In The Matter Of:

LIVINGSTON COUNTY ZONING BOARD OF APPEALS

January 21, 2015

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

January 21, 2015
6:30 PM
Pontiac Township High School
Pontiac, Illinois

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(Commencing at 6:36 p.m.)

CHAIRMAN CORNALE: Okay, we're going to go ahead and call this meeting to order. We're having a little bit of issue with some audio. We'll get that worked out. So with that, Chuck, roll call please.

MR. SCHOPP: Okay, this is the January 21st, 2015, continuation hearing of the Livingston County Zoning Board of Appeals review of Livingston County Zoning Case SU-7-14, Pleasant Ridge Energy, LLC, Pleasant Ridge Wind Energy Project. And Mike Cornale.

CHAIRMAN CORNALE: Here.

MR. SCHOPP: John Vitzthum.

MR. VITZTHUM: Here.

MR. SCHOPP: Richard Kiefer. Diana Iverson.

MS. IVERSON: Here.

MR. SCHOPP: Howard Zimmerman.

MR. ZIMMERMAN: Here.

MR. SCHOPP: Joan Huisman.

MS. HUISMAN: Here.

MR. SCHOPP: We have a quorum.

CHAIRMAN CORNALE: All right, looks like

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they're working on the sound in the box, so we'll go ahead and get going this evening.

I believe the applicant has brought with a couple witnesses this evening for some additional questions. I believe one is Mr. Hankard, one is Mr. Parzyck. I believe those two are here; is that correct?

MR. BLAZER: They are, Mr. Chairman, but before that, we just have some preliminary matters. I've conferred with Mr. Luetkehans and with Mr. Blakeman and Mr. Griffin. We have some additional documents that we need to get into the record. And conferring with everybody, we've agreed there's just -- there's nothing to really examine anyone on. We're just going to put them into the record. I'll identify all of them for the record.

First is actually correcting an error from last week. You may recall that there was a duplication on one of my exhibits during my cross of Mr. Hewson. It looked like it was a duplication of No. 260 and you ended up numbering it No. 1260.

CHAIRMAN CORNALE: Correct.

MR. BLAZER: It turns out it was incorrectly numbered and threw my whole numbering

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system off. It should actually -- and it was the Illinois statute and regulations dealing with clean construction and demolition debris. That should be Pleasant Ridge Exhibit 261. I brought new copies of that one that are properly marked. So I ask to substitute 261 for the one that you marked last week as 1260.

CHAIRMAN CORNALE: Okay, we'll accept that. For the record, we'll accept 261 in place of 1260.

MR. BLAZER: And then these are the documents that are going in. The first is Pleasant Ridge Exhibit 25A and those are the FAA determination of no hazard to aircraft for all 136 turbines that are proposed for this project. And in consultation with Chuck, excuse me, the way we've done it because it's -- in its entirety, the entire set of files is roughly 830 pages long.

So what we've done is actually print out one complete set, so we're not killing too many forests, and then the other multiple copies are -- because each turbine has a group of documents, there's a cover sheet that's the actual FAA determination and then there's documentation behind

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it that supports that determination.

So for turbine 1, we have I think it's six pages, we have all six so you can see an example of what they all look like. For all of the other ones, we just have the determination page, except for turbines 133 and 134 which we were asked to also supply the complete packets. Those are the two that are the closest to the airport. So that again is Exhibit 25A.

CHAIRMAN CORNALE: All right, the county will accept Pleasant Ridge Exhibit 25A as the FAA determination of no hazards. There we go, we've got mics. Thank you. All right, Mr. Blazer, grab a mic.

Did I not -- I probably didn't complete my thing there. We'll accept that as Pleasant Ridge Exhibit 25A, the determination of no hazard from the FAA.

MR. BLAZER: All right, the next one is Pleasant Ridge Exhibit 98A, and those are photos of the transmission line towers that we were requested to provide.

CHAIRMAN CORNALE: All right. The county will accept Pleasant Ridge Exhibit 98A as a two page

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photograph of transmission lines.

MR. BLAZER: The next one is Pleasant Ridge 125. You may recall one of the county's exhibits, and I don't recall which number it is, was correspondence from the Belle Prairie Drainage District expressing some concerns about drain tile. Pleasant Ridge 125 is our response to that letter.

CHAIRMAN CORNALE: All right, county will accept Pleasant Ridge Exhibit 125 as a submittal or as a letter to the Belle Prairie Drainage District.

MR. BLAZER: The next two are related. The county's ordinance requires that we provide certificates of design compliance from a certification agency for the turbines when they are made available to the turbine manufacturer, in this case, GE. Exhibit 130A is the certificate of design compliance from TUV Nord for the GE 1.72-103 turbine. 130B is a letter from TUV Nord confirming that the GE 1.79-100 turbine is under review. They say they are about 70 percent done. They expect to issue the determination or the certification by the end of March. So we're looking to get both of those in. 130A is the certificate for the 103; 130B is the letter confirming that it's coming for the 100.

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CHAIRMAN CORNALE: All right, the county will accept Pleasant Ridge Exhibit 130A as a TUV Nord letter, statement of compliance on a design assessment for the GE 1.7-103. The county will accept Pleasant Ridge Exhibit 130B as a TUV Nord SysTec. It's a letter that addresses the 70 percent completeness of the technical assessment.

