

In The Matter Of:
LIVINGSTON COUNTY ZONING BOARD OF APPEALS

November 18, 2014

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1 LIVINGSTON COUNTY ZONING BOARD OF APPEALS
2 CASE SU-7-14
3 PLEASANT RIDGE WIND ENERGY PROJECT

4 November 18, 2014
5 6:00 PM

6 Pontiac Township High School
7 Pontiac, Illinois

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1 (Commencing at 6:00 p.m.)

2 CHAIRMAN CORNALE: Chuck, roll call
3 please.

4 MR. SCHOPP: Okay. This is the November
5 18, 2014, continuation hearing of Livingston County
6 Zoning Board of Appeals review of Livingston County
7 Zoning Case SU-7-414, Pleasant Ridge Energy, LLC/
8 Pleasant Ridge Wind Energy Project starting at 6:00
9 p.m. here at the Pontiac Township High School at
10 1100 Indiana Avenue in Pontiac. Roll is Mike
11 Cornale.

12 CHAIRMAN CORNALE: Here.

13 MR. SCHOPP: John Vitzthum.

14 MR. VITZTHUM: Here.

15 MR. SCHOPP: Rich Kiefer.

16 MR. KIEFER: Here.

17 MR. SCHOPP: Diane Iverson.

18 MS. IVERSON: Here.

19 MR. SCHOPP: Howard Zimmerman. Joan
20 Huisman.

21 MS. HUISMAN: Here.

22 MR. SCHOPP: Gibs Nielsen. We have a
23 quorum.

24 CHAIRMAN CORNALE: At this time, sorry,

1 I'd just like to quickly address the process again.
2 There were a few questions. First part of the
3 process is you need to make sure that if you're
4 interested in speaking that you get signed up.
5 That's very important. As the applicant goes
6 through their testimony, interested parties within
7 the audience will be allowed to question the
8 applicant's individuals after they're all through.
9 That's why I asked last night to go ahead and jot
10 down any questions that you may have of them.
11 They'll present their whole case. From that point,
12 we'll do the questions that I spoke of. Then we'll
13 allow the interested parties, that's the individuals
14 that have signed up, to present their testimony,
15 their evidence, whatever they may have. When they
16 do that, they will have to be sworn in.

17 Additionally, there will be public comment
18 from anyone that does -- would like to speak.
19 Again, sign up so that we can go through it in an
20 orderly fashion. After that's completed, in reverse
21 order we'll do closing comments, closing statements
22 by both sides. So if you -- if you speak once,
23 address the board, you may have some questions. The
24 questions are -- you don't need to sign up to ask

1 the questions. If you're an interested party,
2 you'll speak and you'll get to speak again in
3 closing, okay, in reverse order. So be sure -- the
4 most important thing I'm trying to tell everybody is
5 if you'd like to speak, please sign up. Okay.

6 With that, we'll go ahead and start where
7 we left off last evening.

8 MR. BLAZER: Actually, Mr. Cornale, if I
9 may ask a question first. Mr. Luetkehans introduced
10 himself yesterday, he indicated that he represents
11 something called United Citizens of Livingston
12 County. He advised me that privately it's an
13 unincorporated association. We have no idea who or
14 what that is, who it belongs to. Since it's an
15 unincorporated association, evidently there are
16 individual members, so I think it's appropriate to
17 get on the record who Mr. Luetkehans actually
18 represents.

19 MR. LUETKEHANS: Yeah, I was asked for
20 that last night and we will provide that at the
21 beginning of the hearing tomorrow.

22 MR. BLAZER: Thank you.

23 MS. BLANK: Testing, okay. Hi, my name is
24 JoAnne Blank, and I did speak a little bit last

1 night about shadow flicker and introduced myself
2 then.

3 MR. LUETKEHANS: The mic's not on.

4 AUDIENCE VOICE: Speak up.

5 MS. BLANK: Okay. There we go. I tend to
6 move, so I'll try to keep my head still. My name is
7 JoAnne Blank, and I'm here to talk tonight about the
8 compatibility study that Stantec completed to
9 compare the compatibility of the land use within the
10 project area to the Livingston County's goals and
11 objectives to see if the project is compatible with
12 the overall of the plan.

13 One of the main points of the plan is that
14 it stresses the importance of agriculture and the
15 desire to preserve the agricultural economy
16 throughout the county. In doing this, they
17 identified goals and objectives within seven
18 categories. Three of the main and largest major
19 land uses of the area in the unincorporated area is
20 agriculture, which is the largest and the part of
21 the plan that's given the most, the most importance.

22 These are the seven objectives and goals
23 within the plan, and I'm going to just talk very
24 briefly about each one.

1 The first one is agricultural land, and as
2 I mentioned, it is stressed throughout the land use
3 compatibility plan. Plan strives to preserve the
4 most productive and suitable lands for agricultural
5 purposes, and it encourages the prime farmland
6 preservation and supports ag land for future
7 generations. 98 percent of the project area is
8 agricultural land use on prime farmland soils or
9 soils of statewide importance. Wind energy is
10 actually very compatible with agricultural land use
11 due to the extremely small footprint of the
12 facilities.

13 Approximately 150 acres of the total area
14 in the project area will be used for the wind
15 facilities, and that's out of 36,000 acres of land
16 that will be under contract and over 58,000 acres
17 within the project area. That's less than one-half
18 of one percent of the land that would be taken out
19 of agricultural use to be used for the facilities.
20 In addition to the limited land use, the money
21 that's paid to the landowners will help to preserve
22 the farmsteads for future generations.

23 Pleasant Ridge has also proposed an
24 agricultural impact mitigation agreement and you

1 heard a little bit about this last night, and that
2 plan helps to ensure the protection of the prime
3 topsoil by isolating it from the subsoils during
4 construction. It preserves the agricultural
5 practices by burying collection lines more than five
6 feet deep. It addresses drain tile damage and
7 repair.

8 The second objective of the plan is
9 residential. The plan strives to provide
10 opportunities for housing, wind energy, and the
11 project area is dominated by single family, rural
12 residential properties and farmsteads. There aren't
13 any large high-density residential areas within the
14 project area and the wind farm will have minimal
15 impact on housing and will not inhibit the growth of
16 rural residential properties.

17 Third objective is commercial and
18 industrial. The plan encourages the mix of
19 industrial and commercial enterprises and it strives
20 to provide a healthy tax base. Here, again, the
21 project is compatible. It diversifies the economic
22 base and increases the tax revenues by millions of
23 dollars. Monies paid to the landowners and the
24 neighbors and workers within the community will

1 trickle down and increase the spending and boost the
2 economy.

3 The fourth category is transportation.
4 Transportation in the plan, they promote the
5 development of an efficient transportation network.
6 The project will not require any new roads and any
7 roads that are improved for construction will be
8 constructed at Invenergy's expense. The operation
9 and maintenance of the wind farm will not require a
10 large amount of traffic on public roadways.

11 The fifth category is utilities. The plan
12 promotes the availability of utilities. Here again,
13 the project uses minimal utility services. They
14 will be constructing a nine-mile transmission line
15 from substation to the point of interconnection.
16 That will be paid for, again, out of the project's
17 expense, not landowner's or taxpayer's expense.

18 Sixth category is open space and
19 recreation. The plan promotes the retention of open
20 space, preserves recreational areas, wildlife
21 habitats and historic and archeological resources.
22 The project is a majority of ag land as we discussed
23 and it doesn't contain large areas of recreational
24 open spaces. The architectural and cultural

1 resources are being evaluated through coordination
2 with the Illinois Historic Preservation Agency and
3 turbines are kept more than 20 -- excuse me, 2,000
4 feet from cemeteries. The Vermilion River will be
5 crossed using a horizontal directional drilling
6 method which is a subsurface method, so there will
7 be no impacts to the Vermilion River. The project
8 is designed to minimize impact to woodlands,
9 wetlands, waterways and it will not conflict with
10 open spaces or recreational lands.

11 And last but not least is the
12 environmental and natural resources. The Livingston
13 County plan fosters a wise and beneficial use of
14 land, air and water. The project is working with
15 the Livingston County Soil and Water Conservation
16 District to ensure that it complies with these
17 goals. Construction activities will be carried out
18 in compliance with the Illinois Storm Water and
19 Erosion Control Best Management Practices. Will
20 acquire permits through the Illinois Environmental
21 Protection Agency before construction.

22 Overall, wind energy produces usable power
23 from a clean energy source that does not consume
24 natural resources in the production of that power.

1 Overall, Pleasant Ridge supports the long-term
2 viability of agricultural and farming practices in
3 the project area.

4 As we can see here, one of the main
5 objects that we talked about was the agricultural
6 land use and preserving that land use. And as you
7 can see from this figure, the project area is
8 dominated by that land use.

9 The project -- the plan promotes the
10 preservation of prime farmland, the agricultural way
11 of life in the community for the present and future
12 generations, and we believe that the project is
13 consistent with the goals and objectives of the
14 Livingston County Comprehensive Plan and the land
15 use planning.

16 MR. BLAZER: Mr. Chairman, I actually left
17 Ms. Blank's exhibits here yesterday. I think
18 they're in that box out there. They are, let's see,
19 42 and 45. Those are collated.

20 CHAIRMAN CORNALE: All right.

21 MR. BLAZER: You should have those on your
22 list.

23 CHAIRMAN CORNALE: Yeah, we got them right
24 there. Okay. All right, we need to sort through

1 the stack. The County will accept these exhibits.
2 They are marked. I'll just go through them quickly
3 on this so that they get in the record. Pleasant
4 Ridge Exhibit 42 is Blank -- Ms. Blank's curriculum
5 vitae. 43 is a shadow flicker report. Pleasant
6 Ridge 44 is the Comprehensive Plan Report. And 45
7 has already been taken, but it's the Power Point
8 presentation from Blank.

9 MR. BLAZER: Mr. Chairman, our next
10 witness is Michael Hankard.

11 CHAIRMAN CORNALE: Very good.

12 MR. BLAZER: Hang on, we have his
13 presentation. Pleasant Ridge 50 is Mr. Hankard's
14 presentation.

15 CHAIRMAN CORNALE: All right. County will
16 accept Pleasant Ridge Exhibit 50 as Mr. Hankard's
17 presentation, Pleasant Ridge Wind Energy Center
18 Noise Analysis Results.

19 Two other notes to mention. Cell phones,
20 if you guys have them, if you could silence those.
21 And we did talk to them in an effort to try to
22 streamline taking these exhibits, so bear with us,
23 but we're working tonight to make it a little bit
24 better than it was last night.

1 With that, Mr. Hankard, go ahead.

2 MR. HANKARD: Okay, thank you. Good
3 evening, my name is Mike Hankard. I am an
4 acoustical consultant, otherwise known as an
5 acoustician and sometimes called the noise guy. My
6 profession involves the measurement and analysis of
7 environmental noise and what is in the environment
8 due to manmade sources as well as natural sources.

9 I'm here to speak to you tonight about two
10 issues. First and foremost, I want to present the
11 results of the noise analysis that we conducted that
12 will demonstrate that the project will meet Illinois
13 Pollution Control Board noise limits.

14 Secondly, I'd like to speak to the issues
15 of low frequency noise and infrasound that have been
16 much discussed with relation to wind turbines in
17 both the press, on the Internet and in my scientific
18 community.

19 A little bit about my background. I'm in
20 my 25th year in this profession. I have been
21 principally involved in the noise analysis for
22 approximately 400 projects. Those have been located
23 across the United States and internationally. I say
24 principally involved because I own my own firm. I

1 have so for 20 years. So when I'm hired, it's me.
2 And I have to not only design the study, understand
3 the limits, conduct the study, but I have to stand
4 by the study. And as an independent consultant, my
5 representation does indeed mean a lot to me. So
6 with all of my clients, Invenergy included, I don't
7 ask them how to do the study. I tell them how it
8 should be done.

9 Over the years I've worked on a number of
10 different projects and various industrial
11 facilities, conventional power plants, wind turbine
12 facilities, mining operations, et cetera. In the
13 last six years, my overwhelming focus has been wind
14 turbines. But that focus is based on my foundation
15 of 25 years experience working in a number of
16 different industries, different projects, different
17 locations, different regulations.

18 So my wind turbine experience. First and
19 foremost, this involves the California Ridge
20 measurement survey that I conducted. It's obviously
21 relevant because it's in Illinois. It's in a
22 similar agricultural community. It involves similar
23 turbines. And it involved demonstrating compliance
24 with the Illinois Pollution Control Board limits.

1 You'll hear throughout my presentation and perhaps
2 those from others that wind turbines are different
3 in terms of noise and in terms of compliance, and
4 one of those primary differences is the need to
5 measure for long periods of time. That is because
6 these are controlled by the wind. So we can't go
7 out there on any given Tuesday and measure it and
8 say that's what it is. You have to measure over a
9 wide variety of conditions.

10 On one of my projects, I've been measuring
11 at a single place for six years. For the last two
12 and a half years, we've been measuring there
13 continuously. That kind of experience is fairly
14 rare in my profession, so I believe that I am very
15 well-qualified to be talking to you tonight about
16 these issues.

17 Lastly -- well, excuse me, two more
18 points. I was involved with a project recently in
19 Wisconsin where I testified before the Public
20 Service Commission on all of the turbine noise
21 issues that will come up as part of these
22 proceedings. So I'm very versed in what the
23 scientific community says about these issues and
24 what public service commissions have said about

1 these issues.

2 Lastly, I was the principal acoustical
3 consultant for the Shirley Wind Project in Brown
4 County. I did all the pre-survey work there, I did
5 all the compliance measurements, including low
6 frequency and infrasound measurements.

7 So in closing, this slide lists a few more
8 projects. But, you know, in summary, I've spent
9 hundreds of hours out in farm fields listening to
10 turbines, measuring turbines, hundreds of hours
11 listening to audio recording of these same sources
12 and thousands of hours analyzing the data.

13 Okay. Noise 101 as we say. Noise is
14 measured, and what we hear, what hits our ears, are
15 pressures fluctuations. It's the pressure of the
16 air being changed by the source. We can detect an
17 enormous range of pressure. And we engineers
18 quantify that in pascals, which is the metric unit
19 for pounds per square inch. PSI is also pressure.

20 The range that the human ear can detect in
21 terms of pressure is huge. You can see it on the
22 left side there of the thermometer. So I don't want
23 to be up here talking about 20 pascals or 200
24 million pascals. So what we have done in the

1 acoustics world is to compress this scale down using
2 the logarithm, and the resulting scale is much
3 easier to discuss. It ranges from zero dB at the
4 threshold of hearing; you know, 20 to 30 dB is a
5 very, very quiet night when the wind isn't blowing;
6 30 to 40 the wind's now blowing; 50 to 60 you're
7 inside watching TV; 70 to 80 you're talking about,
8 you know, being next to a highway. And then you get
9 into, you know, rock concerts and rockets and things
10 like that.

11 One quick note on adding decibels.
12 Because we have jumped into that logarithm world, 50
13 plus 50 no longer equals a hundred. It's because
14 these things are related to each other on the square
15 of the pressure. So there's not going to be a quiz
16 or anything at the end here. I'm just trying to
17 convey that when you're adding 50 plus 50 in the
18 noise world, that equals 53.

19 All right. One more scary technical graph
20 here and we'll get to some data. I like to use the
21 analogy -- the concept I'm trying to get across here
22 is frequency. And it's important to discuss this if
23 you don't understand it, because the Illinois
24 Pollution Control Board regulates noise at different

1 frequencies and we're going to be discussing low
2 frequency noise and infrasound.

3 So think of an ocean wave. The higher the
4 wave, that's the level, that's the decibel level or
5 the pressure. And then the distance between each
6 successive wave is the wavelength. And so the lower
7 the frequency, the longer the wavelength. And I'll
8 discuss more why that's relevant and important later
9 in my talk.

10 So just to put things in perspective for
11 you, human speech ranges from approximately 500 to
12 4,000 hertz. A train horn you can see is 300 to 600
13 hertz. If you're standing out in an Illinois
14 cornfield, as I have done, and there's distant
15 trains quite often, and you'll hear that rumble,
16 that lower rumble that's more in the low frequency,
17 10 to 200 hertz range. And the whole thing is
18 summarized quite well by the analogy of the piano,
19 which ranges from about 30 hertz at the very low end
20 to 4,000 hertz up high. So I can play any note on
21 the piano and I can play it soft or I can play it
22 loud and it doesn't change the frequency. If I hit
23 one note, the frequency is what the frequency is.
24 And then I can change the level depending on how

1 hard I hit the key.

2 Okay. We're getting there. So the human
3 ear can detect frequencies between 20 and 20,000
4 hertz and that's for a young healthy person. Now,
5 the Illinois Pollution Control Board only regulates
6 noise between 22 and approximately 10,000 hertz.
7 There's good reasons for this. Most environmental
8 noise sources, wind turbines included, don't produce
9 that much sound above 10,000 hertz. Furthermore,
10 the atmosphere tends to absorb it. Thus when you
11 get out to, say, 1500 feet from a turbine, there's
12 simply no or very little high frequency noise left.
13 So we don't need to concern ourselves above 10,000
14 hertz. Below 20 hertz is inaudible and, therefore,
15 in that sense we don't need to concern ourselves
16 above that.

17 That said, this infrasonic region, below
18 20 hertz, infra meaning less than, so between zero
19 and 20 hertz which has been classically thought of
20 as inaudible, some have postulated that energy from
21 wind turbines in that range is audible or, if it's
22 not audible, it might cause health effects.

23 I'll talk tonight about the audibility
24 aspects and I'll leave the health effects to

1 Dr. Roberts and Ellenbogen.

2 One last note. The low frequency noise
3 that people talk about, that ranges from
4 approximately 20 to 200 hertz, and you can see that
5 is covered within the Illinois Pollution Control
6 Board limits.

7 Okay, so here are the Illinois Pollution
8 Control Board limits. And so they have broken it up
9 into there's actually nine units. They took the
10 frequency spectrum that we're concerned about, down
11 low, around 20, 22 hertz up to about 10,000, they
12 broke it up into these nine bands, and these are the
13 center frequencies of each band. And each band has
14 a limit. These are the nighttime limits. The
15 daytime limits are all five decibels higher, but
16 because we're designing the project to meet the
17 nighttime limits, we really don't need to be
18 concerned about the daytime limits. They will be
19 met and exceeded -- or not exceeded, but the levels
20 will be lower than the limits.

21 So one last thing on this graph. As you
22 notice, the limit for the low frequency is much
23 higher, and that's because the human ear is not as
24 sensitive to these lower frequencies. The human ear

1 is most sensitive at a thousand hertz and then it
2 drops off as you go lower and higher, so that's why
3 the curve is shaped the way it is.

4 Okay. So I mentioned that we measured
5 turbine noise at California Ridge down in Vermilion
6 County, Illinois. So I've plotted the results of
7 those measurements here. These levels that I'm
8 showing are the very maximum levels that we measured
9 in the California Ridge. And I mean the very
10 maximum. This is not some kind of an average. And
11 you can see that we are below the limits in all of
12 the bands. Now, we're closest around 500 to 1,000,
13 and so we'll keep an eye on that as we move forward.

14 So on that California Ridge project, we
15 measured in August and we got a few days of data
16 that were similar to these levels. But the wind
17 didn't blow that much, so we kept measuring. So in
18 September, we got some more good data. Again, the
19 levels were very similar to what you see here. But
20 we still didn't feel like we had captured enough
21 data, so we kept going through October. We ran --
22 in October, you run into harvest season. And
23 combines and the like produce noise very much in the
24 500 and 1,000 hertz band. So October was a little

1 challenging for us even though the turbines were
2 running quite a bit.

3 So we kept going. In November, we got a
4 lot of great data, covered a lot of different wind
5 conditions. Harvest was at a minimum, and really
6 that's when you see here is the max that we got in
7 November, which was similar to the other months, but
8 this is pretty much what you're looking at.

9 What I have plotted here against the
10 Illinois regulations are the predicted levels for
11 this project. So this is what we think in a very
12 maximum way will be the levels that the Pleasant
13 Ridge Project will produce at the nearby residences.
14 And so I chose to show you the very highest levels.

15 For example, we're considering two
16 different turbines, one with two different blades.
17 One blade is a little louder than the other. This
18 is for the louder blade. This is for the levels
19 predicted at the very highest residence. So all of
20 the residences will have lower levels. So once
21 again, you can see that it's the 500 and 1,000 hertz
22 bands that we're kind of close to.

23 So I'm going to tell you how we feel that
24 these are the very, very maximum levels in that an

1 overwhelming majority of the time the levels will be
2 lower. But to do that, I need to kind of walk you
3 through the process that we acousticians use to make
4 those predictions.

5 So it starts with the manufacturer, GE in
6 this case, going out to a test facility. And
7 there's a standard. It's this International
8 Electrotechnical Commission 61400-11. They follow
9 that standard and it roughly involves them placing a
10 microphone or a series of microphones about 4 to 500
11 feet from the turbine. They allow the wind to kind
12 of do its thing and they wait until the wind has
13 blown through an entire range of speeds and they
14 capture all the data and they reduce it down and
15 they come up with what's called a power level.

16 Now, when you're out at that distance from
17 the turbines, what you're measuring is what's called
18 aerodynamic noise. It's the blades cutting through
19 the air. So the gears inside the turbine, the
20 cooling system, any of the motors, once you get out
21 to 1500 feet and beyond, that's not really what
22 you're picking up. It's primarily the interaction
23 of the blades with the air. And the faster the
24 blades turn, generally speaking the louder the

1 levels.

2 Okay. So this is a table that GE or any
3 other manufacturer would provide. And I don't --
4 you don't need to fully understand the table here,
5 but basically this is increasing wind speed and this
6 is frequency. So on a standard project in a stage
7 -- or a community that has a single number
8 regulation, we would simply choose perhaps the
9 highest level and run with that to do a worst case
10 analysis. But because the Illinois Pollution
11 Control Board regulates each band, we actually went
12 through each band and said what's the highest level
13 in each band. And you can see I've highlighted
14 those here. And it's not always at the same wind
15 speed.

16 So for our critical bands at 500, it's at
17 7 meters per second. But for 1,000, it's way out
18 here at the higher speed of 10 meters per second.
19 So this is one way that we really try to do a worst
20 case analysis by picking the loudest levels in each
21 band.

22 So again, as you've been told, the project
23 is considering both 100 meter and 103 meter blades,
24 so we ran our analysis for both blades. And the

1 results I'm showing you here are for the 100 meter
2 because those are a little bit louder.

3 Now, when you design a wind turbine
4 project, you determine where the turbines go based
5 on all different kinds of constraints, roads,
6 wetlands, noise, et cetera, available land, and
7 eventually you get kind of close to where they're
8 going to go. We got to that point on this project
9 and we were a little bit over the noise limits, so
10 that's when we started adding in these turbines with
11 the lower, the low noise trailing edge blades.

12 Initially, we found out we needed four of
13 them on the turbines, that I believe we went over
14 where those are last night. Then at one point I
15 said to the project, you know, we're actually one to
16 two-tenths of a decibel over the limit in one of the
17 bands. And they said, well, what does it take to
18 get rid of that? And we said another 7 LNTEs. And
19 Invenergy said, fine, let's do that.

20 So I think it reflects on the type of
21 analysis they wanted us to do, being very
22 conservative.

23 Let me use the analogy of the lightbulb
24 here. I told you we just measured the power level

1 of a turbine, how much sound does it put out. What
2 we really want to know is how does that sound travel
3 out and reach a residence that's, say, 1500 more
4 feet away from the turbine.

5 If I take a 100-watt lightbulb next to my
6 bed and I read a book, I'm going to be just fine,
7 plenty of light. If I was to go outside with that
8 same lightbulb and put it a hundred yards away from
9 me and sit out in the field at night and try to
10 read, I'm not going to have enough light. That's
11 because when that power gets emitted from the bulb
12 and it travels through the air, distance makes the
13 level go down. If it was foggy, for example, there
14 would be even less light. Well, it's the same with
15 noise.

16 So the way we mathematically predict how
17 it's going to go from the turbine to the residence,
18 we follow this International Organization For
19 Standardization, ISO, Method 9613. So it starts
20 with the emission levels. You cannot correct for
21 directivity. Some sources are direct. They put out
22 more sound in one direction than another. Like a
23 household fan is similar to a turbine. It's going
24 to produce a lot of noise when you're facing it or

1 behind it, but not so much to the side.

2 Divergence refers to how the wave spreads
3 out. So it starts from the turbine and it spreads
4 out, and it has to cover more ground the further it
5 goes, so it loses energy, and that's why as you walk
6 away from a source, it gets less loud.

7 Atmosphere absorption. When the sound
8 travels through the air, the molecules are bumping
9 into one another and tiny amounts of heat are
10 created, so you have sound energy transferred to
11 heat energy and there's a little bit of loss and so
12 the level goes down.

13 Ground effect. Again, when a wave is
14 coming off a turbine, it's going in all directions
15 and the wave that goes along the ground interferes
16 with the wave that's going through the air, and
17 there's a loss that occurs there. That's called the
18 Brown effect.

19 Barrier. If it comes across, if the wave
20 comes across a barn, you get behind that barn,
21 there's going to be a loss of noise.

22 Vegetation. If it travels, if the wave
23 travels through a stand of trees, again there will
24 be a loss of sound energy.

1 Meteorology, i.e., weather conditions, are
2 very important. We've all perhaps experienced some
3 nights you can hear that highway a mile away and
4 some nights you can't. Has a lot to do with the
5 wind direction. Are you downwind of the source?
6 But it has to do with other things as well,
7 including what's called a temporary inversion.
8 Typically at night it gets colder as you go up into
9 space, right? As you get higher in elevation, it
10 gets colder. But there are some nights when that
11 doesn't happen. It's actually a little warmer
12 above, and then it starts to cool. But that warm
13 blanket of air causes a bit of a cap, if you will,
14 and some of the sound energy bounces off of that cap
15 and it can be louder as a result.

16 So I'd like to briefly walk through each
17 -- how we modelled each one of these and how I can
18 stand here and tell you that it was a very
19 conservative analysis.

20 So, first of all, the ISO method is the
21 method that's used to predict noise on practically
22 every project in the United States, wind turbines,
23 industrial facilities, any kind of facilities. So I
24 already told you how we chose the absolute maximum

1 power, so that's where we started. Directivity, we
2 took no real deductions. Turbines do not put out as
3 much noise in all directions, but we assumed that
4 they would, even though that's not the case.

5 In terms of divergence, there's really no
6 choice in the model, so there's nothing, no choice
7 there.

8 Atmosphere absorption. We chose the
9 lowest possible deduction. Ground effect, we
10 assumed that the ground was not going to interfere
11 with the direct wave. We took no deduction for
12 that. That's not often the case. Most people take
13 a three decibel correction for that. We did not.

14 We assumed no correction for barriers.
15 Yes, someone might have a barn between them and the
16 turbine, but sound can also -- realistically it can
17 reflect off of a barn, so we took no corrections
18 either way there.

19 Vegetation. Sometimes there will be
20 stands of trees between you and one or more of the
21 turbines. They may or may not have leaves on them
22 all year. To be conservative, we took no deduction
23 there.

24 In terms of meteorology, the ISO method is

1 stated to be for downwind conditions for a
2 temperature inversion, so it's fairly worst case.
3 So overall, we did a very, very conservative
4 analysis.

5 So just to summarize that, that part took
6 the loudest emissions, took the least amount of
7 deductions. We predicted for a condition of the
8 atmosphere that is known to produce relatively
9 higher levels, but we'll talk about this in a
10 minute. We compared all this to what we measured
11 because, so far, I'm talking theory. We wanted to
12 go back and see how does our theory match reality,
13 but I'll talk about that in a minute. Bottom line
14 is all the levels are below the Illinois Pollution
15 Control Board limits. And I think compared to our
16 predicted levels, the actual levels will be
17 definitely below.

18 There are a few critics of this whole
19 process. They will make claims and I do not
20 disagree with many of their claims. They say that,
21 hey, when GE goes out and measures those turbines,
22 they only spend a few hours, few days, maybe a week
23 and they may not capture all the atmospheric
24 conditions. That's true, they may not. They say

1 that the ISO method, yes, it's for a downwind
2 temperature inversion, but it may not be for that
3 one night a year or those two nights a year where
4 it's really a worst case. That's true, it may not.

5 I've had criticisms levied against me,
6 well, you should then tack on a safety factor, every
7 engineer tacks on a safety factor. My answer to
8 that is, yeah, if you do a standard analysis, maybe
9 you want to. But we didn't do a standard analysis;
10 we did a very conservative analysis.

11 I've seen criticisms that low frequency
12 noise travels better than ISO predicts. Again,
13 we're going to compare our results to real world
14 conditions to test that. I've seen it printed that
15 you shouldn't, you know, use average levels because
16 averaging kind of hides these instantaneous peaks
17 that might occur.

18 First of all, the Illinois Pollution
19 Control Board limits require you to do an hour
20 average, so I don't really have a choice there. But
21 as I'll show down the road, we took ten second data
22 and analyzed that to make sure that we weren't
23 missing something there.

24 So back to our California Ridge study.

1 Again, we have this model. It's based on a lot of
2 math and a lot of science. But it's a model
3 nonetheless. It's a prediction.

4 Let's look. We wanted to see how does the
5 model stack up against what we know to be very good
6 sound level data from actual operating turbines.
7 Again, we measured over three and a half months, we
8 captured a wide range of atmospheric conditions, and
9 the study was conducted in association with Mr. Paul
10 Schomer. He lives down in Champaign. He's a
11 40-year veteran in this field, very respected. And
12 the study was conducted to a very high degree of
13 professionalism.

14 So how did we stack up? In all of the
15 octave bands, if you remember back to those nine
16 bands that the Illinois Pollution Control Board
17 levies, in all of the bands except 500, our model is
18 overpredicting, so that's good. That means we're
19 even more conservative than we thought. Now at 500
20 hertz, it did actually underpredict by a decibel, so
21 I made sure we took that into account. Made sure
22 that we were at least a decibel below the limit.

23 Again, Illinois Pollution Control Board
24 says you must -- it's an hour average. That's the

1 law. But California Ridge, we actually measured
2 every ten seconds for three and a half months.
3 Every ten seconds the noise meter put the data into
4 memory and we looked at all of that data, and I took
5 the very loudest ten seconds of data to compare to
6 get these results.

7 So again, we're not trying to hide
8 anything that might be of a short-term nature. Just
9 by reference, when you do an airport noise study,
10 you're talking about a 24 hour average, and the
11 World Health Organization nighttime limits are an
12 annual average.

13 One more thing on the criticisms that
14 we've heard and seen in the press and whatnot, and
15 that is again related to the long -- you have to
16 measure for a long time. So California Ridge was
17 three and a half months. That's much longer than is
18 typical. Typical noise surveys are a day, three
19 days, a week, maybe two weeks, not but three and a
20 half months.

21 So on this project I'm working on in the
22 western United States, I've been measuring for
23 years. And when I first started on that project,
24 within the first year we said that the maximum level

1 was 41 to 42 dB.

2 So here's the data for that project for
3 the entire year of 2014 from January to October.
4 And it's smashed together so it's not contiguous and
5 this is all nighttime data. And what you see is the
6 level goes up and down and up and down as the
7 turbines are working hard or the atmosphere is
8 changing, but they're not bouncing up and down over
9 what we already know to be the maximum.

10 So we know what the maximum level is and
11 we know how to design for that and the levels will
12 in reality be less, and I never have seen any spikes
13 that opposition acousticians have talked about that
14 rise above the maximum level.

15 So I did ask myself, well, why do I not
16 see these claimed spikes and others do? Well, part
17 of the reason is I think that, again, you have to
18 measure for a long time. So we don't sit out in
19 these cornfields for three and a half months; our
20 meters do. So they're unattended. And so when you
21 measure, you're measuring everything: cars,
22 airplanes, trains, wind turbines, wind, birds,
23 everything. So you have to separate the wheat from
24 the chaff, if you will, because the Illinois

1 Pollution Control Board regulation is just turbines.
2 It says, well, what's the level of turbines, not
3 what's the level of everything.

4 So I've developed a number of methods that
5 -- let me back up. These graphs are from California
6 Ridge and each is an hour. So this is ten o'clock
7 at night and all of these are cars that are going by
8 on the roadway that's a few hundred feet from the
9 microphone. And interestingly, you can see at ten
10 o'clock at night, there's some traffic. Eleven
11 o'clock, a little less. At midnight, very little,
12 into the late, 1:00, 2:00, 3:00, and of course by
13 the time you get to 6:00, there's all kinds of
14 traffic again. So we have developed methods to
15 separate out the wind turbine noise, which is this
16 underlying data here from all these spikes.

17 One advantage I have when I'm working for
18 Invenergy or another turbine farm developer, I have
19 access to the data that tells me when the turbines
20 were operating and when they weren't. If you're an
21 acoustician working for an opposition group, you
22 often don't have that data. Having that data allows
23 me to better separate the wheat from the chaff, the
24 turbine from the non-turbine. And perhaps these

1 other people are missing some of that.

2 Okay. On to phase two of my talk. Thank
3 you for your patience. Talking now about infrasound
4 and low frequency noise. So back to our audible
5 frequency spectrum. It's from 20 to 20,000. So now
6 we're going to focus -- first, I'm going to focus on
7 low frequency, which is 20 to 200, and then we'll
8 get into infrasound which is zero to 20.

9 The primary points I'm going to make are
10 that wind turbines do indeed produce low-frequency
11 noise, they do indeed produce infrasound, but so do
12 a lot of other things. These noise levels are in
13 our environment due to traffic, trains, wind, all
14 kinds of different sources. I'm going to talk about
15 levels, noise levels.

16 I'm an acoustics guy. I'm the noise guy.
17 I will leave the health effect aspects of these
18 issues to the doctors.

19 All right, back to some Noise 101 real
20 briefly. Again, I mentioned earlier that the lower
21 in the frequency you go -- so these are high
22 frequencies. When you get to low frequencies, these
23 have a much longer wavelength. They can get to be
24 10, 20, 100 feet long. They do go through a house

1 more easily. So that's a true statement. Your
2 house is able to block out the high frequencies much
3 better than the low frequencies. People perceive
4 the difference in low-frequency noise more easily
5 than they perceive the difference in high-frequency
6 noise. That's a known fact. I admit that and I
7 agree with that. But by the same token, we don't
8 hear these low frequencies as well, as I illustrated
9 earlier with the higher allowable levels under the
10 Illinois Pollution Control limits.

11 So this lot here, I brought back the
12 Illinois Pollution Control Board limits and I've
13 brought back the loudest predicted Pleasant Ridge
14 levels and I've highlighted three octave bands that
15 cover our low-frequency noise range. And as you can
16 see, we are below the limit. And I think these
17 predicted levels are a little high based on our
18 comparison to California Ridge, so they're probably
19 more like down here. So in terms of low-frequency
20 noise, we meet the Illinois Pollution Control Board
21 limits.

22 Here, I'm comparing our predicted Pleasant
23 Ridge levels, but now we're talking inside because
24 I'm comparing it to a different criteria. It's

1 called the preferred noise criteria. It's used by
2 architects to design a facility like this. It's
3 like what is an acceptable level of noise inside.
4 And it's usually related to the ventilation system
5 or what have you, but I'm just using it as a guide
6 here.

7 So these, this is what architects consider
8 an acceptable level inside a residence. And so we
9 took our outside predicted levels and we used the --
10 the Netherlands, of course, has a bit of experience
11 with wind turbines and they have published a good
12 set of how much noise reduction does a house provide
13 over the frequency range. So not as much down low
14 and much more up high. So we used those to convert
15 our outside numbers to inside numbers to compare to
16 this inside criteria. And as you can see, we're
17 below that criteria.

18 So now I want to talk a minute about,
19 well, what low-frequency noise is out there as it
20 is? So this is a level, what's called a level
21 versus time lapse. So you have our three different
22 octave bands that are low-frequency noise range and
23 this is two hours of data taken at California Ridge
24 in November when the turbines were operating at full

1 capacity. In fact, the entire wind farm was working
2 at full capacity.

3 And so you can see that these spikes,
4 they're traffic, we know that. We listened to the
5 audio recordings. We looked at the frequency
6 spectrum. There was no question in our mind those
7 were traffic. So that's not what we're concerned
8 about. We're concerned about that this is what the
9 turbines are producing. So if you can see it's --
10 for the 31 hertz band, it's a little under 60. For
11 the next band, it's about 54. And then for the 125
12 band, it's about 47.

13 So this is all of the nighttime noise
14 levels in the 31 hertz band measured at California
15 Ridge just plotted out in time. So this is turbines
16 and it's winds and it's trains and it's traffic and
17 it's everything. I didn't doctor the data or remove
18 anything; this is just what is out there. And here
19 is what we know the turbines kind of max out at in
20 this band. So sometimes the turbines produce more
21 noise than what's out there, sometimes they produce
22 less noise, so they're roughly in the middle. So
23 low-frequency noise is out there, turbines or no
24 turbines.

1 We look at the next band, the 63 hertz
2 band. Once again, kind of in the middle of the
3 pack. And finally on the 125 band, we're actually
4 on, kind of on the low end of things. So traffic,
5 trains, et cetera, are producing more low-frequency
6 noise than the turbines will. Not at all times, but
7 overall they produce either less or more noise.

8 So lastly, this plot here is the threshold
9 of audibility that is used by almost every textbook.
10 It's part of standards. It was relied upon by all
11 the medical studies that will be talked about, or at
12 least most of them, so it's very, very well
13 documented.

14 So here are our maximum Pleasant Ridge
15 levels. Now, we only go down again to 25 hertz, so
16 we're talking about low-frequency noise right in
17 here. So when it's above the line, when the black
18 line -- the turbine noise is above the blue line,
19 you'll hear it. And when it's below, you won't. So
20 around 40 to 50 hertz, it will be audible.

21 So again, I'm not here to tell you that
22 these turbines are not going to be heard, that
23 they're not producing some low-frequency noise, but
24 they are just above the threshold of audibility.

1 And when you get below approximately 30 hertz or so,
2 30 to 40 hertz, they would be inaudible.

3 So in summary, on low-frequency noise, we
4 meet the Illinois Pollution Control Board limits.
5 We meet the preferred noise criteria. There will be
6 some audible low-frequency noise, some of it won't
7 be audible, and it's turbines produce low-frequency
8 noise in the range of what's produced by other
9 sources.

10 All right. My last subject. So again,
11 thanks for the patience. Let's talk now about
12 infrasound, so this is below 20 hertz, this is the
13 lowest of the low. This is a chart that was
14 recently produced by the South Australian
15 Environmental Protection Agency, and they're trying
16 to answer the same questions down there that we're
17 trying to answer up here in the States regarding
18 infrasound and turbines.

19 So they measured infrasound from a number
20 of -- in a number of places. Some of them were in
21 and around operating wind farms and some of them
22 weren't. So the whole idea here is, well, do wind
23 turbines produce a lot of infrasound or are they
24 kind of in the mix with what's already out there?

1 And that is indeed the case.

2 So these yellow squares are the ones near
3 the turbines. Just a word, this is a different
4 scale here. We -- it's kind of an infrasonic scale,
5 but I'm not concerned about the scale here. What I
6 want you to take away from this is here's the
7 turbines in between, say, 40 and -- - excuse me, I
8 guess that would be -- yeah, 50 to 60. Well, here's
9 a bunch of infrasound from sites that had no
10 turbines near them at all. And again, they are
11 similar, sometimes higher, sometimes lower.

12 Some of these other sites I think were
13 urban, so I'm not trying to compare to those, but
14 for these that are all down in agricultural
15 territory or open rural territory, again the levels
16 near the turbines were very similar to the levels
17 that were taken not near the turbines. And the
18 threshold of audibility on this dBg scale is right
19 here at 85. So you can see all the infrasound that
20 was measured near the turbines is below the dBg
21 audibility threshold.

22 So the Shirley Wind Project in Brown
23 County, I've spent many, many hours up there
24 measuring, analyzing that data. One of the surveys

1 that I did, we shut down the entire wind farm. A
2 lot of times when you do these infrasonic
3 measurements, the question is, well, are you
4 measuring the wind blowing against the house or are
5 you measuring turbines? And the only real way to
6 know that is to measure and shut the entire park
7 down and measure again in like -- within like a span
8 of minutes, you know, ten minutes, so that your
9 conditions are the same.

10 So I had the opportunity to do that. I
11 went to one of the homes that had been abandoned.
12 It was about 3,000 feet from a 2.5 megawatt machine.
13 Those are a lot bigger than what we're using on this
14 project. The wind farm was operating at 100 percent
15 capacity. And I took measurements with the entire
16 wind farm turned off in many different rooms of the
17 house. And then we brought the whole park back on
18 line and we measured again.

19 So I'd like to show you how those on and
20 off measurements compare. So I measured in four
21 different rooms. Here's the first one. The green
22 lines are with all turbines off and the red lines
23 are with all turbines on. And kind of circled this
24 lower range because that's what we're talking about,

1 this infrasonic range of 6.3 to 20 hertz.

2 Now, my measurements equipment on this
3 project only went down to 6.3 hertz. I didn't go
4 down to zero hertz or 1 hertz. That's just the
5 equipment I had at that time. But you can see with
6 all the turbines off, in the kitchen, the infrasonic
7 levels are actually highest with the turbines off.
8 With the whole park running, they're a little bit
9 lower.

10 You go to the living room. Now the green
11 line is kind of in the middle. So again, it's in
12 the middle of the pack. The levels were a little
13 bit higher with the turbines on for ten minutes or
14 so; a little bit lower; the off measurements are in
15 the middle of the pack.

16 Upstairs bedroom, middle of the pack once
17 again. Upstairs hallway, kind of similar, on the
18 high side here, but then in the very low range, the
19 off levels were the highest.

20 So I mean I'm not trying to say again that
21 infrasound from turbines doesn't exist. It's just
22 in this case with this wind farm operating at full
23 capacity, there's no clear indication to me that the
24 infrasound from the turbines was any different than

1 what was there without the turbines.

2 Okay. So back -- sorry about that. Back
3 to our threshold of audibility. So also at the
4 Shirley project back at the end of 2012, as part of
5 a hearing that was taking place for another proposed
6 wind farm in Wisconsin, the Public Service
7 Commission in Wisconsin put together a study and
8 commissioned four different acoustical consultants
9 to go and take the highest quality infrasonic
10 measurements that they could possibly take at a
11 house that had been abandoned near the Shirley Wind
12 Farm. So I consider these to be pretty much the
13 highest quality infrasonic measurements that have
14 been taken in this country from wind turbines. They
15 are incredibly below the threshold of audibility.
16 Like let's say at 10 hertz, they're 40 -- 60
17 decibels below. Down at 1 hertz, if this were to
18 carry over, maybe 40 decibels below the threshold.

19 Now, these levels were taken 1250 feet
20 from the 2.5 megawatt machine, so most likely higher
21 levels than we would experience on this project
22 because we don't have 2.5 megawatt machines; ours
23 are 1.7s.

24 I'd like to put into perspective the 40 to

1 60 decibel difference. That's -- in the noise
2 world, that's huge. We try to take -- we usually --
3 you know, 5 decibel change, 10 decibel change is
4 kind of significant. 40 decibels would be kind of
5 like the speed limit. If you had a road that was
6 posted at 60 and you just decided to drop the limit
7 to 20, it's that kind of change. So we are just
8 orders of magnitude below this threshold.

9 So back to what critics would say to this
10 analysis. And they would say, well, there must be
11 something wrong with your threshold. To that end,
12 some researchers named with the last name of Salt
13 and Hullar have conducted studies on guinea pigs
14 where they introduced into the guinea pig's ear
15 what's called a biased tone and they made a bunch of
16 assumptions and related that then to the human ear.
17 And they say that, well, as a result of our testing
18 on the guinea pigs, we think the threshold should be
19 lowered by 40 decibels.

20 Some more recent testing in Munich tried
21 to take the same kind of testing to the human realm.
22 And they did some testing with humans, but they used
23 really, really high levels, much higher than
24 turbines will produce. So I don't really see how

1 that's relevant. So what Salt and Hullar have
2 proposed is this lower threshold based on what's
3 called the outer hair cells. And those are within
4 your ear.

5 I'm not going to go into any detail, but
6 traditionally we have thought of sound getting into
7 the brain via what's called the inner ear cells.
8 Salt and Hullar have proposed that, well, in this
9 infrasonic region it's really the outer hair cells
10 that matter.

11 Here's a chart from their report, and here
12 is the traditional and accepted threshold of hearing
13 way up here, and here's their lower one based on the
14 outer hair cell theory. So I said, well, let's have
15 a look at our levels or the Shirley levels, which
16 again I consider to be very high quality. And you
17 can see down here in this infrasonic region, I mean
18 we're still -- we're still below that threshold. I
19 mean it's kind of -- even if you give people the
20 benefit of the doubt here, we're still below the
21 threshold.

22 Now, we do cross over the threshold down
23 here around 20, 30 hertz. Yes, I believe that --
24 you know, I believed that before and I still believe

1 that.

2 So I consider this a theory, this outer
3 cell, outer hair cell threshold, it's a theory.
4 They're good scientists I'm sure, but I don't see
5 how testing on guinea pigs, and us being so far
6 below even that, I don't see it as the aha moment
7 that the Internet seems to portray those results as.

8 All right, we're almost there. I think I
9 only have three slides left, just so you know. One
10 other theory that has been proposed to try to
11 explain the claims of health impacts due to low --
12 due to infrasound was based on a Navy study.

13 Back in the 1980s, the Navy noticed that
14 its simulator pilots were getting sick, they were
15 vomiting. And so they did a study. They said,
16 well, let's find out what's going on here. So they
17 put people in a machine that physically shook them
18 at various frequencies and at various intensities
19 for hours and they measured how long it would take a
20 person to throw up. And they -- - I have a hard
21 time getting my hands around this graph, so I don't
22 expect you to per se, but what they're saying is
23 when this curve dips, it took less time for someone
24 to vomit. And so right here in the zero to 1 hertz

1 range is kind of the sweet spot.

2 So this theory -- so Paul Schomer who I
3 mentioned earlier, he's a friend of mine, he's a
4 colleague, I respect Paul. He's the one that has
5 brought forth this theory. He has said, well, if
6 people are claiming to have health problems that are
7 similar to seasickness and the Navy had these people
8 getting sick and the frequencies and intensities
9 that we're talking about are the same, Paul has
10 theorized that maybe by shaking the body, that's the
11 same as the air shaking your ear, because, you know,
12 the turbines are creating these pressure
13 fluctuations, and he's saying, well, maybe that's
14 the same effect.

15 Paul himself calls it the motion sickness
16 hypothesis. He's throwing out a theory to be
17 discussed. Others have taken this as kind of
18 proven. And I don't even think Paul would make that
19 claim. Me personally, I find it hard to see how
20 shaking an entire body for 30 minutes up to eight
21 hours is the same as sitting in one's room and
22 having the air move. That's a big stretch for me as
23 an acoustician to take.

24 Furthermore, Paul says that once you get

1 above 1 hertz, you're no longer in the sweet spot.
2 And yet, some of the sickness claims have taken
3 place at distances and near turbines that don't
4 produce anything down this low. So to me, that
5 doesn't match up with Paul's conclusions. It's a
6 theory, but I'm having a hard time getting on board.

7 All right, this is my last point before a
8 quick summary. So this is a chart that was produced
9 by two acoustical consultants, one named Rob Rand
10 and Steve Ambrose. I know these fellows. I used to
11 work with them years ago. I like them, I respect
12 them; I just don't agree with their conclusions.

13 So what they did was, the base of this
14 chart is from the 1970s. The United States EPA
15 developed a method for predicting how communities
16 would react to a new source of noise. It was
17 largely centered on highways and airports.

18 My problem here is that Steve and Rob Rand
19 took this scale -- you can adjust this. The method
20 allows you to adjust this scale. They took all of
21 the corrections that you could possibly take and
22 they kind of, they said, yeah, you know, we're going
23 to take all the corrections, we're going to slide
24 the scale all the way over. And in the end, what

1 they concluded is if you have a project with wind
2 turbine noise levels here at, say, in the mid-40s,
3 like our project, you follow it up to this trend
4 line and you say that you can expect strong appeals
5 to stop the noise and you can expect widespread
6 complaints.

7 Also on this graph is the results of a
8 oft-cited research conducted by some Swedish and
9 Danish researchers which looked at a noise to wind
10 turbine noise. And again, they have taken that data
11 and thrown it over the scale that's been slid, and
12 they are saying that at our noise level, 45 percent
13 of the population will be highly annoyed by the
14 noise from wind turbines.

15 Now, again, in my opinion, this is just
16 postulation. They took a decades old procedure that
17 was geared towards highway and airport noise and
18 they slid the scale all the way over and they come
19 up with a rather dire projection. So I'd like to
20 compare, however, how that projection stacks up
21 against reality.

22 On the left side of the screen is a letter
23 that we received from the Cayuga Ridge project which
24 states that since 2010, when they began operating,

1 they have had no noise complaints. Zero. There's a
2 company called Hessler and Associates. They are
3 acousticians like myself. They've done many, many
4 wind turbine studies. They claim a range of 2 to 5
5 percent. And a quick correction, I was reading my
6 notes this morning or yesterday, and I came across a
7 different number of 2 to 7. So I will -- let's call
8 that 2 to 7.

9 Health Canada recently -- you'll hear more
10 about this study -- developed a large study that
11 just came out. They issued -- I forget the number,
12 but it was hundreds if not a thousand
13 questionnaires, but that's subject to check. But
14 what they found is they studied two provinces.
15 Prince Edward Island, 6 percent of the people
16 responded that they were bothered by noise. In
17 Ontario, 16 percent responded similarly. But there
18 was a lot of anti-wind turbine information being
19 circulated which can influence the results.

20 In Benton County, Indiana, Purdue
21 conducted a study and they went out and asked
22 hundreds of people what they thought. And 7 percent
23 said they sometimes felt bothered by the noise. And
24 these are all people that live in wind farms. These

1 are not people that live, you know, miles away.

2 So the 45 percent projection does not at
3 all stack up with reality; certainly not here in the
4 Midwest.

5 Okay, this is it. This is my last slide.
6 It's a summary. For this project, for the Pleasant
7 Ridge project, we have sited the turbines at least
8 1500 feet away from residences. We used a noise
9 prediction methodology that is much more
10 conservative than is typically used in this country.
11 We looked at low-frequency noise and we found that,
12 yes, they could be audible. And critics will also
13 say they have a modulation component. Modulation
14 means the level goes up and down. And that is true.
15 When the blades pass by the mast, you'll hear the
16 whoosh, so it kind of has a little bit of an up and
17 down. So again, the levels are there, but they're
18 low.

19 In terms of infrasound, we're below the
20 accepted threshold and we're even below some
21 proposed thresholds. And operating wind farms have
22 been shown to not produce significant complaints.

23 Thank you very much.

24 MR. BLAZER: For the record, Mr. Cornale,

1 we have collated sets of exhibits.

2 CHAIRMAN CORNALE: Very good.

3 MR. BLAZER: For Mr. Hankard, they would
4 be 46, 47, 48, 49, 50, 100 and 120.

5 CHAIRMAN CORNALE: All right. All right,
6 the County will accept Pleasant Ridge Exhibit 46 as
7 Hankard curriculum vitae. County will accept
8 Pleasant Ridge Exhibit 47 as the Pleasant Ridge
9 sound study. The County will accept Pleasant Ridge
10 Exhibit 48 as the California Ridge noise report.
11 County will accept Pleasant Ridge Exhibit 49 as the
12 Australian EPA study. County's already accepted
13 Hankard presentation, 50. County will accept
14 Pleasant Ridge Exhibit 100 as the Cayuga complaint
15 report, the letter from Iberdrola. And the County
16 will accept Pleasant Ridge Exhibit 120 as Wind Farms
17 in the Rural Midwest by Mulvaney in 2013.

18 MR. BLAZER: Mr. Chairman, the next
19 witness has five boxes of documents. I suggest we
20 might want to take a ten minute break.

21 CHAIRMAN CORNALE: I would agree. Yeah,
22 I've got a quarter after 7:00. Let's try to come
23 back at 7:30. 7:30, so about a 15 minute break.
24 Grab something to drink, hit the bathroom, we'll get

1 going right away. Thank you.

2 (Recess at 7:15 p.m. to 7:30 p.m.)

3 CHAIRMAN CORNALE: Had a few questions
4 from the audience about the process. Just a quick
5 note. So the applicant is presenting their
6 information. When they're complete with that, when
7 they finish, the Zoning Board has the opportunity to
8 question, the audience has the opportunity to
9 question, counsel has the opportunity to question
10 any of their witnesses. That will happen after they
11 get done presenting.

12 We've done it different ways. Sometimes
13 the questions add to the evening and we don't get
14 through any of their presentation and we get
15 inundated with questions. So we just found this
16 particular method will work the best. So again, I
17 said last night, and Mr. Blakeman, he explained the
18 process, if you have questions, jot them down.

19 The one thing that will -- - we will be
20 strict about is you will have a question of the
21 witness. That's not your opportunity to present
22 testimony or your information. It's your
23 opportunity to ask a question of their witness.
24 Okay? I hope that helped. If I didn't help, ask me

1 again and I'll try to explain it better.

2 With that, Mr. Blazer.

3 MR. BLAZER: Mr. Chairman, do we go -- did
4 we go through the Hankard exhibits?

5 MR. LUETKEHANS: Yes.

6 CHAIRMAN CORNALE: Yes, we did, I accepted
7 them.

8 MR. BLAZER: Okay.

9 CHAIRMAN CORNALE: In front of me, I have
10 Pleasant Ridge Exhibit 96, which we will accept as a
11 presentation by Mr. Mark Roberts, M.D., Ph.D.,
12 entitled Wind Turbines, Low-Frequency Noise and
13 Public Health Impacts.

14 MR. BLAZER: And our next presenter will
15 be Dr. Mark Roberts.

16 MR. ROBERTS: Now it's on. Thank you. My
17 name is Mark Roberts, as this slide says. I'm a
18 physician. I'm also -- have a Ph.D. in epidemiology
19 and biostatistics. I'm licensed to practice in
20 three states: Wisconsin, Illinois and Oklahoma. I
21 carry professional experience. I spent 17 years in
22 the State Health Department in Oklahoma doing
23 rabies, scabies, head lice, asbestos, and issues
24 around landfills and hazardous waste sites. So I

1 kind of bring all this experience with me to where I
2 am today. I'm the center director and principal
3 scientist at a company called Exponent. I have an
4 office in Chicago.

5 And so basically what I've been asked to
6 do is come here tonight and talk about the science
7 associated with wind turbines. This is not the
8 first time I've done this. In the second slide, it
9 lists the projects that I've been involved in. I do
10 other things besides wind turbines. In fact, this
11 is a very small part of what I do in consulting
12 practice at Exponent in Chicago. But basically one
13 of the things that I do is I usually ask a question.
14 Does X cause Y or is X associated with Y?

15 In this particular situation, I was asked
16 is there health effects associated with wind
17 turbines? So what I do is I go into the literature
18 and I use my training as an epidemiologist and my
19 training as a physician and experience of 35 plus
20 years of being in public health.

21 What is an epidemiologist? An
22 epidemiologist is a person that is trained in
23 finding the reasons for various conditions. Usually
24 it's health conditions, but it could be other

1 things. There are epidemiologists that study
2 agricultural issues, automobile accidents. Why are
3 fire trucks not always red, sometimes they're
4 yellow? That's because the epidemiology of
5 accidents involving fire trucks indicates that
6 yellow fire trucks are more visible than red, but
7 red is traditionally the color of a fire truck.

8 So the other thing is the fact that the
9 opinions I've given at various times have showed up
10 in other court actions and that sort of thing
11 indicating that my opinions have been accepted by
12 the federal government and also in U.S. Federal
13 Court. Most recent was in Tule, California,
14 involving a wind turbine project there where I
15 gave -- they cited testimony that I had given while
16 in Wisconsin. So it's not just that I've said it,
17 but it's been approved, it's been repeated in
18 various activities, such as federal court.

19 That's enough about me. Let's talk about
20 what we're here about tonight, and that's really
21 about noise. You heard a very good discussion about
22 noise. Lots of numbers. And I'm not going to go
23 over those again because that's not my area. My
24 area is actually human response to it and the

1 literature around it.

2 But the thing to keep in mind as we talk
3 about this is frequency of that noise. We've heard
4 about the infrasound, we've heard about regular
5 sound, so it's also about sound pressure. And now
6 I'm not an acoustics person, but sound pressure to
7 me is volume. And then we talk about duration of
8 exposure, and that's important to me as a physician
9 in the fact of how long a person's exposed to it.
10 For example, in an explosion, there's forces
11 associated with that explosion, but it's very
12 instantaneous. And then finally the receptor, what
13 is the person -- in this situation, we've heard
14 about guinea pigs, but we're going to talk about
15 people primarily, and what's the person's response
16 to that sound, that noise.

17 One of the things just to keep in mind,
18 sound is all around us. Right now in this room, my
19 voice in this room is about 55 decibels, something
20 like that, maybe 60 depending. But noises are all
21 around us. But we also use noises. Physicians
22 listen to your heart, listen to your lungs. There
23 are fetal monitors that can listen to the heartbeat
24 of a baby through a mother's abdomen.

1 So we use noises, we use sounds in a lot
2 of different ways, sometimes therapeutic.
3 Ultrasound, for example. But also volume movement
4 makes noise. Your muscles make noise when you
5 contract. When you contract your arm, your biceps
6 muscle makes a noise. The blood going through your
7 veins, your arteries, makes a noise. So we're
8 surrounded by noise. Many times it's noise that we
9 can't hear. This just depicts some of the more
10 dramatic areas of infrasound.

11 Infrasound is all around us, as Mr.
12 Hankard stated, but really the point is that noise
13 is all around us. The key to that is the fact that
14 we don't always hear it. We don't appreciate it.
15 We don't respond. Our sensory system does not
16 respond to it. Now, this is -- again, I'm not going
17 to repeat what Mr. Hankard said, but this is to
18 point out that it's not just the frequency. You
19 hear about infrasound, low frequency sound, that
20 sort of thing. The point being it's the pressure.

21 How much volume do you need -- pardon me,
22 I'm going to take volume. How much volume do you
23 need to appreciate that sound? And we can see from
24 this table it takes a high volume, a high decibel to

1 appreciate some of the lower frequency sounds. It's
2 important to remember that it's not just frequency,
3 but it's also the pressure.

4 Now, there have been noise concerns as
5 long as there's been written documentation. Believe
6 it or not, there were health concerns about
7 telephones. There's a thing called telephone
8 tinnitus, telephone ringing in your ear. Not the
9 ringing of the phone, but the fact that it would
10 cause ringing of the ears. There's also things
11 about cars, the unheard sounds of cars. So it's not
12 new to have health concerns about noise.

13 Now, one of the things is what are of the
14 qualities, and when we get into the literature,
15 we're going to talk a lot about annoyance, but the
16 thing is annoyance is common, it's a normal
17 response. And one of the things to keep in mind,
18 I'm not saying a person's crazy, but I'm saying it's
19 a normal response. When a baby cries, for a mother
20 it might be reassuring that the baby is breathing
21 and doing well. It might be that the baby's hungry.
22 It might be that the baby's diaper needs to be
23 changed. Those are all responses as a result of
24 that sound.

1 The father, or maybe the mother, watching
2 football or basketball hears a cry and may be
3 annoyed that they have to get up right at the point
4 in the game when they have to go check the baby.
5 Those are all responses to a noise, a sound.

6 So sounds can create feelings in a person,
7 emotion. Movies, for example, use sound tracks to
8 stimulate certain responses in the viewers. They
9 also can use sights as well as smells. So each of
10 these produce a set of emotions that -- baking of
11 bread, for example, or the cooking of an apple pie,
12 these all stimulate a certain response. So I'm
13 saying literature -- medicine tells us that
14 annoyance is an emotional response to stimuli.

15 Now I always like this sign. That guy
16 didn't last very long probably at the highway
17 department, but it brings the point to the fact that
18 we get annoyed every day at something. Somebody
19 cuts us off, somebody's playing loud music. But the
20 whole thing is the fact that, as my example with the
21 baby crying, sometimes that creates a negative
22 response and sometimes it creates a positive
23 response in that individual.

24 Dr. Leventhall out of the UK is a senior

1 person in the science of sounds and response, and he
2 has pointed this out in a number of his publications
3 concerning the perception of noise and the emotional
4 response.

5 So we've got the situation where annoyance
6 or an emotional response is attributed to a
7 particular impact, say, wind turbines for example,
8 and about negative attitudes towards those. What
9 we're seeing is a growing body of literature,
10 peer-reviewed science literature indicating that
11 there's definitely an association of annoyance with
12 the response to various stimuli, whether they be
13 roads, airplanes, airports or wind turbines. That
14 body of knowledge is growing and we're being able to
15 use it.

16 But I've got to go back and point out that
17 this response to noise is normal. Doesn't feel good
18 sometimes. Sometimes there's anxiety. Sometimes
19 there's fear, happiness or even anger. But the
20 point being these are normal responses and they're
21 also conditioned responses.

22 So wind turbines annoy us. As Mr. Hankard
23 pointed out, wind turbines have a noise associated
24 with them. Everybody that's visited a wind farm

1 site has heard this. But the thing is that is part
2 of our environment, and the fact that responding to
3 that, that is a signal of what might be annoying to
4 that individual.

5 Now let's put that sound in perspective.
6 I talked about the sound in the room. We've heard
7 about the sound of turbines at various points, and
8 understand that's 1500 feet, it could be another
9 sound level at 1250 feet, there could be sound right
10 at the hub, but the point being that there's noise
11 around us all the time in different frequencies.

12 And so this is another example like the
13 thermometer that Mr. Hankard showed. For example,
14 this just points out the importance of understanding
15 that noise, sound, is around us all the time. It's
16 something that we experience every day. And when we
17 experience it, normally it's not a problem unless
18 it's associated with a particular feeling or
19 emotion.

20 Now, the Internet has brought out a lot of
21 information. This evening, I Googled wind turbine
22 health and I hit 5.6 million sites on the Internet.
23 Now I didn't go through all of those, but you can
24 imagine how much information is out there. And it's

1 very important to keep in mind that that's got to be
2 evaluated carefully.

3 Now, there are some theories out there,
4 some hypothesis about how wind noise and noise in
5 general affects individuals. And these are
6 interpretations. And sometimes they're
7 misinterpretations. Sometimes they use information
8 from guinea pigs to reflect on what humans might
9 respond to. EPA does not use animal studies when
10 there are human studies available for comparison.
11 There have been situations where researchers have
12 applied other types of information to the issues of
13 wind turbine noise.

14 For example, the Schomer example that was
15 used just a minute ago involving the Navy pilots,
16 those were young recruits that they shook them
17 intensely in order to produce that. Two other
18 things. Work by Dr. Ingber involving mechanical
19 transduction, that particular work has been applied,
20 attempted to be applied to response to wind turbine
21 noise, but, in fact, Dr. Ingber has said it does not
22 apply. Same thing with Mulvihill's work in
23 tensegrity, which again that has -- it's a great
24 name, it's scary, that sort of thing, yet it does

1 not apply to wind turbines. It was applied in
2 another particular area.

3 So the point is that really you've got to
4 be careful when you look at material, whether it be
5 on the Internet or in books or in the literature. I
6 would point out, and I think it's something that we
7 all need to consider, is the fact that information
8 is not knowledge. What you see on the Internet is
9 not peer-reviewed. It's not reviewed by anybody
10 usually. It's somebody's idea. So it's very
11 important to understand the source of the
12 information used, and there's got to be some way to
13 validate it, some way to give it some weight.

14 And the thing that we use as scientists is
15 a thing called the peer review process. That is
16 where a researcher goes out and does a study,
17 submits it to a journal. That journal then submits
18 it to a review board that's blinded to the author
19 that has knowledge that can be applied to it, and
20 there's a critical process where they're saying is
21 this a good study, is this one that should be in
22 that particular journal.

23 The thing is that various journals have
24 different standards. So you might get it accepted

1 in one journal but not another. So it's very
2 important to understand that not all journals are
3 created equal.

4 The other thing is to understand that in
5 the Internet or, for that matter, talking to
6 individuals, they could be very persuasive, but
7 you've got to guard against the use of volume
8 instead of veracity. I'm always reminded talking to
9 somebody that doesn't understand English, English is
10 not their first language, we always tend to talk
11 louder to them thinking that we're going to get them
12 to understand us better. That's not the situation
13 in that example or in science.

14 So let's look at it a little bit more
15 carefully as far as the scientific method because
16 what we're doing is we're looking at the
17 peer-reviewed published literature concerning
18 exposures to noise and specifically noise related to
19 wind turbines. The scientific method is one where
20 really science is trying to determine causation.
21 There's a difference between association and
22 causation. Again, those are misused and used
23 interchangeably in the Internet, but really you have
24 to be very careful about that.

1 We could look outside, let's say tonight
2 in this example, and we saw out of the next ten cars
3 that passed us, that five of them were yellow. Does
4 that mean that 50 percent of the cars in Pontiac are
5 yellow? No, that's just we have seen that it's
6 associated with this particular building at this
7 particular time. That's an observation.

8 Scientific method is that researchers make
9 a series of observations, they publish it, that
10 forms a body of knowledge that can be used then to
11 determine about causation, but those scientific
12 studies start with a hypothesis. I had a
13 hypothesis. Five yellow cars out of the ten that
14 went past the building were yellow. My hypothesis
15 was that 50 percent of the cars that go past -- or
16 that are in Pontiac are yellow. So we've got to
17 test it. So everybody goes out and counts the color
18 of cars. Then we begin to get a body of scientific
19 knowledge and we put it together.

20 And that's what we're going to talk about
21 next as far as wind turbines, is the fact that there
22 is an effort in the literature to answer the
23 question of whether or not there are health effects
24 associated with wind turbines.

1 Now I talked a little bit about
2 epidemiology and what I do, but here's the official
3 definition. It's the study of the distribution of
4 determinants of health-related states or events for
5 a specific population. Epidemiology of the yellow
6 cars, for example. It could be heart disease, it
7 could be cancer, it could be any number of things,
8 but that's what we study in epidemiology; specific
9 techniques, specific study designs that are used.

10 Let's talk specifically about wind
11 turbines because one of the things is, as an
12 epidemiologist and as a physician, in order to look
13 at the science, you really need to get into what
14 you're looking at, what are the parameters of the
15 exposure.

16 And wind turbine noise, there are two
17 things that come up. One is the mechanical noise
18 and one is the aerodynamic noise. Now, I'm saying
19 this as a layperson here in this part because I'm
20 not an expert in the sound measurements and that
21 sort of thing, but I have to look at it in terms of
22 what's in the literature. And as a scientist, I
23 have to evaluate what sort of measures they use in
24 order to evaluate exposure.

1 So one of the things that comes up in
2 looking at the literature, that over time wind
3 turbines have changed. They've gotten -- mechanical
4 noises have been decreased. Aerodynamic noises have
5 been decreased. The noise levels in general in the
6 newer turbines are better or lower than they were in
7 the older ones.

8 So again, as a scientist, as an
9 epidemiologist, I've got to be careful as I look at
10 the literature to make sure that that's not a
11 compounding factor in evaluation of those studies.

12 So what I've done is gone in and pulled
13 out the majority of the studies that had been used
14 to evaluate the question that I was asked. It's
15 very important to understand that there's -- this is
16 a limited volume of literature, it has been
17 evaluated by a number of different agencies, but
18 this is the best data available.

19 So in addition -- these are really
20 cross-sectional. They go in and they do a survey of
21 individuals in, say, a wind farm and there is a
22 range of credibility or value of these studies, but
23 the point being that these have been used for the
24 evaluation.

1 In addition, there's some very interesting
2 studies that are done. Another way of looking at
3 wind turbine noise is to expose people to it in a
4 controlled manner. The lower three studies did just
5 that. They went in and exposed individuals to
6 recorded wind turbine sound noise and to a sham, but
7 they didn't tell them what they were doing other
8 than the fact that they were exposing them to a
9 level of sound. But what they did is they also
10 created expectations by showing them either a video
11 or explaining to them about the study that was one
12 of testing for the effects of wind turbines.

13 And what they found was that that
14 suggestion was a very -- it was positively
15 associated with their response to that sound.
16 That's important in the fact that there was a
17 controlled exposure to that sound and a -- so it's
18 called a randomized controlled trial.

19 Some people were exposed to the wind
20 turbine sound first. Some of them were exposed to
21 the sham first. So it really is a very powerful
22 method of testing for a response. This is used all
23 the time in drug testing, for example. And so what
24 we see here is this clearly indicates that a

1 person's perception of the exposure is very
2 important. Again, that is a normal response that we
3 have as humans.

4 Now there's been two recent reviews. I'm
5 going to talk about a whole series of reviews that
6 have been done, but it's important to point out that
7 there's a growing body of literature out here
8 indicating the magnitude of the studies and the fact
9 that there is no adverse health effects being
10 associated with wind turbines in the literature.
11 But these are the international reviews.

12 So you've got the researchers in that list
13 I showed you. Then you've got how that information
14 is used. And today, governments and -- state,
15 local, federal and national governmental
16 organizations look at this literature and are trying
17 to answer the very question that you are being posed
18 with tonight, and that is about is there an effect
19 of wind turbines on -- a health effect of wind
20 turbines.

21 As you see, it's quite a varied group.
22 These are all governmental organizations, they all
23 use a panel, they use the peer-reviewed published
24 literature, and they evaluate it much like I have.

1 This is -- I'm going to go through some of
2 these in more detail. You've got copies of all of
3 them, I believe, in the stack. But Health Canada
4 just came out with one and this one is a little bit
5 different in the fact that there was a review with
6 it, but they also did some studies on their own.
7 And again, they really pointed out what they came
8 across with was the fact that annoyance is a very
9 important part of what is driving the health
10 concerns revolving around wind turbines.

11 It was very interesting that the
12 Australian Medical Association again in 2014 came to
13 a very similar conclusion. This is interesting in
14 the fact that these are physicians in Australia.
15 There's a lot of interest in wind turbines in
16 Australia and certainly very active individuals that
17 are against wind turbines.

18 It's very interesting that the Australian
19 Medical Society came out with the point that there
20 are not adverse health effects associated with wind
21 turbines.

22 These are -- the states have even gotten
23 into the evaluation of potential health effects. We
24 see Minnesota, Vermont, Massachusetts. We'll hear

1 more about Massachusetts in just a minute, because
2 one of the individuals involved with the
3 Massachusetts study is actually going to address
4 you.

5 But again, they're using the information,
6 they're looking at it independently. We even have a
7 panel here in Illinois that has looked at it. I was
8 part of the Wisconsin effort. And they basically
9 all talk about the annoyance. They all talk about
10 the health concerns that are voiced. But again,
11 they point to the fact that there's no consistent
12 scientific evidence of an association.

13 So it's really, again, multiple people
14 looking at it from multiple different directions and
15 coming up with basically the same conclusion. And I
16 think that that's very important as we look at not
17 only the science they're using, but the process that
18 they're using to come up with these opinions.

19 Minnesota was interesting in the fact that
20 they're one of the first. And again, they come up
21 with talking about the hypothesis of the vestibular
22 stimulation system. And again, more information has
23 come out since 2009. And that's the second part of
24 my point here is the fact that not only do wind

1 turbines change over time, but also as these panels
2 review the scientific information, they begin to get
3 more information that they can use and strengthen
4 the opinion and the science and use the strengthened
5 science in making that opinion.

6 I talked a little bit about Massachusetts.
7 Here we have Maine. Again, went through their
8 review process independent of the other states. The
9 panels are different. They use -- look at the
10 information. They use a very similar process to go
11 through it and to question the science. And they,
12 too, came up with a very similar conclusion.

13 This is the one from Illinois. Again,
14 this is 2012. So more information is available and
15 they're coming up -- we're beginning to see a
16 commonality of these panels of experts. They
17 include physicians, they include acoustical
18 specialists, some of them include community members,
19 as well as industry representatives. So it's a
20 mixed group. There's no uniform pattern to how
21 these groups come together. But in the material
22 I've provided you with, it gives you the details of
23 how these panels come together and what information
24 they've used.

1 Again, here's Oregon in 2013. It's in the
2 pack. And again, they come to a very similar
3 conclusion. There are some variations in what sound
4 levels that they discuss and recommend. But again,
5 the question is for this panel: Is there a health
6 effect associated with wind turbines?

7 Wisconsin. Again, Wisconsin just came out
8 with their latest report October 31st, 2014. So
9 again this is evolving. But yet we see a trend now
10 in all the review of the material that's available
11 and each review panel come up with very, very
12 similar conclusions when they review the material.

13 This is Tule. Again, they used
14 information that I provided in 2009. And this also
15 got into the issue of Dr. Pierpoint and the coining
16 of the term "wind turbine syndrome," which is not a
17 recognized medical condition. And it's very
18 important, this has gotten a lot of media play, a
19 lot of play on the Internet. And you -- it is not a
20 disease, it's not a diagnostic criteria; it's merely
21 one person's hypothesis.

22 Remember, I talked about doing an
23 epidemiology study based on the hypothesis. Her
24 hypothesis talks about the fact of low level

1 airborne infrasound and its effect on the vestibular
2 system, which we mentioned prior to that, that's the
3 balance system of the body.

4 The second one is about the effect of
5 infrasound on internal organs, such as the diaphragm
6 and the lungs. Again, these are hypotheses that she
7 has proposed in a self-published book that was put
8 out several years ago.

9 Let's look at those points more carefully.
10 There's no credible science to base her initial
11 hypothesis about the wind turbine sounds and the
12 vestibular system. In fact, really when you look at
13 it, that level of sound is lost in the background
14 sound that our bodies produce, not just the sound
15 from the outside. So it doesn't hold water.

16 Let's look at the second hypothesis. This
17 is the one about the shaking of the diaphragm and
18 that sort of thing, internal organs, based on her
19 hypothesis related to low frequency sound. Again,
20 the body has a number of sources of sound at this
21 level, so why would external sounds affect the
22 internal body when the internal body is making those
23 same sort of sounds? It doesn't make sense. But
24 this hypothesis has been put out there and it's one

1 that has to be considered.

2 So how do you do that? Well, you look at
3 the various -- what's the study design? What did
4 she do? She testifies that she has actually tested
5 this. In fact, she did a case series of interviews
6 and she talked to 34 subjects. She advertised on
7 the Internet and that sort of thing to get these
8 individuals to contact her, and they're from around
9 the world, those 37.

10 But one of the things that she did in her
11 book, she says a before and after study, that is
12 where she asked them did they have the symptoms
13 before the wind turbines came in or after. That is
14 not an acceptable design to test that hypothesis.
15 It's not an effective and accepted design to test
16 anything.

17 So -- but the other thing is the fact the
18 way she collected the information is also very
19 important to look at. There was a selection bias.
20 And you have to understand that, again, is a normal
21 process. A person that feels that they're affected
22 by any particular activity is more likely to report
23 it.

24 Second one is information bias. Just how

1 is that information collected? It can be very much
2 affected by the individual's perception of the
3 exposure. And if that information is not collected
4 from both affected individuals and non-affected
5 individuals in the same manner, you will have
6 information bias.

7 So really and truly when we look at it,
8 Dr. Pierpoint's wind turbine syndrome has not been
9 peer-reviewed in the scientific literature like the
10 other studies that I've talked about. It just
11 doesn't hold water medically. It's published in a
12 book and I have a copy of it and I've read it, but
13 it's a self-published book and it's -- the peer
14 reviewers, one of them was her husband and then two
15 friends.

16 So the point being that I'm concerned
17 about the use of the words "wind turbine syndrome"
18 because it actually directs an individual to think
19 there is a condition when, in fact, there may be
20 another condition affecting them, which we'll hear
21 about a little bit later when Dr. Ellenbogen talks
22 about independent medical evaluations.

23 Now the other thing is that we heard
24 something about shadow flicker. And this is --

1 again, it's a real phenomenon. Anybody ever watch
2 the old movie Casablanca? There's a scene in the
3 restaurant where the light is above the fan and
4 there's a flicker in the room. We've seen that at
5 various activities. Strobe lights, for example, or
6 mirrored balls in dance halls. But the point being
7 that this is -- there's a subset of the population
8 that are affected adversely by flashing lights, and
9 it's about 5 percent of the population.

10 It's called photo-sensitive epilepsy, but
11 the point is, and it goes back to, very similar to
12 what I was talking about noise, the fact that
13 there's certain frequencies that are associated with
14 that. And as the United Kingdom Epilepsy Society
15 addressed this because of concerns, and they're
16 talking about there has to be a flashing speed of
17 three flashes per second in order to trigger it.
18 Well, we know that wind turbines -- normal wind
19 turbines rotate at between .6 and 1 hertz, which
20 does not meet that standard.

21 In fact, in the U.S., they talk about 10
22 hertz is more likely to cause epileptic seizures.
23 And an example is the strobe lights used in light
24 shows are around 3 hertz. So we don't see

1 photo-sensitive epilepsy in those situations, and we
2 would not see it in wind turbine flicker either.

3 Now, what's going on? Why do we see this?
4 Why the annoyance? Now, I talked about annoyance
5 being a normal response. Sometimes it can be an
6 abnormal response to a normal sound. But it's
7 there, it's a condition. This is not new to
8 medicine. We talk about the placebo effect. If you
9 think a drug is going to help you, it has a better
10 likelihood of reducing your symptom than if you
11 don't think it does. That's called the placebo
12 effect.

13 There's also called a nocebo effect.
14 Didn't make it up; it's in the literature. And that
15 is if you feel there's going to be an adverse effect
16 from the drug, you're more likely to report that
17 adverse effect, you're more likely to feel it. And
18 this is very, very similar.

19 Remember when I was talking about those
20 studies where they exposed the individuals to sham
21 sound versus wind turbine sound and preconditioned
22 them with information about wind turbines. You can
23 affect the person's perception of a sensory input,
24 whether it be smell, sound, or sight for that

1 matter. So it's not new. What we're seeing in the
2 literature is not new, and it's something that the
3 scientific literature, the peer-reviewed literature
4 is addressing.

5 Is it addressing it as fast as everybody
6 would like and have the definitive answer forever
7 and ever? We're continuing to get information. But
8 the information continues to indicate that there's
9 no adverse health effect from wind turbine
10 exposures.

11 So this is really the important thing.
12 You look at these studies that have been done.
13 They've been done in different countries, they've
14 been done by different methods, different
15 researchers. This information has been reviewed by
16 international panels, by state panels. They each
17 come out with a very similar conclusion. They're
18 not identical conclusions, I never would say that,
19 but what they do is they point out that overall
20 there is an association between wind turbines and
21 annoyance.

22 No question. People are irritated. Some
23 people are irritated -- you saw that percentage that
24 Mr. Hankard put up there concerning maybe 16

1 percent. I don't think it's 45 percent, I would
2 agree, I think that's wrong, but I think that what
3 we do see is in the peer-reviewed literature that
4 there's clear indication of no direct effect of
5 adverse health effects from exposure to wind
6 turbines.

7 The epidemiology is there, the controlled
8 study which I talked about, very interesting in the
9 fact that they exposed individuals to wind turbine
10 sound pre-recorded, but they had to get it reviewed,
11 that study had to be reviewed. Normally we review
12 all studies involving human subjects. That study
13 had to be reviewed before they could do it and it
14 was approved that they could expose these
15 individuals to wind turbine sound for this study.
16 So again, that gives us some indication of what the
17 scientific feeling is for the noise associated with
18 wind turbines.

19 So what I'm saying is the fact that the
20 literature is clear. I've provided it to you. It's
21 been looked at in a number of different fashions,
22 and there is not a substantiated indication of
23 increased risk of adverse health effects associated
24 with wind turbines. Thank you.

1 CHAIRMAN CORNALE: Thank you, Mr. Roberts.
2 One quick question just about your Power Point.
3 Were Vermont and Massachusetts scientific review
4 panel and findings, did you go through those and I
5 just missed those? They were in our packet and I
6 want to be sure.

7 MR. ROBERTS: Yes, I did.

8 CHAIRMAN CORNALE: You showed them up
9 there?

10 MR. ROBERTS: I showed them up there.
11 Vermont is up there.

12 CHAIRMAN CORNALE: Can you scroll us back
13 to the slide? That way -- otherwise, we may have to
14 amend this. Okay, very good.

15 MR. ROBERTS: All right?

16 CHAIRMAN CORNALE: We missed them. Thank
17 you.

18 MR. ROBERTS: Not a problem.

19 MR. BLAZER: With that, Mr. Chairman, it's
20 three large piles. They are Pleasant Ridge Exhibits
21 51 through 95 are the studies, reports and analyses
22 that Dr. Roberts identified. 96 you already have,
23 that's his presentation. And 97 is his c.v.

24 THE CHAIRMAN: All right.

1 MR. LUETKEHANS: Do you want -- do you
2 want to note that 56 is not the full study?

3 MR. BLAZER: Oh, that's right, thank you,
4 counsel. Our Exhibit 56, just for the record, is an
5 excerpt from the Tule wind environmental impact
6 statement, environmental impact report. The total
7 report is 7,204 pages long. The excerpt is
8 approximately 300 pages long. It's that excerpt
9 that is our Exhibit 56. We've made the entire
10 report available digitally. Excuse me,
11 Mr. Luetkehans has one. Mr. Blakeman has one.
12 Mr. Griffin has one. I think I gave one to --

13 CHAIRMAN CORNALE: It's my understanding
14 that that will be available --

15 MR. BLAZER: Mr. Schopp has one.

16 CHAIRMAN CORNALE: -- on the County
17 website.

18 MR. BLAZER: The full-sized one.

19 CHAIRMAN CORNALE: Yes.

20 MR. BLAZER: It's roughly 400 megs, but if
21 you want it, that's fine. Just so it's clear, 56 is
22 an excerpt from that full report.

23 CHAIRMAN CORNALE: All right, I'll go
24 through these real quick for the record. We can

1 make this available to the court reporter, too, this
2 sheet, so that if you miss something.

3 Okay. Pleasant Ridge Exhibit 51,
4 Minnesota Department of Health 2009. Pleasant Ridge
5 Exhibit 52, Vermont Department of Health 2010.
6 Pleasant Ridge Exhibit 53, UK Health Protection
7 Agency 2010. Pleasant Ridge Exhibit 54, Ontario
8 Chief Medical Officer of Health 2010. Pleasant
9 Ridge Exhibit 55, KFL&A Public Health 2011.
10 Pleasant Ridge Exhibit 56, the Tule EIR/EIS, excerpt
11 only, 2011. Pleasant Ridge Exhibit 57 is a
12 Springfield/Sangamon County Regional Planning
13 Commission 2012. Pleasant Ridge Exhibit 58 is a
14 Maine Department of Health and Human Services 2012.
15 Pleasant Ridge Exhibit 59 is the Massachusetts
16 Department of Public -- Department of Environmental
17 Protection 2012.

18 Pleasant Ridge Exhibit 60 is the Oregon
19 Health Authority, Public Health Division, 2013.
20 Pleasant Ridge Exhibit 61 is Scotland 2013.
21 Pleasant Ridge Exhibit 62 is the Australian Medical
22 Society 2014. Pleasant Ridge Exhibit 63 is the
23 Health Canada Study Summary. 64 is Wisconsin Wind
24 Siting Council 2014. Pleasant Ridge Exhibit 65 is

1 the Bakker et al. 2012. Pleasant Ridge Exhibit 66
2 is Chapman 2013. Pleasant Ridge Exhibit 67 is the
3 Crichton et al. 2013. Pleasant Ridge Exhibit 68 is
4 the Crichton et al. 2014. Pleasant Ridge Exhibit 69
5 is the Fiz 2008.

6 Pleasant Ridge Exhibit 70 is the
7 Ingber-Progress in Biophysics and Molecular Biology
8 in 2008. Pleasant Ridge Exhibit 71 is the Ingber
9 2003. Pleasant Ridge Exhibit 72 is the Ingber 2008.
10 Pleasant Ridge Exhibit 73 is the Janssen et al.
11 2011. Pleasant Ridge Exhibit 74 is Knopper et al.
12 2014. Pleasant Ridge Exhibit 75 is Leventhall, A
13 Reviewed Published Research on LFN. Pleasant Ridge
14 Exhibit 76 is the Maffei et al. 2013. Pleasant
15 Ridge Exhibit 77 is McCunney et al. 2014. Pleasant
16 Ridge Exhibit 78 is the Mroczek et al. 2012.
17 Pleasant Ridge Exhibit 79 is the Nissenbaum et al.
18 2012.

19 Pleasant Ridge 80 is the Pedersen and
20 Larsman 2008. Pleasant Ridge Exhibit 81 is the
21 Pederson and Waye 2004. Pleasant Ridge Exhibit 82
22 is the Pedersen and Way 2007. Pleasant Ridge
23 Exhibit 83 is the Pedersen and Waye 2008. Pleasant
24 Ridge Exhibit 84 is the Pedersen et al. 2009.

1 Pleasant Ridge Exhibit 85 is the Pedersen 2011.
2 Pleasant Ridge Exhibit 86 is the Pedersen 2010.
3 Pleasant Ridge Exhibit 87 is Protect Our Communities
4 Foundation versus Jewell-Tule Wind. Pleasant Ridge
5 Exhibit 88 is the Roberts Roberts 2013. Pleasant
6 Ridge Exhibit 89 is the Sakai 1971.

7 Pleasant Ridge Exhibit 90 is the Shepherd
8 2011. Pleasant Ridge Exhibit 91 is the Taylor et
9 al. 2013. Pleasant Ridge Exhibit 92 is the
10 Wisconsin PSC testimony, Dr. Leventhall, 2009.
11 Pleasant Ridge Exhibit 93 is the Witthoft and Rubin
12 2013. Pleasant Ridge Exhibit 94 is the Wolsink
13 1993. Pleasant Ridge Exhibit 95 is the Wolsink
14 2000.

15 And 96 and 97. 96 has already been
16 accepted. And 97 is the Roberts curriculum vitae.
17 And that's all of them. And 99 has been skipped.

18 All right. And those will all be accepted
19 and they are available if the public would like to
20 look at them.

21 With that, Mr. Blazer.

22 MR. BLAZER: That is it. That's not it.
23 We're going to do something a little bit different
24 with the next witness, Mr. Chairman. The next

1 witness is Dr. Ellenbogen, and we're going to
2 present him in a question and answer fashion. We'll
3 not be doing a presentation with him.

4 CHAIRMAN CORNALE: All right. He doesn't
5 have -- he has no formal presentation?

6 MR. BLAZER: We didn't do a Power Point
7 with him, no.

8 CHAIRMAN CORNALE: Okay.

9 MR. BLAZER: It will be --

10 CHAIRMAN CORNALE: As the audience
11 inquires, he may opt to answer the questions
12 at-hand. Is that --

13 MR. BLAZER: No, I will be conducting a
14 direct examination of Dr. Ellenbogen. It's not a
15 Power Point presentation. It's --

16 CHAIRMAN CORNALE: Understood, okay.

17 MR. BLAZER: Okay. I was going to suggest
18 maybe the best thing to do is since I'll ask the
19 questions from here, maybe slide the podium around
20 over there so he can both hear me and talk to you.
21 Is that --

22 CHAIRMAN CORNALE: Very good, whatever you
23 feel will work the best.

24 MR. ELLENBOGEN: Hope this bottle of water

1 is mine.

2 EXAMINATION OF DR. JEFFREY ELLENBOGEN

3 BY MR. BLAZER:

4 Q. Would you state your name, please, sir?

5 A. Jeffrey Ellenbogen.

6 Q. Could you describe your educational
7 background, please?

8 A. Sure. I'm a medical physician. I did a
9 bachelor's at University of Michigan, medical degree
10 at Tufts University in Boston, and master's in
11 medical science at Harvard Medical School.

12 Q. What is a master's of medical science?

13 A. Master's of medical science is basically
14 extra education meant to train people to take
15 scientific information and translate it into applied
16 medical sciences so that it can be useful to doctors
17 that see people.

18 Q. Do you have your statement of
19 qualifications or c.v. in front of you, Pleasant
20 Ridge Exhibit 101?

21 A. Yes, I do.

22 Q. And is that a current and accurate
23 statement of your educational and professional
24 history and qualifications?

1 A. Yes, it is.

2 Q. Do you specialize in a particular field of
3 medicine?

4 A. I specialize in two fields. The first is
5 neurology which is a discipline focused on disorders
6 of the brain and neurological system. And the
7 second specialty is sleep medicine, where people
8 have concerns about the medical problems that they
9 might encounter with their sleep.

10 Q. And do you also -- do you also do clinical
11 work?

12 A. Could you repeat that?

13 Q. Do you do clinical work?

14 A. Yes, I do. I see patients at
15 Johns-Hopkins Hospital in Baltimore, Maryland, where
16 I see a potpourri of problems, including outpatient
17 clinical neurology, mostly focused on issues
18 relating to sleep disorders. And occasionally I do
19 inpatient neurology which involves medical
20 emergencies and neurological diseases, things like
21 meningitis and head trauma and motor vehicle
22 accidents.

23 Q. Do you hold any professional licenses?

24 A. I hold a license to practice medicine in

1 the state of Maryland.

2 Q. How long have you been a practicing
3 physician?

4 A. I finished my medical doctorate in 2000,
5 got my medical license in 2001, and have been a
6 practicing attending for the past eight years.

7 Q. In the course of your work, have you had
8 the opportunity to study the issue of alleged health
9 impacts from wind turbines?

10 A. Yes, I have.

11 Q. And could you describe how your experience
12 in that area began?

13 A. Sure. I was approached by the
14 Massachusetts Department of Environmental Protection
15 and the Massachusetts Department of Public Health.
16 The commissioners from both of these government
17 agencies asked me to join a group of people to
18 evaluate the potential health risk of wind turbines
19 on humans. And that was in -- I'm sorry I didn't
20 mention that. They approached me in 2011.

21 Q. And was a study -- was a study conducted
22 as a result of that request of you?

23 A. Yeah, that's exactly right. The
24 commissioners asked us -- they charged us to bring

1 together a group of people who could perform an
2 independent evaluation of the scientific and medical
3 literature. And also we were charged to extend the
4 breadth of that reach by soliciting information from
5 the public in order to hear any potential complaints
6 that might not have trickled into the medical
7 literature but were areas of potential concern.

8 The commissioner was very concerned that
9 we were -- not only address existing scientific
10 knowledge, but also make absolutely sure that we
11 were not leaving stones unturned with respect to
12 even potential plausible medical problems that might
13 be a consequence of wind turbines.

14 Q. And is Pleasant Ridge Exhibit 59, which is
15 identified as Massachusetts Department of
16 Environmental Protection 2012, the results of that
17 effort?

18 A. Just double-check. Pleasant Ridge Exhibit
19 59?

20 Q. Yes.

21 A. Yes, it is.

22 Q. All right. How many people were on the
23 panel that was commissioned by the Department of
24 Environmental Protection and the Department of

1 Public Health?

2 A. This was a group of seven people.

3 Q. Could you identify them, please?

4 A. Sure. There was myself. There was also
5 Dr. Sheryl Grace, who is a mechanical engineer at
6 Boston University. Dr. Wendy Heiger-Bernays, she is
7 an environmental health expert at Boston University
8 as well. Then there was Dr. Jim Manwell. He is a
9 biophysicist who focuses on wind turbines and
10 engineering. Dr. Dora Anne Mills, she is a person
11 that had extensive experience as a state health
12 officer in Maine. She also has a public health
13 degree.

14 And two more folks real quick. There was
15 Kim Sullivan. Dr. Sullivan worked at Boston
16 University in the Department of Environmental
17 Health. And then finally, but not least, Marc
18 Weisskopf, who was a neuroscientist and
19 epidemiologist.

20 Q. What was the general conclusion of the
21 study?

22 A. The general conclusion, the big picture,
23 is that wind turbines do not pose a risk to human
24 health.

1 MR. LUETKEHANS: Mr. Blazer, could we take
2 about a 30-second break so I can actually get the
3 study since it's all sitting in front of us please?

4 MR. BLAZER: Oh, sure. And I neglected to
5 do that. I apologize, these are your stacks. It's
6 going to take a little more than 30 seconds. Do you
7 want them all right now or do you want to --

8 CHAIRMAN CORNALE: Do you guys just want
9 59? Just 59. Is he going to reference anything
10 else?

11 MR. BLAZER: No.

12 CHAIRMAN CORNALE: Okay.

13 (Brief pause.)

14 MR. BLAZER: Everyone has one, Mr.
15 Cornale.

16 CHAIRMAN CORNALE: Yeah, we have one or
17 everybody has one.

18 BY MR. BLAZER:

19 Q. All right, I'd like to go through with
20 you, Dr. Ellenbogen, some of the specific findings
21 of the study. It's lengthy. We're not going to go
22 through the whole thing.

23 First page, ES -- excuse me, the section
24 is entitled ES 4.1A, Production of Noise and

1 Vibration By Wind Turbines.

2 A. Uh-huh.

3 Q. I'd like to focus on finding number two,
4 page ES-5. And for the ZBA, these are all -- I'm
5 going to be going through the findings in the
6 executive summaries so we don't have to dig all the
7 way through the 100 and some odd pages of this
8 report. Those conclusions are repeated throughout
9 the report.

10 All right. The first finding, number two,
11 that I'd like to ask you about, Doctor, typically at
12 distances larger than 400 meters, sound pressure
13 levels for modern wind turbines are less than 40
14 dB(A), which is below the level associated with
15 annoyance and the epidemiological studies reviewed.
16 Could you explain what that means?

17 A. In plain English, that means that at
18 approximately 1300 feet, the existing literature did
19 not demonstrate sound pressure levels that were
20 really above a whisper and would not expect that to
21 lead to substantial annoyance.

22 Q. Finding number three on the same page,
23 infrasound refers to vibrations with frequencies
24 below 20 hertz. Infrasound and amplitudes over 100

1 to 110 dB can be heard and felt. Research has shown
2 that vibrations below these amplitudes are not felt.
3 The highest infrasound levels that have been
4 measured near turbines and reported in the
5 literature near turbines are under 90 dB at 5 hertz
6 and lower at higher frequencies for locations as
7 close as a hundred meters.

8 Could you explain what that means and how
9 your panel came to that conclusion?

10 A. Yeah. Again, coming back to the same
11 process of evaluating existing scientific
12 literature, I think that actually Hankard spoke to
13 that very nicely. This is infrasound. This is
14 sounds beneath the level of human hearing. And the
15 turbines that exist that have been published and
16 described out there in information are well beneath
17 the levels we would expect people to actually feel
18 those vibrations.

19 And I think the analogy from a piano is
20 really apt. Imagine if a piano, if you went even
21 lower frequencies from high to low and then the
22 piano -- imagine the piano had even more keys beyond
23 which you could even hear so low. And then imagine
24 tapping that extremely softly, gently, so that we

1 would expect that not only would you not hear
2 infrasound, which is the defined feature of that
3 band width, but also that one would not feel that
4 pressure wave.

5 Q. Finding number four, same page.
6 Infrasound from wind turbines is not related to, nor
7 does it cause a continuous whooshing. Could you
8 explain what that means and how your panel came to
9 that conclusion?

10 A. Right. This was an important one because
11 it wasn't as much in the scientific literature as in
12 the population of people that were near wind
13 turbines were describing. And they use various
14 vernacular to describe. The common one they came up
15 with was a whooshing sound, said we were hearing
16 whooshing sounds.

17 Looking at the literature, hearing
18 people's complaints, thinking about it and talking
19 to acousticians and having our panel, we recognize
20 that whooshing is an audible signature that are
21 within the band waves that are well into the audible
22 range. So the only main point that we're making
23 here is infrasound, meaning the sounds that we don't
24 hear, are not the thing that causes what people

1 describe as a whooshing. A whooshing is from
2 different kinds of sounds, the sounds that are well
3 within the range that we normally hear.

4 Q. I'd like to go to the next section now, ES
5 4.1.B, Health Impacts of Noise and Vibration.
6 Finding number one on page ES-5, most epidemiologic
7 literature on human response to wind turbines
8 relates to self-reported annoyance. And this
9 response appears to be a function of some
10 combination of the sound itself, the site of the
11 turbine, and attitude towards the wind turbine
12 project.

13 Could you explain that finding and how
14 your panel came to that conclusion?

15 A. Wow, that was just a mouthful to simply
16 say that different people get annoyed at different
17 things and there's lots of things that contribute to
18 that. But really, annoyance with respect to a wind
19 turbine is a very personal issue that brings a lot
20 of psychological background to that and has a
21 diverse set of causes depending on the person.

22 Q. Was that finding, in part, the result of
23 the individual interviews that you say you
24 conducted?

1 A. That finding was part of the solicitation
2 -- I didn't interview people just to clarify the
3 process. It was we had a comprehensive review of
4 the scientific literature and we solicited input
5 from folks who would literally submit things by
6 email or mail. We later had town meetings that
7 supported this notion. So it was not through
8 interview per se, but through a solicitation of
9 information, yes.

10 Q. The next finding, number 5, that's page
11 ES-6. There is insufficient evidence that the noise
12 from wind turbines is directly, i.e., independent,
13 from an effect on annoyance or sleep causing health
14 problems or disease.

15 A. Yeah, we recognize --

16 Q. Go ahead.

17 A. Seems to be the same question on every one
18 of these. We recognize that for some people wind
19 turbines annoy them, be it the sound, the sight, the
20 very presence, complex notions of economics, but --
21 and that annoyance can lead through downstream
22 effects to physiological effects, but that there
23 were no direct physiological effects on health in
24 humans from wind turbines.

1 Q. All right. Let's go to finding six on the
2 same page, ES-6. Claims that infrasound from wind
3 turbines directly impacts the vestibular system have
4 not been demonstrated scientifically. Available
5 evidence shows that the infrasound levels near wind
6 turbines cannot impact the vestibular systems.

7 Now Dr. Roberts also mentioned the
8 vestibular system. So first, could you explain what
9 that is?

10 A. Absolutely. And this was something that
11 came up quite a bit among our staff of folks that
12 had registered concern or things that they had heard
13 about, not necessarily that they experienced
14 themselves, many things came up, including the term
15 vestibular came up a lot. So I wanted to take a
16 moment to explain that.

17 I'm a neurologist, so I can't help
18 thinking about the world through a neurological
19 lens. But we talk about the five senses, I won't
20 bore you with the details, but we have many more
21 than five senses: temperature, vibration,
22 proprioception, position sense. And one of them is
23 the vestibular system which is responsible
24 ultimately for deciding our position in the world.

1 Yaw, pitch and roll for pilots in the audience.

2 And the vestibular system is a physical
3 system. A physical system has fluids, neurons, hair
4 cells. And there was concern among people that this
5 dynamical system that's responsible for helping me
6 figure out where I am in space could be affected by
7 the vibrations produced by a wind turbine.

8 And we did not -- so we took that concern
9 very seriously. We did not find evidence in the
10 human or animal literature to support that
11 vibrations of the kind produced by a wind turbine
12 could influence the vestibular system. And we spent
13 a lot of time thinking about, okay, there's nothing
14 reported, but does that make biological --
15 biologically plausible sense, meaning sort of that
16 next threshold doesn't exist in the medical
17 literature, but maybe it makes sense and maybe this
18 is something that hasn't been discovered yet.

19 So we debated that quite a bit, looked at
20 animal models, discussed theory and came to the
21 conclusion based on all of that in our deliberations
22 that wind turbines do not influence the vestibular
23 system, which is to say they don't cause problems
24 with balance and position sense.

1 Q. Finding seven on page ES-7, there is no
2 evidence for a set of health effects from exposure
3 to wind turbines that could be characterized as a,
4 quote-unquote, wind turbine syndrome. What did your
5 panel do to reach that conclusion?

6 A. Well, the first thing that we all did was
7 read the book "Wind Turbine Syndrome" by Pierpoint.
8 And we discussed the notion of -- the idea of what a
9 syndrome is. Remember, a syndrome is a medical
10 term. It means a constellation, a repeated
11 constellation of symptoms that many people
12 experience accompanied with a disease.

13 And so we looked at the full potpourri of
14 what was described in this phenomena called wind
15 turbine syndrome, looked at the scientific
16 literature, the medical literature, discussed
17 biological plausibility, deliberated it, listened to
18 individual concerns from people in the Commonwealth
19 of Massachusetts, and came to the conclusion that
20 based on the available scientific and medical
21 literature and our existing knowledge, that there is
22 no such thing as wind turbine syndrome.

23 Q. Finding eight, still on page ES-7, the
24 weight of the evidence suggests no association

1 between noise from wind turbines and measures of
2 psychological distress or mental health problems.
3 How was that conclusion arrived at?

4 A. All through the same process. But I just
5 want to clarify that piece. We did acknowledge and
6 do acknowledge that wind turbines for some people
7 can cause annoyance. What we were referring to in
8 this piece was the concern that it would cause
9 depression, anxiety, medical and psychiatric
10 illnesses of a clinical magnitude.

11 And again, looking through that same area
12 of process -- you're all probably bored of hearing
13 me say it -- but medical literature, scientific
14 literature, hearing complaints, deliberating,
15 thinking about plausibility, we did not find any
16 evidence to support the idea that wind turbines
17 cause mental illness.

18 Q. Finding number nine, page ES-7 still.
19 None of the limited epidemiological evidence
20 reviewed suggests an association between noise from
21 wind turbines and pain and stiffness, diabetes, high
22 blood pressure, tinnitus, hearing impairment,
23 cardiovascular disease and headache/migraine.

24 First of all, could you tell us where that

1 list came from?

2 A. That list was sort of this massive
3 compiled -- not just using wind turbine syndrome,
4 but really just anything that people would submit,
5 we took every concern seriously. That was the
6 charge by the commissioner was to leave no stone
7 unturned.

8 So if someone said I have joint pain from
9 these wind turbines that are nearby, we looked at
10 joint pain. And if they said they had hypertension,
11 cardiac disease, headaches, whatever it was, we
12 looked at all of them. And you can imagine that
13 this was a fairly tedious effort.

14 I mean I think -- I don't mean in a
15 negative way, but it's a lot to disprove. Many,
16 many negatives. But we took them seriously because
17 these are serious medical illnesses that were raised
18 as a potential concern.

19 And I just want to be clear. Compiling
20 that list was not a list of all the ailments that
21 people necessarily had. It was in many ways what
22 people had heard might be caused by wind turbines
23 and raised the potential for concern. So even if it
24 was just simply the raising of a potential concern,

1 that was enough to make it to the radar for us to
2 consider.

3 Q. One aside at this point, Doctor. When
4 your panel was charged to conduct this study by the
5 Department of Environmental Protection and
6 Department of Public Health, were you directed to
7 arrive at a particular conclusion?

8 A. Absolutely not. And in fact -- blanking
9 on the commissioner's name now -- it was a couple
10 years ago, but he was an unusual person in that he
11 said if there's a problem, I want to know about it.
12 Massachusetts is gearing up for a lot of wind
13 turbines and I don't want to know about the problem
14 after they're all over the state, so please look
15 into this. Maintain your independence. You will
16 not see me again until the report is published. But
17 I just want to be clear, I want to know what you
18 think and I want to know what's out there. And so
19 he was a great person to work with and I appreciated
20 that freedom and flexibility.

21 Q. Going back to this list of potential
22 symptoms that people have provided to you and that
23 they felt were associated with wind turbines, what
24 do you take from that as a treating physician?

1 A. As a treating physician -- you know, look,
2 I think it's really important to be able to address
3 problems that people have, and I think it's as
4 important to address problems that people are
5 concerned they might have or that they have and that
6 are concerned or caused by something because --

7 And one of the things I'd like to talk
8 about, I hope we get into, this is a question and
9 answer session, so I want to follow your lead, but
10 one of the really key things here is, and this is
11 true for all of medicine, does the patient -- it
12 could be me as a patient or a patient that comes to
13 see me, do they have a complaint and a concern that
14 they ascribe causality to that concern to such a
15 degree that that's the only thing that's focused on?

16 And my goal here and my take-home point,
17 it's really important to allow for the possibility
18 that wind turbines were causing medical problems. I
19 think we looked at that. I felt very clear that
20 they weren't. But I think I'm glad we spent the
21 time looking at those.

22 At the same time, I want to -- it's really
23 important to me as a practicing physician to see
24 people open to the possibility of what the actual

1 cause of their problems are so that those medical
2 problems can be adequately addressed and treated.
3 And I think if there's an unusual overemphasis on
4 one particular cause, that can be an incredible
5 disservice to a person who's trying to pursue an
6 understanding of their disease, get to a diagnosis,
7 and get to a real treatment strategy if the focus is
8 diverted elsewhere.

9 Q. Let's go to the next section, ES 4.2.B,
10 Health Effects of Shadow Flicker. Finding one, page
11 ES-7, scientific evidence suggests that shadow
12 flicker does not pose a risk for eliciting seizure
13 as a result of phobic stimulation. Can you explain
14 that?

15 A. This is an important one. It was
16 mentioned by Dr. Roberts, but it may be worth taking
17 a few seconds to explain in a little bit more detail
18 from the perspective as a neurologist. I treat
19 seizures. Of the many seizures that people have,
20 when they have repeated seizures and you don't know
21 why, there's no cause, that's called epilepsy,
22 unprovoked seizures.

23 But a little bit of a subset, a very small
24 portion of people that have seizures, now this is

1 not a small portion of the total population, it's a
2 small portion of the small portion of people that
3 have seizures, they will have seizures that are
4 provoked by little flickers of light, stimulation,
5 lack of stimulation, stimulation, lack of
6 stimulation, bam-bam-bam, and flashes of light.

7 And if they have this special kind,
8 usually generalized seizures that start as a kid, if
9 that small group of people are exposed to flashes of
10 light, they can actually have a seizure. And so we
11 spent a long time on it, and this is one of the
12 areas that I focused on myself in this panel was
13 thinking about shadow flicker and the concern that
14 that might actually cause seizures because that
15 would be a real problem.

16 And especially for houses that were cast
17 in the shadow of the turbines, if the sun is going
18 to hit at a particular point on the horizon and the
19 blade is going to be spinning and the sun is going
20 to kind of pierce through it, and periodically as
21 one of those blades come across, it's going to cast
22 a shadow onto the house and onto an existing person.
23 If that turbine got whipping around and hit a
24 certain frequency, could that cause a seizure in a

1 kid, adult, anyone that had epilepsy?

2 Okay. What's known fortunately about
3 photic stimulated epilepsy or the small portion of
4 people that have epilepsy that will get seizures as
5 a result of flashes of light is that those happen as
6 a result of frequencies at about 10, 15, 20 hertz,
7 usually on the higher range or even higher than that
8 is what will actually cause a seizure, and actually
9 we use this clinically.

10 So people come into a lab and say I think
11 I might have epilepsy, and we'll bring them into the
12 lab in a controlled condition and we'll bring a
13 strobe light in and say, okay, we're looking for
14 brain waves. No seizures? Fine. Hit them with
15 flashes of light to see if we can cause a seizure to
16 make a diagnosis, and the flashes of light that
17 we're using are on order of magnitude 15, 20, 25
18 hertz or faster.

19 The frequency of -- because of the nature
20 of the speed and size of these turbines, the
21 frequency of the flashing will be about half a hertz
22 or one hertz, which is well below the range that
23 would elicit a seizure even in someone who was
24 vulnerable to photic stimulation seizures, so I feel

1 really comfortable that shadow flicker does not
2 cause seizures. Now it certainly may cause
3 annoyance, but that's not what we're talking about.
4 From a point of view of seizures, shadow flicker
5 does not cause seizures of any kind.

6 Q. Now, in two or three instances that we
7 haven't discussed, Doctor, the study concluded that
8 there was insufficient evidence regarding some
9 issues rather than evidence of absence, which is
10 what you've been talking about. Has there been any
11 further information generated since that study in
12 2012 was issued that resolves those doubts?

13 A. Yeah. Actually just a few weeks ago there
14 was the Health Canada report that came out. Now
15 keep in mind this is a preliminary read of their
16 data, it hasn't yet been peer-reviewed, so I'm eager
17 to see it go through the proper channels, and we're
18 asking ourselves to have that threshold for all of
19 our data including this, but the Health Canada data
20 is out, a brief summary a couple weeks ago, and will
21 be reviewed and forthcoming I guess in the coming
22 months.

23 In that study they looked not only at a
24 medical literature review, which is a study but it's

1 not really a study, it's really an examination of
2 existing knowledge, where this Health Canada study,
3 they actually did physiology, measuring sleep,
4 cortisol levels, sound pressure levels of wind
5 turbines, and this is in Canada, hence the Health
6 Canada label. And they did not show relationship
7 between sleep problems and noise from wind turbines.

8 So I'm looking forward to that being a
9 full throttle peer-reviewed piece of data, but it
10 does help to convince me further that wind turbines
11 do not cause health effects in humans.

12 Q. I'd like to go back to finding number 7
13 from the Massachusetts study, page 8 of 7. There is
14 no evidence for a set of health effects from
15 exposure to wind turbines that could be
16 characterized as a wind turbine syndrome.

17 Now, Dr. Ellenbogen, since that study was
18 published, have you personally had the opportunity
19 to test the conclusions reached by that study
20 including that so-called wind turbine syndrome does
21 not, in fact, exist?

22 A. Yes, I have.

23 Q. Could you explain that please?

24 A. Yeah, even though I made my position

1 clear, and maybe I should just repeat it, from a
2 medical and scientific point of view, wind turbine
3 syndrome does not exist. Despite that, many people
4 feel that it does and I acknowledge that. Many
5 people in the population feel that it does, and as a
6 result, there are people who have raised concerns,
7 people living near wind turbines, that say I have
8 wind turbine syndrome or a variant of it.

9 There was a population, is a population of
10 people in Michigan who had raised such a concern,
11 and I had the opportunity to go out and interview
12 them. I was able to not only interview this small
13 group of people, but I performed an independent
14 medical examination of them. So while it was not --
15 a patient/doctor relationship was not built, but it
16 was as if they were seeing me in clinic. We did a
17 full history, full examination, I also had the
18 opportunity to look at the physical location where
19 they live, I also -- not inside their house, in the
20 neighborhood, seeing the turbines themselves, and I
21 had the opportunity to interview their spouse as
22 well.

23 Q. And could you describe what you found in
24 the course of those independent medical exams?

1 A. What was common to all of them, now this
2 is a very small sample, it's only four people, those
3 were the only people that I was allowed to have
4 access to, all four of these people raised concern
5 for having some sort of wind turbine syndrome-like
6 problem.

7 And what I would like to do, I know it's
8 getting kind of late, but just take a couple of
9 minutes and show you why this has become kind of a
10 soapbox for me in terms of how to think about
11 relating to a person who has such a complaint.

12 These are four people that live near wind
13 turbines in Michigan, I don't know the exact
14 distance that they were, but they had raised concern
15 for their medical health and well-being. And so I
16 went to talk with them and interview them and
17 examine them, talk to their spouse. And I just want
18 to give a couple of examples of what I ran into.

19 The first is a 53-year-old industrial
20 designer who complained, who raised a concern,
21 excuse me, of insomnia and of palpitations in their
22 chest, boom boom boom, at night and was absolutely
23 convinced that the wind turbine near his house was
24 causing the medical -- or these two problems.

1 And I won't bore you with all the details,
2 but suffice to say, in talking with him in great
3 detail, he had in recent years gained a lot of
4 weight, snoring, witness apnea, meaning his wife had
5 seen him gasp and stop breathing in the middle of
6 the night. This gentleman absolutely had
7 obstructive sleep apnea, so he was using the
8 expression insomnia in the vernacular sense,
9 insomnia, disrupted sleep, he would wake up
10 periodically throughout the night, but he didn't
11 have insomnia the way a doctor who studies sleep and
12 treats with sleep medicine would deal with insomnia.
13 He had disrupted sleep almost certainly from
14 obstructive sleep apnea.

15 And obstructive sleep apnea. While he had
16 spent six months, a year, thinking about how to sell
17 his house, stressing about that, dealing with
18 lawyers and the courts and litigation and mediation,
19 and I don't even know the legal terms for all the
20 discussions that people have, he was missing an
21 opportunity to get a solid diagnosis and a treat --
22 a treatable condition, a condition that puts him at
23 risk for stroke, heart attack, sudden death. So he
24 was wasting a lot of time and energy in my opinion,

1 you know, going in one very particular direction.

2 Now it's perfectly reasonable for him to
3 have had that theory, but that theory in his mind
4 was crystal-clear, and it did, in my opinion, a big
5 disservice for him. As a follow-up by the way, I
6 mentioned the racing heart, he did end up seeing a
7 doctor who did measure, I think it was a 24 hour or
8 48 hour electrocardiogram, that showed abnormal
9 heart rhythm that did not relate to the wind
10 turbine. So I'm hoping that he was getting
11 treatment for something also unrelated to the wind
12 turbine.

13 I should add, by the way, that I
14 interviewed people, examined them, have spoken to
15 their spouse, went to their neighborhood, but I also
16 reviewed all of their medical history as well. So
17 that was the first. And I know the hour is late,
18 but let me just give a couple more examples because
19 I think they're very instructive.

20 The next is a 45-year-old high school
21 teacher, and she said I have a constellation of
22 symptoms not unlike wind turbine syndrome, perhaps
23 that very thing, headaches, sleepiness, anxiety,
24 forgetfulness, poor mood, and it's all because of

1 the wind turbine just down the street. When I spoke
2 with her at length, examined her, and I could feel
3 on her exam, from her headaches, I mean she had real
4 pain, discomfort where the mandible meets the skull,
5 sometimes called the temporomandibular joint. She
6 had very classic symptoms of TMJ. She did get some
7 relief from a mouth guard, so that was great.

8 The sleepiness, anxiety and forgetfulness,
9 we had talked together a lot and discovered in that
10 time period the major change she did was she took a
11 new job and was now waking up at 4:30 in the morning
12 for a long commute, hadn't changed her sleep time
13 and so was profoundly in sleep deficiency, which is
14 well-documented to cause forgetfulness, sleepiness
15 and irritability.

16 And finally for her mood, we talked a lot
17 about her life. And my board certification as a
18 neurologist is from the American Board of Psychiatry
19 and Neurology, and so we talked about her mood in
20 great detail, and she became instantly tearful when
21 we hit her children who had just moved out to
22 college and she felt a deep sense of loss to her --
23 what some people call empty nest syndrome or the
24 fact that she was somewhat estranged from her kids

1 who went off to college.

2 And so I think she had probably a mood
3 disorder provoked by life circumstances, I think she
4 had a job that caused her to be sleep deprived, I
5 think she had temporomandibular joint problems
6 leading to TMJ-related headaches, and though I don't
7 know those to be the absolute causes, I think those
8 are the most likely based on my medical evaluation.

9 And I can tell you that she wasn't
10 pursuing them in a meaningful way and she wasn't
11 getting treatment for any of them. She had in her
12 mind, implanted in her mind, I don't know whether
13 she picked it up through the Internet or talking
14 with folks or for whatever reason, that the wind
15 turbine had caused those symptoms, and I think that
16 was unfair to her.

17 Two more quick examples and then I'll have
18 mercy on you. The next is a 52-year-old bookkeeper
19 who had headaches, and so I measured her blood
20 pressure and it's through the roof. I mean when you
21 have high blood pressure, the pulse is going to
22 transmit that pressure into the skull. People with
23 that high of blood pressure that's untreated get
24 headaches. I'm not saying that was the cause of her

1 headaches, but I think that that's a good culprit.
2 I think it's untreated. I think she's spending a
3 lot of time thinking about the cause of that being
4 the wind turbine syndrome. Again, I think unfair to
5 not allow her to have a full throttle of treatment
6 that would be available to her if she saw a doctor
7 that day.

8 And then the last one is a farmer, a
9 60-year-old farmer who had balance problems, and he
10 was absolutely convinced the balance problems were
11 from the turbine. He was around the turbine all the
12 time. When he was around it and it was really
13 noisy, he would lose his balance. And when I
14 examined him, he had a serious neuropathy, which is
15 a problem of the nerves to his feet. He could not
16 feel his feet. When I asked him to walk, to do a
17 tandem walk, which is just going one foot in front
18 of the other, he was like he was intoxicated.

19 And he had three main problems. One, he
20 had a neuropathy which is often treatable. It could
21 be a vitamin deficiency. It could be another kind
22 of a disease totally undiagnosed. The other is that
23 he had a very severe alcohol problem which is not
24 being addressed that can cause cerebellar

1 degeneration, problems in the back of the brain
2 that's responsible for balance. And the last thing
3 was that he was given a medication decades ago that
4 he forgot about how to dose correctly. He hadn't
5 been seeing anybody about it. He's one of those
6 folks, like my father, who doesn't go to doctors
7 very much and had just been taking the medication
8 not realizing it was a drug that can cause fairly
9 substantial balance problems.

10 So as, in my opinion, his nerves in his
11 feet were backing out, his alcohol problem was
12 getting more severe, and he was still taking that
13 medication that when he was younger he could handle
14 the balance problems but now was really catching up
15 to him, all of those things are addressable
16 medically, none of them were being addressed.

17 And I'm not saying that if it wasn't the
18 wind turbine syndrome that he would have been a guy
19 to go to a doctor, maybe he just never would anyway,
20 but he had clear in his mind a constellation of
21 symptoms caused by wind turbines. As a consequence,
22 in my opinion that created a huge disservice to him.
23 And I think that's true for all four of these
24 people. And I bet that if I had the opportunity to

1 interview more of these folks we would just uncover
2 much more of this.

3 For me, this is a reasonably passionate
4 issue. I'm not saying wind turbines don't annoy
5 people, if it was in my backyard maybe it would
6 annoy me, but I think to stretch it out to say that
7 it's going to cause a whole host of medical
8 problems, to make up a syndrome that is unrecognized
9 and unsubstantiated, that causes people to unduly
10 emphasize that problem and not pursue other causes,
11 is a big problem to me and it's an issue for
12 individuals and the public.

13 Q. Thank you very much, Doctor.

14 MR. BLAZER: What I have, Mr. Cornale, an
15 unusual witness, I have only one exhibit and that's
16 his c.v. It's Pleasant Ridge 101.

17 CHAIRMAN CORNALE: All right, we'll except
18 Pleasant Ridge Exhibit 101 as the Ellenbogen c.v. I
19 would like to note for the record that 98, Pleasant
20 Ridge Exhibit 98, 99 and 100 do not exist. There
21 are no 98, 99 and 100.

22 MR. LUETKEHANS: Mr. Cornale, there is a
23 100. It's under Hankard.

24 MR. BLAZER: Some of these aren't in

1 order. 100 is Hankard right there.

2 CHAIRMAN CORNALE: All right, strike that.

3 MR. BLAZER: And 98 -- 99 is skipped. 98
4 does exist also.

5 MR. LUETKEHANS: And 98 is in the papers.

6 MR. BLAZER: Yeah. Yeah, under 26. That
7 one's already there.

8 CHAIRMAN CORNALE: All right, got it. So
9 strike all my comments on the record. And 99 for
10 sure is skipped, but 98 and 100 do exist.

11 MR. BLAZER: Mr. Cornale, the only other
12 question, maybe I missed it, Ms. Blank Exhibit 42, 3
13 and 4, did those go in?

14 MR. LUETKEHANS: Yeah.

15 MR. BLAZER: They did? Okay. Sounds like
16 that's all we have this evening, sir.

17 CHAIRMAN CORNALE: All right. With
18 that --

19 MR. BLAZER: Oh, here.

20 CHAIRMAN CORNALE: With that, we're
21 looking at tomorrow evening, 7:00 p.m. start time,
22 back here. Mr. Blazer, can you just fill us in on
23 what we have to expect as far as looks like you
24 have --

1 MR. BLAZER: Two more witnesses.

2 CHAIRMAN CORNALE: Two more witnesses.

3 MR. BLAZER: Birds, bats and other
4 wildlife, and then economics and we'll be done.

5 CHAIRMAN CORNALE: Okay, so is that
6 realistically --

7 MR. BLAZER: An hour.

8 CHAIRMAN CORNALE: About an hour. So
9 about half the night give or take.

10 MR. BLAZER: I'm guessing.

11 CHAIRMAN CORNALE: So we'll start
12 questioning after that.

13 MR. BLAZER: Sure.

14 CHAIRMAN CORNALE: All right.

15 MR. BLAZER: For the record, the only
16 folks I won't have here tomorrow are Dr. Roberts and
17 Mr. MaRous, but I believe they will both be
18 available next Monday.

19 CHAIRMAN CORNALE: Okay. All right. So
20 tomorrow evening, 7:00. For those that weren't here
21 last night, we do have another meeting scheduled
22 Monday the 24th at 6:30 and the location is in
23 Fairbury at the Walton Center, 100 West Locust
24 Street, and that's as far as we've looked at

1 scheduling wise.

2 So, Mr. Blakeman, do you have anything to
3 add.

4 MR. BLAKEMAN: Not at this time.

5 CHAIRMAN CORNALE: With that, we need a
6 motion to recess. John Vitzthum motions, Joan
7 Huisman. All in favor?

8 ALL MEMBERS: Aye.

9 CHAIRMAN CORNALE: Opposed?

10 AUDIENCE VOICE: Aye.

11 (Adjourned at 9:08 p.m.)

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1 STATE OF ILLINOIS)
)SS
2 County OF FORD)

3

4 I, June Haeme, a Notary Public in and for
5 the County of Ford, State of Illinois, do hereby
6 certify that the following Livingston County Zoning
7 Board of Appeals, Case SU-7-14 hearing was taken at
8 the Pontiac Township High School, 1100 Indiana
9 Avenue, Pontiac, Illinois, on November 18, 2014.

10 That the said deposition was taken down in
11 stenograph notes and afterwards reduced to
12 typewriting under my instruction and that the
13 deposition is a true record of the testimony given.

14 I do further certify that I am a
15 disinterested person in this cause of action; that I
16 am not a relative, or otherwise interested in the
17 event of this action, and am not in the employ of
18 the attorneys for either party.

19 IN WITNESS WHEREOF, I have hereunto set my
20 hand and affixed my notarial seal this 24th day of
21 November, 2014.

22

23

24

25

JUNE HAEME, CSR
NOTARY PUBLIC

26

27 "OFFICIAL SEAL"

28 June Haeme
29 Notary Public, State of Illinois
30 My Commission Expires:
31 September 27, 2016

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