Yuri Gorby

Interviewer: Michael Kline
Date: Unknown
Place of Interview: 114 Boundary Avenue
Transcriptionist: Adept Word Management

Michael Kline: **0:00:01.9** Okay, my name is Michael Kline, and I'm here at 114 Boundary Avenue with my wife Carrie Cline, and we're having a remarkable visit from a handsome, fine young man I have known for I expect 40 years, over a period of 40 years, and never as well as I would like to, but here you are. And so would you say "my name is?"

Yuri Gorby: Yeah, my name is Yuri Gorby.

MK: And your date of birth, please?

YG: I was born May 6th, 1961.

MK: And if you want to, let's start off telling me about your people a little bit and where you were raised.

YG: I was born in Steubenville, Ohio up in the hospital up on the hill. My father raised my 3 older brothers and my older sister on South Sixth Street in Steubenville, Ohio. He was a steel worker. My mom was from—is from Nuremberg, Germany, and she was brought back as a war bride in 1948, and they moved down to Steubenville, and my mother started raising my brothers, my 2 older brothers there, Dean and Bill. And they continued to have kids, and so my brother Richard was born and then my sister Stephanie, and then I was born in 1961, and my sister Tewani (?) was born a couple of years later. And when I was 5 years and Tewani was 3 years old my father moved us to Bethany, West Virginia I think to get us away from the city, get us away from the steel mills that were pretty—belching out some pretty terrible toxins back then. I think that when we moved Steubenville, Ohio was rated the worst city in nation air quality for 3 years in a row, and I think that was the end of it, and my father moved out of there. He also gave up drinking that year too. He was a drinker, an alcoholic, a motorcycle rider, labor union organizer. I think that the people he hung out with probably didn't—the most trusting people you could have in the world, but they were hard people, Greek and Italian mafia, and lot of card games I think I recall, people in the house, labor meetings. It was a pretty intense time in Steubenville,

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Ohio. When we moved to Bethany, West Virginia, that's a town of 250 people. There's a small college there, a fine arts college that had about 1,000 students in it, and so you can just imagine what the effect had to my older brothers and sister. They were in high school coming to this little podunk town, 250 people in West Virginia, out in the middle of nowhere. They rejected it a little bit, but for my sister and I it was heaven. We had creeks around, dogs. We'd never seen anything like that except in the summertime when my father would take us out to Freeport, Ohio. He had a camp out there to get away from the city in the summertime on Piedmont Lake, and so when we moved to Bethany, for the younger kids, me and my sister, it was a great time. Now, my little sister, Michelle, was born when we were growing up there. She's about 9 years younger than me. Yeah, it was a really nice town. The environment around Bethany, West Virginia, again, it was a really small town, but there was this fine arts or liberal arts college on the top of the hill. Lots of folks from New England would be coming down, lots of children from rich families. I think the Rand family, one of their sons was there, Dickie Rand. They had a good theater group there, and so Bill Macy, who is a pretty well known movie star now, he graduated from there. Frances McDormand, she was in *Fargo*. It was an interesting place, but my father was more on the fringe. He wasn't really your typical West Virginia hoopy. He had experienced a lot of the world during his growing up. Well, I mean, if you want to go back a little ways he's from Silver Hill, West Virginia. When he was 15 years old him and his 2 older brothers joined the Army and went to the Army, and they started fighting as soldiers, and that was when he was 15, mostly to get out of poverty-stricken West Virginia. He grew up in an area where he tells me he lost 5 brothers and sisters to exposure one winter, and that was enough for him. I think he was about 10 years younger than the rest of his brothers and sisters. I think he just needed to get out of those hollers for survival, and that's when him and his brothers went to the war.

0:05:23.9 After he fought in that Burma theater, he was stationed in Germany, and we were just occupying Germany at the end of the war there, and that's where he met my mom in Nuremberg, Germany. She always tells the story that her and her girlfriend would hang out in front of the opera house and try to get the soldiers to come and take them to see the opera. They were standing there, and there were a couple of soldiers, and my mother's friend said, "Well, I want the Greek. I'll go in with the Greek." And my mom said, "Oh, good, because I want the big one," because my dad was tall. He was 6'6"-6'7", something like that. I'm going back pretty far. Sorry about that. It's a long story.

MK: Maybe we could—because I think I could do 10 hours with you just on this part. Why don't we skip now, because I love the way you tell this story. I really want the rest of it. But for right now, why don't we skip to tell me about your education and training and the direction of your work. Why don't we skip to that just for today and then come back to the other.

YG: All right. Well, we moved to Bethany when I was 5 years old, and so I started first grade there, and I went to Bethany middle school, Bethany elementary school and middle school. Then I went to Brook High School, which we were being trucked out of there or bused out of there down to Follansbee, West Virginia. I attended high school there, and then I decided to attend Bethany College, the college that was in our hometown. I knew I was interested in science, and I loved biology, and they had a reasonable premed program there, pre-dental program and a good biology department. One of the professors there, Jay Buckelew, was a microbiologist, and he was also a bird watcher, an ornithologist, and he would take us for nature walks out in the woods, the

woods where I grew up and ran around in the creeks with my dogs and stuff like that. He started talking to me or telling me about the science that was all around us, the ecology of the streams, the relationship of trees and microbiology. It was fascinating for me to hear all of this in my hometown, and he received his PhD from the University of New Hampshire in Durham, New Hampshire and suggested that I might apply there, and maybe I was interested in microbiology, and I was. And so I went to the University of New Hampshire, met a guy there that was working on an organism or a group of organisms called magnetotactic bacteria. These are little bacteria that make little single domain magna-type particles in our bodies. They orient themselves in the Earth's magnetic field. They're everywhere. They're in Cat Ponds. They're everywhere. But this one scientist discovered them just by observing things, and that's the type of scientist I am. I do observational science.

0:08:35.9 And I found it fascinating, and I started getting interested in the interaction of bacteria and different types of metals, iron, manganese, how these organisms interacted with the natural world and how they made these little particles. And then at that same time, there was some discovery that organisms, these microorganisms, could actually breathe iron like we breathe oxygen. They can breathe rust, they can breathe iron minerals that you'd find out in soils, and this discovery had just been discovered down at the US Geological Survey in Reston, Virginia, and I was fascinated by it. I wrote a proposal to the NASA Research Council Fellowship for what they call a postdoctoral fellowship. And in that proposal I was interested not so much in the interaction of those organisms with iron and manganese and those other metals, but my knowledge of chemistry thought, well, these organisms might be able to actually use things like uranium as an electron acceptor, so breathe these heavy metals and radionuclides that are being used and were being processed through the Cold War effort, especially in the US Department of Energy. I wrote a proposal to see if these organisms could do that, and I discovered in fact that they could, and they changed the chemistry of uranium and had big implications for the migration of those contaminants in groundwater. That provided an opportunity to get a job with the US Department of Energy as a scientist in Richland, Washington to study the activity of these organisms and would use these bacteria to actually clean up these contaminated groundwaters. I worked for 15-16 years trying to understand how we could apply microbiology to so-called remediate or bio-remediate these contaminated groundwaters. And we had some successes. We could demonstrate that these organisms did this type of thing, but the vastness of that problem out there, it was just overwhelming. There was no way that you could engineer a system to clean up 600 square miles of contaminated subsurface, and so it was interesting work, but it really didn't lead to anything. I mean, I quickly became aware that once you screw something up in nature, it's very difficult, maybe impossible, to clean it up.