MR. BLAZER: And then the last one, Mr. Chairman, is Pleasant Ridge 229 and that's actually an email string. It's a series of communications between Invenergy and Mr. Rick Reed who is the head of the Illinois Aerial Applicators Association in which we were consulting with him regarding any concerns that his association may have regarding the project in general. The only concerns he raised were with respect to marking of the MET tower --

MR. LUETKEHANS: If Mr. Blazer wants to testify --

MR. BLAZER: I -- all right.

MR. LUETKEHANS: I mean as opposed to put it in.

MR. BLAZER: That's fine. It's correspondence between Invenergy and the IAAA.

CHAIRMAN CORNALE: All right, the

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county --
MR. LUETKEHANS: If I may, the only question I have, and I just want to maybe clear it up for the record, that I think if Mike, Mr. Blazer, could confirm or stipulate that the pictures that are referred to in Pleasant Ridge Exhibit 229 are the same picture or pictures that are in Pleasant Ridge Exhibit 22.
MR. BLAZER: Yes.
MR. LUETKEHANS: Okay, thank you.
CHAIRMAN CORNALE: All right. The county will accept Pleasant Ridge Exhibit 229 as a series of emails between Allyson Sand and Rick Reed identified within the email as the executive director of the Illinois AAA.
All right. With that, I'll turn this over to counsel. Mr. Blakeman has a few comments.
MR. BLAKEMAN: As we move into a new phase of the hearing, a few reminders of some of the rules that were presented in the early days of this hearing. All witnesses who have signed up to address the ZBA shall be sworn and shall testify under oath. Even if you are represented by an attorney, you will be able to present evidence and

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testimony or a statement.
As each witness or interested party testifies, presents evidence or makes a statement, it shall be subject to cross-examination from other parties in the following order. First, members of the Zoning Board of Appeals; units of local government including school districts; applicant by its attorneys; other interested parties represented by a licensed attorney, unless that attorney represents the witness, then the attorney cannot cross-examine his own client; any other interested parties not represented by an attorney; Livingston County staff and consultants; and again the ZBA.
If you have exhibits to produce, if possible, please have 15 hard copies so that the ZBA, staff, attorneys, others, parties can have a copy.
Now, one further matter. It has been brought to my attention that some people do not intend to participate in this hearing and plan to wait until the county board considers the application to make a statement or presentation during public comment prior to the board vote. Please be advised that there will be no public

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comment before the county board votes on the application. If you have something to say or present, you should present it during these proceedings before the ZBA for the county board to consider whatever it is you have to say or present.
CHAIRMAN CORNALE: Thank you. I believe at this time the Livingston County counsel has some questions that you'd like to present. Okay.
MR. GRIFFIN: Good evening. Jim Griffin, attorney for Livingston County. We've asked the applicant to bring Mr. Parzyck and Mr. Hankard here because the county has some additional questions. So I'd like to start with Mr. Parzyck if he's ready.
QUESTIONS BY
MR. GRIFFIN:
Q. Good evening, Mr. Parzyck. I want to ask you some questions about financial assurance and also setback waivers. Let me start with setback waivers. My understanding is that the project is relying upon setback waivers in order to site the turbines in the locations that have been selected; is that correct?
A. That's correct, there are -- yes.
Q. Do you know how many setback waivers the

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company's relying upon in siting?
A. I do not have that information, no, I don't.
Q. That would be information, then, that we would ask that you provide to the county, the -- I want to know the turbine number upon which the setback waiver applies to and, you know, identify the participating property owner that approved the waiver, and then the distance from either the property line or the residence that's being waived.
MR. BLAZER: Such a list does exist, Mr. Griffin. I think I can probably get that to you sometime before tomorrow's hearing.
MR. GRIFFIN: Thank you, appreciate that.
Q. All right. As to financial assurance, Mr. Parzyck, you recall that Ms. Gerwin asked you a number of questions about financial information for Invenergy. Several of the questions you did not respond to, so I did ask your counsel to bring you back because I was hoping that you could provide additional information. As you know, financial assurance of the company's ability to construct the project is a requirement under the zoning ordinance and you're aware of that, correct?

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A. I am.
Q. All right. Well, first, there's been some testimony that -- about a power purchase agreement. Does the project currently have a power purchase agreement?
A. It does not.
Q. And will the project be constructed without a power purchase agreement being in place?
A. That's still being determined as to what the exact financial transactions that will be required to sell the power. There's a number of different ways that it could be sold: under a power purchase agreement with a large entity or utility, through a hedge structure with a financial institution where the power is then sold into the PJM market which this project would be connected to from an electrical transmission perspective.
So we are investigating those matters with a number of different companies, utilities, et cetera, and in fact some of that is dependent upon, you know, how things proceed with regard to the development of the project and permit.
Q. All right. Well, concerning the financial assurance that the applicant has the wherewithal to

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construct the project if it were to be approved, what information can you provide to demonstrate to the county that the company does have such financial ability to construct the project?
A. Certainly. Based on your desire to have us come back and address this, I've done -- subsequent to my testimony earlier last year or late last year, I've gone back and looked at, researched some of the issues that were raised. And I do want to say again we are a private corporation, so there is no -- there are no documents in the public record that I could refer to.
What I thought I'd be able to do is go through the process that we will be going through and identify some of the assets that are held by the company to show that we have a long-term track record and the financial wherewithal to move forward with this project.
As I think I said in some of my earlier testimony, Invenergy has over -- has 46 wind projects across the United States with 4300 megawatts of installed wind generation capacity and nearly 1900 wind turbines installed. And those are all installed under long-term agreements with both

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landowners and power purchase companies.
Now, with that, those 43[sic] wind projects and our wind, solar, natural gas and storage operations, we have approximately $8 billion worth of installed infrastructure across the United States. And in that -- within that structure, $2.8 billion worth of that installed infrastructure is an equity position, the balance being debt that is being held to -- that was secured to build those projects.
So with this very robust installation across the United States and this $2.8 billion worth of equity, that's the sort of structure that allows us to continue to develop projects throughout the United States; for that matter, the United States, Canada, Mexico and Europe.
Now, here within Illinois we have some significant installations as well. We have approximately $1.25 billion worth of wind, solar and natural gas and storage within Illinois itself, and of that $1.25 billion of installed infrastructure, approximately $350 million worth of that infrastructure is an equity position that Invenergy holds.

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So we have the wherewithal with regard to building, constructing throughout the United States, but the difficulty in terms of saying exactly which company holds what assets has to do with the arrangements that we have with regard to developing, owning and operating our facilities.
Invenergy's corporate structure is such that we have a series of affiliated limited liability corporations, or LLCs, similar to the same structure that real estate developers, owners and operators have. And within that, those affiliated corporations, are LLCs for development and operational assets. And with Pleasant Ridge at this point, we are in the development stage. We have not moved over to building the project.
So the development LLCs manage ongoing development efforts for each project and on the order that's millions of dollars per project. Thus far, with the Pleasant Ridge project, we are spending north of $5 million on this project to date from a development perspective.
When projects are being constructed, they move over into operating LLCs, which in this case would be Pleasant Ridge, LLC, and the assets for

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those operating LLCs are there for construction and operating and they are typically hundreds of millions of dollars. On average, one could say, you know, you could spend several million dollars per turbine to install a project of this size.

So we have these -- we go from development LLCs to operating LLCs, and when we make that move, we would go into a company like Pleasant Ridge, LLC, would be funded through a debt and equity structure, and that's done on an individual project basis. And that funding is put in place prior to the commencement of significant capital outlays, such as construction, turbine contracts, et cetera. And that's the hundreds of million dollars that I'm talking about.

And as we stand here today, the funding for the Pleasant Ridge project is awaiting this process that we're going through right now. So we are keying things up with off-takers as we mentioned earlier as well as with funding institutions, both debt and equity, to go through a funding process subsequent to us receiving a permit on the project.

Now, that is very common practice throughout the industry, and most recently it was

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done on the project we just completed called the California Ridge project which many people -- which has been mentioned before. It's a similar project of scale and attributes. It's 217 megawatts, 134 wind turbines, so very similar to what we have going on here. It's located in Vermilion and Champaign Counties, and county approvals were secured in both counties prior to project financing. The project value was approximately $465 million, so that's kind of on a par with what we're talking about on this project, and of that, the equity component was approximately $65 million.

Now, there was very broad interest in the project, and we concluded funding subsequent again, as we are here, to the permits that we received from Vermilion and Champaign Counties. And with that, we were able to secure financial support from a whole list of financial institutions: Santander, Prudential, Rabobank, the Union Bank of California, the Royal Bank of Canada, Lloyds and Allstate. So we have a series of investors, both debt and equity, that we will be going to subsequent to our permit here and moving through that process.

And the -- the history that we've had to

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date with that, and even with the letter that we had submitted from CoBank in our application, indicates that we expect to go through the same process as we did with California Ridge. And based on our experience at funding these sorts of projects in the past and the interest in these sorts of projects, that we would see a similar effort ongoing and be successful to start construction and have that secured financing prior to significant spending of funds.

Q. Would you expect the company to take a similar equity position in Pleasant Ridge as in the California Ridge project?

A. Yes, we would.

MR. GRIFFIN: That's all the questions we have for now. Thank you, Mr. Parzyck.

A. Thank you.

MR. LUETKEHANS: I think certain people have questions of Mr. Parzyck. Is that allowed or --

CHAIRMAN CORNALE: All right, due to the procedure that we've pretty well spelled out, the audience did, in fact, have their opportunity to question Mr. Parzyck, so we're going to let Mr.

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Parzyck go at this time without those questions.

MR. MARK SLAGEL: I wasn't here at one of the meetings and I'm on the school board and I have questions regarding that. Can I come up?

CHAIRMAN CORNALE: I think once we start this, it's going to just continue. I know that we had one question for Hankard that wasn't -- that we didn't get to when he presented. So with that, Mr. Parzyck, go ahead.

Okay, I believe you have additional questions for their other witness.

MR. GRIFFIN: Yes. Mr. Hankard.

QUESTIONS BY

MR. GRIFFIN:

Q. Mr. Hankard, I'm Jim Griffin. I'm an attorney for Livingston County. I want to follow up on your testimony that you gave earlier in this case, in this zoning matter. You testified that the model you ran gave results I believe to the nearest tenth of a decibel; is that correct?

A. Yes, that's correct.

Q. And then you would round those numbers to the nearest whole number integer, correct?

A. Yes.

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Q. All right. And I think you testified that some of the model -- so for model results that came in at 41 or, excuse me, at a point four-tenths, you rounded down, correct?
A. Correct.
Q. And five-tenths you would round up.
A. Correct.
Q. All right. Now, some of the model results showed, for example, a 41 decibel limit at 1,000 hertz frequency, which is right at the Pollution Control Board limit, correct?
A. Yeah, the Pollution Control Board states that you shall not exceed the limit, so in this case, you shall not exceed 41.
Q. All right. Well, maybe that's the point of at least this series of questions. So you had test results that were at 41 point something and you rounded that down to 41.
A. Yeah, just to clarify, they weren't test results, they were model --
Q. Model results, excuse me.
A. Yes.
Q. All right. Preliminarily, I know there were some at the 41 decibel 1,000 hertz level that

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the model showed right at 41. Were there other decibel levels where the model came up with a number that was at the Pollution Control Board limit?
A. There were receptors where the predicted level was 41 point something; nothing 41.5 or above.
Q. But besides the 1,000 hertz frequency -- I want to know were there other model results besides 41 decibels at 1,000 hertz that also were right at the maximum Pollution Control Board number?
A. Okay. The other frequency bands?
Q. Correct.
A. Yeah, in the 500 hertz band, it gets close to but of course not above the limit, and then in all of the other bands, it's really many decibels lower than the limit.
Q. Were any of the numbers that the model produced at the 500 hertz the same number as the Pollution Control Board limit?
A. I would have to check on that, I apologize.
Q. All right. So what is your justification for rounding the model result, say, that's 41.4 down to 41?
A. Sure. Well, again, it starts with the

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fact that the limits are integers and that the text of the Illinois Pollution Control Board regulation says you shall not exceed those levels. It does not -- the regulation itself does not give any recommendation as to number of significant digits that one should do their analysis, so we're left with professional judgment.
The ISO 9613 method that we used to predict the noise levels, that can be carried out to a hundred decimal places or ten or three or anything that you want. Our particular software model is fixed at one-tenth, but you could easily do these calculations in a spreadsheet, and again you could come up with ten, you know, decimal places, anything that you want.
So we're obviously not going to display something to ten or even three decimal places. I don't think that's warranted or useful. So then the question becomes to what degree does one round to be warranted and, again, useful.
So a few examples of why we chose integers. The uncertainties of both the ISO and International Electrical Commission methods that were used to predict levels here, the uncertainties

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of those methods are in integers. They don't talk about tenths of a dB(A). As I said, the Illinois Pollution Control Board limits and every other regulation that I know of, federal regulations, state regulations, local noise limits, they're all integers. Nobody splits those kinds of hairs when it comes to the limits.
We did a search for something relevant here, and the one thing that we came up with is, and I believe it's being entered as an exhibit, it's ISO, International Standards Organization, Method 1680, which is a test code for measuring noise emissions from rotating electrical equipment, so fairly relevant. And it clearly states in there that you should round to integers.
I started looking around at other consulting firms to see what they did. Robert Rand who you'll hear from next week, his Falmouth study reports noise levels in integers. Dr. Salt and Lichtenhan that we've heard much about, all of their numbers in their reports are integers. Dr. Punch who you'll hear from tonight in his What Audiologists Should Know study, all of those levels are integers. In fact, they're more on the 5

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decibel and he speaks in terms of 10 or 15 to 20 decibels.

The EPA document that -- the 1974 levels document that's much referred to in my presentation and in others, that's all in kind of 5 decibel increments. They even say in there, the quote is, "Correction for these factors were initially made in 5 dB intervals since the magnitudes of many of the corrections are based solely on the intuition of the authors." In other words, when it comes to environmental noise, it's hard to get down -- when you're predicting levels, it's hard to get down to a very fine resolution.

Lastly, you know, human hearing, it's generally known that we can detect a change of about a plus or minus one decibel in a laboratory setting. Outside, that's about a plus or minus three. So people really can't even discern tenths.

My next question that I asked myself is: Is it useful to present the data to a tenth of a decibel? And I would say that about ten years ago my firm, we came to the realization, we do a lot of these presentations, tables of numbers presented to county boards or citizens groups or what have you.

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And when you look at a table of numbers that's got one, even one decimal place to it, I find and I think we found a lot of our clients found that it's very hard to just make a lot of sense of that, and as soon as you round it to integers, it becomes clear. You can say, yeah, this level is below that level or it's below the limit.

So it's been our practice on every project we do, power, not power, wind, gas turbines, whatever, that that's how we present our results. We find that it's industry practice, it makes sense, and it's what's warranted under the circumstances.

Last point. The California Ridge project that we used to validate our modelling process on this project was measured to a tenth of a decibel, so we did measure to that degree of accuracy. So I hope that answers your question.

Q. Yes, it did, but I would ask that you provide the model results to the nearest tenth, would you be able to do that, of a decimal? Do you still have that information?

A. We certainly have that information, yes.

Q. All right. Well, if the county were to determine not to accept a model result that was rounded down to get to the integer limit of the Pollution Control Board standards, then the model would show, then, that those were not in compliance with the Pollution Control Board standards, so what then could be done? Could you add additional low-noise blades in order to make sure that the limits were no greater, you know, the noise decibels were at, say, 41.0 and not any greater than that?

A. Yeah, that would be I believe the client's preferred method. You could always eliminate turbines, you could move turbines, you can do various things, but it would be their preference I believe to add more LNTE blade turbines to the project to reduce the predicted levels.

Q. In your opinion, would adding a blade or multiple blades in the vicinity of a receptor that was four-tenths of a decibel above the limit, would that reduce the noise such that it would, you know, reduce it by four-tenths of a decibel?

A. Absolutely. The low-noise blades target the very frequency range of interest here, the 1,000 hertz and the 500 hertz, and they bring the levels down anywhere from two to three, I think even four decibels. So yes, that can be achieved in that manner.

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Q. Okay. Well, I would ask that generally the applicant -- I mean we're going to get the list from Mr. Hankard of the decibel levels to the tenth. And for receptors showing for which he had to round down to get to the limit, I would ask that the applicant -- although I understand your position that that was appropriate to round down, I would ask the applicant to assume that that position was not agreed to by the county and identify what the solution or the remedy would be so that the model would demonstrate compliance at all the receptors.

MR. BLAZER: We have that list tonight, Mr. Griffin.

MR. GRIFFIN: Okay.

MR. BLAZER: I actually have two exhibits. Mr. Hankard referred to ISO 1680. I have copies of that and we've marked that as Pleasant Ridge Exhibit 131. And then we also have marked as Pleasant Ridge Exhibit 16A, this would be the updated list. The current list shows I think four of the 103 turbines with LNTEs and 11 of the 100 turbines with LNTEs. This new list, which I've marked as 16A, shows 20 of the 103s and 24 of the 100s. And that's inclusive

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of the prior list.
MR. GRIFFIN: All right. Well, what I would suggest is that everyone have the opportunity to look at those two exhibits, including Mr. Luetkehans, and I think you'll have to be back because Mr. Luetkehans hasn't had a chance to look at this and this would be new information I think beyond the scope of the direct testimony, so I think you may be back for another night. But let me move on to some more questions I have that don't relate to these exhibits that we haven't seen before.
BY MR. GRIFFIN:
Q. Did you -- Mr. Hankard, did you assist in determining the placement of the low-noise trailing edge blades that were identified on the existing application?
A. I reviewed the results, but I would not say that I assisted in determining which turbines were assigned as low noise. That's done by the consultant Stantec that has kind of overall control over the project layout, but I certainly reviewed the results.
Q. All right, a question generally about the modelling process. Several of the -- and maybe many

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receptors have turbines that may surround a receptor where there's clearly multiple turbines that may be transmitting noise to one receptor. How do you model for that when you've got multiple turbines emitting noise potentially to one receptor?
A. Well, the model assumes that every turbine is putting out its full noise emission in all directions. So it has -- really what it does is it calculates the distance from -- let's say a house has four turbines, one in each direction, north, south, east and west, and it's going to calculate the distance between each turbine and the house, and really the equations just boil down to distance. We know how loud the turbine is right at the turbine. That's going to dissipate with distance as it gets to the house.
So it's going -- the model is going to calculate the contribution from each of those four turbines around the house and add them up and that will be the total predicted level at that house.
Q. When you say the model assumes -- let me ask you, what other assumptions does the model make about wind direction and other things like that that may affect the sound emitted from a particular

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turbine to a particular receptor?
A. Here again, it assumes that -- the ISO model, as it states in the method, that it assumes that the source is upwind of the receptor or I guess, better put, that the receptor is downwind of the source. So the model is again assuming that it's -- that if you have that house that's got four turbines around it, it's downwind of each one of those. Of course, that can't really be the case, but that's essentially what the model assumes.
Q. All right, so the model assumes the conditions -- the conditions are such that the noise will be maximized at the receptor that's being produced by each turbine. Would that be correct?
A. Yes.
Q. Perhaps not stated the most artfully, but --
A. No, that's fine. No, that is correct. I mean, generally speaking, a source is going to be loudest when the receptor is downwind from that source. So by making the assumption that it's downwind of every source, then it is assuming in that respect the loudest case condition.
Q. Do you know who at Stantec assisted the

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applicant in determining which turbines to place the low-noise trailing edge blades on?
A. That would be JoAnne Blank.
MR. GRIFFIN: That's all the questions I have. Thank you, Mr. Hankard.
A. You're welcome.
CHAIRMAN CORNALE: All right, I believe at this time, after we asked you questions and we kind of run out of some time and as we knew we were going to have you back, I believe there may be some questions in the audience for this specific witness.
Do I have any questions for Mr. Hankard? All right, looks like I've got two gentlemen out here. If you want, yeah, come on up. Just state your name for the record.
MR. HAYES: All right, will do. My name is John --
CHAIRMAN CORNALE: All right, go ahead and turn that on for us.
MR. HAYES: My name is John Hayes, H-A-Y-E-S.
QUESTIONS BY
MR. HAYES:
Q. Good evening, Mr. Hankard. Hope I

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pronounced your name correctly.
A. Yes, that's fine.
Q. I just have some questions about the ISO model. I just wanted to understand it better and I'm sure you can help me with some of the misconceptions. I believe at the earlier testimony you were asked if the turbines were to be considered a point source or they are considered a point source. Would you consider two turbines to be two separate point sources?
A. Yes, that's -- that is how it is modelled, correct.
Q. The ISO model I think could possibly be used to make sound predictions for other things, like maybe a lawn mower or tuning forks?
A. Well, it was developed with environmental noise in mind. So the lawn mower, yes. Perhaps not the tuning fork. But it -- really what it does is it models how sound propagates through the atmosphere.
Q. Sound doesn't -- from tuning forks doesn't propagate through the atmosphere?
A. Well, I guess, sure. If you want to find out how that propagates, you can --

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Q. Yeah. Well, there's a reason for that. And I'm not trying to pull any fast ones, but if you were to strike a tuning fork, you get some -- you can get some interesting things that I'm sure you can explain, so just hold on for a second.
I'm going to strike these two tuning forks and you'll hear a sound. I'm going to strike two tuning forks and you'll hear a sound, and I'm just kind of wondering an explanation for what we hear.
(Demonstrating tuning forks.)
There seems to be an increase in the sound level as they're vibrating. So if we had two turbines going, you know, would we experience that same thing? Can you explain what's going on here?
A. Well, every time you add a source, you add three decibels, and that's what the model is going to assume as well. So, yes, I mean when you strike the second one, it's going to get louder. That's when you've got two sources.
Q. But it was pulsating.
A. Well, that's a function of the resonance of the metal of the tuning fork. That's how it creates its sound. It pulsates.
Q. Well, I don't really think that explains

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it. I mean I'm not trying to say that you don't know, but you didn't answer the question correctly for some reason. Actually it has to do with interference of the two sound waves that are produced, so when you get the -- what's sometimes called a compression of one sound wave --
MR. BLAZER: Mr. Chairman, I'm really loathe to interfere at all with this, but this is supposed to be questioning not testimony.
CHAIRMAN CORNALE: I understand. Let's let him continue here a little bit. I think I might understand where he's going with this. Just remember, you're trying to ask the expert to identify or further explain.
MR. HAYES: Yeah, I apologize for that. I just expected a little different answer to my question than what I got, so that was -- so I went ahead and was trying to explain it and I shouldn't have maybe done that.
BY MR. HAYES:
Q. But anyway, this sometimes with wind turbines is called amplitude modulation; is that correct?
A. Yes. Amplitude modulation is typically

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associated with a single turbine. You can get constructive and -- constructive and destructive interference between two sources. I think that's your point.
Q. That is my point. I was not -- well, in terms of physics, a single point source can't have interference. So considering a turbine a point source, so a single point source can't have interference, so that's where I'm kind of confused.
Now, maybe considering a turbine a point source is not the best thing in the world, but I'm not sure I follow and maybe you can explain to me how a single turbine can have amplitude modulation.
A. It's generally considered because of inflow turbulence, for example, or passing a mast, you get some pressure turbulence when each blade passes by the mast, and that will create amplitude modulation.
Q. Okay. Does the ISO model that you use, does it include amplitude modulation in the calculated predicted value?
A. No, it does not.
Q. So would it be fair to say that the actual sound that's heard by someone at that residence

Page 1298

would be louder if there was amplitude modulation occurring at that point at that time?

A. Well, I mean it's not louder. The level is what the level is. Whether or not they're going to perceive it differently than nonamplitude modulated sound, yes, there could be a difference there.

Q. Okay. Would you agree that if amplitude modulation was to occur, such as -- I realize tuning forks are not wind turbines, but there was a pulsating sound, and would you agree that people might find that annoying?

A. It depends --

MR. BLAZER: I think that's beyond the scope of this witness's testimony, Mr. Chairman.

CHAIRMAN CORNALE: Mr. Hankard, why don't you go ahead and answer that question for us?

A. You know, it depends on the degree of amplitude modulation. And the Illinois Pollution Control Board anticipated impulse of sources and they list them as things like drop forges and blasting explosives, things with serious modulation. To put the sound of a wind turbine in the same category as a drop forge is just to me not a fair

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comparison at all.

Q. Are you aware of any studies that have been done on the effects of amplitude modulation?

A. Indeed, there are many studies and there are conference papers and the like. It's -- yes, I am certainly aware of that.

Q. The predicted values from the ISO model, those are for -- are using input numbers that would be values for a brand-new turbine or one that's four years old or one that's ten years old. Where are the input numbers for? What particular stage of a turbine's life?

A. I'm not a hundred percent sure what a manufacturer like GE does. I assume they test relatively new turbines. They might be testing some over years of time as well. I'm not quite sure to be honest with you.

Q. Okay. Are you aware that as turbines age that they may increase two to three decibels?

A. Yeah, there was a paper recently and I reviewed it and that was the theory. And when they tested turbines of a couple years old and compared them to new turbines, there was actually very little change, no detectable change. The only way they

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were able to get the three decibel change of which you speak is they actually wrap the blades with tape to simulate what would happen if the turbine blade became very irregular, pitted or somehow worn with time, but they were not able to measure any change by just comparing a new blade to a blade of a few years age. There was no difference.

Q. Okay. So are you saying it's not possible for a turbine as it got, say, ten years old and the blade got worn and pitted and things, that it most likely would not increase in sound level?

A. No, if a surface becomes rough and irregular, it's going to create small amounts of turbulence and that is noise, but note that the turbine manufacturers have a vested interest in not allowing this to occur because noise basically equals energy that's not going into electricity production, so --

Q. Okay.

A. -- there are blade maintenance programs that will occur.

Q. Okay. That will be it for the ISO model, but I had a few questions about the Cal Ridge study. In that Cal Ridge study, did you subtract the

Page 1301

background noise from the measured values?

A. We did, yes.

Q. Would it be fair to say that a person who was hearing the sound would also hear the background noise plus the turbine noise?

A. Well, there were a few primary sources of background noise, so probably the primary source was traffic and distant trains, and that was fairly easy for us to mostly separate. And then there was the wind, which once it gets over 5 meters per second, roughly 10 miles per hour, it becomes difficult to sort the two out. And most measurement standards recognize this and actually kind of prohibit measurements under those conditions.

So we cut the wind at 5 meters per second, and we were able to see in the time histories of the levels where the cars were and eliminate those at least to a reasonable degree.

Q. Okay, but my question was would a person hear that sound?

A. Well, sure. If you were standing at one of the residences near where we were measuring, when the cars come by, that's what you hear, and then they go away and it's back to the background level,

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which would be turbines if they're operating or a distant train if it's coming by.

Q. Would you agree that a person would hear a louder sound than the ISO model's predicted value due to the background sound?

A. You mean would they add together?

Q. Yes.

A. Well, sure. I mean all sources of noise in an environment add together given their different frequency and level and time distribution.

Q. Okay. The -- you mentioned that you did -- and this may not have been part of the Cal Ridge study, I'm not sure, that you actually tested the abandoned house at the Shirley Wind farm. Is that also in that Cal Ridge location?

A. No, those are two separate projects. The Shirley one is in Wisconsin and the Cal Ridge is here in Illinois.

Q. Okay. Then -- okay. Do you by any chance have your Cal Ridge study with you?

A. I do.

Q. Okay. I'm going to ask you to -- on page 23, there's a heading that says low turbine days. I have no idea what that means. Can you explain to me

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what that means?

A. Yeah. It's on days when the turbines weren't operating or at least operating at a very low level. You can see, for example, that the RPMs of the turbines is in -- I see a lot of zeros, ones and twos, which means it's barely moving.

Q. Okay. All right, let's see. I mean I realize you just said something I was going to ask you about which is related to that 5 meters per second, but if you will go to say -- let's just pick page 27, that table. At the -- oh, let's see. At the -- I believe the column's called noise levels without vehicles, so I'm assuming that means the background sounds have been subtracted off?

A. The vehicle background sounds, yes.

Q. Okay. At the bottom of the chart, when I look at, say, you know, a thousand hertz, I notice that many of the values exceed the limit. And I understand that you didn't include those numbers in your conclusion that none of the data collected exceeded the values; is that correct?

A. Well, yeah. Again, if you look at the wind speed column, you'll see that right at 5 meters per second, yes, some of the values when the wind

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was above 5 meters per second, they exceed the limits, but that's because we're no longer really measuring turbine noise. Now we're measuring basically wind blowing through trees, along or around grass or on the microphone.

Q. Would it be fair to say the greater the wind speed, the noisier the turbine is going to be?

A. Up to a certain point. Turbines reach a maximum RPM, and then as the wind continues to get stronger, the blades pitch and the turbines don't spin any faster and therefore don't get any louder.

Q. Right. What is that maximum RPM?

A. On these particular turbines, it was 16, 1-6.

Q. Okay. And what I'm getting at here is it seems to me when we're getting to sound levels exceeding the maximum level, that occurs on the windiest times, which is when we're seeing greater than 5 meters per second. And I understand that someone, some committee came up with these recommendations. Do you know anything about where that 5 meters per second came from?

A. Well, that's part of an American National Standards Institute standard that's been around for

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decades, so it would have been that standards committee that would have consisted of an array of acoustical consultants got together and pored over that issue and that's what they came up with.

Q. Are you aware that when that group of people made these recommendations that the majority of those people were associated with the wind industry?

A. Well, that wouldn't really be my recollection because I think that this was -- this standard has been in place for decades and the wind industry really hasn't been so, so that would seem a little odd to me.

Q. Okay.

MR. HAYES: Thank you.

CHAIRMAN CORNALE: All right, thank you. I believe someone else had some questions. Do you have several questions or a whole page full of questions? It's 7:30. I didn't know if we want -- if it's all right, why don't you come up for maybe 10, 15 minutes, ask some questions, and then I may stop you and we may take a break, okay? If you're all right with that.

MR. SLAGEL: Yes.

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CHAIRMAN CORNALE: Okay.
MR. SLAGEL: Hello? My name is John Slagel, S-L-A-G-E-L.
QUESTIONS BY
MR. JOHN SLAGEL:
Q. Okay, you're the sound guy and this case hinges on sound. Lots of people are telling me these are going to be too loud. Some people, like the union guys that work on them, say they'll be quiet and everybody else who thinks they're loud is crazy.
You presented a lot of stuff and I want to be very clear on what you're stating. Will these turbines be quiet and not cause anyone issues or are you simply saying that they meet Illinois Pollution Control Board limits?
A. I am saying that they meet the Illinois Pollution Control Board limits.
Q. Okay, thank you. Now, on the California Ridge noise level compliance, were you responsible for the entire planning and carrying out of the study?
A. That study was conducted by myself in association with Paul Schomer. I did a majority of

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the field work running out to the meters, downloading data, but when it came to choosing measurement locations, analysis methods, that was a joint effort between Mr. or Dr. Schomer and myself.
Q. Okay. What's your relationship with Stantec Engineering? Like they did the sound study, so --
A. Right. They did the modelling on this project, and I am kind of the acoustical consultant in charge, if you will. I'm the one that decides how we should proceed in terms of what assumptions to make and what modelling methods to employ, and then Stantec people actually run the models.
Q. Okay. Okay, so the California Ridge noise study compliance analysis, what was the purpose of the study? Why did you guys do it?
A. To determine if that project -- if the noise levels from that project met the Illinois Pollution Control Board limits.
Q. Okay. And are you going to do that on our project also when it's completed or is there a specific reason you did that project?
A. That project was the result of a noise complaint, so --

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Q. Okay. So after you did the study, what was the -- did it pacify the people that had noise complaints?
A. I don't know if it pacified them.
Q. Okay. Well, I guess people were saying the turbines are too loud, and so you guys came in, do a study, correct?
A. Yes.
Q. And your study said?
A. That it meets the Illinois limits.
Q. Uh-huh. So then what was your conclusion about what to do about the residents complaining about that it was too loud?
A. I guess that was the end of my responsibility. That was what I was hired to do, determine if we met the law.
Q. Okay. So if I can summarize what you did, people were complaining about noise; you came in, you did a study and said we legally meet the limits, so nothing we're going to do about this, see you later, correct?
MR. BLAZER: Again, I'm -- I rarely if ever object when a civilian is asking questions, but I think that's --

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CHAIRMAN CORNALE: Mr. Slagel, yeah, if we could keep it to questions, just -- you don't need to reiterate his response. Just go ahead and continue with your line of questions.
MR. SLAGEL: Okay.
BY MR. SLAGEL:
Q. Did the residents ever record complaints when the turbines were shut down suggesting the nocebo effect?
A. No, I was actually supplied whenever -- when we were doing our study and one of the residents complained about noise, I was always given that information, and I compared it to the turbine operations and the noise levels that we were measuring at that time, and I found that they were -- they understood when the turbines were working. They did not complain when the turbines weren't working.
Q. Okay. So there was no nocebo effect going on with those residents?
MR. BLAZER: I have to object again. It's beyond the scope of this witness's testimony. We haven't established that this witness even knows what the nocebo effect is. That wasn't his

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testimony; that was Mr. Roberts's testimony.
MR. LUETKEHANS: But he sat here through all of it.
CHAIRMAN CORNALE: That is correct, it was not his -- he had no reference to the nocebo effect. Okay, so sound-related questions --
MR. SLAGEL: Yeah, sure.
CHAIRMAN CORNALE: -- to Mr. Hankard please.
MR. SLAGEL: Okay, yep.
BY MR. SLAGEL:
Q. So basically when the residents complained, the turbines were running at or near max capacity every time.
A. Almost every time, that's correct.
Q. Okay. Now, from the California Ridge study, people were complaining about turbine noise as you were measuring it and found it to be under the IPCB limits, correct?
A. That's correct.
Q. So we can conclude that meeting the IPCB limits will not protect you from noise complaints from residents, correct?
A. It did not in that case.

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Q. Okay. Now, this one here, I hate to rehash what's already been rehashed, so I'm just going to say I don't buy your whole rounding argument either. 41.49 is above 41.
MR. BLAZER: I don't know if there's a question pending here, Mr. Chairman.
Q. Okay, why did you round to the nearest ten, ten digit, like 40. Instead of 41.49, why did you choose 41? You could have rounded to anything apparently.
A. Yeah, but I gave I believe a pretty good list of reasons why we chose integers. That's the overwhelming -- I mean I've been doing this for 25 years and that's how we've done it on countless projects and other consultants. It makes sense given that, you know, a 5 dB change is significant, so you wouldn't want to round to 5 dB. That would not be appropriate.
Q. Well, okay, fair enough I guess. I still don't buy it, but okay. I mean -- yeah. Okay, in 9 on your conclusions of this test, you say you stopped testing when the wind is over 5 meters per second I think because the wind is too loud, correct?

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A. We didn't stop testing, the meters ran continuously, but we didn't include that data in the analysis.
Q. Okay. Now, the people that are complaining about the noise, were they outside where the wind would be in their ears or were they inside their houses?
A. I presume they are at times either.
Q. Okay. So really as the wind gets faster and the turbines make more noise, the wind noise you say is hard to separate, but if you're measuring inside the house, which is where the people are complaining, the wind noise is nil, there's no wind noise in the house, right?
A. Certainly not as much. If the wind is buffeting the house, you'll certainly hear that, but it's obviously not as great as it is outside.
Q. Okay. So your test basically proved that outside, you know, on the property line here you were fairly under the IPCB limits. