going on, if it’s a crack that goes on for quite a distance, doesn’t capillary action draw that fluid all the way to wherever that crack goes?

DR. CLINE: No, because the capillary

action only happens in the very tight low permeability pour space. If you're talking about a crack, which is nothing different than what we're doing with hydraulic fracturing, that's a high permeability path. That path, when the flow direction is toward the well boar would take that water back to the well boar. That's why we do get some of the water back because it is in those fractures.

MR. GOTTFRIED: So you're sure that none of the unique geological features that are 3,000 feet down and several miles away where nobody's ever been you're quite confident that none of those unique geological features can generate the capillary action that you described? How do you know that?

DR. CLINE: That's my position and I hope if you read my paper and references, I think the people that are in the petroleum engineering ports, fluid, flow and ports - - it's universally accepted that this is the case.

MR. GOTTFRIED: Okay. And one last question. I've heard many people say that we

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don’t know what the chemicals are that these companies will be using and that now only is that scary, but if we don’t know what chemicals they’re using, how can we do research where they’ve been using those chemicals to know whether they have gotten into the water. What’s wrong with that statement? Do we, in fact, know what chemicals you use?

DR. CLINE: Well--

MR. GOTTFRIED: Is that publicly available?

DR. CLINE: Well, let me say that I am totally in favor of full chemical disclosure.

MR. GOTTFRIED: Is someone--

DR. CLINE: Most, most of--

MR. GOTTFRIED: --stopping your member companies from doing that disclosure?

DR. CLINE: Most major companies have already disclosed, in fact, I—there is a new website available where you can go to, they’ve been set up by the groundwater protection counsel, they interstate petroleum compact commission I believe it’s called where you can—

actually go to on a map to every well that’s being drilled in the northern part of Pennsylvania and the chemical disclosure list will come down. That’s a volun—so far a voluntary registry, but the major operators that are doing the work are all members of that and participating in that. And I’m certainly in favor of full chemical disclosure. As far as your question about how would we know what to test for, it’s not just—we know the sweep of chemicals that are used and we know the formation brine composition to their proposed regulations in New York that list many, many chemicals and actual natural constituents that will be tested for in baseline testing, ongoing testing, and testing after the well pad is done. So in New York we should have all the information we need to make those assessments.

MR. GOTTFRIED: But if researchers have wanted to do that research on existing long horizontal wells, have they had that information so that they could do that research?

DR. CLINE: Well--

MR. GOTTFRIED: I'm not—I'm not particular excited about the notion that years after hydrofracking has been working in New York we'll be able to see whether the chemicals have migrated into our drinking water. I'd rather know that in Pennsylvania and other places researchers had had the opportunity to do that research and had done it and could demonstrate that the chemicals, in fact, did not migrate as you have assured us they won't.

DR. CLINE: Well, as you're probably aware from reading the Duke paper that's been talked about here quite extensively, even though that was a limited database of, I think, 60 some wells, one of the conclusions of that report is they found absolutely no evidence of any chemicals used in hydraulic fracturing in any of those wells.

MR. GOTTFRIED: And that's research in which they knew all of the chemicals that they should be looking for and was peer-reviewed research?

DR. CLINE: To my understanding, that

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was a peer-review researched paper and they had access of the universe of what chemicals are used in hydraulic fracturing. So they could have tested for every conceivable thing, even though maybe only of a small handful, those could have been used, but they found no evidence of any chemicals used in hydraulic fracturing and the well water.

MR. GOTTFRIED: Okay.

MR. ENGLEBRIGHT: I'm concerned that there seems to be a conflict between your statements and those of others who have Ph.D.s next to their names. Have you seen the Osborne, at all paper published in the proceedings of the national academy of sciences last month?

DR. CLINE: I'm not quite sure - -.

MR. ENGLEBRIGHT: Well, I'll get a copy of it to you before you leave today. I have a copy here. It's trihalomethane contamination of drinking water accompanying gas well drilling and hydraulic fracturing and they evaluated drilling operations in and round Dimmick, on the border between Pennsylvania and New York.

DR. CLINE: Is that the Duke study that I just referred to that came to the conclusion that there were no chemicals related, although, I understand they made a correlation with methane?

MR. ENGLEBRIGHT: They said that they had found in this study no evidence for contamination of drinking water supplies with the saline brines or fracturing fluids. That part is consistent--

DR. CLINE: Yes.

MR. ENGLEBRIGHT: --with what you've testified. However, they also indicate that there are—that there is a high correlation between theromogenically derived methane and drilling operations and they've actually got several rather compelling graphs and displays in the paper that showed that there is that relationship. That does not square with what you're saying. You're saying that there's no pathway of migration, in fact, in the paper these scientists from Duke University spend a good deal of time evaluating possible pathways showing that there are, in fact, numerous possible pathways.

The mechanism that they focus on on page four of the paper indicates that a leak could occur at hundred of meters underground with methane passing laterally and vertically through fracture systems. Another mechanism is that a process of hydraulic fracturing generates new fractures. And enlarges existing ones above the target shale formation increasing the connectivity of the fracture system. The reduced pressure following the fracturing activities, they say, could release methane and solution leading to methane exsolving rapidly from solution allowing the methane gas to potentially migrate upwards through the fracture system. This does not square with what you have testified. They go on, methane migration through the one to two kilometer thick geological formations that overlie the Marcellus and - - shales is less likely as a mechanism from methane contamination than leaky well casings. But might be possible due to both the extensive fracture systems reported for these formations and the many older uncased wells drilled and abandoned in the last half century in Pennsylvania and New York. The hydraulic conductivity in the overlying Catskills and Lock Haven aquifers is controlled by a secondary fracture system with several major faults and liniments in the research area. Consequently, the high methane concentrations would dissolved positive carbon and—carbon 13 and methane and hydrogen two methane values in the shallow ground water from active areas could, in principle, reflect the transport of a deep methane source associated with gas drilling and hydraulic fracturing activities. That’s pretty straightforward. It doesn’t seem to me that you’re statement that there is, quote, no pathway of migration, is substantiated by recent data published by peer-reviewed data and inferences drawn from that data through our most prestigious scientific publication.

DR. CLINE: Well, first of all, I would—those are conjectures on their part. And I think I showed from scientific evidence and my long experience in the industry, which I would say these individuals do not have that type of experience and I would disagree with those conjectures. They do not have any evidence isotopically that methane is coming form the Marcellus. It is theromgentic and, as I mentioned earlier, in my conversations with Department of Environmental Protection, the gas at Dimmick has been fingerprinted at being non-Marcellus. In other words, it's coming from a shallower zone. And that is the source, undoubtedly, of the thermogenic gas in that area. I also want to point out that no baseline testing was used in this study. We have a correlation according to their study of more methane in wells close to actual drilling operation, however, they have not established that there is a causation, and if there is a causation, as I mentioned, I believe it could be shown through further testing and that it would be from the very shallow methanes not related to the deep Marcellus hydrofracture stimulations, which, again flow would only be directed back to the low pressure

MR. ENGLEBRIGHT: Actually, the data shows that there is a thermal and chemical fingerprint from isotopes of carbon and hydrogen that are unique in the deep formations into the thermogenic origin. Again, reading from the paper, on page three, they say, for instance, 12 dissolved gas samples at active drilling sites follow along a regional gas trajectory that increases with reservoir age and thermal maturity of organic matter with samples from Susquehanna County, Pennsylvania specifically matching natural gas geochemistry from local gas wells. And then they plot them on diagrams and they show quite clearly that there is, in fact, a correlation between deep gas and they've been able to, as I've indicated here separate deep methane from shallow methane. Within this context, there seems to be a difference of opinion, you dispute what this publication from for scientists at Duke say. You say that they are not as experienced as you, you know, I'll let others argue about that, but let me just ask the question, do you think that there is a controversy here?

DR. CLINE: I will have to study the

paper further and I'd be glad to get back with you on giving my expert opinion on that.

MR. ENGLEBRIGHT: So--

DR. CLINE: But it does not--

MR. ENGLEBRIGHT: You don't—you don't believe that this represents a—like a contest of ideas?

DR. CLINE: I will have to study the paper further, but it is my opinion and the opinion of the Department of Environmental Protection that I've worked with and talked to that gas in the wells that have been allegedly affected by drilling are not sourced from the Marcellus. They are thermogenic, though, and they are also from the - - shales. But from the Marcellus, specifically, no.

MR. ENGLEBRIGHT: Actually, that sounds like a contest of ideas. Within that sense, do you believe that it's appropriate for the industry that you represent to help underwrite a resolution of this and related controversies?

DR. CLINE: I'm always in favor of further scientific study and also in conjunction with what you're saying, though, I think you want to point out that if it was gas coming from the Marcellus, wouldn't we expect to see the chemicals and brines also showing up in those wells, and we do not. So that seems to me to be pretty--

MR. ENGLEBRIGHT: No. There's a difference in permeability between gas and water. Something that your paper points out.

DR. CLINE: That's true. But gas—if water is available to flow from—if you had connection from the deep brines of the Marcellus and you had gas pathway, some of that water would be accompanying the gas, to some degree.

MR. ENGLEBRIGHT: That sounds like conjecture. Not that conjecture is a bad thing. But it doesn't sound as if you have absolute knowledge of how to explain what is measurable and what has been measured and reported on in a peer-reviewed scientific paper. Within that context, what we're hearing redundantly here today is form others is that there is a crying need for basic research to take place to resolve some questions that have the potential to impinge rather dramatically on human health and quality of life. And I, again, ask do you not believe that your industry before getting permits to go and drill should help us as policy makers and to a larger extent the people of this great state and nation to help resolve these open questions, which seem to be important to answer before we make a step and a direction that might, in fact hurt people and compromise human health?

DR. CLINE: I think we have the technology and the regulations in place here in New York to safely proceed with drilling. Of course, industry and all of us understand that we will continue to learn, will continue to study, and that process will never end.

MR. ENGLEBRIGHT: Well, I'm sure it will never end. The question is when will it adequately begin? And we're hearing here today that it hasn't adequately begun in part because of restrictions placed on the Environmental Protection Agency at the Federal level in 2005 by an act of Congress initiated through Dick

Chaney's collaboration with the oil and gas industry of this nation. So I characterized it before as an intentional blinding of the scientific community. It seems to me, though that this level at this state level of that the chairman of health and environmental conservation are not blinded and they are asking for the scientific community we've heard from today and they say that they think that we should be doing basic research before we take action, meaning permit this activity extensively throughout our State.

DR. CLINE: I think our Department of Health and DEC are doing a very thorough analysis of this at this moment and until we see the regulations and their findings, we're a bit premature in making all of those conclusion, perhaps, but I look forward to seeing what the final regulations look like and making an objective scientific analysis.

MR. ENGLEBRIGHT: Oh, well, I'll be happy to give you and what I perceive as an objective scientific analysis. And, again, reading from the summation of the study these data are consistent with deeper thermogenic methane sources such as the Marcellus and Utica shales at the active sites and matched geochemistry from gas wells nearby. Thank you Mr. Chairman.

MS. SCHIMEL: Thank you both for your testimony. I want to question a little bit about emergency scenarios. Ms. Blake, you touched upon it—actually, you don't touch upon it, you actually focus, which I'm grateful for. Judging, you know, how to deal with emerging situations and I want to ask you with regard to personnel and organization formulas when you deal with emergency situations and I judge people and organizations as to how they deal with an emergency. The day-to-day routine generally doesn't get much press, you know, nobody questions it. Everything is hunky-dory. But it's really how does an industry, how do personnel, how do first responders deal with emergency situations and, in particular in the last year or so, it's been very telling. Your testimony talks about conceptual modes and tools for model surprise scenarios, exposure pathways, if you will. But what I've learned and what I've focused on in the last year are these surprises sometimes are well beyond the scope of what is expected and particularly this happens when we're dealing with energy sources and I hate to say it, it's low hanging fruit, I'm going to speak to what happened in Japan, a natural disaster with nuclear energy, as well as what happened in Louisiana. Those are the things, the hallmarks of what the people are paying attention to. So I ask you, if you can give us at least some insight in terms of the specific focus that the DEC can give with regard to their—I know they have a spill response program, it seems to be something that is, you know, that deals with the number of scenarios, but in my mind and this is, again, my opinion, this is a whole new broad based knowledge and as we've talked about this morning, it is still influx, if you will. In other words, it's not concrete. It is organic. It is growing. How do we come up—how would you help the DEC come up with measures that would allow them or do you think there should be specific focus on this spill response program to hydrofracking, and how can you—you know, shed some light on that today? Thank you.

DR. BLAKE: I can only speak within my expertise. What I know I develop within the industries is, you know, the best management practices. It also includes developing emergency response programs where they work with the local—at the local level to develop programs that, as he said, you know. To try and beat as many surprises as we can come up with, we model them best we can, and come up with the best ideas. Short of not knowing what's in the regulations, I don't really understand your question.

MS. SCHIMEL: Well, I'm actually going to just come out and say it. You have more expertise, you've, you know, spoken to the fact that there are mousetraps out there. You've dealt with this in other states. I'm just learning about this because I'm a State representative. But I know this has been, if you will, focused on other state's anticipating the worse-case scenario, and I think we have an obligation as policymakers to focus on that, as I pointed out with the other situations that I cite in terms of the ability to anticipate as best as possible worse case scenarios. And the reason why I bring it up it's on a personal level. I spend my life trying to avoid spilling things on myself. I am a walking spill disaster. Right? Coffee, water, food. I just can't help it. Hopefully you will never put me at one of these sites. But that being said, there is the human error, but it's sometimes the impact of the human error on a technology such as this is much more awesome than anything else that in my mind I can fathom, you know, in terms of the uninten—I hate that term, it's so overused—unintended consequences. So that's what I ask you, and if you feel you can't speak to it now, but certainly the focus for us, and I'm asking what question should we—I'll phrase it another way. Maybe it's a fairer question, and I don't mean to be unfair. What should we be asking of the DEC, of the stakeholders in terms of putting together an emergency response report, specific to this hydraulic fracturing processes?

DR. BLAKE: It's a little bit out of my expertise, but I do know as having worked in a little bit in the industry we do have emergency response people--

MS. SCHIMEL: You do have what?

DR. BLAKE: We do have emergency response teams, you know, that put together programs and it's discussions like this that bring up, you know, the little surprises that, you know, we talk about. And so, I believe, from my point of view a lot of the information that I have gotten about scenarios, I have gotten them from talking to people just like you said the stake holders, everybody involved, you know, just asking what do you perceive as something that you think would happen. And then I could model it. And maybe the same can be done at that level as well. I don't know if that helps you.

MS. SCHIMEL: Well, it does. Well, maybe what I would ask the Chairman, is can you make available, Mr. Chairman, of any information that you have gathered, perhaps, even from the DEC in terms of emergency response that is not even necessarily based statewide, because you know, forgive me, but I am not as privy to that. So that’s a concern of mine. Thank you very much.

MR. SWEENEY: Mr. Abinanti?

ASSEMBLY MEMBER THOMAS J. ABINANTI: Thank you, Mr. Chairman, I’m going to try to turn this on. There it is. Thank you, Mr. Chairman. Thank you both for joining us today and sharing your views. I must say that I’ve been studying this for quite some time and I thought I had a basic understanding of what this process was about until I read Mr. Blake’s presentation and heard him speak. Never before have I seen so many words put together in a fashion that I didn’t understand anything that was said. I don’t know if it was intentional, to make us believe that somehow this is a very complicated process and we have to trust the, quote, experts. But it seems to me very simple, what you’re trying to do here is take a whole bunch of substances and pour them into the ground, some of them come back out and you leave the rest of them there forever. But what I most struck by is both of you over and over again seem to say that safety and quality of the environment are dependent on the quality and the effectiveness of the enforcement of government regulations. Is that a fair summary of what both of you are saying?

DR. CLINE: I don’t know if that’s exactly how we said it, but certainly there is a place for regulation and to make the rules and to make sure that they’re implemented.

MR. ABINANTI: Well, as I go through your reports here, like, for example, let me deal with—I think I misspoke. It was Dr. Cline’s report that I had a problem putting the words together. I confused the two of you. For example, Dr. Blake, it specifically states on page six of the report, in summary, and to reiterate, the key to protecting human health is containment and regulation. So it seems to me you're saying that the industry can't be trusted and we need good and strong regulations. And you previous refer to examples of that where you say on page four permit mandated physical barriers can also be erected. So I gather we must rely on the permitting process because it's not traditional or to be expected that the industry would do this on its own. And then you talk on page five about how we deal with accidental spills and you refer to the New York State DEC taking action through its spill response program. Nowhere do I see in either of these any reference to how the industry itself has set up standards or has tried to do what is best for the community. Is that correct?

DR. BLAKE: I do talk about best management practices. One of the reasons I probably put an emphasis on the regulations was in a lot of my discussions with community members, they—oh, let me back up a little bit. I'm an independent consultant, which sometimes I don't get paid to do that industry brush. And so a lot of my conversations with people they'll feel that they don't have trust for the industry and so to remove a lot of that uncertainty in people's ideas in how they perceive risk, and that if the industry, I'm sorry, not the industry, if the DEC had regulations which were a bar then people might feel more comfortable. I talk about best industry practices a lot and I have worked with different industries in trying to implement it in their practices. What I do is I'll look at the regulations and I'll try and anticipate anything that comes--

MR. ABINANTI: Um-hum.

DR. BLAKE: --that might happen that's not included in the regulations and we will--

MR. ABINANTI: Can I—I understand where you're going. But the question I have to both of you now is, where do we find these best industry practices? Where are they published? Where is the ratings? Where is the industry regulation of itself, which published the best practices and then rates the companies on using the best practices or not using them? Is there anything out there that does that?

DR. BLAKE: The API, I believe publishes some--

MR. ABINANTI: The API, what's that?

DR. BLAKE: The American Petroleum Institute. Is that right?

DR. CLINE: Yes. The American Petroleum Institute. Yes.

DR. BLAKE: Yes. They do have some published best industry practices.

MR. ABINANTI: Well, can we get a copy of this document that talks about best industry practices?

DR. BLAKE: Yes.

DR. CLINE: Certainly. It's voluminous, but they do have standards, industry standards for casing, cementing, various--

MR. ABINANTI: Okay. What about setbacks? And what about, for example, in here, one of you refer to—here, for example, this—we're on page four. That's Dr. Blake. It says modeling has been used to illustrate air emissions dissipate over distance groundwater undergoes natural attenuation that limits the movement, well, how many could be put in one place? How far from the population must it be located, what must be the wind conditions, what must be the ground conditions? Is that the kind of thing we'll find in best practices?

DR. CLINE: Generally, the states set those setbacks and those regulations individually depending on their particular--

MR. ABINANTI: So I guess we've just come back to my point. That without government regulating this the industry is just going to do its own thing.

DR. BLAKE: No. The industry also does assessments. I mean, we have done risk assessments as well.

MR. ABINANTI: Right. But there are no standards out there--

DR. BLAKE: Which are more—which are more site specific, you know--

MR. ABINANTI: You tell us—so we could look to see what the industry best practices are on all of the things that government must regulate.

DR. BLAKE: The API doesn't include a lot of them, but, again, I will say that just based on the regulations we work on anticipating.

MR. ABINANTI: Right.

DR. BLAKE: You know, some of the issues.

MR. ABINANTI: But talking about, because as I go through here, you talk about different ways of minimizing the possibility that there would be a problem, but in every case, what I see here is it goes back to permit mandated or state regulated. And, of course, it has to be state regulated since the Federal government has been removed.

DR. BLAKE: And I use that specifically just to clear out uncertainty. That whole thing of people tend to take more value in the regulations than they would in industry best practices.

MR. ABINANTI: Okay. Well, I appreciate that, but the second point that I'm concerned about here is you talk about from the health point of view and from the environment point of

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view, what’s left after you’ve closed the well? Does the company just leave? Is there any attempt to restore the environment to its natural condition?

DR. CLINE: Yes. After the well is plugged what—during the actual building of the initial location, that topsoil is taken off and stockpiled or set aside for later reclamation. Once the well is plugged and the wellhead is removed, the site is reclaimed using the original topsoil to, and reseeded and allowed to come back to its natural state.

MR. ABINANTI: But the well is still there, correct? The concrete is still in the ground?

DR. CLINE: The well is--

MR. ABINANTI: And 70-percent of the water is still in the ground?

DR. CLINE: The well has been plugged, yes.

MR. ABINANTI: But the concrete is still there?

DR. CLINE: The concrete and casing are

still in place, yes.

MR. ABINANTI: And the 70-percent of the water that was pumped in with all of the chemicals in it is still in the ground?

DR. CLINE: It's there for geologic time, yes.

MR. ABINANTI: And do we have any studies or, I guess studies, showing for how long that will stay where you placed it without migrating?

DR. CLINE: We believe it will stay there forever, because there is no pathway for it to leave. It doesn't even have any energy. We have depleted the formation of its pressure and you need a pressure gradient and permeability for a fluid to flow.

MR. ABINANTI: Now in your report, you, yourself state that natural fractures become partially mineralized and disconnected. And the object of the fracture stimulation is to reconnect these fracture systems.

DR. CLINE: That's correct.

MR. ABINANTI: So that means that there

are, in fact, fractures, natural fractures?

DR. CLINE: There are natural fractures, but they do not extend vertically in through the surface in a systematic way. These—the Marcellus is a closed sealed system and that's why it has the gas still maintained in it.

MR. ABINANTI: Why does it have to be in a systematic way. All it takes is a couple of fractures, correct?

DR. CLINE: No, because the fracture—any fractures that are not propped by a proponent because of the millions of pounds of overburden seal even the fractures that we generate within the Marcellus that we can't prop, are immediately closed upon relieving the pressure.

MR. ABINANTI: I see. So without the pressure nothing is going to migrate?

DR. CLINE: That's correct.

MR. ABINANTI: And so your theory is that only if there is a crack in the concrete doing down is there any way for the—there's some defect in that is there any way for the gas to work its way back up?

DR. CLINE: That’s correct.

MR. ABINANTI: What about in the process of drilling and in the process of applying pressure? You speak of levels of methane above the deepest levels that you’re trying to reach. Are you not disturbing those in the process?

DR. CLINE: When we drill through the shale formations, we’re normally drilling with simply air. We’re not really applying any pressure to the formation and, in fact, at each casing before we drill ahead, we actually fun what’s called a formation integrity test. In other words, we pressure the case, the casing up to the point where we see a change in the slope so that we know that’s the maximum pressure that we can apply during drilling before we could fracture any of the formations.

MR. ABINANTI: That’s going vertical.

DR. CLINE: And we never--

MR. ABINANTI: What about all--

DR. CLINE: We never--

MR. ABINANTI: --of the layers that you’re disturbing along the way down?

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DR. CLINE: Those—once they're drilled, we case and cement them.

MR. ABINANTI: That's once they're drilled, but in the process of drilling down, you could be disturbing all of these different layers, correct?

DR. CLINE: There can be some short term disturbance and that's one reason we've had some shallow methane migration problems because you can introduce some turbulence, temporary into the shallow formations before they're cased, but it's a very rapid--

MR. ABINANTI: How do you measure that--

DR. CLINE: --process--

MR. ABINANTI: --that temporary disturbance? How do you measure its impact on the surrounding environment?

DR. CLINE: If there is an impact on any of the water wells, you would see that.

MR. ABINANTI: How would you see that?

DR. CLINE: You could have turbulence in the water.

MR. ABINANTI: You could have methane in

the water.

DR. CLINE: But generally you don't—we drill these things so fast that this is typically not even a problem.

MR. ABINANTI: Typically, but there are circumstances where it happens?

DR. CLINE: There have been some occasions, yes.

MR. ABINANTI: And what techniques do we use to minimize those?

DR. CLINE: We drill rapidly with air or fresh water through the surface bodies in a close conjunction with the ground water and we get them cased and sealed.

MR. ABINANTI: Yeah. But, again, that's talking about spilling from what you're drilling in. I'm talking about disturbing what's around it. Because you could have natural fractures, correct? At the higher levels in to which you could be forcing methane, by disturbing those levels.

DR. CLINE: We encountered the same situation just with water drilling, even.

MR. ABINANTI: Okay. So how do we—how do we minimize that? What kind of standards do we put in, is it possible to minimize that?

DR. CLINE: I just mentioned how we minimize it is we drill rapidly through there and we case and cement the well--

MR. ABINANTI: Okay.

DR. CLINE: --within a matter of days.

MR. ABINANTI: Now you said you're removing approximately 30-percent of the water coming back out, so we're in effect permanently removing from the eco system 70-percent of the water that you're using, correct?

DR. CLINE: That's not exactly correct, because it is true that that 70-percent we are taking and leaving behind, but if you understand that when we actually use methane, combust methane in during when we burn methane we create carbon dioxide in water and we can generate approximately 11,000 gallons of water from a million cubic feet of gas. And if you can back that into a typical reserve, figure for Marcellus - - 4BCF we will generate approximately 44 million gallons of water just for the combustion--

MR. ABINANTI: And how many gallons of--

DR. CLINE: --of gas--

MR. ABINANTI: --water will you use to get that amount out?

DR. CLINE: And we will only—we will use five million gallons, and we will usually leave four behind. So we’re actually contributing eight times what we put in to the hydrological cycle.

MR. ABINANTI: That’s fascinating. I would like to hear more about that, but I can’t discuss that at this point. So you’re saying that we’re actually producing water by taking gas out of the earth and burning it?

DR. CLINE: We are if you’re looking at the entire hydrological cycle as a whole. It’s obviously not going back into the streams and rivers that we’ve taken it from, but I think is--

MR. ABINANTI: Right. We’re rearranging it. It may end up in the ocean somewhere at salt water.

DR. CLINE: Because the water that we're taking out is going to end up in the ocean anyway. And we're converting it to water vapor through combustion.

MR. ABINANTI: Right.

DR. CLINE: So we're not really losing it in that.

MR. ABINANTI: Where would you take the water from to put into the ground in the Marcellus shale?

DR. CLINE: Most of the water in the northern part is coming from various tributaries at the Susquehanna system.

MR. ABINANTI: And does that eventually go into the New York City drinking water supply, if undisturbed?

DR. CLINE: I don't think it has anything to do with New York City drinking water supply.

MR. ABINANTI: Is that anybody's drinking water supply?

DR. CLINE: The source of the water?

MR. ABINANTI: Yeah.

DR. CLINE: I'm sure the Susquehanna is the source for some communities, but I'm not that familiar with it.

MR. ABINANTI: Has anybody done an analysis of what the impact would be on the drinking water supplies for those communities?

DR. CLINE: The Susquehanna River Basin Commission regulates all water withdrawals from that watershed and they have done thorough analysis, actually, industry has been permitted to take up to 30-million barrels a day, they're currently only taking two-million. The Susquehanna River Commission determined that they felt that 30-million was a manageable amount to take from the system, which, as I understand it is not even a per year—yeah—a manageable number. So.

MR. ABINANTI: Can you tell me what the difference is—what would be a quantity of natural gas? What would be, you measure it in what?

DR. CLINE: I'm sorry?

MR. ABINANTI: What do you measure natural gas in quantities? Gallons?

DR. CLINE: Thousand cubic feet--
MR. ABINANTI: So a thousand cubic feet. Okay. Do you have any idea what it costs to produce a thousand cubic feet through hydrofracting process? Are there any number anywhere from the industry?
DR. CLINE: Well, it would be quite variable depending on the depth that you drill the well and the location and the horizontal extent. I couldn’t give you an exact number per thousand cubic feet.
MR. ABINANTI: Okay. Are there any numbers--
DR. CLINE: I--
MR. ABINANTI: --to say what it costs per thousand cubic feet through other processes of producing natural gas?
DR. CLINE: I’m sure that those could be computed, but I don’t have those statistics.
MR. ABINANTI: Then why is the industry even doing this if we don’t know whether it’s economic to do it?
DR. CLINE: Well, certainly the industry

wouldn’t be drilling the wells if it wasn’t economically--

MR. ABINANTI: Isn’t that speculation? Isn’t it, in fact, the reason they’re doing this because it’s such a highly subsidized industry and the Federal government gives great tax breaks and credits and incentives?

DR. CLINE: I can’t comment on the—that aspect of it. That’s beyond my expertise.

MR. ABINANTI: See, I’m amazed at this because I’ve asked the industry this question over and over, and over again. What is the comparative cost between doing it this way and doing it the normal ways that you—from the normal sources of natural gas, and nobody seems to be able to give us any comparisons as to the difference, the difficulty, the cost.

DR. CLINE: Well, we—what we can say, the important thing is that the price of natural gas now, which is approximately $4 per thousand cubic feet is the lowest it has been in many years, just five years ago it was $13 per thousand cubic feet and because of being able to drill these wells and unlock this large quantity of natural gas, it has driven the price down. So that it—but that price it is still apparently profitable for the companies to drill. But it has been a great benefit-

MR. ABINANTI: But we don't know if it will be profitable if we removed all of the subsidies?

DR. CLINE: I didn't catch that.

MR. ABINANTI: I said, we don't know if it would be profitable if we removed all of the subsidies and just let the market factors take over.

DR. CLINE: I don't know of any companies that would drill if it wasn't profitable. And--

MR. ABINANTI: Just the last--the last question that I have is there have been some circumstances which were acknowledged where there have been human error and problems, in particular locations. Do we have any indication, has there been a study what the industry response has been? Is the industry set up in a funds or programs where people who are damaged could come in and respond?

DR. BLAKE: That's a little bit out of my expertise, but I'm sure we can find some information--

MR. ABINANTI: All right.

DR. BLAKE: --to get to you.

MR. ABINANTI: I would appreciate if you would get me that information. Mr. Chairman, thank you very much.

MR. SWEENEY: Mr. Englebright, one more question.

MR. ENGLEBRIGHT: Thank you, Mr. Chairman. Dr. Cline, it's just hopefully many interactions, of course, occur between oil and gas companies and the Department of Environmental Conservation. In some instances, some confidential information is shared. I wonder if you would address the possibility of whether your industry would be open to turning over all geological, geochemical, and geophysical data to the DEC in order to help advance our basic understanding of the variables involved in this enterprise and to enable scientists and the general public to have a broader understanding and whether you would be willing to do this as a condition of receiving permits to drill?

DR. CLINE: I cannot speak for the industry as a whole. I'm not a member of—I'm not even a member of the Independent Oil and Gas Association. I could not speak for that. I can say from a personal standpoint, I would be more than happy to share anything that I know or any of my expertise in the development of regulations and as far as the industry as a whole, I can't really comment on that.

MR. ENGLEBRIGHT: Okay. Let me just make one observation before yielding back to the Chair. You've elaborated and I believe that I have also provided correlating evidence that migrating fluids upwards is probably from deep aquifers that are being stimulated by horizontal hydrofracking is probably not itself a cause of problem. Gas is another matter. It is direct contradiction to part of the conclusion in your paper from the writings of others, who are quite credible. That notwithstanding, I just want to be real clear, there is something else that you have said in your paper that is true and that is that there is some risk of exposure in the case of large surface spills, and so the management of the fluids and there's so many gallons of water, even though a lot of it is retained in the ground after its pressurized and pumped down into the ground, and even though your paper elaborates on why we really are absolutely certain as to where that water goes, we do know, that it mixes with connate water and stays in place at great depth. To the—to a large extent, but that's not the problem. The problem is what do you do with it when you pull it out of the well and you have to do that to let the gas come out. So you have to vacate the well boar of at least the standing water to have an efficient gas retrieval and then what we have found is that the management of this contaminated water, even though it isn't the full amount that was injected into the ground there's still a lot of water, a substantial amount and sometimes it's put into pits, and sometimes it rains like pretty much everyday in this latitude and in this climate. And so rainwater mixes with frac water in open pits and it becomes and inconvenience and sometimes people have taken shovels and cut the pit linings in order to allow the rainwater to not cause overflowing, there is a purposeful disbursement of frac water through cuts in the lining that can’t be seen by a casual observer. It then ends up in local streams. It then becomes a meaningful problem at the surface and this behavior is difficult to regulate. That’s part of the problem. Another problem is that the frac water has been, in some cases been taken to sewage treatment plants. Benzene and, that’s one of the soup of chemicals that’s in there and other hydrocarbons that are used as surfactants in order to lubricate, in order to put the sand as - - into the cracks, those lubricants are not compatible with what the sewer treatment biology is designed to handle. And, in fact, it kills many of the bacteria that otherwise would be available to help clean and polish the water that goes into a sewer treatment facility. So we have seen - - of people trying to say, well, we'll use some of that frac water to wash the roads, or we'll get some of that saline water and we'll use it on the roads instead of having to buy salt in the winter. That hasn't worked out very well. So we have a management problem and while you may be technically correct, about that a lot of the water says in the ground, and a lot of it can't migrate upwards through disjointed fracture systems through thousands of feet of vertical sediments, that's not really the point. And it's a distraction. The real point is how that stuff has been managed in recent years, some of the problems that we've seen emerging from the management of that frac water that must, in fact, come out of the horizontal part of the upper casing and that has a sorry record of mismanagement and is something that causes great concern. And if you want to speak to that, I'd like to hear your thoughts.

DR. CLINE: Yes, Chairman, or—I would like to speak to that. My—I was asked to come here to specifically address the topic that I did, but I can address or at least give you my feelings about what you just spoke about. It is true that even though 30-percent of the water or 20-percent comes back there is still a large volume of water to deal with at the surface. No question about that. But New York regulations, again, are required that that water first be directed to tanks. We do not allow open pits on location, per proposed regulations. And that water industry has taken the approach of recycling that water. They actually, you know, there were questions about the chemical analysis. They do a very detailed chemical analysis of that, because their intention is to take that water and filter it onsite without having to truck it away to the largest extent possible, and mix it with fresh water, again, to be reused on the next fracture stimulation. As a whole, the industry has actually just recycling through that simply process approximately 70-percent of the water and some of the companies are close to 100-percent. So the amount that has to actually be processed is only 30-percent of the 20 or 30-percent that comes back against the large volume of water. I agree with you. And that water needs to be taken care of properly. Absolutely. New York's regulations as Uni spoke about we can't take that to simply a wastewater treatment plan as was done in Pennsylvania, it has to be to a plant that has a pre-approved treatment program with a complete head works analysis of what's in the water, what it's effect would be on the biological processes if it was released. And I'm not even sure in the regulations whether they're even going to allow release to surface waters even after treatment. Industry is really trying to do recycling and even when they can't recycle on site, plants have been built just a - - facilities to actually distill the water, then reuse the water and the crystallization, the salt that's left behind is either taken to injection wells in Ohio or is disposed of in landfills. And so all these things are solvable, it's just a question of setting the bar. What are the standards that are acceptable for the water and there is nothing that can't be treated, technologically, but I am quite confident the Department of Health and DEC together in the final regulations will address this very stringently and permits will not be issued unless there is an acceptable plan for taking care of that water, but it is a large volume of water, you're correct, and transportation, safe transportation and treatment of that water is essential.

MR. ENGLEBRIGHT: Well, that's how the mismanagement of that water is the greatest potential threat to the aquifers. And there has been a sorry record developed so far, which causes a lack of trust, quite frankly, that the industry is going to change its ways and that New York's aquifers are going to be treated differently than the aquifers have been in Pennsylvania and other places, so that's part of why you're seeing this hearing today and so much interest in this matter. There's a lot at stake. Our communities will not be able to rehabilitate aquifers just one sloppy day on a site and an aquifer is contaminated for thousands of years, for longer than the history of our state. And that's a real problem. So we're very concerned about the outcome of this and--

DR. CLINE: I totally agree, though, water treatment is something that has to be addressed, very specifically. Part of the problem in Pennsylvania is it's not necessarily industry, it's industry was basically following what the regulations were in that state. And on top of that, they tried to go to the recycling as much as possible, which wasn't mandated. They didn't have to do that. They found that that was a more effective and environmentally safe way to do it. But, you know, the rules and regulations in Pennsylvania were never really formalized sufficiently and they changed over time. They changed just a few months ago, again. I'm quite sure when the final regulations in New York come out, which were all ready, I think, addressed a lot of these problems are going to be quite specific and then I'm sure industry can step up to the bar and comply with them.

DR. BLAKE: Can I just make a comment on that real quick?

MR. SWEENDY: No. We're—we need to move on.

DR. BLAKE: Okay.

MR. SWEENEY: We have other people waiting to testify. Thank you for being here today.

DR. CLINE: Thank you.

MR. SWEENEY: Next we'll call Larysa Dyrszka, Dr. Larysa Dyrszka, pediatrician, retired. Welcome.

DR. LARYSA DYRSZKA: Honorable Assembly Committee Chairs Sweeney and Gottfried, and Assembly Members Schimel, Englebright, and Abinanti. Thank you for this opportunity. This is the first time that the health impacts of gas drilling exploriation and development techniques, including hydraulic fracturing are being addressed in a public hearing in New York State. It is critical that health issues are included in the natural gas debate because humans may be the short-term beneficiaries of natural gas. But the development and production of it cannot imperil the heath and safety of people. The Assembly's concern regarding the human health impacts is important and appreciated. The Department of Environmntal Concervation as lead agency on the Supplimental Generic Enviornment Impact Statement, as not looked at the mechinism of how toxic chemicals used in hydraulic fracturing fluids, polluting air emissions and waste from drilling operations can degrade air and water quality and affect public health. The draft SGEIS issued by the DEC in September of 2009 fails to conduct public health risk assessments associated with these exposure pathways. These issues must be addressed, and they apparently have not been addressed as yet. Having practiced medicine as a board certified peditrician for 25 years and currently continuing as a children's rights and public health advocate, I have great concern that if not addressed now the health and safety of New Yorkers will be in danger.

There are two peer-review studies on the health impacts of gas drilling. One is the white paper by Witter (phonetic), et al, and that was published in 2008 and it is available, and the other is a health impact assessment associated with an environmental impact statement that was written by Erin Wernim (phonetic) on gas drilling in Alaska.

So on the basis of some of those two studies and on information, other information that I have gathered, I can tell you that there are stressors on human health in areas where gas drilling is ongoing, and those include air pollution, water contamination, chemical—concerns about chemical safety and contamination, waste management, and radioactivity issues, noise, traffic, and accidents. And also, finally, but not lastly, and less importantly, are the psychological stressors issues about health infrastructure and socioeconomic issues.

Air pollution—so I'll very briefly go over these few areas, because I've covered them more thoroughly in my written testimony. Air pollution has been shown to be associated with neurodevelopment disorders, lower IQ in babies born to mothers with polycyclic aromatic hydrocarbon exposure during pregnancy and learning disorders in exposed children. In the western United States, air pollution is identified as the most significant stressor in the second draft of the health impact assessment written by Witter, et al. It is already a public health hazard in western states.

Regarding our water resources, Governor Cuomo has stated that watersheds are sacrosanct. That must include the protection of every watershed. Since water sources in proximity to gas drilling operations have already been known to be contaminated and there is still much unknown about the technology and effects of hydraulic fracturing. We cannot cay it is safe. And therefore, it should not be allowed to proceed unless and until it is proven to be safe.

Regarding chemicals, we don’t know enough to protect the public. We do know, however, that many of the chemicals are suspected carcinogens, neurotoxins, endocrine disruptors, hazardous air pollutants and mutagens. The chemicals are insufficiently documented and that, it itself, is a hazard to public health.

Waste from gas drilling operations should be treated as hazardous. Three's currently no safe way to process the waste, which contains radioactive elements, brine, and gases. Shales, more than any other kind of rock, also selectively trap heavy metals such as lead, arsenic, barium, strontium, and chromium. It is toxic and hazardous to public health and should be classified as such. It has been dumped, it has been lost, or used on roads as the dust control, de-icer, and also as a soil application. These are threats to public health. In a peer-reviewed article, Frederick Steinhausler writes that radiation exposure of workers in the oil and gas industry can occur by inhalation of high levels of radon gas and increased gamma dose. The waste also has elevated contents of long-lived radionuclides. And the recycling of waste originating within the oil and gas industry can pose a contamination problem. He also states that non-occupational exposure via the incorporation of radionucides are the result due to practices associated indirectly with oil and gas industry, such as the use of sewage, sludge from oil processing plants in agriculture. And this can cause an undesirable contamination of agricultural products.

Accidents can occur at any point of gas production from the transport of gear and chemicals to the site, to the construction and operation of the well, to the processing of the gas and to the delivery of it via pipelines, and at any of those points explosions can occur with serious threat to life and actual loss of life has occurred.

And the last stressor I'd like to address is the psychological combined with socioeconomic. People already under stress from an underlying illness or because they're of a poor socioeconomic status, or because they are simply very young or very old and therefore considered a vulnerable population, suffer environmental insults less well than people who are not so stressed. Consider the Southern Tier already has—just so you can look at the state county-by county health outcomes already have very poor health outcomes. Sullivan County, where I reside, is 61st in the State in health outcomes. Exposing the vulnerable populations to environmental stressors will be a social injustice.

So why don't we know more—you've asked some questions about the Federal exemptions and I've listed them in my written testimony. But briefly I can tell you that there are documented instances of illness, we don't know if they're due to gas drilling because of the exemptions from major public health and environmental health laws. Really a result of an uninformed Congress, which acted on recommendations from a 2004 study, which really was not about hydraulic fracturing and they made recommendations there were no risks—saying that there were no risks to public health, but it was not a study to be making recommendations about hydraulic fracturing.

So as far as the safe drinking water act, hydraulic fracturing operations are exempted from some regulation under that act and the underground injection control of fracking fluid was defined to exempt it from EPA regulations. So there’s the clean water act, the exemption, that part that was exempted expanded the definition of oil and gas operations and activities to include the construction of the drill site, waste management pits, access roads, infield treatment plants and transportation infrastructure. It also eliminated sediment as a pollutant in managing storm water runoff from drill pad sites and all oil and gas field construction activities and operations.

So NEPA also weakened the issues that the review process, CERCLA (phonetic), also known as the Super Fund Act, the list of hazardous substances excluded crude oil and petroleum and RCRA, which is Resource Conservation and Petroleum. And RCRA, which is Resource Conservation and Recovery Act, the solid waste disposal act of 1980 exempted oil field waste from the subchapter of RCRA until the EPA could prove that the wastes were a danger to human health and the environment, and in 1988 the Environmental Protection Agency made a regulatory determination that oil field waste should be exempted because of adequate state and Federal regulations. And this includes produced waters, trailing fluids, and associates wastes.

And then there’s the exemption from the Clean Air Act, so there is not aggregation to determine if maximum achievable controlled technology, so they’re not subject to that. And it also extends the exemption extends to pipeline compressors and pump stations in some instances.

For the protection of public health, these exemptions must be reversed, if not at the Federal level, then at the state level. So that’s something for your consideration.

I have a letter that was written by a group of doctors to years ago already to Congress—to several members of their—of Congress. And in it they specifically asked that these exemptions be reversed, especially from the exemption from the Safe Water Act, and they also asked for health impact assessment at that time.

And I just came across this letter, and it’s included in your packet, so, you know, people have been asking for health impact assessments. Not done.

So the health concerns, other groups, there are clear indications that the production and development of natural gas will cause adverse health effects and there are good indications that this has already happened. The question is not whether, but where and how many people will be affected. And the medical community is concerned. In my written testimony I have included a list of anecdotes and these anecdotes are people, their cases. I have two pages of just cases of people who have been affected and I also have some testimonies and there’s even somebody here who has been, herself, been impacted. These are people who have been—who have become ill after the gas drilling started. And someone has to make that connection. The public health community must become involved. They must look at these anecdotes and treat them as people and address this as a public health issue. I've included, also, besides what—my statement, I've included letters, resolutions, testimonies, and memoranda of support from many physicians including the medical societies of the Counties of Oneida, Herkimer, Madison, Chenango, Oswego, Cayuga, Onondaga, and Tompkins. And as already been read the Medical Society of the State of New York has issued as well as Bassett Healthcare Network.

But I was particularly honored to have been asked by the American Academy of Pediatrics, District II, which includes all of New York State and represents more than 6,000 pediatricians and advocate on behalf of the millions of children they care for across the state to relay to you their support for a moratorium on hydraulic fracturing pending further studies. This American Academy of Pediatrics District II membership is concerned about the potential negative impacts on water, air, soil contamination, increased traffic, and possible spills of contaminated materials in areas where many children and families live. They encourage the study of potential public health impacts of hydraulic fracturing and for New York State's leaders to have that information before it makes any decision about permitting hydraulic fracturing in our State. So that's the end of their request for a statement. So what we have currently is an - - which is inadequate to protect human health, and that's clear. There was no chapter dedicated to human health risk assessment, and no health risk assessment has been done. The New York State Department of Health should take a more active role in this issue and conduct public—conduct health impact studies. Thus far, they have said they will not do it, since they have apparently addressed it in the current draft. But we haven't seen it and no health risk—no health impact assessment was done. And so I find it very difficult to have a very complete study of these issues without that.

The conclusion that—of the New York State Department of health that essentially there has been no change since the 1992 GEIS is wrong. The DEC, itself, identified possible exposure pathways in the 1992 GEIS, which were never explored. And, also, in the table that I found in the DEC literature, slick water fracturing fluids were only introduced in 1996, several years after the 1993 GEIS was finalized. So how can it have addressed all of the chemicals and the technology and everything else that was in the GEIS? So clearly there have been indications of problems and certainly there have been changes in the technology since the 1992 GEIS, which the DOH and DEC have not adequately addressed.

There are public health tools, and I've included some of those in the written statement and just regarding the ATSDR that was mentioned two speakers ago, there is, you have this is pathway in your—the right side of the pathway says that—indicates that—and that's the potential pathway, which was not mentioned. What was mentioned was a completed pathway and the way you would eliminate a pathway. But a potential pathway is, if there are some indications but many unknowns, you follow that pathway down and it's called a potential pathway and what you do is then is conduct health effects evaluations for all contaminants potentially found in the pathway. And it gives you the chapters on how to do that. And the other tool or process that should be very helpful and has only been used twice in gas drilling scenarios is the health impact assessment. And what the aims to identify is how development induces unintended changes in health determinants and resulting changes in health outcomes. It provides a basis to proactively address any risks associated with health hazards. The health impact assessment also addresses health improvement opportunities in development. And this was developed in 1999 at a meting of the World Health Organization in Gothenburg and it's called the Gothenburg Census Paper. Our CDC and as I mentioned the World Health Organization and other institutions are promoting the use of the health impact assessment, because it's comprehensive, it includes all stressors on human health. And it elevates the role of health in decision-making.

So in science and medicine, we follow

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the precautionary principle that's been mentioned, which states that, when an activity raises threats of harm to the environment or human health, precautionary measures should be taken, even if some cause and effect relationships are not fully established scientifically. So all statements of the precautionary principle contain a version of the formula when the health of humans and the environment is at stake, it should not be necessary to wait for scientific certainty to take protective action. The principle applies to human health and the environment and the thought behind the precautionary principle is that humans are responsible to protect, preserve, and restore the global eco systems on which all life, including our own depends.

So thank you. And I will take any of your questions.

MR. SWEENEY: Thank you.

MS. SCHIMEL: Thank you, too, for your testimony. One thing that stands out is, well, you connected some of the dots for me in terms of certainly the slick water fracturing fluids, which I didn’t realize were done after the 1992 GEIS. That’s—thank you for bringing that to my attention. But you had one line, in particular, it says the question is not whether but where and how many people will be affected. And this is coming—that statement is coming on the heels of a previous testimony, which, you know, I don’t even know how to ask the question. That there was such a - - contrast between your statement about not a question or whether, but how many people will be affected versus what I’ve heard that even going so far as staff and personnel have shown no impact. You know, people who in their daily lives are dealing with this process, have not had any health impacts. And I’m a centrist by nature, but I can’t imagine this disparity. Can you account for that?

DR. DYRSZKA: The public health system had failed. The people who have been impacted whether—it’s failed to address the fact that they’re ill, to send them to the right center to be evaluated, to look for the source of the possible contamination. It's failed to protect the health and welfare and safety of the citizens. And that's the responsibility of a state, county, even a local health agency. Now, you know, there are many reasons why it has failed. Part of it is, you know the federal exemptions. Well, if the Federal exemptions are there, well, we don't have to look for it and the state regulations are weak and then the Susquehanna River Basin Commission and Delaware River Basin Commission, respectively, dictate what goes on in their areas. Well, none of those entitles have done health impact assessments.

MS. SCHIMEL: So it's a question of collection of data in—is it a question that people may be sick and they're not being diagnosed as this is it's just not being—the data is not being--

DR. DYRSZKA: It's not being looked for.

MS. SCHIMEL: Looked for. Okay.

DR. DYRSZKA: They're self reporting only because they start having symptoms and then they go to a doctor, a local physician who doesn’t understand what the possible—what the possible problems are, because we hear that there are not problems. So if the press is there and if the public relations are there for—there are not problems and nobody is going to look for problems. So doctors, first of all, need to be better informed of what to look for, and, you know, not to treat these people as, you know, as having anxiety, which is what they’re often just given medication to treat anxiety.

MS. SCHIMEL: Right. I just want to make one last comment and this is in response to my Chair. I’m on the Encon (phonetic) Committee that I would say that probably about two years ago I didn’t even know what hydraulic fracturing meant and that is a testament to the Chair that now most people know what it means. So I imagine if medical professions is not looking for it because I didn’t know what it meant. Now I do. Oh, boy, do I. But a question of, you know, information getting out there, are you able to, you know, educate all aspects of society to look for it? Thank you.

MR. SWEENEY: Thank you very much, Doctor.

DR. DYRSZKA: Thank you.

MR. SWEENEY: I'll now invite up Dr. Ronald Bishop, Chemistry and Biochemistry Department, SUNY College at Oneonta. Welcome.

DR. RONALD BISHOP: Do you mind if I get a drink first?

MR. SWEENTY: Sure.

DR. BISHOP: The Honorable Sweeney, Chairman Gottfried, Members of the State Assembly's Enviornment Conservation and Health Committees, and other concerned citizens of New York here. I'd like to thank you for inviting me to join you in exploring potential health issues related to shale gas as it is produced today.

My name is Ron Bishop, I live near Cooperstown, New York. I've been a scientist and a teacher of science for more than 30 years. I received a Bachelor's Degree in chemistry from Youngstown State University and a Ph.D. in biochemistry from the West Virginia University School of Medicine. I'm also a nationally certified Chemical Hygiene Officer, a hazardous materials specialist, if you will.

I did cancer research and bio-safety research full time for 17 years before transitioning into full time teaching 12 years ago. I currently teach in the Chemistry and Biochemistry Department at SUNY College at Oneonta. Now, in addition to my academic and professional live, I have a robust background in construction. For what it’s worth I’m an industrial commercial electrician. And that and the fact that I lived for many years in the fossil-fuel extraction area I might have to explain how I came to study the natural gas industry that we are discussing here.

As I encountered the concerns of many people about this industry’s safety, I looked for some meaningful risk assessment. There were a couple industry analyses of oil and gas operations done from the global perspective, and almost the only really salient quantitative - - that they offered us was that blowouts happen from .5 to 1-percent of all gas operations worldwide. But they didn't really measure parameters about which all of my neighbors were asking.

An excellent risk assessment was done, actually close to here by Hazen and Sawyer for New York City and the Department of Environmental Conservation. But projecting the conclusions from that study statewide seemed to be an untenable stretch for me.

New York's 1994 regulatory program review by the Interstate Oil and Gas Commission was scathing, was not followed-up, and it left many questions unanswered, as well. And a recent Groundwater Protection Council study examined elements of state regulatory programs, but made no attempt to actually access their effectiveness. And all of those studies, by the way, are cited in this larger document, which I'm sure you have by now, or you will by the end of the day.

So not finding what I was looking for, I bit the bullet and set about producing some risk assessment for the gas industry in New York.

It’s focused primarily on areas of my strengths, chemistry and biological aspects of risk and, therefore, it touches on health impacts.

And I want to touch on three points from that report during my written—you know, my verbal testimony. I’ll be happy to answer questions on anything that you might have seen in my more comprehensive report. But these three points are levels of risk from various sources, potential contamination pathways, and chemicals are of special concern.

Now from where I sit, given the dates that there are to work with, quantitative risk assessment uses past performance to predict future impacts. That’s a model typical of insurance industry, risk assessments and just about any risk assessments. So using data from states which systematically report incidents and sadly enough, New York is not one of those states, and also from the United Stated Environmental Protection Agency and industry sources, I found that about one out of about every 50 gas well projects results in local groundwater contamination in the short term.

Put in a different way, that's about a two-percent, you know, groundwater contamination incident rate, nationwide.

Over the longer term, that is to say a century that pollution rate rises to one out of every six gas well projects. Now that particular 16-percent, you know, rate of failure is actually estimated by the Environmental Protection Agency, and it's underpinned by research not brought forward before that I know of by Maurice DuSoul (phonetic) and his coworkers, you know, in Montreal. He's actually an industry analyst and published his research through the American Petroleum Institute. Showing that subjected to the high temperatures of these deep wells and the, of course, brines that are done there, concrete in response to these pressures of temperature and high salt content, shrinks and cracks over a period of time. And in Maurice DuSoul and his team's research they estimated over a time, a 50-year timeframe, that these cracks are inevitable, even in wells sealed with concrete. It was estimated, again, by the EPA that one out of every six abandoned and orphaned oil and gas wells in the US known at that time were already leaking. Things to the surface. In another paper produced by Maurice DuSoul, he indicated that these wells, even after they've been played out and depleted of oil and gas will recharge, will re-pressurize because the same forces that permitted the migration of gas from lower shales and all gas oil, you know, originates in shales, that we know of, might, you know, break free, eventually, through their various processes, including microsizemic events, you know the slippage process that Maurice DuSoul mentions in his, you know, paper on the special geography that we have in the northeast. And so re-pressurizing of these wells long after they have been completely tapped of hydrocarbon resources is known to occur.

So that's part of the story when we're looking at the long-term impacts of this infrastructure left in the ground.

Now conventional wisdom would predict

that as the industry matures and improves, you know, their best practices and so forth, those rates of, you know, contamination of collateral damage should go down. But in Pennsylvania, which happens to be the state with the most comprehensive and recent data that prediction is not supported. In their incident rates, they're actually running ahead of the national average for the last three years running.

Air quality is known to be impacted by natural gas development, but it's incidence is not expressed quantatively in any studies that I could find. Now the study that's been cited so often today done by our own DEC's, you know, office, to look at air impact assessments, was focused on the operations around a single well pad operating a single well. They did not include anything to do with, for example, a well pad operating multiple wells, did not take into account any of the other operations that include, for example transportation of the gas, which requires purification of the gas, dealing with the aerosolizing and the vaporizing of the condensates that are stripped away from the methane before it can be put into a high pressure gasoline. Or the effects of, you know, compressor stations on air quality. So although there wasn’t a study that was done that was elegant in what it covered, there was so much not covered that would be done in an accumulative review that I find it not possible to actually quantitative their impacts except to say that they’re not zero.

And, okay. Now the specific severity of these impacts, of course, would include any use of open pits and these engines and on the proximity, duration and intensity of people’s exposure to those particular chemicals coming out of that process. Particularly, as I mentioned in my longer report, you know, the exposure to ozone.

I should mention that it was, you know, Scot, you know, mentioned earlier testimony that the proposed regulations by the DEC are going to eliminate the use of pits. That’s not technically correct. They’ll eliminate the use of pits on all small projects or single well pad projects, but multi-well projects, which are proposed in a four mile radius can make use of a centralized impoundment facility, not only for fresh water, but for flowback fluids. And so if you have a small project, you may not use a pit, you must use a closed system. But for a really enormous projects, you may, in fact, use a pit for flowback fluids in the proposed regulations, at least the last time I saw them. I'm hoping that that doesn't stay there, by the way.

So New York's regulatory system has so far failed to prevent or completely mitigate these impacts and some of what I'm about to talk about will illustrate that. And it also should not be expected to succeed without some substantial adjustments in resources and legislative support.

You all are probably already aware that within the division of mineral resources the Bureau of Oil and Gas regulation has a total of 16 field agents statewide. And we already have approximately 13,300 active oil and gas wells for them to monitor. An average of more than 800 well projects for every inspector now. They're not, obviously, inspecting all of these each year.

The principle contamination pathways in New York are probably improperly abandoned oil and gas wells. In a 2008 annual report, the DEC estimated we have more than 57,000 of them. And in their 2009 annual report they brought up that more were discovered in 2009 than were plugged. These wells include a range of depths, specific pollutants that could be released to the surface of local groundwater and proximity to people's homes. And they are not limited to the intensive gas drilling activity that was—that we know was carried out in the western part of the Southern Tier. We actually know by trying to track down - - taxations from the 1940's fifties, and sixties that quite a few well projects, wildcat projects, were done even in the western counties. For example, my own county of Oneonta. Unfortunately, following them by - - taxes only gets us within a square mile of where the actual well is. More than half of these 50,000 wells are in locations not known to anyone in the state. Risks from these pollution portholes far outweigh accidental spills and other chemical releases, significant as those may be, so after reviewing several reports of industry impaired waterways form the 1920s to the 2000's. I couldn't believe that so many impaired waterways, particularly in the western most counties could have no health impact, so I went on what I would call a fishing expedition and I went back to my research roots which were - - cancer research. So I investigated cancer rates for Chautauqua, Cattaraugus and Allegany Counties. And compared them with demographically similar counties specifically - - Otsego and Delaware Counties. And I poured through cancer mortality statistics available from the National Cancer Instituted covering a 50-year span. I didn't expect to find much, because if you're looking for a cancer cluster, you never look county-wide, you never look regional-wide, you're going to look say, for example, at a village that's next to a paper mill, or a village that's next to a chemical processing plant. You wouldn't dream of finding significant statistical data popping out region-wide or county-wide. Well, to my surprise, women in New York Southwestern corner topped the charts nationally over, consistently over a 50-year period for deaths of cancer of breast, cervix, colon, endocrine glands, larynx, ovary, rectum, uterus, and vagina. Men in those three counties topped the national statistics, again, consistently over 50-years for deaths from cancer from bladder, prostate, rectum, stomach, and thyroid cancers. No such mortalities profiles were seen in the demographically paired counties to the east.

Now clearly, I need to throw in some sort of a recapitulation here. These data could never be used to argue that every cancer death over the national average and those intensively drilled counties was caused by gas and - - pollution. But neither can it be safely assumed that the oil and gas industries had nothing to do with that public health anomaly.

Therefore, widespread contamination of a wide swath of Upstate New York from oil and gas development is not a prediction, it is a present reality. We are not waiting for collateral damage to occur. It’s already here. If we fail to address this issue before the gates are open to intensive new drilling, and hydraulic fracturing activity, we should anticipate health impacts on New York residents that are greater than those which are just now beginning to be documented. So I’m going to make an unusual request of you today and not ask for additional research. I would like to ask for something a little harder. We should clean up the mess we have now before making more.

Finally, I want to highlight a few chemicals used or produced by the natural gas industry, which I regard to be of greatest concern. And I’m not going to sing a blue’s song about not knowing what the chemicals are. More than many of the other people in the room, I read patent literature very well. And fluently. And I know a few more of the undisclosed chemicals than maybe, you know, the industry people would like me to know. I've actually published a little bit of that online and I can give you resources for that. Although, they're also sited in my risk assessment. But a few of these are of special concern. Because they happen to continue to be dangerous at vanishing small concentrations, they include the shale components barium, especially in its more soluble salt forms, lead, arsenic, chromium, and benzene. And you've heard about all of these already today. I won't elaborate, unless you ask me to. Radium, uranium, and radon may constitute radiation hazards, but they're occurrence in the shale is not uniform. And it's also not predictable. There are lots of cold spots in the Marcellus and Utica shales that do not harbor elevated levels of radioisotopes. There are also hot spots in the shales. It just turns out by some trick of history that Marcellus New York is one of the hot spots and people who live there with their basements in Marcellus shale have radon problems. And so monitoring at a minimum should be required by the State. It may not need to be acted on in every case, because some shale samples, frankly, are cold and some of the cuttings will come up cold. And some will not.

Chemical additives used by the industry, which are of special concern include, - - glutaraldehyde, DBNPA, DBAN. The corrosion inhibitor propargyl alcohol, very widely used. The surfactant and foaming agent 20bytoxyethanol, and also heavy naphtha, which is fairly broadly used for as a lubricant, especially in the mid—part of the drilling of the well. And this last chemical, 4-nitroquinolin-1-oxide, or 4N2O is neither naturally occurring, nor an additive chemical. It appears to arise from an interaction of additives with naturally occurring substances. It’s of special concern because it actually is one of the most potent cancer causing chemicals known to science. It’s used by research scientists to induce tumors in animals because it never fails. In humans, it’s especially prevalent for inducing cancers of the mouth, but it’s able to actually induce cancers in a wide variety of tissues. But at the really low concentrations it's also, you know, potential oral carcinogen. So these chemicals are, as I mentioned all of really special concern because they constitute human health hazards at really low concentrations. Some of which are at or below their chemical detection limits. So saying that you can't find it doesn't mean it's not there at a damaging concentration. I should mention in particular, since I haven't heard so far, although I trust Amy Freeth is coming behind me to bring up some of these things, a couple of these, for example, the 2-butoxyethanol and bromide are also endocrine disruptors for which there is no known threshold for beginning to induce human health effects.

I want to thank you very much for your time and attention. I'll be happy to answer any questions that you have.

MR. SWEENTY: Yes. Thank you, Doctor, very much. Well, first of all, I'm curious, you gave us a list of chemicals that you considered to be of greatest concern and so I'm wondering why those and how you developed that list.

DR. BISHOP: I have heard over and over from a wide variety of industry representatives some things that actually are almost true that the concentration of additives used in hydraulic fracturing fluid constituted very small proportion of that fluid. I'm aware from having looked into the specifics of certain well projects, which you can get by freedom of information law requests that they're reporting of typical levels of additives runs short of the actual level additive levels used in particular well projects and including in the Finger Lakes region of New York State. But even so, they constitute a very low concentration within these fluids. Unless, of course, you let the flowback fluid come into the pit. Because if you let the flowback come into a pit, the organics, except for the bromined ones which are heavier than water float to the surface and then, you know, it's the organics alone that make your top couple of milliliters of the surface of the pit, and then they're no longer dilute. They're really concentrated. But partly to answer this question of well what constitutes a risk even when it’s extremely diluted, I went looking for not only chemicals that have health impacts but have health impacts at parts per trillion for the low parts for billion kinds of concentrations. And that’s where I put my focus here. Part of my thinking was that as a chemist I can easily handle two hundred chemical products approved for use in New York State. I have a pretty good working knowledge of 20,000 chemicals, but I’m a chemist. I put out this chemical and biological risk assessment report more or less for the general public, who I am very aware from having been a teacher of chemistry really aren’t warm and fuzzy with a lot of chemicals all on one page. And partly to highly the point that extreme dilution whether it’s by going through convoluted pathways or by being trickled into water treatment plants before being released into streams is really not a valid excuse for releasing this material. Extreme dilution does not remove the health risk with respect to this handful of chemicals I have pinpointed. And that—so it's almost no matter what you do with that material, if you don't completely remove it from possible pathways of exposure to people, it will continue to be hazardous material. I should mention that, and then I'm sure you all already know, and it's part of the legislative support and I mentioned very briefly in my written testimony here, right now the law and the recommendations in New York State classify all flowback fluids as industrial waste, not hazardous waste. And they identify all drill cuttings as being of no concern. And those are typically encapsulated on the drill sites. They actually just wrap them up in plastic, you know, that the drill cuttings was lined with and bury them. The drill cuttings contain many of the same chemical additives that the hydraulic fracturing fluid contains. And more often than not in the drilling fluid, they are used in higher concentrations, because it's not millions of gallons, it's only a couple of thousand gallons of drilling mud. I think it's inappropriate for our State to continue to classify drill cuttings and drilling muds of no concern and to continue to classify flowback and produced fluids from these wells as mere industrial waste rather than, you know, analyzing it to see whether there are components worthy of making it truly, you know, hazardous waste, which must be handled in that kind of way. I hope I answered your question.

MR. SWEENTY: Yes. And actually, I want to expand upon another point that you made in your testimony because we talked a great deal including here today about substances of concern that occur naturally in the shale underground and the substances that we pump down there, some of which we know about. But you mention a third area of concern, which doesn't get much discussion, which is what is the interaction between those two and what is the product interaction between those two, and you mention one in particular that is not an additive and not naturally occurring, but results when you put the two of those together, and which is, if I'm not mistaken, both a mutigen and a carcinogen, which would, obviously make it a considerable concern when we're talking about impacts on human health. So with regard to the one that you specifically mention, which is 4-nitroquinoline-1-oxide is, that's something we would expect to see pretty much regardless of whatever additives or chemicals are used or is that a specific interaction and, secondly, how many more of these might there be that we know about, or perhaps, don't yet fully understand.

DR. BISHOP: My students love it when I do this, a two part question, but I'll take this one at a time. I'm working, by the way, on how 4N1O was being formed underground in the laboratory, but I'm not ready to pop yet. But I have some ideas based in real organic chemistry that I can speak to. Quinoline is known to exist in the condensate part of the gases, you know, that are found deep underground. The gases extracted from the Marcellus and Utica shales, towards the eastern ends of the reservoir tend to be drier and the ones on the western end tend to be more oil like. But no oil reservoir is free of natural gas. And no natural gas reservoir is completely free of oil. So there are trace amounts of analyn, quinoline, and a benzene and things like that. With the natural gas, even the dry gas, you've heard about, that are more exploitable, you know, closer to our eastern part of the state. So quinoline is already there as a naturally occurring substance, not only in the shale but also in the oil that accompanies the gas within the shale. How does the nitro group and the oxygen get attached to that? Those are really where the real questions come from. There are a couple of routes, if I want to synthesize for nitroquinoline-1-oxide in the laboratory, I'll take some quinoline and I will first oxidize it. We have a lot of oxidizing agents that are used among the various things that go into the ground. These oxidizing agents can even include the metabolic products from the bio-sides used because when microbes, as well as - - metabolize DPNPA and DBAN among the things that we make are aldehydes and other highly oxidized, you know, kinds of substances. But if I'm going to oxidize quinoline in the laboratory, I don't just need an oxidizing or an oxidative situation, I also need some acid, which is routinely used to clean out the pores, you know, because after they do their perforations that they then do an acid wash to clean out the holes before they go and do hydraulic fracturing. And although the hydrochloric sulfuric acid are believed to be short-lived because they're often neutralized in a timeframe of minutes to hours, you know, by the - - site that's in the rock, they're not neutralized right away or they wouldn't work. And so the acid is there as one of the components that we need to get this organic, you know, chemical reaction to occur. Acid is also required for the nitration to occur. And, of course, nitrates are already preexisting in the rocks. And so the classical organic synthesis around to make that happen is one way that we could see it go. Another say that we could see it go underground is actually even older synthesis and it's called the combs synthesis and it's even more attainable. Reacting anoline with one of these products of metabolism, you know, from our DBNPA and you'll have a one-step route, you know, by the combs synthesis, you know, to produce a chemical. So I'm working on trying to nail down what's really actually going underground with that one chemical. As far as I know, no other studies have ever been done to explore interaction of chemical additives with preexisting naturally occurring components of the shale rock or the sandstones or the other things along the way. But I found this to be part of a pattern as I've dug into the patents where the various products either been developed by other industries and then appropriately reiterated by the gas oil industry or where certain proprietary - - have been, you know, produced, specifically for the natural gas industry. Typically, these research studies are done, you know, by people, a little like I used to be, you know, post - - in a lab in - - Wales, or in, you know, Sidney, Australia. No health impacts are ever looked at. No interaction studies are ever done. In fact, what I've observed from the industry when I went looking for health impact studies and there are a couple of more, for example, by Dr. Wilma Subra (phonetic), who's done three health impacts, not perspective health impact studies, but after the fact impact studies, but those were actually a fairly small scale. Every impact study that has come forward has resulted in the authors of those studies being threatened by somebody over the phone or in the case of Wilma Subra someone actually shot at her in her office. It appears to me that industry finds plausible deniability, a little easier tract to take than funding studies that could show things they don't want to show. But that's just my personal opinion and I won't—it's not a scientific anything.

MR. SWEENTY: I have to ask you about the study that you did in the three counties comparing them to similar counties in the eastern southern tier with regard to cancer rates, because this is quite astounding to me. And although you are very careful to say that we can't come to the conclusion that they were caused by, in this case, what would be vertical drilling, which occurs in those counties, you also point out that you can't say it wasn't either. And you do have a background in cancer research, so this is interesting. I'm wondering where you got the data from for this study and given the fact that you do have a background in cancer research and was carefully as you frame your conclusions, I'm wondering, is there anything else that you came across in the course of your study that would account for such an incredible disparity in cancer rates between the two sets of counties.

DR. BISHOP: Okay. Again, I'll hedge my bets by saying this work is preliminary and ongoing. I chose those three counties in the southwestern corner of the state to try to minimize confounding factors that would make anything harder, you know to evaluate. Probably more drilling, for example, happened in Erie County than happened in those eight—well, not more than in Chautauqua County but there's been a lot of drilling in Erie and Tennessee counties, but there’s buffalo in Erie County, a major metropolitan center with lots of other industries doing on. Tennessee County has - - which is actually quite a hot bed of quite a bit of industrial activity and I wanted to try to simply the model as much as I could if I possibly could. By looking at some of the old reports on water quality, I also got a good sense of what were the concerns to environmental workers across the state in the 1920’s, thirties, seventies, 1990’s of industries already going. And so we had in those southwestern counties and in the counties where I lived, you know, coal gas production. Okay. So we were producing methane from coal, which has, as you know, a large number of problems with, you know, the heavy - - you know, just quite often left to bleed in the ground. We also had lost of wood alcohol production also responsible for all kinds of these things. Lots of tanneries in both of these areas of the State. Lots of dairy in both of these areas and state including the processing or not processing of - - dumping - - into the streams. And the same problems with failing sewer treatment plants all across the state. And so as closely as I could, I tried to demographically match the counties that, you know, close to where I live with the counties in the southwestern corner to try to minimize the glaring difference in that, you know, those three counties of Cattaraugus, Chautauqua and Allegany have had intensive, you known, gas and oil drilling and we have not. I can’t presume to say that I eliminated every confounding variable but as far as the population densities, and the prevailing industries, including, you know, wood and timber and leather and all of those, they were pretty well demographically pared. There are a couple of population centers in those three counties. There is, of course, Jamestown, but we also have, you know, Oneonta as under whelming as that may seem, we’ve got quite some industry going there. So I did the best I could with what I had in the short term. As for what I used for data, the National Cancer Institute maintains a database similar to mortality statistics. Basically maintained by gender, by tumor type and they distinguished 55 different tumor types that they'll lump together individually. And also by period of time, so there was data from the 1959 to the, you know, 1970-somehign, you know, set of data and then the 1975 until the present time now set of data they obtained. And those data extended through 2002. I should also mention that if you're going to do a study looking at cancer mortality you can't do this in a real perspective way, because you often won't see cancers arise unless there's a - - event for 20 to 40 years. So if you're going to embark on a study like that, you'd better have some children and grandchildren to carry it on. So this is the kind of thing that you can almost only do in a retrospective manner. So this is how I carried out the study. The number of individual data points at this point is rather small for a study of this type. It's only about 150,000. But I'm working on that because what I'd like to do is do some more exploring outside New York and look for other demographically similar regions both not much involved with gas drilling and also involved with gas drilling and see if these conclusions hold up or if there’s something really, really special about the southwestern corner of New York State. So I freely admit that much more needs to be done. I have to say, in regard to this I have also received a lot of meaningful support from county health officials all across the state. You’ve heard a lot of people talking today about real people and real incidents. I have got a lot more useful data on impacts to people’s water as a result of natural gas drilling from county health officials than from the DEC across the board. And if—I spent much of the summer of 2009, actually attempting to call public health officials of every county in New York where natural gas drilling and oil development had occurred. And I’ll be happy to send you my reporter’s notes from that if you’d like.

MR. SWEENEY: Thank you very much.

DR. BISHOP: Okay.

MS. SCHIMEL: I just—would you define what do you mean by pollution portholes, you mentioned that--

DR. BISHOP: I wish I could take credit for that phrase. It's actually originated with Roberto Suro (phonetic) who first reported this EPA's, you know, report in his 1992 article in the New York Times.

MS. SCHIMEL: - - pollution?

MR. BISHOP: Well a pollution porthole means a pathway, basically a wide-open pathway. The greatest obstacle that we seem to face with these abandoned and orphaned wells is that the resumption is that the vast majority of them were never plugged. Now I mentioned a historical breakdown in my larger report but to capsulated it, it's been illegal to develop an oil or gas, you know, well and then abandon it without plugging it since 1879 in this State. But there wasn't anybody in this State whose task was actually monitoring and enforcing that. They made an amendment to the law in 1880's that offered half the fines that they might collect from this kind of activity to people who reported violations. But it wasn't until 1895 that we actually had a meaningful state infrastructure or even collecting, you know, violation reports. And the forest and wildlife service which morphed into department of conservation, which then morphed into the DEC as we know it, has been, you know, incrementally improving its oversight of this industry all along and I have to say, you know, from what I know of the DEC and I know a lot. You know, I've been down here to their offices more than once and had some discussions with them. They're a lot way from the Department that we had just 20 years ago. I mean, 1993 we had only six field inspectors across the state and they carried out no impromptu inspections that year. We only have 16 now, but that's a lot better than what we used to have. So having said that, you know, we're looking at a lot of residual damage that nobody in particular was responsible for fixing. The problem is it's not getting fixed now. And so presuming that we can lean on the best regulations in the country, even if they were to emerge, to fix all of these problems, to me, isn't even funny. I just don't believe that regulations can solve this problem. When I talk about pit problems in presentations, you know, that I make in various places, I show an example problem pit. It’s a photograph taken in Preston, New York. Now it’s the law in New York now that you’ve got to have 18-inches minimum of, you know, headspace on a pit and if your water level gets closer to the rim than that, you’ve got to pump it down. And yet, I have a perfectly nice picture that’s obviously overflowed, the organics have floated to the top of the water there are—have this nice sheen going in the trenches that are beside the pit and it’s just an object lesson that the presence of a regulation doesn’t mean that the regulation is being followed. This, by the way, is not an incident in the DEC database, because, as I understand it, the local inspector wasn’t able to respond to that citizen’s complain for four days, by which time the pit was pumped down and capsulated and buried. So it’s just one of those things. I don’t believe the DEC can be blamed for lack of effort. Or lack of expertise. The people I know working in the DEC are some of the most dedicated, most savvy and hardworking people I've ever met. I just don't think they're up to it. It's too much.

MR. GOTTFRIED: Were you here during the testimony of the two people from the Independent Oil and Gas Association?

DR. BISHOP: Yes. I was.

MR. GOTTFRIED: Their testimony seems to be quite different from yours in it's—

DR. BISHOP: I'm aware of that.

MR. GOTTFRIED: --conclusions. Could you comment or critique some of what they said or explain how you come to such different conclusions?

DR. BISHOP: Okay. IN interest of full disclosure, I note both Uni and Scott on a personal level, so Uni better than Scott, she's actually almost a neighbor of mine in Oneonta County. What Uni says about closing the loop for an exposure pathway is a valid point. We already have evidence that a lot of these exposure pathways have been closed. But we have before us a bit of a technological problem in proving that to the satisfaction of the oil and gas industry.

MR. GOTTFRIED: Excuse me. When you say a pathway closed, you mean--

DR. BISHOP: We have people who--

MR. GOTTFRIED: --the path is complete?

DR. BISHOP: Yeah. We know that there are people who have health effects, barium toxicity has been shown in people next to oil and gas wells. And again, I come from a database perspective that's different than someone who depends on the DEC. I've talked to county health inspectors across the state. So I know of several incidents of not only methane, but also brine contamination of water wells next to oil and gas operations in Chautauqua County. Several in Cattaugua County, a couple in - - County, one in Tennessee County, I mean, it goes on and on. Because I'm working from a different data set of different set of conversations, so we know that those exposure pathways have been closed but here's a technological challenge for you. If you were going to look for a crack without making more, how would you do that? If I defy you to show me the crack that you found in the ground, short of digging in the ground, how do I show you that? I find it a very technically challenging thing to do. And a wonderful talking point for just what level of scientific certainty is appropriate in this discussion. So that’s one way that I resolved some of what we’ve been hearing. What you’re hearing from industry spokespeople and what I’ve been learning from industry spokespeople and I try very hard to say abreast of this, is the best of the best. And what I have seen in practice and in the field is there are the best and there are also the rest. Who aren’t the best, who aren’t using the best practices? Who are letting the concrete cure for a total of eight hours before they go on with the next, you know, round of drilling. Who are cutting corners because, well, nobody is around? They are there. They just simply are. It’s sad, but it’s true. And to say that everyone is going to follow best practices is just not facing the reality that we’ve seen on the ground. I’ve been on too many construction projects, obviously, not oil and gas. Most of my construction projects had to do with building, you know, simple things like schools and hospitals and assisted living centers and such. But if no one is watching someone is going to cut corners. It's just how—it's just kind of what I've seen. And some of the corners matter more than others. And so without an ability to really monitor, we're going to be hard pressed to maintain a high level of performance across the board. As one avenue there's—you asked about the industry self-policing, I've asked this question before. You may be aware that a New York energy company, US Energy Development Corporation, they're based in Getzville, New York, just north of Buffalo. In 2010 they were hit with a cease and desist order in the Commonwealth of Pennsylvania as a result of racking up more than 300 violations over the course of a year and a half. And DEP inspectors in Pennsylvania had worked tirelessly over that year and a half to try and guide them into compliance rather than hitting them with a bunch of fines. And they finally gave up, because they found, not only your simple things like not adequately posting, you know, signs, but things like, you know, laying pipelines through wetlands without permits and other rather nefarious things. And they finally just shut them down. And in the consent order under which US Energy Development Corporation finally got moving at a reduced pace, under DEP supervision, DEP also acknowledged the filing of a neighbor’s water well in northwestern Pennsylvania. At about the same time, US Energy Development Corporation was doing a ring of wells around the home of one David Eddy and his family, near Andover, New York, and this is in the town of Independence and Allegany County. And, again, I didn’t learn about this from the DEC, I learned about it from talking with Tom Hull (phonetic), director of Environmental Heath there in Allegany County. As is typical, you know, for operators, they had predrilled a number of these vertical wells and they weren’t into the shale, they were into the tight sands that are out that way. And then all in one week they got a subcontractor to come in and do the hydraulic fracturing because some of these tight sands, you know, perform better when they're fractured and when they're not. And in the middle of frac week the Eddy family started having problems with their water well. But it wasn't a problem with methane gas, tests didn't show a problem with any chemical additives, or with brine. Oil had migrated into their drinking water aquifer and they found, you know, traces of flat out crude oil in their water well. As I mentioned, you know - - was the sanitary who first started doing water samples out there, Tom Hull from the county health department got involved and later Brian Jandrew (phonetic) from the Allegany Office of the DEC. The conclusion eventually was made that the Eddy's water well was contaminated by a band in the oil well that was, you know, previously unknown that was closer to his house than this ring of gas wells going on around it. No conclusion was made or surmised whether the pressures from the hydraulic fracturing or the concision from the sizemic testing had any impact on the sudden malfunction of that abandoned oil well. No conclusions of that kind were put into print. But it was concluded that the problem with the Eddy's family water had nothing to do with natural gas drilling and that the case was closed. So it never went into the DEC's statistics or spill hotline. This is one of those troubling real world cases and, again, I'm not—I don't focus on anecdotes routinely but this is one of those things that just has be scratching my head a little bit. So soon after these two incidents, both with US Energy Develop Corporation had come to light, I contacted New York Independent Oil and Gas Association through Vicky Melody, their secretary and I asked is US Energy Development Corporation a company in good standing with New York Oneonta? And the answer that came back was, well, sure, they're a founding member. So there's really not at that level much policing within the trade association, if you will, that I can see. Now in their defense, US Energy Development Corporation, while maintaining any, you know, absolution from any culpability for the incident, at, you know, the Eddy family’s well, installed a Culligan water treatment system, including a carbon filter to remove the oil residues from their water well. And they also offered them a cash payment in return for a non-disclosure agreement. We wouldn’t know much about this except that David accepted the water treatment plant, you know, facility, but refused the cash. But these non-disclosure agreements are rife across the state. When I was in communication with—oh, my golly, we just—you want your brain to work for you—the water quality specialist, Lindsay Brown, from Shumung (phonetic) County. I asked him if Shumung County had had any, you know, adverse experience, you know, with oil or gas development in Shumung County and he said, a very strange thing. He said, officially, no. And I said, hum. What does that mean, officially no? He said, my office had not received any communications of water well contamination as a result of any natural gas or oil development activity in the county. I said, so why did you say officially no? He said, well, I'm not at liberty to discuss it. But I'm aware of three incidents in the county that might suggest otherwise. And that's all the information I can publicly share. Another head-scratcher for you. So it's my heartfelt belief that up until now the DEC as hard as they've tried to make up for lost time have not been able to make up for lost time. They are trying desperately not to spend taxpayer dollars on problems they didn't create like, you know, the abandoned well issue, but it's not getting fixed. As I mentioned in 2009, more new abandoned wells were discovered that were plugged, and I can't imagine going forward safely while those obvious pathways still exist.

MR. GOTTFRIED: Thank you.

MR. SWEENEY: Thank you very much. Appreciate it. Donald Siegel, Dr. Donald Siegel, Laura and Douglas Meridith Professor Department of Earth Sciences, Syracuse University.

DR. DONALD SIEGEL: Well thank you Chairman Sweeney and Members of the Committee for allowing me this opportunity to speak at the hearing. I've had the advantage of hearing the testimony of quite a few people before me. And I'd like to commend Dr. Bishop for that I thought was the most coherent piece of the day. And he's given me some things to think about. I might even take the opportunity to revise my testimony a little bit. Because that's the way science is.

A little bit about myself I'm not going to read my testimony. I'd like to take as many questions as possible and hope you'll ask me some of the same questions you've asked other people. Sort of seeing the questions, a pool here.

I've done research on and taught on water quality and water quantity for almost 30— for over 30 years at Syracuse University. Before that I was with the US Geological Survey, I aw s research hydrologist. I've worked in pretty much every area of water that you can think of and published on these ranging from how methane forms in the natural environment. I've published on the brines I found deep in New York rocks. I published a paper on the natural cements that are found in the Marcellus, which turn out to be barium sulfate and all sorts of those kinds of metals that you already heard as being naturally in that formation. And I've served a National Research Council, which is the Army National Academy of Sciences on many committees. Including a recent one on the environmental effects of the produced water out of coal bed methane in the America West. So much of my understanding of this whole hydrofracking issue, at least the fundamentals of it came from my work with the National Academy panel. And so that's where I come from. And you can go and look at my CV on the web or the brief one that I provided you for this hearing. My main conclusions, really, which I'll simply reiterate and then we can talk about them, largely, I think still hold, although, I will take the opportunity to revise them a bit based on the very last presentation. I'd like to learn more about what Dr. Bishop has done in what seems to be a pretty thorough study. I fully recognize that in any industry there is human error. And it's absolute. Any industry there's human error. You can't get around it.

There’s no zero risk in anything.

I also understand that the past regulatory practice in Pennsylvania and other states around the country that I’ve looked at regarding coal bed methane and now shale bed methane hasn’t been perfect either. And that indeed, in Pennsylvania there was a disposal, legal disposal and still is of flowback fluids that are very salty and have some radioactivity in them and, perhaps, other stuff as well. But whenever I look at a problem I always try to do some simple calculations to see what is scientifically plausible is really plausible. You know, I always teach my students the three rules of proof. You have what’s possible, which is anything. I’m 63 and I could drop with a heart attack right here. I don’t think I will. I don’t think it’s very plausible, in fact, I would say it’s not probable because I’m in pretty good shape and I come from good genes. But it’s possible. And I think the challenge at the legislature has and the DEC and the other regulatory bodies is to find some sort of a way that we can deal with an industry in a prudent way that incorporates the plausible the most plausible, but not all the possible, because, I'll tell you right now, and I've been asked by citizens as an independent kind of thinker, can you tell me with 100-percent certainty Dimmick won't happen here and wherever, and I could say, no. Humans being humans, things happen. So were the industry to come to New York, yes, we will have accidents. The question is whether the accidents will create an systemic problem to our water quality and quantity issues in New York. A systemic problem, not the equivalent of an underground storage tank that's leaking or a state—a salt depot that isn't fully sealed so you have salt contamination or in the case of the Midwest, pesticide and nutrient contamination that is followed much of Iowa and so forth. We don't want a systemic problem. But we have to recognize that there will be human error if we allow an industry to come in. Much like any other industry. That's part and parcel of the devil's bargain if you want to call it that. If you want the industry, there will be some mistakes, there will be some harm.

Now the question, a couple of questions I could dismiss quickly. The whole issue of these fractures, the possibility of fractures that upon hydrofracking could open up and allow gas and fluids go and migrate up thousands of thousands of feet upwards to the land surface, that is a no go. I’m sorry. Physics says it can’t happen. Terry Yengelder (phonetic) at PennState is giving talks about the Hazen report of New York City in which when I first looked at the figure it violated the principles of physics, regardless of what people think it is, that’s not going to happen. If it’s going to be a problem with the drilling process itself, it’s with the cement. And that’s probably what happened at Dimmick and what probably happened, whether that gas is deep Marcellus or it’s shallower thermogenic gas, the point is something in the drilling operation caused it to go up the outside of that pipe through the cement and do the contamination. That’s the best knowledge I have on it. And it was a terrible situation in Dimmick. And there's no question about it. All right. But that's the avenue by which methane is going to get out. It's going to get out through failed cement and I'll be addressing that in a little bit, and then up into the shallow aquifer, thousands and thousands feet above where the Marcellus is. So the question is an engineering issue here of their try to control that pathway in which the methane can move through there. But that's an engineering issue and I'll give you some ideas of what the State might do to try to help that out.

The energies of doing the hydrofracting itself, the creation of not shattered rock but rather fractures that are literally as narrow as this piece of paper. The energies to create one of those fractures, we know by micro sized - - is equivalent to literally a popgun or a BB-gun. I know that sounds incredulous, but when Mark Zoback (phonetic) told me of that out of Stanford, I actually did the calculations and he was right. We've complete hydrofrack job, we've seen the data from the industry. There’s no reason to suspect they’ve fudged it. Some of the high end fractures may be of 22 rifle, but the vast majority are what we call rector scales of negative three, negative four, negative five, I don’t have the math in my head, but, you know, it’s millions of times less energy than any earthquake we’d ever feel. And that’s the physics of it. You can’t propagate a fracture or open up and existing fracture using those tiny energies. Now, of course, if you took all the energies of all the fracs in a mile long well, a horizontal well, and put them in all one place, it would be what you see in shale shock a bunker busting bomb, but that’s not the way it is. It’s as if I took a BB–gun and shot 1,000 times at that wall, I challenge you to tell me that I’m going to break through the wall. If I make little fractures, so that’s simply not going to happen, folks.

So the issue is really the flowback water. Okay. Now what I did in my testimony that I don’t know if I’m allowed to change it, I like doing little calculations so I said, okay. Let’s assume an absurd situation. Let’s assume that we have a tanker truck of pure hydrofrac fluid and we spill it out onto all the gauge streams of each gauge stream that the Delaware and Susquehanna River, the ones that are gauged by the USGS and back in last October I thought of the idea and it was low flow time so I got the USGS median data, average data for what low flow is at that particular day and I did the simple mixing calculation, it’s literally a seventh grade problem. To figure out what were the concentrations be. You have typical frac fluid got pulled off the DEP’s website of Pennsylvania and took what I—the frac fluid compositions I could get from the web that they released, the DEP for the upper counties in Pennsylvania, which would be most like the ones here in New York. Taking frac fluids from southern Pennsylvania, western Pennsylvania, southeast Pennsylvania, that’s a no go either, because the chemistries change as you go to the south. So if anything the chemistries in New York in terms of the brines in associate with Marcellus is probably even more dilute than you find just south in Bradford County and Susquehanna County. So I took an example. This is not, you know, it's a proof of concept calculation. And then I bled it out at ten gallons a minute over a course of 24/7 continuously is such an equivalent to a full tanker truck everyday. Just imagine this kept on going and I did it for every stream. Not cumulative, but stream by stream to see what the chemistries would do. And what I found in the simple calculation is that the drinking water standards, the MCLs or EPAs and for the DEC would not be compromised at all except for the little tiniest streets, the creeks. Just the creeks, but any water supply that we might view as a potable water supply for a city or an urban area, even if you did that nonsensical scenario of allowing the drillers to come with a truck filled with pure hydrofrack flowback fluid and just dump it into the streams, a tanker truck a day, which I would view as absurd, even with that, with the exception of barium, it didn't exceed drinking water standards at low flow, at low flow. During normal times, nothing would have been exceeded. So the question I keep bringing up is MCLs. What are we as a state and you as a legislature going to use as benchmarks to allow something? Now we've heard a lot about things that concern you a lot because I'm involved. I'm the chair of the national research counsel's committee that's evaluating the national—it's called NWQA, the National Water Quality Assessment of the USGS. We're guiding the USGS in what they're going to do next. And one of the things USGS discovered were - - inhibitors in many of the drinking water supplies. Particularly the surface water supplies across the country. These are things like antibiotics, pesticides, hydrocarbons and so on, at very, very low concentrations. Some of which, may, in fact, be very harmful if ingested over some period of time. The problem I see that you have to access, whether you're going to allow this industry or not, is what benchmark are you going to set before you make such an allowance?

For decades, we've allowed-we've used the MCLs as our drinking water standards. Whether you agree they're too stringent or you agree they're not stringent enough, the MCLs are the lynchpin behind we make regulatory decisions. Every underground storage tank I could consult on. You know, we always look, you know, does benzene exceed 5PPBs. It's it more than 5PPBs, we have to do something. If it's less than 5PPBs maybe we don't. We'll let it naturally clean itself up. So how do we deal with these rare compounds at extremely low concentrations that we don't know very much about, and how do we set some sort of bar that this industry or any industry in the further that might want to come that does something different. How do they know where to go? Do we simply say, let's just dump a lot of research money and just do research forever and ever, what's the goal? And sometimes we might not be able to answer that because we don't even know what the goal is but the point is we have to make a decision. And I think the decision needs to be made on something that's prudent, that's some sort of middle ground.

And what I've heard today with one exception in the talks I heard, the two end members an environmental end what I view is almost extremism and then on the industry end, you know, it's not me. So it's a real challenge for this body and the State to make the proper decision.

What's the benchmark? I think MCLs are a good benchmark. I have no problem with instituting new MCLs for compounds that are new and unique to the hydrofracking process or the flowback coming out. But if we are going to allow fluids to be discharged to our waters, we have to come up with some guideline and I don't think it's prudent for the state to simply say, we're not going to do anything until we know everything because we never will. We never will.

So what to do? I'm going to give some suggestions. And then open it up for questions. And do ask me about the Duke study. First of all, what has happened in the past in Pennsylvania does not mean that that's what's going to happen in the future in New York. And surely what's happened in Vermillion, Wyoming, or in Utah or in Alaska, or in Colorado has absolutely no bearing on what the Marcellus is here. They're completely apples and oranges and I see this happening all the time. Different kinds of gas, different kind of geology, different kinds of processing, Vermillion is—I've been to Vermillion. I know Vermillion. I know a lot of these places through the NRC panel. And I've seen it. And you have the ozone problems there but it's a very different process there. Different kind of gas. It's not good. It's not going to happen here in New York. The first thing I think you need to do is think about what kinds of regulatory apparatus needs to be put in play. I would argue some prudent regulation. We should follow Pennsylvania's lead. You know, in Pennsylvania very soon there's no flowback problem, except what was grandfathered in like that recent report and I forgot the name of the town where they're discharging to the Monongahela or the Susquehanna. You just go on the DEP website and you can see that for the major bas players, the flowback is all being reused either subsequent hydrofracking or in cement jobs. Where it's not, it's being shipped to Ohio and put down in deep injection wells and in some places it could be processed and the State will allow it to be discharged if it meets drinking water standards. You have to drop something that's 30, 40, 50, 60,000 parts per million to 500 parts per million. That involves one heck of a lot of technology, whether it's reverse osmosis or evaporation. And my logical understanding is that very soon in Pennsylvania you're not going to have as many mom and pop operations out there. You know, working. It's going to be the big guys who can afford the process and have the chemistry to do the reuse. So the flowback problem issue is not going to be a problem in New York, if it's handled properly and the state should demand New York follow Pennsylvania's suit. If, in fact, the State wants to allow frac fluids or flowback to be discharged without that kind of treatment, then the State should also as part of the regulatory process get some hydrologist to figure out some measure of beyond—at some flow condition where you should not allow the stuff to be put in the water. Now I just used some average kind of quick concept calculation but perhaps you could use some drought indicator such as a seven-day—70-day, ten-year low flow and anything below that level you can't either take water out of a stream or put anything in it. I would hope the State wouldn't allow anything being, you know, put into the streams but if they decide they want to do that, then at least they ought to know at some point some threshold beyond which can't be done.

The fact is there's a lot of natural gas in rocks in New York. I get calls every year from people's whose water wells have methane in it. Every year I set water on fire in wetlands. It's really important to understand that if there is a groundwater contamination problem or a surface water problem that you lay the proper blame on where it's coming from. Salt, road salt. There's a front of road salt hitting our water supplies in the USGS has published a report on it. I just published a report on it. We don't know where we are on this curve, but we could get nailed for road salt pretty quickly. So if someone's water well gets all this salinity and there's a well nearby, a gas well, is it from the well or is it maybe the front of road salt that's moving down. You can forensically distinguish it. If there's barium, if there's strausium. You can forensically distinguish it as an associate from natural gas and from other sources. And it's not rocket science. I do it all the time with my students. The methane itself you can characterize and you've already heard this using chemistry. Of whether it's deep Marcellus or if it's shallow, thermogenic, I mean, all the way down the stack of rocks you have thermogenic methane. And at that very top you've got what we call biogenic, associated with wetlands and lakes. So I think there should be something in the regulatory process that specifically fingerprints those particular compounds that unequivocally can be used to say that's flowback water versus another source. If it’s not doing that, all you’re going to get is a lot of litigations and false positives. And I see this all the time.

Now, of course, all these things what I’m saying rely on future revisions of the GDIS and whatever else the regulatory process has here in the state and I’m not expert on law so I really don’t know the full process. But I can’t believe that New York State would be so derelict in its regulatory framework to come that they will allow the kinds of things that’s happened in the past. As far as the things in the past from my perspective, although, I’m rethinking a bit based on, to be honest, you know, I want to see what Ron Bishop came up with in terms of the frequency of contamination and what were the causes. I mean, if there’s one thing saying there was a cement problem in the well, that’s one problem. Another problem could be a spill on the land surface that could contaminate shallow water. I mean, there’s lots of different causes for groundwater contamination, also what were the concentrations and what was actually considered groundwater contamination. I worked to Chattagua County looking at their landfill and it was claimed at that time by the DEC that the landfill was contaminating the whole area with salt. Very unusual salt, calcium chloride, which is very expensive, and I don’t know why people would put calcium chloride in a landfill. Well, it turns out it was disposal of brines as road salting agent for wintertime. Brine is produced by - - wells and used as a road deicer. And that was— that had contaminated a lot of shallow wells and had nothing to do with the landfill. So you can forensically figure it out.

So to end, I just want to say, again, the challenge you have is to find some kind of middle ground between two very extreme ends and isn’t this what society is all about now. You know, adversarial politics at every level. Enviornment is not any exception. You know, you need to access what plausible harm would be, not what possible harm is and then you’re also going to have to make the tough decision of how much harm is acceptable. If the decision is no harm, all right. Then ban it. But you probably ought to ban a lot of other things too. You ought to ban agriculture, you ought to ban wineries. You ought to ban, you know, just go right down the line because there's harm in everything. But that's the challenge the legislature has. I think it can be done, I think we have a huge, wonder opportunity to revise our regs in a way to do it properly while allowing enough flexibility to actually get the drilling done and also have the appropriate regulatory apparatus which might include, by the way, taxing the production of gas like other states to fund the new people in the DEC to do the regulatory practice. The industry I am told is ready for that. But the state I'm told, hearsay, I'm not—has rejected that as possibility. I'm not sure why. But we have the opportunity to have it both ways. Will it satisfy everybody? No. It's not going to satisfy the—oh, yeah. Another thing. I just forgot. As far as the cement issue the State ought to go with the industry and talk with them and figure out, you know, what to do to make sure the cement doesn’t fail as frequently as apparently is has, which doesn’t still seem very frequent, but you don’t want a Dimmick, so, all right. Have them sit on the well for a day or two, let that cement set. Do the proper geophysics to see that the cement is everywhere before you do the fracking. It’s not rocket science to come up with a way to engineer these things so that the failure rate is much less.

And then finally, the last thing, watch where your data sources come from. When people say that wells fail all over the place, see where—look at the original reference, not everything is the same. Okay. Wells, for example, that fail in the Gulf. There’s a lot of cement failure in the Gulf of Mexico. These wells are on the bottom of the ocean in the oceanic environment. It’s very different than in the land environment. So you have to—it’s hard for lay people to distinguish it, but you have to find someone to help you parse out this given the adversarialy nature. So that’s all I have to say. I want to thank you very much for the opportunity to come here and speak and I'm happy to take any questions, you can ask me anything you want, but one caveat, I can't speak to air quality. I speak to the—I only give expertise on what I know and that's water. Now if you want my lay view on something I'll preface it by saying well, my lay view on this is this. But I'm not going to ever opine on something that I don't consider myself qualified based on my expertise and experience. So that's the only caveat. So, you know, water away.

MR. SWEENEY: Well, thank you. And what was the question you wanted to be asked?

DR. SIEGEL: The Duke study.

MR. SWEENEY: Well, go ahead.

DR. SIEGEL: The Duke study has gotten a lot of—I saw it before it was published. And I know the authors, I recommended one for tenure and promotion just this year. I know their work, they're capable scientist the Duke is a good group. But I looked at the paper and I was struck by the fact that a large under of wells that had high methane concentrations were centered in the Dimmick area. So I called on of the authors and I said, number one, why didn't you publish the data set on the proceedings of the National Academy of Science's website. If you go and look at the PANS website what they urge scientists to do is publish all their data so other people can look at the data and use it. This is done by most made flag shift journals, you know, science, nature, et cetera. That wasn't on there. The other ancillary figures they prepare but the raw data wasn't there, including where the data came from what were the longitudes, what were the wells actually sampled. So I was talking with one of the authors and I asked him, well, how many of these wells are form Dimmick. The ones that are high methane concentration. He said, about half of them are from Dimmick. He said, but there were some in Bradford County there weren't from Dimmick, that had high methane. And so they weren't Dimmick. So I said, that's interesting, so I went to the DEP website and I saw in Bradford County there were a couple of wells that people already now there’s some cement issues. So in my view, until I see all the data and evaluate it, what they did was equivalent to seeing a burning building and the going, let’s measure the smoke concentration in the air to see if the air is burning. It was not the kind of study that was designed or put it this way that design in my view was not of a kind to actually test the hypothesis if you drill wells you have higher methane concentrations close to them. Not if you selectively pick places where you already know there’s a problem. Now I can’t say for sure that that’s the case in all their—in the entire report. But I have to tell you, I was surprised that it got out given that the metadata wasn’t published with it, number one, and number two, it looked so apparent that it was skewed to find the methane they’re looking for. I don’t know how they sample, how they got the wells, I don’t know if they simply I mean, I don’t know why they selected those wells. But the way to do a kind of study like that is very different. You go and you say, there’s 1,500 wells in Pennsylvania, however many there are now, all right. And you randomize it, you statistically pick a certain number and then you go around those wells and you sample systematically away from those wells, farmers and so forth are there and then you see what's there. You don't specifically look for where you know there are problems. That to me is not good science. And I'm actually struck and surprised that that's what happened. Now they caveat it by saying this is just a preliminary truth of concept. It's not even a truth of concept. Not if they go to Dimmick and say, oh, see, the wells failed. We know they failed, for Christ sakes. Five of them failed there. Same contract. You know, so to me the data is interesting, no surprise of what they found, but I don't think it has the purchase that a lot of people claim it has simply because it's been published in the PANS. So that's my speal on that. And I say that will all respect to the two authors, but frankly, I don't know why they did that. I know them both.

MS. SCHIMEL: Just want to ask you.

Maybe I missed something in trying to string together the last three speakers culminating your discussion. In terms of when you abandon a well site is there a shelf life for that well site. Meaning, what I mean to say, is it inert, essentially once you have done your—is it inert?

DR. SIEGEL: Okay.

MS. SCHIMEL: Or do I have to worry about it again?

DR. SIEGEL: Right.

MS. SCHIMEL: Because you know what, because I'm hearing from others you have to monitor it--

DR. SIEGEL: Yeah. Yeah. Yeah. Yeah.

MS. SCHIMEL: --there could be, you know. I'd like to know when we're no longer, you know, pulling the gas ten years from now, I don't have to think about it because as a state person I have other things to worry about.

DR. SIEGEL: Yeah.

MS. SCHIMEL: Do I have to worry about that site ten years later?

DR. SIEGEL: It all depends. First of

all, about abandoned wells. You know, I had a discuss debate and you probably have heard about me, right, you know, I mean I was on - - I was not paid. I did it as a citizen I had a debate with Tony Agraffia (phonetic) and he brought up this whole issue of the DEP is reported however many thousands 30,000 abandoned wells. He don’t know where they are. And I was kind caught flat. I mean, I guess that’s a big deal. If in fact we have that many scattered around the state, we really have to know where they are. So I called Don Drazen (phonetic) at the DEP—DEC, who is the guy who came up with that number. It turns out he’s a long time—old-timer in the DEC and he’s still there. He’s some position in the oil and gas part and he’s the guy who published that number and I said, Don, what is this about. He said, oh, yeah, yeah. These were mostly shallow wells and almost all of them are over in the southwestern New York. Those counties that you hear Ron talk about. He says—I said, what about in the southern tier, you know, where the Marcellus is, he says, oh, Don, don’t you know,

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your own faculty member figured out where those are. And, yeah, when I first got to SU in the eighties, the Joe Robinson was our petroleum geologist and he had all these grad students out there scouring the files of all the oil and gas companies and they found all the deep wells effectively. There may be a couple out there that they didn't find. Effective they found the deep wells and know where they are in that area where the Marcellus clay is. And Don said, no, that's a red herring. He didn't say those words, but it sounded like he said, no, it's all, yeah. Those are shallow wells there, yeah, they cause problems, but don't worry much about it with the Marcellus. And they upgraded. They said, there's more we don't know where they are. There are, okay. There's more we don't know. But according to Don, I'm just repeating what he said, and he should know they're out and he published actually a report. He said I'll send you the reports showing all the abandoned wells are. So what happens when you abandon a well? First of all, in the—the plateau where all the drilling will be south of Binghamton and so forth, we’re on a big plateau and it slopes down into Lake Ontario. The hydrology of the deep aquifers, if you want to call the brine filed rocks above them Marcellus on this plateau, the flow is downward of liquid fluids. So, in other words, if you had a well and the cement failed, an abandoned well, you wouldn’t have fluids from below coming up, they can’t. They’re dense down there. They’re not dense on top. It’s like oil, that’s a bad analogy, oil floating on water, okay. The oil can’t go down the water. Okay. And the flow is downward. If you contaminate a shallow aquifer near Elmira and that hits the water table and if there’s communication to the rocks below, that contamination will go vertically downward. I know that. I’ve worked on consulting projects there. And so the whole notion that you’re getting fluids or liquids coming up even with an abandoned well, even if the abandoned well had its cement completely fail, the idea of that popping up is ridiculous from first hydraulic principles. What could come up once a well is done, they close it, you know, they no longer—it's no longer economically viable, you could still get natural gas and if the well isn't sealed properly, if the cement isn't sealed the gas could come on the outside of the well, all right and then build up pressure under the cement that has been installed to isolate the upper aquifer. Now I just recently heard from Bill Compel, from the US Geological Survey that companies now are not only cementing the upper thousand feet or so of the vertical pipe, but he claims that they're cementing the entire stream of pipe even a mile out. Now I just repeated what Bill said. But he's pretty up there on the—you should have him come here to testify on what's going on in the Marcellus. So I think industry is trying their dandiest not to have problems. As far as old wells, okay, you might have methane bleed out, but it's not going to bleed out on any great pressure because, after all, it can only really come out where the fractures are. A lot of companies used to, as I understand it, you know, when it's no longer commercially viable, they give—they hook up the gas well to whoever they leased the land from and they provide them with small amounts of methane sufficient for a home forever. And so that's what's done in the west all over the place for coal bed methane. And once a well's gone—so will they fail, the cement fail? If it does, you may have a little methane bleeding out, but that would be about it.

MS. SCHIMEL: Well, you know, again, just to reiterate, I hate to say it, why do I have to know where they are? In other words, you've abandoned the well, it's not an economically viable, the oil and gas company are long gone. Talking about way out.

DR. SIEGEL: You're talking about old wells or new wells?

MS. SCHIMEL: I'm talking, going forward. I'm going to now allow hypothetically, permit, you now can do hydraulic fracturing.

DR. SIEGEL: Um-hum.

MS. SCHIMEL: They pull what they need--

DR. SIEGEL: Yep.

MS. SCHIMEL: --it’s now decommissioned, five years, ten years, why would I as a policymaker need to know where that well was ten years out. I’m ten years out, Michelle Schimel ten years from now hydraulic fracturing is—why would I have to know where that is? You just mentioned that if the cement fails, there are--

DR. SIEGEL: If the cement--

MS. SCHIMEL: --concerns.

DR. SIEGEL: If the cement fails--

MS. SCHIMEL: I’m going to assume--

DR. SIEGEL: Yeah.

MS. SCHIMEL: Forgive me.

DR. SIEGEL: Yeah.

MS. SCHIMEL: I’m going to assume that it’s going to fail--

DR. SIEGEL: Okay.

MS. SCHIMEL: --at some point--

DR. SIEGEL: Sure.

MS. SCHIMEL: --or another because there are shifts, whatever I know, you know, I know things are--

DR. SIEGEL: Right.

MS. SCHIMEL: --human things are meant to fail.

DR. SIEGEL: Right. So--

MS. SCHIMEL: --over the long time, you know, so I'm going to—so that being—if you take my hypotheses if it was done by a human--

DR. SIEGEL: Yeah.

MS. SCHIMEL: --even if it was done amazing, over a period of time there is deterioration, there is failure, and sometimes naturally there are shifts in the land, there's, you know, earth movement--

DR. SIEGEL: Yeah.

MS. SCHIMEL: --it's going to break. Why would I ten years out from this moment Michelle Schimel ten years from now be concerned about where the well is?

DR. SIEGEL: Well, it would be nice to know in case if there were suddenly methane getting very locally, very locally in that case, because the pressure build up and the amount of methane coming out will be, as my understanding, very minimal because, after all, it's coming from the fracture shale absorbs from the shale and then there’s no more methane or it just slowly bleeds out.

MS. SCHIMEL: Okay.

DR. SIEGEL: So if, if farmer Joe who maybe has—is right near the well and suddenly he starts getting methane in his water, it would be nice to know where there was a well on his property so then you could tie it together.

MS. SCHIMEL: And what happens once you tie it together, what is the process and--

DR. SIEGEL: Well, that I can’t answer. I would hope that the legal framework would be such and certainly what I tell landowners if they want to lease, I say, get yourself one damn good lawyer, pardon the expression and you make sure they’re contingencies in the lease to allow for such circumstances if methane should come into the well, there should be background information, first of all on the farm, I agree with what’s been said, there should be full background of parameters that would fingerprint flowback water and the natural gas. All right. Now what a lot of people don’t realize, they focus on things that really aren’t the best indicators. Do you want to know what the best indicator is? There are two parameters and I’m about to publish on it with one of my students. Chloride the major thing in there and bromide, which is associated with Chloride. Now people know about bromide, because it can cause trihalomethanes and so forth. But the chloride to bromide ratio, the proportions of the two dead ringer for flowback water. I mean, you could with that, it’s flowback, it’s salt, it’s septic systems, it’s road softeners. Boom. And if there’s fluids, liquids coming in to play, the chloride doesn’t react, it’s got to be there. So if someone has a water well that suddenly you get all this barium in it, and strauntium, and iron and manganese and there’s a gas well nearby but there’s no chloride, it can’t be coming from that gas well. It’s got to be coming from a nature variability if they have no water supply which, by the way it happens frequently. You get these in high concentrations during particularly summer months when water levels are low. And I could tell you the chemistry if you want, private. So, but, no. I—there's got to be a legal framework and that's another big challenge. But I don't know if that's what you guys or DEC does, it's--

MS. SCHIMEL: Yeah.

DR. SIEGEL: --I don't know how that's going to make it.

MS. SCHIMEL: Well, I want to speak to that, because that's part of the reason I'm here now. One of the concerns that I have is, you know, the long-term effects, and I don't even want to get into the legal issue, but that's a big concern for me. In terms of are we creating and lack of a better term, you'll forgive me, the Brownfield's of tomorrow. In other words that is a very serious, you know, once it's abandoned it's used as economic development usefulness, what is the recourse years from now when I'm gone, I'm not going not be here and the people that had put this in play, how do we remedy, if need be, remediate the problems down the line. Because, like I was hoping, now you'll forgive me. I was helping you because I was like, nope, you do a good job, it’s inert. You will never have to deal with that because, you’ll forgive me my impression when I spoke—when the people before--

DR. SIEGEL: Yeah.

MS. SCHIMEL: --Dr. Cline--

DR. SIEGEL: Yeah.

MS. SCHIMEL: --and I got the impression that it’s essentially and—like I’m not a scientist. I am in a different sense.

DR. SIEGEL: Yeah.

MS. SCHIMEL: It’s not inert. I get the impression that it is inert. That you don’t have to worry anymore. It is there are no impacts once the well is abandoned and now if it’s not inert then this is other things that we have to consider long term and I have to tell you, the way I work it’s always the long term. It’s never the here and now. It is ten years from now, 20 years from now, 30 years from now. You know, do no harm, but boy, do no harm for the - -. And you’ve just given me pause that--

DR. SIEGEL: Well, you know, you could say that for anything, right?
MS. SCHIMEL: Yeah. You can.
DR. SIEGEL: A road, a bridge.
MS. SCHIMEL: Some things are--
DR. SIEGEL: A gas station. Any company whatsoever that builds a thing in America. Home Depots, Wal-marts. I mean, I've been involved--
MS. SCHIMEL: Risk assessment. Getting back to your first comment.
DR. SIEGEL: Yeah. So, you know, it's inherent if we wish to live in a first world nation where we take the benefits of the technology, we have to also understand there's risks and there's detriments to technology. I don't care if it's oil or gas, plastics or agriculture. All right. So there is not zero risk. What I can say is from my experience working in both the coal bed methane and now the shale bed methane, if there is a well failure, the effects of it don't go very far from the well. Even Dimmick where multiple wells failed, it wasn't just one, my understanding, I don't

know all the details. Maybe I shouldn't say it, because there's litigation and I can't get a lot of the details. But my understanding is that there are multiple wells that failed at Dimmick, not just one and the people who were affected, their shallow water supplies were in a radius of about a mile around those wells. Now a mile may sound like a lot of area, but it really isn't, and what I'm seen elsewhere in Pennsylvania is when there's been a fugitive gas release, it's just right next to the well, and even the Duke paper shows that. You know, it's an exponential drop in the amount of methane at Dimmick the further away you do. So a couple thousand feet and there's vary little methane. So it's not like I've heard environmental groups tell me it's deep horizon all over again. No, it's not deep horizon all over again. Now I'm not making light of this at all. Obviously, if it's my well, I'm 100-percent in problems. But you have to put things into context. That's another thing I always tell my students. If someone says something is bad, the first thing I say, compared to what? What are you comparing the badness to? Of if someone is going to argue that endocrine problems with frac fluids are really bad and they may very well be. I'm soon going to be in touch with Ron about this. Are they as bad as the pharmaceuticals and the hormones that we're dumping in our waters everyday through our sewage treatment plants through human use? Estrogen, ammixocilin, I mean, is it that bad? Would it be that bad? Can you put some sort of a handle on it? Because not all bad is the same.

MS. SCHIMEL: Just in answer to that, is - - snapshot in time. If you know something, you must do something and in addition to that, at a time, you know, when they have these pharmaceuticals, if you will, the method was to flush or to - - .

DR. SIEGEL: Sure.

MS. SCHIMEL: Now we know otherwise. So that's, you know, that's when you - - snapshot - - does the remedy take care of that snapshot--

DR. SIEGEL: Absolutely.

MS. SCHIMEL: --know enough to remedy.

So I don’t know if I understand the pharmaceutical argument, you know, because, again, that was done at one time. Now we know better. Now we have to catch up - - so that’s the - - but I will - - .

DR. SIEGEL: Yeah. Yeah. I accept that.

MS. SCHIMEL: Okay.

MR. GOTTFRIED: I have some questions about the geology that you started out with, because it doesn’t seem right to me and, you know, I know next to nothing about geology, so fill me in. About how the water couldn’t go up, it could only go down, after all gravity. It seems to me if the earth gets denser as you go down, right? I mean, topsoil is not as dense as the stuff of 3,000 feet down, why doesn’t—why wouldn’t it be that the downward pressure of the earth might induce the liquid that got squirted under there to go up rather than down if there’s pressure on it? I mean, if you poke a hole in an underground pool of oil, you don’t have to suck it out of the ground, it will come shooting up.

Why if we're putting into one well an amount of water and chemicals equal to the daily drinking of the City of Ithaca as it was mentioned earlier, if there's a crack somewhere why wouldn't some of that water to up and why couldn't it through a series of cracks go just several thousand feet?

DR. SIEGEL: Okay. Let's see if I can express this without benefit of AV equipment. You know, I'm looking around here to see what I can do. Okay. The reason why, as you said, you punch a hole in an oil field or say an artesian aquifer, you know, and artesian aquifer you punch a hole through say a clay bed or a shale bed and the water will sometimes flow at the land surface. You don't have to pump it. I guess what I'm thinking the best way to describe it is a siphon. You hold a—take a tube, you fill it with water, it's filed with water here, and you open the bottom and the water's going to go down from high elevation, above sea level and flow out the bottom of the siphon. On the Appalachian plateau, you're at the top of the siphon. You're at the top of the siphon and where it comes out, if there’s open fractures, it isn’t Lake Ontario. This is actually something that a student and I worked on, you know, again, earlier when I got here. We modeled this. And so the water that falls on these high areas in the Appalachian plateau percolates down and if there’s hydraulic connection, if there’s any hydraulic connection at all it will keep going down and then move horizontally and ultimately come out in Lake Ontario and in western New York there are actually some liniments where we can identify those point discharges of vary salty water coming into Lake Ontario. There’s also one up on the closer to home that I saw. The Indians used salt spring there as their—here’s another—it’s well, I forget, we’re not in Syracuse. But the salt issues in Syracuse, the natural salt deposits naturally flowed for the same reason. So you’re at the top of the siphon, is probably the best way to describe it. So even if you inject water in the bottom, first of all, the other fella who provided testimony is absolutely right.

Capillary tension holds that excess fluid in there. The best analogy there is this, think about it, this is if you took this table and you had hairline fractures just in the middle of it, all right. And you poured water in those hairline fractures, and you tipped it upside down. Some water would drip out, but most of the water would stay in the hairline fracture because of capillary tension. Basically the sides of the fractures have a negative electrical charge and the water has a positive side and they stick together. Or put it this way, you puncture your finger and you put a capillary tube on it. The blood goes up. You take it off and that blood won't come of to the tube unless you blow it out. The same thing applies with this hydro fracking process. Absolutely. It's been shown at PennState in experiments. If you know how wide the fracture is, it will tell you how high up the water will water will actually move and I can— it's a very simple calculation. It's done all the time in hydrology. If you're in an open thing like sand and gravel or large cracks, it

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hardly moves upward at all because of capillary action. But if it’s paper thin, it could go up, well, I don’t have it in front of me. My guess is it would go up 30 meters, 90 feet. That would be about it. It just can’t go up any more. And certainly when the hydrofractive pressure is released, it all then indeed goes into the well and so it drains. The gas blows out 30-percent or so of the water, the frac fluid and brine. And then the remains just stays in there. And, in fact, it’s very inefficient. The gas companies don’t like to use water, now in Canada they’re using liquid propane. I know it sounds scary, but liquid propane is a far better frac fluid. You get zero water out, and you get all the propane out along with the gas. You can separate natural gas, you can separate it out and reuse the propane. And without any of the additives at all to speak of. Now the problem is, well, I don’t know—I understand they’ve only been doing this in Canada up to a few thousand feet and they haven’t gone deep enough to see if they can—but I hope that somebody somewhere in

Pennsylvania will try using propane as a frac fluid. That would solve the flowback problem immediately. You know, some people would argue, what if the propane trucks blow up and all that, but we've been using propane for decades and decades without too many disasters. So that's probably a pretty good approach. Now whether it's going to be used in New York, whether they can use it or not in the Marcellus, I don't know, in the Marcellus.

MR. GOTTFRIED: Well, I'm still not convinced, but my guess is that it would take a lot longer them than we would have now to teach me geology. So I'll stop there.

MR. SWEENEY: Thank you.

DR. SIEGEL: Thank you, again, for allowing me to speak here.

MR. SWEENEY: Sure. Dr. Eric London, psychiatrist.

DR. SIEGEL: Is there any information like additional information just send me an email out.

MR. SWEENEY: Thank you, Doctor, provide

it. Thank you.

DR. ERIC LONDON: Thank you for the opportunity to testify on this important topic. I'm restricting my testimony to the potential health impacts of air pollution produced by unconventional gas extraction activities. Although issues concerning water contamination and other health issues are of great importance, I believe that air pollution is of particular significance and has received less attention publicly and in the press. I know that air pollution has been mentioned already quite a bit. What I so discuss though, is a little bit more on the medical side and I think I'm talking about little harder numbers that what we've actually heard.

With respect to my professional background, I'm a physician and the Director of the Autism Treatment Research Lab at the Institute for Basic Research in Developmental Disabilities in Staten Island. This is the research institute associated with OPWDD. However, I want to make it clear that I am not testifying on behalf of that institution. This is my own testimony.

There has been extensive research done worldwide on the effects of various components of air pollution caused by the burning of fossil fuel and it appears that the life-cycle activities associated with unconventional shale gas extraction will significantly increase these same pollutants. These pollutants include ozone and the subjects that contribute to formations, specifically nitrogenous oxides and volatile organic compounds.

In addition, there is evidence of pollution including particulate matter, polycyclic aromatic hydrocarbons, or PAH, the BTEX compounds, hydrogen sulfide and fugitive methane. Unfortunately, in the ten minutes which I prepared I can’t go into everything so I’m going to restrict myself mostly to the ozone discussion.

Air pollution caused by the burring of fossil fuel resulting mostly for motor vehicles and coal burning power plants. And it is currently causing a very large and I think ignored public health crisis. I think that's actually fair to day. And as Ron Bishop said, I think the problem is already here, whether we're recognizing it or not. To illustrate this, in July of 2010 the EPA proposed the Transport Rule requiring the controlling of emissions of sulfur dioxide and nitrogenous oxides across state lines in 31 eastern states. The EPA predicts that the implementation of this rule could avoid 14,000 to 36,000 premature deaths per year. I'm no sure how anyone else hears this but to me this is an astounding number. We're up to 12 times the number of people who died in the 9/11 attack. Yet we seem to absorb this fairly easily. In addition to death, implementation of this rule is estimated to safe 21,000 cases a year of acute bronchitis, 23,000 cases per year of non-fatal heart attacks, 26,000 hospital and emergency room visits, 1.9 million sick days when people miss work or school, and 240,000 cases of aggravated asthma. So these are all very large numbers and the EPA estimates the cost to the public in implementing this rule at $2.2-billion. Whereas the estimated benefits range between 120 and $290-billion per year. So when calculating the alleged economic benefits of hydrofracking are we including the costs that will be shifted to the health sector and other indirect societal costs such as missed work and school?

These are all EPA numbers that I was quoting and the EPA utilized many studies to justify these numbers. And there's a lot of study in the literature. This is a well-studied topic. One study of three Latin American cities, the authors concluded that 156,000 premature deaths could be prevented over a 20-year period assuming only a ten-percent reduction in air pollution. And included in these deaths was 3,700 infants deaths.

In a very large study published in 2009, in America in which almost a half million subjects were studied over 19 years following 118,000—some odd people to their death, they found that there was as 2.9 increase in respiratory death based on only a ten part per billion increase in ozone level. Studying two pollutants ozone and particular matter 2.5 there was a four-percent increase in death risk. And there was a threefold risk of dying of respiratory diseases in areas with the highest ozone compared to the areas with the lowest ozone.

I’d like to add, which I didn’t put in this report that the EPA has been asking for reduction in the ozone levels down from 75-parts per billion to somewhere between 60 and 70 and thus far they have not been able to achieve that, although it seems clear that this would be very good for public health and these are standards that are used by the world health organization.

Although it is much easier to study the outcome of adults, which I have been alluding to, it is highly likely that relatively speaking there is more mortality and morbidity in the unborn. These pollutants are DNA adducts and therefore cause chromosome abnormalities and these chromosome abnormalities are consistent with the most recent genetic findings in Autism.

Studies correlating air pollution with infant mortality existed since 1950s. However recent studies in Korea, the Czech Republic and Brazil have found remarkably consistent findings of increased infant mortality rates with air pollution with risk ratios between 1.66 up to 1.95. So almost, you know, twice the risk of infant mortality.

A study in Mexico City found an increase in particular matter 2.5 of ten micrograms per cubic meter led to almost a seven-percent increase in infant death.

Aside from mortality, there is also the likelihood of an increased birth defects, developmental disabilities and the possibility of creating templates for disease in later life. Low birth weight in prematurely present a very large and an increasing problem and is associated with a host of problems including respiratory disease and developmental disorders such as cerebral palsy and autism.

Specific birth defects such as valve problems, blood vessel defects have also been correlated with air pollutants. PAH and particulate matter have been correlated with immune abnormalities in the cord blood of the developing fetus.

There's a growing literature implicating aberrant immune functioning with brain development abnormalities, including autism.

One recent study found that living within 300 meters of a freeway during the third trimester of pregnancy yield twice the rate of autism compared to controls.

The BTEX compound, although, well known as carcinogens, we've heard something about that already, may also have a role in birth defects. Mothers in the areas of the highest benzene levels had babies with more than twice the rate of spina bifida, a disease characterized by aberrant neural tube closure. One of the leading hypotheses of autism involves brain development abnormalities around the time of neural tube closure. Also alluded to earlier were the elegant studies using nasal catheters to study the air pregnant women are breathing and found that lower IQ scores in the children who were correlated with PAH levels.

These health risks are relevant if, as a result of the life cycle of extraction, transport and processing activities conducted within these gas shale plays, these pollutants are placed in the environment. And I want to emphasize that we’re really talking about the life cycle of the gas including the piping, and including the compressor stations. This is not just a hydrofracking process that one little process that the gas industry likes to talk about.

There is now compelling evidence to believe that this is the case. Armendariz who is now a regional director of the EPA in 2009 studied air pollution from fugitive gases in the Barnett Shale near the Dallas-Fort Worth area. And he concluded that these polluting gases come from the gas play more than matched all the motor vehicle pollution in the Dallas-Fort Worth metropolitan area.

Texas is not alone having evidence of unconventional gas drilling producing air pollution. Rather, there is compelling evidence from several other western states in which the gas drilling has been expanding for many years.

In Wyoming there were 13 days between January and March of this year when ozone levels exceeded the eight hour health standard of 75 parts per billion, including a level of 124 parts per billion on March 2nd.

In Utah's Uintah Basin there were 26 days between January and March of 2011 in which the ground ozone level exceeded Federal health standards according to EPA monitors.

On February 16th, there was an eight hour average of 146 parts per billion, which is nearly twice the Federal standard and potentially dangerous even for health adults to breath. And there were anecdotal reports where doctors were saying people were just coming in, healthy people were coming in, joggers who's nose all of a sudden were bleeding and having respiratory problems. This puts the rural area of Utah in the same categories as the worst ozone locations in the country. These are higher levels than they’re getting in California, which is the worst in the country.

Similar ozone problems have been documented in Colorado and New Mexico. All of these areas with little other explanation for the high ozone levels other than the unconventional gas extraction activity. Keith Guille, spokesman for the Wyoming Department of Environmental Quality said, and I quote, we recognize that definitely the main contributor to the emissions that are out there is the gas and oil industry and we’re trying to control those.

While New York State, more than any other state has wisely taken the time to ponder the issues around gas extraction, in terms of air pollution, it is likely we will not be able to absorb a huge source of pollution in addition to the amount already produced in our densely populated state.

As opposed to Wyoming, our vehicular traffic will continue to create ozone pollution. According to the American Lung Association, 17 out of the 30 New York State Counties which were monitored received an F or failing grade for ozone pollution, while another six received Ds. Air pollution caused by intense drilling activities in upstate rural areas, not only will adversely affect residents in those areas, but it will migrate for hundreds of miles and add to the pollution in the cities and suburban regions.

So this air pollution should not be thought of as much of what we have been talking about that just around the wells things will be bad, we're really talking about adding air pollution to the whole state.

Sadly, there has been huge neglect or perhaps even a shielding of the industry on the part of state officials to document these pollutions. Since 1993 in Texas, for example, employees of the Texas Commission on Environmental Quality have earned more than $32-million lobbying for the industries that they once regulated. Four out of the five directors of that agency became lobbyists soon after leaving their post. Some thing is true in Pennsylvania.

Even when the gases are smelled and the residents report medical problems, small towns and private citizens have had to pay for their own air testing after state agencies repeatedly reported no findings.

In conclusion, by way of an analogy, it would be inconceivable that arguments such as it is good for the economy, would allow state officials to ignore or be haphazard with potential and infectious diseases which would threaten the public health. I hope and trust in the equal measure of precaution will be taken in regulating and determining the wisdom of permitting unconventional gas drilling in New York. Thank you.

MR. SWEENEY: Thank you.

MR. GOTTFRIED: Just one—when you've used the term unconventional gas drilling, you mean vertical and horizontal hydrofracking? Or other things as well?

DR. LONDON: Well, to the best of my understanding, I'm a medical guy, I'm not a drilling guy, but to the best of my understanding, the issue here really is intensity and volume. Some of these studies that I'm quoting, all the studies I'm quoting were done with horizontal, not vertical drilling. But I think the issue with gas is it's really drilling in general that causes it. Estimates are that up to seven or eight percent of all methane that's brought up from the ground will escape. And so, again, the escaping is not much at the drilling sites as it is during the piping and the compression stations. In Texas, the town of Dish, Texas, which is a lot of—had now received a lot of attention, that's by where all the pipes come together and there's a compression station and so the people are around the compressor station and smell the gas. The Texas agency repeatedly failed to find anything and that was the town I was referring to. Has to chip in with their meager budget and do their own testing.

MR. GOTTFRIED: Okay. Thank you.

MR. SWEENEY: Doctor, thank you very much. And Dr. Amy Freeth, endocrinologist. Welcome.

DR. AMY FREETH: Thank you Chairman Robert Sweeney, and Chairman Richard Gottfried, and Members of both Committees. I’m privileged to have the opportunity to speak to you today regarding the concern for health impacts of natural gas drilling and hydraulic fracturing.

My name is Dr. Amy Freeth and I’m board certified in Internal Medicine, Endocrinology, Diabetes, and Metabolism. I currently live and practice in Cooperstown, New York. And I am the medial director of the Comprehensive Diabetes Program and a clinical research scientist at Basset Healthcare. I’m here today representing myself as a physician, scientist, and citizen of New York State who has great concerning regarding the current considerations being given to natural gas, industrialization and exploration within the deep shale of New York State.

The potential for widespread, long-stand, and cumulative health impacts for humans, animals, and environment are considerable and have not been fully evaluated to allow full mitigation of risks that will ensure the protection of public and environmental health.

The questions being asked today are challenging public health issues, especially in the light of rapid development of these industries, the lack of published peer-reviewed medical and scientific literature, the magnitude of the unanswered questions, and lack of staffing to assure proper regulation, and lack of local controls, no clearly identified outcome thresholds that would halt the drilling process.

Based on Health People 2010 it is accepted that our health is directly connected to the to the health of our environment that we live in. Our environment consists of outdoor and indoor quality air quality, water quality, toxics and wastes, health homes, and communities, infrastructure, and surveillance and global health. In the process of natural gas development in New York State, towns will become inundated with heavy industry. Landscapes will change, constructs of the community will change, and government and health infrastructures will be stressed posing a major threat to the short-term and long-term sustainability of these towns.

Concerns regarding the impacts of the environmental health exists along the entire life cycle of the gas drilling and the gas processing. And it’s not really a question or the health impacts of hydraulic fracturing whether it be conventional drilling or the hydraulic fracturing high volume fracturing that we’re telling you about, it’s really the life cycle of all of this industry coming into a small town and setting up in the backyards that wasn’t there before. Despite the physical and environmental risks, there are also published health impact statements that show there are psychological and social impacts to communities where natural gas is taking place and should be included with equal concern in this assessment.

I would like to impress upon you the concept of the natural gas life cycle and inherent risks. I’ve included in here a statement and in a little time I chose not to read though it but you can read through it. This—the Colorado health impact statement that this came from is a recently released paper that was done out in Garfield County, Colorado. It was done in a small, rural, retirement community where they were proposing to put 200 wells into this community and they did a very extensive and very thorough evaluation of the potential cumulative health risks. I'd be happy to provide the whole paper to you, but clearly in here they've outlined a comprehensive pathway along the entire life cycle. It's true that New York State is not Colorado and, in fact, I can add to this list, based on my own investigations. According to this same document, eight identified stressors, including air quality, water quality, soil quality, traffic noise, and accidents would have a negative impact on the community. Higher risk of pulmonary disease, cancer, and acute toxicity are apparent. Implementing and successes of the proposed mitigation for its procedures is determined whether the community would have wellness.

We've already talked about the extensive evaluation that's been done based on the material safety data sheets by Dr. Theo Colburn. 47-percent of the chemicals identified at least in one state were known to be endocrine disruptors and 43-percent had other known health effects.

These chemicals can be either water or airborne. Based on known toxicology, these chemicals and profiles of health effects include all organ systems.

I would like to bring to the forefront of your attention the risks of endocrine disruptors on the individual and on our society as a whole. Endocrine disruptors are chemicals in our environment that interfere with our body’s complex and carefully regulated hormonal messenger system. These chemicals bio-cumulate in our food chain. This means very low levels of a chemical in the air, water, or soil result in higher levels in plant life. Even higher levels in herbivores and even higher levels in carnivores. And individual will accumulate more chemicals throughout his or her lifetime. Fetal exposure to endocrine disruptors can lead to developmental toxicities both physical and psychological. There is typically no known threshold of exposure for these chemicals, as they do now follow conventional toxicology, meaning very low levels of exposure can lead to irreversible and generational damage. Exposure to hormonally active chemicals may also result in a range of adverse health effects such as cancer and reproductive abnormalities.

A statement taken directly from the wingspread Consensus Statement on endocrine disruptors outlines the potential dramatic impact these chemicals can have on our health. And I quote, unless the environmental load of synthetic hormone disruptors is abated and controlled, large scale dysfunction of the population is possible. The scope and potential hazard to potential wildlife and humans are great because of the probability of repeated and/or constant exposure to numerous synthetic chemicals that are known to be endocrine disruptors.

Granted, these endocrine disruptors can come from multiple sources at the—the adage is that we probably should not be adding more of these chemicals into our environment and the less chemicals we use the better. It's very difficult for me to sit here as a clinical endocrinologist and tell you how these endocrine disruptors have impacted our society to date. There are clearly reports of lower sperm counts, higher risks of miscarriage, higher risks of premature puberty especially in our young girls. Our obesity epidemic had been contemplated that that could be related to endocrine disruption. Our obesity and diabetes epidemic is certainly something on the forefront of our health infrastructure. New York State spend $174-billion in 209 on diabetes and 90-percent of diabetes, the excess diabetes that we're seeing is related to obesity.

You've heard about the documented illnesses associated with the drilling in both people and animals. There's mounting health complaints. I do want to bring up that the livestock and wildlife are also being negatively impacted as direct reflection of our environmental health. Just as one case in May of 2010, the Department of Agriculture quarantined livestock related to pollution from natural gas drilling in Pennsylvania and there are plans to return those livestock to the food supply after an allotted timeframe. The lack of full disclosure by natural gas industry and the lack of knowledge that toxicology of the processes makes evaluating these cases from a medical perspective very difficult.

Further investigation is imperative, non-disclosure agreement should be outlawed. Full federal protection of our water, land, and air should be restored from its current exemptions.

Based on the overwhelming concern for human and ecological health it's clear that the gas development should not proceed until full accumulative review and mitigation procedures for the above concerns are established and operational. Regulatory agencies should focus on entire eco system as a whole and not regulation of specific contaminants. It is agreed upon that all aspects of life has risks. And how we deal with these risks depends on the knowledge we have about them. The complexity of the current proposed heavy gas industrialization of New York State lands and the decisions that need to be made and will be faced by this committee deserve answers that are sufficiently comprehensive.

The statewide and local impacts combined with the high financial and environmental stakes require coherent, consistent, and transparent process to make these decisions with keeping in mind the best possible outcome for all is the priority.

Enforcing existing rules on ecological and health cumulative impact statements can address broader magnitude of public health and environmental questions to have to date have not been included in the regulatory documents.

With this information we can further develop policies and legal decision making structures designed to reduce cumulative impacts. It’s our duty to protect the citizens of this state and we’re making decisions now to decide now not only the immediate future of our communities but the future of our children and generations to come. We really owe it to ourselves to know what we're getting ourselves into.

I was going to stop there, but I've been sitting here all day listening to testimony and my testimony continues to evolve and one of the questions that you proposed was what kind of research projects should be doing and I really started to think about it and as I'm not an epidemiologist, but as a clinical researcher I started to develop some real ethical concerns on how you would develop a research project to answer some of these questions and whether or not it would be ethically or morally okay to do these studies. We have very strict ethical standards for the treatment of human subjects and there are special considerations that are afforded to children and pregnant women and it would be really difficult to pass these studies through an institutional review board, which I've sat on before, and to give informed consent. I'm not sure if I would sign the informed consent of these studies, and so with the precautionary principle in mind, I really do struggle with the concept of figuring out how we would answer some of these questions. I was reminded of the Tuskegee (phonetic) experiment which I'm not sure if you're familiar with, but was an experiment done long ago on African-American men who had known syphilis and they were doing an observational trial to assess the natural history of syphilis and along the time of that study along came penicillin. And these men were not given or informed that this treatment was available and they were allowed to progress along into later stages of syphilis, and this became—when this became available, when this information became available, these regulations of how we treat human subjects really came about and so I have to say if we're thinking about all of these potential health risks and we're starting to see it, how do we let it go on so that we can see what else happens. So ethically, I'm starting to really just consider how we would work on these studies. You asked what the legislators can do, one, is to provide a voice to local towns. I'm from a small town and I know a lot of our local townships are struggling to be heard. You, obviously, have heard the concerns and share some of the concerns. Also in my written testimony, let’s see if I can find the page, starting on page six, I provide you with some local—some recommendations that I’ve been making to local towns on how to prepare their infrastructure for natural gas drilling should it occur and before any state, county, town, land should be leased, all of these recommendations that should be evolved upon should really be in place before anything happens. A community advisory board is certainly something that should be instituted so that people know where to go. I think in medicine if we are developing a drug and doing a clinical trial, we have very clear outcomes that are unacceptable and once we reach those thresholds of too many heart attacks, too many kidney problems, the study is stopped. And in this situation there are really no mechanisms to stop our halt the drilling process if any of these outcomes reach those thresholds. The thresholds have yet to be defined as well.

Clear communication, emergency preparedness with protocols, evaluation procedure should be clear and communicated, quarantine procedures for livestock, baseline assessments for air quality, baseline assessments for water quality, again, with plans for proper compensation and relocation for person whose property is destroyed. I also think we need, especially in our smaller towns support and advancement for public safety. A lot of these health impacts studies and show that there is risks for increased crime, increased substance abuse, even sexually transmitted diseases are mentioned. So support of our public safety that would include our hotlines for sexually transmitted diseases, rape crisis, and suicide hotlines, first responders, and public safety officials would need to be hired. We also need to educate our physicians. I think that the physicians here are not representative of all of the physicians and we really need to protect our first responders and the people who are on the scene. Also, education of the county residents because there is a lot of misinformation out there. And I think that, you know, there are a lot of questions, especially with the endocrine disruptors is what we need to sit down and really think about how to mitigate those risks because we don't really know right now. So thank you for your time and I'd be happy to answer any questions.

MR. SWEENEY: Thank you and just for the record, I'm not sure that anyone is suggesting that we should experiment on people as part of any of these studies that are being discussed. I think it's the closest we would come to that is taking a look at the people who have medical conditions that they attribute to drilling and attempting to determine whether that, in fact, is the case or not. The other studies would be studies on air pollution created generally water pollution, et cetera, et cetera, so just to clarify.

DR. FREETH: I think my point—

MR. SWEENEY: No. I'm looking to

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DR. FREETH: No. I think my point was more that the clear thresholds that if these epidemiologic studies are showing problems then that needs to be communicated to health officials and the local people so that we can halt the process.

MR. SWEENEY: Thank you. All right. Thank you very much.

DR. FREETH: Thank you.

MR. SWEENEY: And that concludes our hearing. Thank you all very much.

(Music plays)

(The public hearing concluded at 4:06 p.m.)

C E R T I F I C A T E

I, LisaAnn M. Fromert, do hereby certify that the foregoing typewritten transcription, consisting of pages number 1 to 324, inclusive, is a true record prepared by me and completed from materials provided to me.

LisaAnn M. Fromert

LisaAnn M. Fromert, Transcriptionist

June 7, 2011 Date