I worked there for 15 or 16 years, and during that time I discovered something in about 7 or 8 years ago that bacteria, many different types of bacteria, produce these little electrically conducted filaments that they build. We call them bacterial nanowires, and they integrate these communities into electrically integrated neurobiological networks. And all of these microorganisms not only in soils and sediments but on our teeth, they grow on rocks, these biofilms that are everywhere appear to make these little electrical connections, and this is something transformative for microbiology now because now these organisms can share energy, and we think they might be able to communicate electronically so that they can send electrical signals to one another through communication, like our brain works in an analogous way. We

continued to study that, and realizing that these little electrical connections are not confined to organisms that are important to the Department of Energy problems but are in fact broadly distributed in the microbial world, I sought other employment to see if I could expand that. Then I went down to San Diego, California. I got a job with the J. Craig Venter Institute. This is the institute that did the human genome sequence and also sequenced the global ocean sequencing where they were sequencing the genes of microorganisms in the open ocean, taking the same transect around the globe or circumnavigation that Darwin took. It was on the 200th year anniversary. It was a big deal, and it was interesting.

0:12:50.4 I worked down there for 5 years, and then I received a position at the University of Southern California as a research faculty there, and I was still continuing my work on microbes and metal interactions, and lots of people were interested in these electrical connections between bacteria. I was going on kind of a world circuit tour giving talks on this topic that's kind of bringing a lot of attention right now, and I gave a talk at Duquesne University here in December of 2011. My friend and colleague that invited me there, he's worked with metals and microbes like me for a long time, worked in Department of Energy research, and so after my talk, he said, "Yuri, have you heard about hydraulic fracturing?" And I had heard about it. I knew the term, but I didn't know really what it was, and so my friend John Stolz, he said, "Come on, I'm going to take you for a ride. I want to show you something." We left Pittsburgh, and we went out of town maybe 10 miles. We started seeing all this truck traffic. I started seeing all of the empty lots that are now filled with pipes, different types of truck that I've never seen before, tanker trucks, strange shaped little triangle canisters. I'd never seen anything like that, and then I started seeing all the rigs, the drill rigs that were around on these 5 or 10-acre pads. It was like an industrial area now. It looked like Long Beach. Right outside of Pittsburgh there's these big industrial facilities, and he said, "Yeah, it's not just here. It's all over this area. It's called the Marcellus shale. It underlies this whole region. There's 93,000 square miles of it. It's been targeted by the shale gas, and oil industry," and John proceeded to explain to me all of the new technology that was developed in the late 90s and early 2000s that allows for not only can these drill bits go down 2 miles into the Earth, but with the invention of directional drilling where they can take that drill bit and then turn it horizontally and go into these formations that they can drill along into these formations for over a half a mile in any direction.

That technology, directional drilling, coupled with this—it's called slickwater fracturing or high volume hydraulics or slickwater hydraulic fracturing—allows you to extract massive amounts of gas from the subsurface. The impact zone now with directional drilling is not just a couple of hundred feet in every direction but half a mile, over a half a mile in any direction from a single bore hole. It completely changes the game, because now you can extract gas in much higher concentrations, and as I looked into it all, I realized that there were a couple of things that allowed this new technology to advance quite quickly: the technology itself, which has exclusive —well, it's a new technology and only developed by the Halliburton Corporation, and Halliburton Corporation had all the instrumentation, all the machinery. They knew how to do this. Not only was it a new technology, but the 2005 Energy Policy Act provides for exclusive exemption to Clean Air and Clean Water Acts, all of the RCRA, which is Resource Conservation and Return Acts. I can't even remember what it stands for. But the Section 322 of the 2005 Energy Policy Act just gives exemptions of this new technology, high volume slickwater hydraulic fracturing, to those protective acts, Clean Air and Clean Drinking Water Acts, and so

now with those exemptions, the 2005 Energy Policy Act allows that technology to go forward without any regulations that were for protecting environment and human health. That's what happened in 2005, and I was working for the US Department of Energy in 2005, and I remember the time pretty well, because something happened during that time. Not only was this 2005 Energy Policy Act passed, but the US Department of Energy was provided through this act a new position called the Undersecretary of Science for the US Department of Energy. I remember when that happened, because that position was filled by a guy named Ray Orbach, and he came out to the Pacific Northwest National Lab where I worked at the Hanford Nuclear Reservation and introduced himself to all of us. He said he was a big supporter of fundamental research. We're going to get this going.

0:18:13.9 The funny thing is that 2005, prior to 2005, all of the research that I did with hydrologists, geochemists, microbiologists like myself, computational modelers that build these really complex integrated computer models to look at contaminate fate and transport in the subsurface, all of these people now were introduced to this new Undersecretary of Science, and funding for us prior to that was really good. We were trying to investigate how do we deal with the contaminants in the subsurface? How do we predict and understand their transport in groundwater? But starting in 2005, funding for our subsurface science research corps started to go down, and that started to take a turn in 2005.

I'm going to skip forward a little bit just to give you what really happened with that position. Ray Orbach is the director of—or was until very recently—the Director of the Energy Institute at the University of Texas in Austin. In February of 2012 of this year Ray Orbach and his deputy, Chip Groat, that institute released what they called a Grand Challenge Report. They called it a publication. They even called it a peer-reviewed publication. They announced this report at the AAAS meeting. It's the American Association for the Advancement of Science. It's one of our largest and most reputable scientific organizations in the United States. It was in Vancouver. They had a big press release about this report that they were putting out, this Grand Challenge Report, and Ray Orbach—the conclusions of this report were that there's no evidence that high volume hydraulic slickwater fracturing contaminates groundwater. That's basically what they were reporting.

Since that time, February of just this last year, so 11 months ago, they reported that as fact. They were reporting the facts, that this is a peer-reviewed publication. Since that time, not only has it been shown that that was not peer reviewed, that the only reviewer that received a copy of that manuscript sent it back within 48 hours saying that he was unable to review it because there are some serious flaws with the research, and then just about 3 months ago from now, so that was in the summertime, the middle or late summer, it was revealed that Chip Groat had taken about $1.2 million from the shale gas industry into his personal bank accounts through stocks and dividends and that this report now was in question because of the obvious conflict of interest. Let me just review again. Ray Orbach was the first person to hold this position of the Undersecretary of Science for the US Department of Energy. That position was invented by the 2005 Energy Policy Act, the same act that gives exclusive exemption to high volume slickwater hydraulic fracturing. That is a Halliburton technology invention. Our vice president at the time was Dick Cheney, who was the past operating executive of Halliburton. If you just look at it in that way it

was very convenient that that energy act provided exclusions for that industry, exclusive exemption from protected measures for human and environmental health.

Ray Orbach has now resigned from that position at the Energy Institute. In fact, the Energy Institute is poised now to close. We've seen Penn State University has also released multiple reports that slickwater hydraulic fracturing will bring an economic boom to the state of Pennsylvania and anyone associated with the Marcellus shale, that there is no science to suggest that this is an environmentally damaging technology. The reports coming out from Penn State now and the reports by Terry Engelder, who really promoted in the state of Pennsylvania when this professor—he was I think a professor of geological economics, that's the use of geology to make money—was doing some back-of-the-envelope calculations. He said that this can provide I think it was 250,000 jobs within the state of Pennsylvania alone, that there was going to be so much resource brought up from the surface that we would not have to worry about energy in this country at all.

0:23:31.0 Well, the US Geological Survey now has downgraded his estimations. They were about 10 times too high at least. Terry Engelder has publicly stated that these zones where gas extraction is going to happen will be difficult for people and that these sacrifice zones, as he calls them, the people that live there are doing their patriotic duty for sacrificing themselves for the welfare of the rest of us here in the United States. So Terry was very explicit in describing these as sacrifice zones, which has set a lot of people kind of questioning what are his real motivations and also what lengths will this person go to see the economic benefits of extracting this gas by sacrificing these people?

Let me name another one, SUNY Buffalo. The State University of New York system of Buffalo had an energy institute-like system up there also reporting bogus reports. That was recently shut down. We can see that the "science" behind all of this now that was being put out there—and I use science with quotation marks around it—that the "science" that was being promoted was actually material that would advance the objectives of the industry but not providing factual information about what's happening. So now credible scientists are trying to catch up to say there are short and long-term implications, environmental and human health implications for the extraction of these resources, because I can briefly explain what high volume slickwater hydraulic fracturing is.

The process includes somewhere between 1 and 3 million gallons of water that's mixed with tons of crystal and silica sand. Silica sand is the proppant. That's what holds open the fractures once you fracture these formations, and a number of chemicals that are used for different reasons in this system, and we can't go into the details here, but there was a 2011 Congressional report that listed somewhere on the order of 750 different chemicals in these frack fluid recipes, and these were proprietary recipes that the industry holds as proprietary because they say they have different effectiveness of being able to extract resources from the ground.

But really, some of the components in there are quite hazardous. We see a class of compounds called biocides. These are chemicals that will kill microorganisms, especially one group of organisms that I specialize in called sulfate-reducing bacteria. These sulfate-reducing bacteria use sulfate as an electron acceptor. Again, instead of them breathing oxygen or these metals that

I was studying before they breathe sulfate, and when they move electrons onto sulfate, they generate a compound called hydrogen sulfide. It's a toxic corrosive gas. It has that smell of rotten eggs. Our noses are sensitive to mere molecules of this because it's so toxic our olfactory senses have evolved and developed a very high efficiency for detecting that gas to protect our body from the toxic effects. These microorganisms in these formations, if they produce hydrogen sulfide, hydrogen sulfide is corrosive. It sours the gas stream, and it makes the gas stream useless, so these so-called biocides, which include glutaraldehyde, formaldehyde, which is the active ingredient in embalming fluid—

Carrie Kline: **0:27:26.1** What was the thing you said before formaldehyde?

YG: Formaldehyde and glutaraldehyde. I mean, these are chemical—you can say fixatives. They chemically fix biological material, so stop its activity, and that's why when folks are embalmed it preserves the tissue from microbial attack or degradation. Well, each one of these frack jobs, as they're called, will use somewhere in the—and you can see them on the emission permits that are published in local newspapers around here—they will include somewhere on the order of 0.3 or half a ton of formaldehyde will be released off that single pad during the year. Most of that material that comes back up out of these holes is released in a very short period of time, which can be 3 days or a week or 2. And so locally—I'll go back just a little bit.

CW: Most of it is initially released?

YG: Yeah, when they put this down in the well—and again, it's not just the crystal and silica sand, the causative agent of silicosis and these other 750 chemicals, including formaldehyde and glutaraldehyde. There are neurotoxins in these mixtures, like acrylamide is one. Acrylamide is used I think as an anti-scaling agent, but we use acrylamide in the laboratory, and we have to handle this as toxic material because it has neurotoxicity. It will alter, affect the activity of neurobiology. You can lose your sense of smell, memory. You can develop tremors from this chemical. It's used in these mixtures, again, on hundreds of thousands of pounds of these can be released into the atmosphere and into the environment during these fracking processes.

So what they do again in the process of hydraulic fracturing is multiple layers of activity. First there's the installation of a well pad, and these can be 1-5 acres or larger flat zones. Around here they're put mostly on tops of the hillsides. There's some reason for that, mostly to keep it out of view. There's sound protection for people that may live in the valleys below them, but most of the pads you see around here are put on tops of hillsides. Also the water impoundments that they use to store water that will be used in the fracking process and also to temporarily store the spent frack fluids, the things that come back up, and we'll talk a little bit about those. There's flowback. There's condensate tanks that collect the water that's being brought back up out of these formations. There's a whole series of secondary waste streams that are generated during this process. But there are also solids that are generated, solid wastes that are generated during all of these processes. They install a well pad, they will drill a vertical well that goes down a mile or 2, they will put in the directional drilling bits, and they'll turn that bit into the formation, and they'll drill a half mile, and I think these can be 20 or 30-inch drill bits at the end. And so all of that material that's in that formation is brought to the surface. Now, we're not just talking about drill cuttings, like cut and drilling through rock. When you're drilling into these shale formations

you're bringing up all of the complex organic materials in there, and that's all of the toluene, benzene, all of the different types of reduced organic compounds. But because these are ancient seabeds you're also bringing up a lot of very, very salty water. The water that comes back up out of these formations can be 10 times the salinity of seawater. In the Marcellus shale in many of the regions this can be high in uranium, radium, radon, so radioactive components that have accumulated in these 350 million-year-old formations are now brought to the surface. And they have to be disposed of. Those things can't lie around on the well pads. I've met some of the drivers that take this material out of there, and I can tell you that where they dump this material is everywhere. Some of it is so hot. Well, the drivers themselves don't know what they're hauling. I know that for a fact. They are truck drivers. They are doing a job. They're told take this material, take it over to Ohio, put it down this hole in the middle of the night, and a hole will be like at a water treatment facility. There will be like an injection well head, these old wells. They put their trucks in there, they attach the hose, and they put this stuff down in these holes in the middle of the night in the city of Youngstown, Ohio. We know about Youngstown right now because a lot of the deep well injecting there to get rid of a lot of the waste associated with this last year has caused a number of significant earthquakes in that town that ranged up—I think the highest was about a 4.0 magnitude earthquake. And this is because these deep injection wells, which are attempting to get rid of this toxic waste that's generated during this whole process, is injecting this into deep abandoned gas wells, and these sandstone formations that they're injecting in now become basically a hydraulic sheet, like a layer. And so now formations, the rock formations, can slide along one another, and many of the geologists at the university in Youngstown are studying the seismic activity that's been impacted or caused by the injection of this waste material.

0:34:02.2 But I have to say that there are places in that town that the citizens of Youngstown, Ohio do not know about what they're receiving from the drilling activity that's happening over in Pennsylvania and in West Virginia. They're accepting a lot of waste, and they have no idea what they're accepting. The drill cuttings are not only being shipped there, but in the past 6 months New York state, which has a ban on hydraulic fracturing, has accepted 55,000 tons of these drill muds containing radioactive materials, toxic, toxic organic compounds that, again, are part of that formation. These are being landfilled in 3 landfills up in New York state. Now, these landfills are not prepared. There is no certification. There is no training for the operator of these landfills to handle what in the Department of Energy we used to call low-level mixed radioactive waste. That's a mixture of organic compounds, metals, and radionuclides all in one at low-level concentrations of the radionuclides, or low-level activity, not like plutonium or one of the really hot radionuclides. But again, radium and uranium. These are being treated—and they're not even classified as hazardous materials at all anymore. They're calling these things drill mud. They tell the drivers that these are drill cuttings. Drill cuttings from somebody that has been operating in gas fields. A drill cutting is something where you're drilling through rock, and you can pick it up in your hand. Well, this material, again, that they're pulling out through the horizontal drilling of these formations is not benign. This is toxic material. It's radioactive material, and it is being spread around this country like it was not hazardous at all. These truckers know that they're hazardous because some of them that I met now have been impacted by them. Their health has been degraded by being exposed to this on the work site, and we'll talk with Randy here about that.

Anyway, I have to say that when I really started understanding what was going on here and hoping that my scientific background and my scientific colleagues within even the US Department of Energy, who were probably the best equipped group of 200 or more scientists, and it's not just US Department of Energy but also university scientists that were funded by those programs that were funded by the US Department of Energy, I thought, "Okay, I can come back here. I can work with my colleagues. We can show that there are long-term implications of impacting these deep formations that we may be seeing manifested decades from now, that our children and our grandchildren will be dealing with waste." And we're pretty confident that when you disturb deep formations like that that eventually that does come to the surface. That will promulgate into some problems for future generations, and so we wanted to have the opportunity to study this.

0:37:40.4 In March or April of this year there was a meeting. We have an annual meeting for the subsurface science research corps from the USDOE, and we had a special breakout session to discuss high volumes like water hydraulic fracturing, and maybe there is some research opportunities for us because all of us were suffering from lack of funding. As you recall, our funding started going down in 2005. So here we are. We have a breakout session. There's 250 people, scientists, policymakers, program managers in the room, and we bring it up to everybody. "How many of you"—I asked for a show of hands—"how many of you have heard of hydraulic fracturing?" And maybe 15 hands went up in this room of 200 people. None of these people were aware of what was going on, and in that breakout session a number of my scientific colleagues took it upon themselves to learn a little bit more about this so they could present this to the rest of us. We sat there with our jaws agape just listening to—there is all this subsurface activity that's going on that is not science, and not only do we not have funds to participate, all of these people did not know anything about it.

So I started digging a little bit deeper. I wanted to know, okay, what role did the US Department of Energy play in the development of technologies or that was in support of this new technology? And I found out something. I think it was in 2002 when directional drilling had just been demonstrated to a small group of people that what they also needed to be able to make this functional were computational tools, computer programs, to be able to interpret the seismic data that they were getting back from these deep formations. So the US Geological Survey for decades had been developing methods for visualizing or imaging subsurfaces by using detonation. You drill a well, drop some dynamite in there, blow this thing up. You have a detector array that is on the surface, and then by the echoes you can look at these formations and map them out.

Well, there was a group within the DOE that was receiving about $60 million to develop not just near-surface imagery but deep, deep subsurface formations, the formations that were a couple of miles down. And those computer codes that they were generating not only gave them some information about what the formation looked like but also its composition. Does it hold gas? Does it hold oil? What are likely to be the components of these? It gives you a peek down 2 miles into the Earth with these new computational tools to be able to interpret that seismic data so that they can make some decisions about where they going to drill, what type of drilling they're going to need, what direction they're going, how many fracks. All these decision points about what we're going to do were based upon the data coming out of these holes.

0:41:24.6 I think that the American population, the public, should know that $30 million of taxpayer dollars went to develop those codes. Those codes were given exclusive licensing to directional drillers and the Halliburton Corporation to use those codes so that they can progress in a more—it's not just wildcatting as it was. They now have the ability to peek down, get a little bit better feel about what was down there, and then make better decisions about where they're going to drill to make it most cost-effective to extract as much as they can out of there. No one, including myself, my colleagues within the US Department of Energy, have access to those computer codes. Those are exclusive rights of Halliburton and all of its subsidiaries, which is massive. Even the people that invented directional drilling—I think his name is Mitchell, and he's from Texas—you can go online and hear him thank the US Department of Energy. "We couldn't have done it without you guys. We wouldn't have been able to make this work without you." So everything that we're experiencing around here is thanks to our own taxpayers' dollars funding the technology and the computational tools that are necessary for this to go forward. Isn't that amazing? I mean, how does something like that happen?

MK: So the DOE supported the development of this technology and now does not have access to the findings of the technology. Is that what you're saying?

YG: Yeah, the licensing for those computer codes are for the shale gas and oil industry and how they're applying—I have to say now that around here you'll see—well, over in Western PA I don't know if you've seen helicopters dropping in any seismic gear. You'll start seeing helicopters around here, and they drop it from the air, and then they'll do their test. You'll see the seismic trucks. They're called geotechnic trucks. They'll come in. They're big, massive things. And you won't really feel anything. They'll detonate some charges, and it will be quick, but the information that they get out of there brings the next wave. The next wave is basically we're going to drill here. We're going to frack in this direction. We're going to expect that we're going to extract this much out of here, so we need to develop the gas connector lines. These are pipelines that come off the well pads that connect into another infrastructure. We have to build compressor stations so we can move gas in those pipelines. We have to build separation facilities and these gas cryo separators are 100-acre industrial complexes that you can see around. MarkWest is the big operator in Pennsylvania and Ohio right now.

CW: What is it?

YG: MarkWest Corporation. And you can follow the stocks on that company. I mean, it's just—because this is the—right now we're in a situation where we have been so effective at extracting so much of these resources out of the ground that we've filled all of our storage reservoirs. We're full to capacity. We need the infrastructure to be able to process that gas, pressurize that gas to move it through these big pipelines that are being constructed, and those pipelines are running south to the Gulf of Mexico and then across—plan to be running across New York state over to Connecticut and Maine where Shell and other corporations are putting in the liquefaction plants. These are the plants that will compress that gas—(phone ringing) I can start back.

CW: Sorry about that. You were talking about all the infrastructure that's needed to move this around.

YG: **0:45:38.8** Yeah, we have to look at this like high volume slickwater fracturing as a complete system. Take a system's engineering view of it. This is not just the frack pad drilling, hydraulic fracturing and all of the waste that's generated from that. There is the whole processing of that product and getting that product to market that is the real objective of all of this. The industry needs to sell product to pay off the bills that they have incurred already to build up this infrastructure. In fact, companies like Chesapeake Energy made deals with France, England, China that was—I think on the order for France it was $1.3 billion. I think for England it was somewhere in that same region, maybe $3.5 billion investment from those countries to build the infrastructure to do all the permitting to set this all up and that they would pay that capital investment back in product. Well, because that investment was made 6 or 7 years ago when the price of gas was $11 a thousand cubic feet and now it's running somewhere on the order of $3.50 or $4 a thousand cubic feet to be able to pay off those bills they have to give back more than double or triple the amount of product to just pay back their investors. That means getting more product out of the ground, getting it to them and taking care of their bills. Well, they produce so much that the price has dropped off. The excess gases and material has been put down into holding reservoirs. We can store gas in old abandoned sandstone formations from these more conventional wells. Those can serve now as underground reservoirs for these resources. Those are all filled now. What's lacking is the infrastructure to process that product and move it to market. And again, those markets are not here in the United States. The big markets are overseas, and so the infrastructure for processing, transporting gas and oil products includes cryo separation plants for wet gas streams. Wet gas is like mixed gas. Not just methane, but it also has ethane, butane, propane, other components in it, and there are processes, techniques for separating those gas streams out. One is a cryo separator, and that basically is you start to chill down or cool down the mixed gas streams, and at different temperatures different gases then turn into liquid, and those liquids can be separated and processed, and then you can continue to decrease the temperature and separate these further.

The problem with these cryo separation plants is that they generate lots of byproducts, stuff that has to be—again, secondary waste streams that have to be disposed of. And the way that these cryo plants dispose of their waste streams is by flaring them into the atmosphere. You can have a 100-acre plant. You can have 10 flare stacks on these things. I know of one in Houston, Pennsylvania now that is an eighth of a mile away from the home of a man that we met, who is a third generation stone mason. His name is Joseph Giovaninni (?). We went and visited him in his home a few weeks ago and—sorry. This one always gets me. My friends, my crew and I, we were trying to document this. We went to this guy's house, and we knew that he had been impacted by living too close to this plant. He lives about an eighth of a mile away from the MarkWest plant in that town and just down in the valley. And we walked up, and the first thing we saw was a sandstone castle-like structure that is just beautiful, and on the outside was a for sale sign on this home, and the second thing we noticed was that these arched windows that Joseph had built with his father by hand had been cemented shut. You can see on the outside it was like a cement job, and all of the windows were closed. When we approached the house, the door opened, and a guy about 6'1" comes out, and his hands are shaking, tremors. He knew we were coming. "Come on in, come on in. We've got to go inside." "Joseph, this is a beautiful place. Did you build this?" "Oh, yeah." And we walked into the doorway, and there on the left-hand side are these large sandstone sculptures: Jesus on a cross, I think a scene of it looked like a vineyard. This was carved into stone, and I was like, "Joseph, did you do this all?" "Yeah, I did

those a while ago." And it had to be a while ago, because his hands—there was no way that those hands that I was looking at did that because of the tremors that he was having.

0:51:53.0 "Come on in." And now we see the darkened—we're in his home, and it's dark in there, and he explained to us that, well, "Sorry I don't have any running water. We haven't had running water in here for 3 years." When they drilled the well and put one pipeline in through by his place it ruined the well, and that was gone right away. Joseph described to us how he'd been trying to collect water—(background noise)

CW: Sorry, another second here.

YG: No worries.

MW: Can you say—describe how he collected water?

YG: So Joseph described to us first how he had lost his water by the wells that were being put in around his house and that for some time he diverted the rainwater from his roof down into a cistern, and then he could take showers with that rainwater and things like that. But that had gone on for a couple of months and then one night he heard—it sounded like rain on the roof, but it was clear outside, and what was coming down were little droplets of oil. He described it as oil, and it was raining down on his home, and then stuff rained down in his cistern, and there was a sludge area produced, and there was a slick of oil on the top of this underground cistern. He later took us out there and showed that, and you could see this was a contaminated reservoir. There is no way that you would want—forget about drinking this water but bathing in it, touching it. It was gone, and that had been for 3 years. So for 3 years this man hauled water to his house for everything: bathing, drinking, food preparation, in this darkened, cold home. He wants to get away from that place, but the value of his land now is basically zero. He has no savings. He can't get away from it.

His friend and caretaker—because now he suffers from what they call hypersensitivity syndrome, which is he's sensitive to everything, and he has allergies to everything—she came in too a little bit later on.

MK: She?

YG: Her name is Jeannie Moten (?). She's from Rae, Pennsylvania. This is the town that had 12 families in it. Five years ago they started suffering because they had some wells about a quarter mile from their place. Everybody in that town has tested positive for toluene, benzene, methane in their urine and their blood. They all have skin lesions all over their face, on their back, on their underarms. That's a completely other story I've got to tell you. But Jeannie is trying to help this guy, but Jeannie, she came, and I had heard about her before because of the horrific events that have happened in Rae, Pennsylvania to the people there. That is another story, but she's there to help her friend Joseph, and she came in, and first of all, she was a little upset that Joseph had been standing outside prior, and when we went for a little walk later on she said, "We can't stay out here very much longer. He is going to have an episode," because he has these reactions to being outside in his own place, but he wanted to show us around his place. Jeannie said, "Okay,

we'll go out." I'm going to tell you that Jeannie, like I said, suffers from all these same things. She lost, in that town, her bird, her dog, her cat, her father. She said that her father turned to stone in his own home. When he died, he was hard as rock, and she said he was embalmed in his own home. Anyway, it's another story.

These people don't have any place to go, man. I mean, they have no place to go. That's why I wanted to get out and see them again. Anyway, we went outside, and we started walking around, and they were explaining how this all happens. It's not bad out in the daytime, although I've got to tell you, myself and my crew, my friends, we started getting headaches. We definitely smelled something in the air already, something that these people couldn't smell anymore. They don't have a sense of smell anymore. They also are losing their memory, an effect of neurotoxins. But we were out there, and I started feeling a headache coming on, and my throat started seizing up, and then I realized that the camera person that was with us, the woman that's documenting all this, she started to cough, and I asked her, "How are you feeling?" She goes, "I'm starting to feel ill." We all became ill in the brief hour that we were outside in this place. This is why his windows were sealed shut, because he sealed himself in that house. He built himself a makeshift filtration system that filters the air in that valley, because outside is toxic, and why it's toxic is because that plant that's a mile and a half up on that hill emits material that's heavier than air, and it comes down into that valley and sits in there. We experienced it in just 2 hours. That guy has been living there for 3 years by this plant that was going on, and they have pictures. It's not even bad in the daytime, he says. It's at nighttime when they burn all this stuff off, and they showed us all these images we have now of the night sky light up like it was daylight out there, enough that you can see those burners, the plumes of black smoke that are coming off these burners, these flare stacks that are burning off all the impurities. And that's what really hurt those people in that valley, including Joseph. The other reason why they don't burn it off in the daytime is not just so you don't see it, but even closer to that plant is the Houston High School. It's down right at the base of this facility, and outside is a big, shiny, lit up sign, LED lights, "Range Resources proudly supports the Houston" whatever their name is. Wow, wow. And the reason why they don't set off all those things in the daytime is so—I think is so that they don't dose those kids when they're in school, so they're at least some way away from them.

0:59:34.8 These processing plants are part of the facilities, so again, this is not fracking. This is just the infrastructure related to it. These are the other industries and the people that live by those plants—and there's a new one going out in Cadiz, Ohio now. And they're going up all over the place, because that's part of the infrastructure that will help to process the product into something that could be transported away from here to market. And so I don't know if you guys have actually experienced what happens in different waves. There were the pads that went in. Lots of fracking had gone on around here in the last couple of years. But when all the reservoirs, again, filled up and they didn't have a way to get that out, when I came back 6 months later everything seemed to be pretty quiet around here. You don't see a lot of trucks on the roads. You don't see a lot of flare stacks out on the well pads. But what you see now is the development of these cryo separators and compressor stations to build that portion of the infrastructure, and they're going up like crazy and the trucks that we see now—because the pipeline network has not been established the trucks that we see around here are the big, white gas tank trucks that are taking the product by road and getting it away from here until the pipeline infrastructure is set.

I'm going to skip a little bit. I'm trying to draw a picture about what this whole scene really looks like. New York state, the state where I live right now, is at the end of a 5-year moratorium on hydraulic fracturing, but all this time they've been accepting waste products, like I mentioned, the 55,000 tons of drill cuttings that they've accepted over the past 6 months at 3 landfills. The 225,000 tons of spent frack sand, the crystal and silica, now coated with all the chemicals they use in the fracking process are being taken to these landfills and landfilled, and there are leachates that go through those landfills, and I met drivers just this last week that their job is to go into these landfills that are accepting the waste products, the drilling cuttings from this operation, and this leachate comes out in the bottom of this. They collect that, and then they ship that by truck to Ohio to do deep well injection, because that stuff is really nasty.

Well, this is not a process where these people have been trained to handle this type of waste material. Those landfills are meant for municipal dumps, the stuff that comes out of our kitchens and our homes, not low-level mixed radioactive waste. And so these guys are spreading something around that will eventually contaminate thousands of square miles of area with the contaminated effluents that come off here. This is the type of stuff the US Department of Energy was trying to clean up at the Hanford site where I was working, migrating contaminants in ground water. It's being spread around with no oversight, no paperwork. Even the truck manifests are completely bogus. These guys, I'm sorry, but they are hauling materials, and they are hauling them legally because these materials have been reclassified and are protected for disposal by the 2005 Energy Policy Act. They're not breaking any laws, but they are contaminating huge areas of our country, and I don't know how this is going to stop. That's one of the things that I'm really—as a scientist, again, the long-term implications of the migration of these contaminants away from these landfills or away from a truck that went down over the hill and spilled its load into a creek, this is not being monitored, and we had better get a handle on that pretty quickly, because generations down the road will be suffering from this. If you're hearing this 50 years from now, you're lucky. You're lucky you're still around this area. I don't think that this area will survive that. The Marcellus shale is 93,000 square miles. It's not going to survive it. I went off on a tangent there, sorry.

CW: **1:04:08.2** Not at all, not at all. It went beautifully with everything else you said.

YG: Here is what is going on in New York now. The argument is still they want to ban fracking from New York state. There are all types of activities, rallies. They're meeting with the governors saying, "Please don't do this." We don't know how it's going to turn out. But one thing is for sure. There is still movement to build a pipeline across that state, a pipeline network, and there is resistance within New York, but it's more famers or landowners that don't want this pipeline running through their backyard literally. There's some discussion about putting it along the Interstate 81 corridor, putting it in the median strip. We just know that last week down in Kanawha County here in West Virginia a 21-inch pipeline blew up and took out I-77, melted the pavement, destroyed 3 homes. There are reported no deaths so far, but as it turns out, that class of pipeline is not required to report deaths. Injuries they are required to report, but deaths around that pipeline are not required to be reported, so we don't really know yet if anyone has perished in that or not. By law, they don't have to report it.

So when that blew up, it brought some attention up in New York, but I don't think the New Yorkers really understand that if they allow that pipeline to go through—which is probably one of the least environmentally impactful portions of the process. If you're standing by one of these pipelines, you could put your hand on it. Nothing is coming out of there typically, unless it's a catastrophic failure like we saw in West Virginia this last week. But the people that are around there, they have to understand that what's moving through that pipeline, at the other end of that is the gas fields, the extraction wells, and that's where the people are getting dosed. We met a family, David and Linda Hedley. They're from Green County, PA. They live up on a hill. They bought their farm in 2005. They bought up the coal rights, because everybody around here worries about coal because coal will take your water and your life away if you don't own those mineral rights, so they bought those up. And they heard about the shale minerals that were way, way down there, but they were more expensive, and so they passed on that because at that point there was no knowledge to them that there was a means to get that material out of there. That wasn't really a bother to them.

But just a year after they bought their farm I think it was Chesapeake—yeah, it's Chesapeake—came in and they started putting in the access road. David said, "What's going on here?" He found out they were going to extract this and that they were putting in 5 wells. When they drilled the first one, the Hedley's water went bad, so for 2 years they trucked water in, and I'm not going to get into the details of what they experienced, but I've got to tell you that when they first started installing and fracking those pads it was in the wintertime. Dave is a tow truck operator. He had his own business, and he was working long hours driving the tow truck and I think a bus. And he'd come in, and his wife was pregnant, and she had complained that there were some smells from outside, and she wasn't feeling very well, but he was working hard, hard, hard. Well, as it turns out, during that winter they began to realize that they were suffering from health impacts from being around this. They didn't know if it was from the water. They didn't know if it was from the air. Again, their water had been contaminated. They were still showering in it. They were starting to get rashes. Their oldest boy, I think he was 13 at the time, started developing nose bleeds. Linda just gave birth to their son Adam.

1:08:49.9 Adam is 4 years old now, and he doubles over in pain. His stomach hurts so bad that he can't move. He's a thin boy. We were interviewing Linda Hedley and David on their porch. The boys were out playing, and they sat down, put the microphones on them. We record some of this thing, and Linda coughs a little bit. I thought she had a dry throat, and so I said, "I'll go in and get you a glass of water," and David said, "No, no, that doesn't help. She's going to cough all day here." And that's what she did. (phone ringing)

MK: Just a second.

1:09:48.0 (end of audio 1)

0:00:00.7 (audio 2 starts)

CK: You brought the tissues and all the stuff you have in here.

YG: So we know a family, the Hedley's. They're down in Green County, Pennsylvania, and they all suffer from health effects by living by 5 wells on their farm. They all have persistent dry coughs. The oldest boy has nose bleeds and rashes. The youngest boy, Adam, doubles over in pain from stomach pains and will have that all day long. None of them can smell the smells, the vapors that I could smell and my colleagues who were visiting them could smell. They'd lost that. We sat there on their porch, and she pointed over to their horses, and she pointed to one of them that's blind in one eye now because of being too close to one of those pads when they were flaring. They showed us a progression throughout this last summer of a gum tree that was just up the slope a little bit from where this one pad was located, and you can see it progressing. From May it was in full green, and by the middle of June all of the leaves on the bottom of this huge tree were gone. It looked like it had been defoliated from the bottom of it. That can be from heavier-than-air emissions. It can also be from flare stacks generating ground-level ozone that will burn out plant life like that. We don't know what it was, but you can see it in the progression of these images that they were showing us. And when we were there, we were taking a stroll a little bit later on to look at the place and I heard this—it sounded like kind of gunfire. And one of our camera guys was down over the hill, and I was wondering what it might be and then we could see this white—like it was a cool morning. It was still out, and it was cool, and you could see this white vapor cloud—it looked like a ghost—move across that field from that pad where this well had just—they call it selling. It releases, it vents off. Normally it vents off emissions into the atmosphere. That well goes off every 110 minutes, Linda told us, like clockwork. In any case, this vapor moved across and then kind of spread out and then went down over the hill, heavier than air. And it was just an eerie thing to watch this silent specter move across the air and then down over the hill.

A couple of days later when I returned to visit the Hedley's because of the impact they had on me, and I was trying to convince them first of all to let's try and find you someplace else to live now, get you away from these things, because you're being exposed from normal emissions. The normal operating of these 5 wells on their farm was impacting their health directly. It was obvious to all of us, and so I went back there. We'll raise some funds. We'll get you a place. After I visited them I called them up the next day to try to first of all talk Linda into going to see a doctor, because I had asked her about her cough, and she said, "Yeah, I know, I probably have to go, but I don't have any insurance." I was like, "Insurance or not, you have to get that looked at." Well, when I called back the next day because I was so concerned about them, she did say that she actually went to see the doctor earlier that day. She took my advice, and they did what they do to everyone around here. They diagnosed her with asthma. They gave her prednisone and an inhaler, and she didn't take the prednisone because she saw what that did with her boy, the behavioral changes. He was taking this stuff 2 years prior, and she won't take it because she saw what it did to him and why they had to take him off it. Everybody around here has inhalers that live by these sites, inhalers, prednisone, and a whole cabinet full of other pharmaceuticals that they'd been prescribed by their doctors, who can't tell them what's wrong with them. In any case —

MK: **0:04:59.5** Can't tell them what's wrong with them? Is that what you said?

YG: I could say don't tell them what's wrong with them. I can say that in Pennsylvania over there because they have Act 13 that is part of that Act 13 that has a medical gag order where

doctors can't tell the patients that they've been exposed to something that they know about from the emissions from these plants. That's part of the Act 13.

CK: The Act 13 of—

YG: It's a Pennsylvania Act 13. It allows for drilling operations to come within 500 feet. Or maybe that was actually 300 feet of a dwelling, of a home, 300 feet. It also requires that doctors do not divulge any of the components of frack fluids or any of these emissions from these plants to their patients, and to do so is a breach of state law.

CK: How are the doctors supposed to know from the exam?

YG: Most of them don't know what they're dealing with. That is one thing that a couple of the Southwest Pennsylvania Environmental Health Project has demonstrated now that most of the doctors are not trained to deal with migrating skin rashes or these open lesions or these deep-seated coughs that people develop or loss of memory and loss of smell or all of these symptoms simultaneously. I mean, these doctors are overwhelmed, and many of them admit that they've never seen anything like this, and that's all they'll say.

Today I brought one of my recent friends, a truck driver. He's been suffering for the last 13 months and has been to how many hospital visits, doctor visits over these last 18 months. This person cannot drive his own vehicle. He sees spots, like sparkling spots, so he can't operate. He was a trucker. He has his 2 of his own rigs, big Volvo big rigs that he can't drive because he is afraid that he'll wreck them. In any case, he was exposed to this stuff 13 months ago, and it still manifests in his body in terms of his hands swell up. He will cough, have coughing fits that will last for an hour. His backside and bottom is covered with open sores. He's in bad shape, but that was from acute exposure, and he hasn't been there since. These people that live near these wells and these operations, including the cryo separators and the compressor stations, are exposed to it day in and day out, 24 hours a day, and theirs is a more long-term exposure with lower concentrations, because they're not in the tanks where these truckers go in to physically squeegee out the sediments that accumulate in these tanks. They don't get acute exposures like that, but it's lower concentration but longer term, and they have these chronic effects, and they're progressive.

0:08:25.4 When I went back there on the third day to try to convince the Hedley's that we should try to find them another place to live, and I'd help to raise some funds to cover the extra expenses of renting a home. We just needed to get at least a mile away from one of these well pads or any of the other facilities, and Jim Hedley looked me in the eye, and he said, "Yuri, first of all, there is no place in this county where we can go that's less than a mile located to one of these sites. And secondly," he humbly stated, "we are not the worst off here." And I said, "What?" And he said, "Well, down over that hill right there," and this is the hill where we watched that cloud move down and migrate into the valley, "is a guy that can't get out of his bed. We worry about him a lot. And he doesn't want to talk to anybody because he's paying his kid's health issues off with some of the money that he gets because he leased his rights." If he talks about this, then he breaks their contract of not talking to the public about health impacts. That was part of their lease agreement. And he loses the funds that he's using to treat the illnesses that are coming up in his

own family. And so here I'm worried about these people, and they're diverting us to say you need to take care of those people down in the valleys, and that's what we see. It's called valley effect. It's a well-known phenomenon in pollution modeling. Heavier-than-air components can settle down in low-lying areas. Most of the people that I know where I grew up, they don't live on hilltops. They live down by creeks, and I think that what we're going to see, because they put all these frack pads and processing stations on the hilltop, so the people that are going to get hit hardest in the middle of the night will be the people living down in the valleys, what I call the death valleys, because these are kill zones. There is no doubt about it that those heavier-than-air emissions under normal operating conditions are going to impact tens of thousands of people in this area, maybe hundreds of thousands. If you were to look at Southwest Pennsylvania and the counties that have been impacted and you were to draw a circle around each of these facilities and say people within a 1-mile circle, those people have to be removed in Southwest Pennsylvania, I think 4 counties alone, that's 55,000 people that would have to be moved, evacuated out of there if that was what—to protect their health. That's how many people would have to be dislocated.

MK: Who are currently—

YG: Who are currently there, just right there.

MK: Affected.

YG: **0:11:22.3** Affected, and that's just 1 mile from these wells. In the valleys where these things —the heavier-than-air components then tail out, they'll spread down the valley—that 1-mile zone could extend easily to 5 miles and possibly to 10 if you have one of these long, calm, sleepy hollows with all of these heavier-than-air toxins coming down in there. The accumulation effect, the concentration effect, it's like a big, long tongue. It will just stick right down there and impact people at least 5 miles away from those sites. We have a real issue with immediate concern. What we're now posing, I mean, forget the science of what we're doing in the long-term implications of the environment. We have an immediate public health crisis. It can't be categorized, I guess, as a disaster because you have to have so many number impacted, and it would almost have to be a natural impact.

But the health crisis that is developing in many areas is fully developed, and these people are suffering. And so I have tried to start to divert myself away from the science that I'm actually capable of doing and trying to put my efforts toward just protecting people that are in these kill zones around these pads. And through that type of activity now I've met many, many people that are not only suffering but need help trying to help to establish a network of resistance, something that we can say, banding together, we are here. You can't poison these people, and the shale gas industry and all those operations, but it's the state governments, and it is the protection of the federal government, the protective measures for the industry that's the real problem. All the federal government has to do, all Obama and the current Senate has to do is to remove those protective exemptions from the 2005 Energy Policy Act, and this industry would go away. It's as simple as that. If we try to target Governor Corbett or Governor Kasich or Governor Cuoma or Tomlinson down here, we'll never make any headway. You can't convince—I mean, the federal government gave all the power to the states, states that are poor, that had faltering economies,

that had resources that they say that they believe that they could build those economies back up just by extracting and selling those products. But they weren't really knowledgeable. I hope that the state governments were not knowledgeable on how destructive the industry is and how it is directly affecting its own citizens here in West Virginia and in Pennsylvania and Ohio.

In my estimation, in my opinion, the states' control structure has sided with the industry, and it would be very difficult, maybe impossible, to stop that in the state. The federal government has the opportunity here to do the right thing, to remove those exclusive exemptions for this industry and then let it be a level playing field with other industries, and that includes solar, which has problems with the metals that they mine. There's regulations on mining of those metals to use in solar panels. There are regulations on bird migration routes for wind turbines in this area. There are regulations for fly ash for the coal industry, and all these, which are good regulations, protective of people and wildlife. But the shale gas and oil industry gets exemption from those regulations. That is problematic in so many ways. The economics of giving exclusive exemptions to one industry, there is no way that these other alternative energy possibilities—which not just possibilities, these are realties. We have alternatives to shale gas and oil. But with those exemptions there is no way that these others can compete. That's the bottom line, so I think what we're doing right now is—when I talk about this let's focus on the 2005 Energy Policy Act, remove those exemptions, and we will immediately start to protect people. As we move forward toward that objective, more attention to these people that are being impacted, like Joseph, like Jeannie Moten, like the Hedley's. And again, this is just completely forgetting about the workers that are on these pads doing these jobs without any OSHA oversight, no protective gear. You see that man in there. They give him a hard hat and safety glasses, but they send him into these tanks, hose down these big pads with a steam sprayer. They can't see 2 inches in front of their face when all the steam is in there, and then 2 days later he's in the hospital with something that he can't get out of his body, and doctor after doctor after doctor in Pennsylvania diagnosed it as asthma, hives, and allergies to sandwiches. That's what they say.

MK: **0:17:21.7** Allergic to sandwiches?

YG: Sandwich materials. Maybe there's some mayonnaise in there or you have some peanut butter. You develop sensitivities to things, but the doctor that we met today down here at Morgantown said it's highly unlikely that any man of 48 years old would simultaneously contract allergies, neurological damage, which includes loss of memory, loss of clear vision, constant ringing in his ears or a buzzing and these deep-seated coughs. I mean, this is something that doesn't occur simultaneously by anything like lupus, which can cause changes in your skin complexion and sensitivity to touch. But blood tests have excluded all those possibilities that this is a disease, a blood-borne disease or anything like that. This was exposure to toxins at a work site, and for the last 13 months that man in there has not received a dime of workmen's compensation. That's all he wants. He can't pay his bills. He can't pay the co-pays for these doctor visits that he's going to. He can't pay tithings at church. He can't buy his boy, his 7-year-old boy, Christmas presents. He can't drive his own truck.

MK: So this industrial accident occurred when he was cleaning out a big tank rather than anything to do with his own trucks? Or what kind of trucks does he have?

YG: He was a long hauler. He has big 18-wheelers. I think his pride is a Volvo, a nice, big Volvo. I haven't seen it yet.

MK: To haul.

YG: To haul, yeah, for long hauling. But he wasn't getting a lot of jobs and so there was this—he can tell you this story, but there was an opportunity to drive these water trucks for Curry Supply and Trucking, I think is the name of the company. And this is to take material up to the pads, bring water, move things around. A pretty good job, pays really well, really well. He was hauling this stuff, but then he started to haul the waste from these tanks. He started to—and these drivers, they're not just drivers. They have to get out—at least in this company they have to hook up the hoses to these tanks. They have to turn on all the pumps. They have to vent their trucks when they're filling these things, and so there's a catch bucket the drip hose goes into, and when they fire up and open up these valves, that truck is pressurized I think to just 10 or 12 PSI. But 4,000 gallons of vented gas inside these trucks go into this little bucket you set down there, just filling up. Then he takes this material, and he's told to dispose of it in places, and these are nighttime disposals. These are in the middle of towns in areas that you pull up and there's no lights. Nobody is around. Hook up a hose, open up these valves, and pump it down into this disposal well. It's an old abandoned gas well, and they're everywhere around here, and they've been instructed to put this material down into those wells. That's trucking it from Pennsylvania over to Ohio where they can dispose of this stuff.

0:21:15.5 Where he developed an acute health impact was on an event where he was told to—they have these big pads that they lay around the drill site, these big mats, and these mats are kind of like corrugated rubber mats, and they come in and they're I think 3 feet by 5 feet, something like this. They forklift them up on top of these slanted racks, and then they take these high-pressure hoses, and they spray this stuff down and get all of this material that's accumulating on it that includes these black drill cuttings from these deep formations that we were talking about earlier that can contain radium, uranium, all of these complex organic materials that are themselves toxic. He's supposed to go into these things and spray off—in 2 days him and a couple—well, he sprayed off 1,000 of these pads hour after hour after hour. And when he came away from the pad and he got back in his truck to take off his boots—he knew he was standing around in this stuff, but his socks were soaked with the material that he was washing off these things. They were brown and black colored, and then he took off his socks, and his feet were inflamed. He stuck it by the heater and he said it was like someone poured gasoline on his feet and set them on fire. He stuck them out of the side of the truck in the cold air to try and cool them down, and then over the next 12 hours or so that developed and went up through his body. He did go back to work the next day and tried to work, but on the third day he was in the emergency room with welts, edemas. There were large areas of his chest that were raised, like swollen, like a bee sting that covered a square foot of his chest. He was already starting to cough. He had a headache that he couldn't get rid of. This is what happened now 3 days after this exposure. He was in the hospital with this, and for the last 12 months he's been receiving medical attention, and again, the diagnosis you can read in his documents. Asthma, skin rashes, hives. He has a whole medical shelf full of the steroids that he was prescribed, inhalers. The inhalers are all he really takes right now because he had 4 episodes where his tongue swelled up and they had to put a nebulizer—he was rushed to the hospital, and they had

to push his tongue out of the way and ventilate him and put a nebulizer down there so they could try to reduce the swelling. I think the last episode of that where his tongue swelled up to block his passage was about 2 months ago I think or 3 months ago. Some of the pictures that we'll show you where his lips are swollen, the end of his nose, I mean, he has been severely impacted by this single exposure. And again, his lawyer, which he really kept on his lawyer for a divorce that he had gone through, was now serving as his defense lawyer for trying to regain or gain his workmen's compensation so that he could take care of this issue, she has not been able to have a positive outcome with that litigation. None of the doctors in the area will say anything other than this is asthma and hives, and so with those types of diagnoses he has no power in court to say that this was related to an incident on this site, as part of his occupation.

Today we're hoping that the doctor that he visited in West Virginia here in Morgantown would be able to say that this is not a blood-borne disease. This appears clearly to be a result of exposure to chemical toxins at the work site, and that's what we're waiting now. We'll have the final report in a couple of days. He can take that to his lawyer, and we'll see if he can be successful.

MK: **0:25:49.9** Okay, that's a perfect introduction to him. We'll stop it here. I just want to ask you if everything you have told me is absolutely the truth as far as you understand it.

YG: Everything that I said to you here is absolutely factual from my personal experiences and my personal knowledge. There's lots that I haven't told you here about these other things, these people that we've met that we've documented ourselves. Those stories need to be told. One of the cameramen now that traveled with us down here is just traveling around now the northern tier of Pennsylvania just taking video, documenting history and oral history, just recording people's testimonials basically of what they've experienced.

MK: But as far as the chemistry, the workings of the procedures and so on that you have been entirely accurate as far as you could be.

YG: To my knowledge, everything that I say is accurate.

MK: Okay, thank you.

CK: But the Hedley's, their situation had to do with the 5 wells on their place or a processing plant nearby?

YG: No, these are from the wells. They have 4 vertical wells, and then they have 1 horizontal well. Again, the emissions of these wells—well, for a demonstration on the little tube where are these vents they would stick a condom on the end of there, and then you'll count down, and when it went off that thing—and then—so we don't know what the composition of that was. We don't know what the volume is being released from these wells. But these are intentional, regular emissions that are not being monitored. If we have global climate models to predict the impact of methane or other organic compounds into our atmosphere those models aren't really good unless you have the data about how much of this material is being released to the atmosphere. The releases from these well pads are going absolutely unmonitored. The only reason that it has now

been published in a peer-reviewed publication in Colorado, the only reason why they brought attention that there were these rogue emissions from these places is because they have an atmospheric modeling station there for methane and other gases in the atmosphere. This is part of the Noah—it's not Noah. I'll think of it, but it's a government program to measure, evaluate atmospheric methane. Every once in a while one of these detectors would have these big spikes, and then they started to correlate those spikes with a change in wind direction, and then they started moving these air monitors, these methane monitors, down the hill toward where they were thinking this might be coming from, and they clearly identified that the emissions were coming off of rogue emissions from these frack operations in that Colorado area. That was the only way that reputable scientists were made aware that there are more emissions from these facilities than we'd been told about. And now really if we do not start to monitor and evaluate how much of these rogue gases are being released from these pads our best climate models will vastly underestimate the impact to global climate change, and so we will continue to be surprised that all of our models were too conservative. There's a faster change in our environment than was previously thought, so we've got to get this under control.

MK: Great.

0:29:56.7 (end of audio 2)

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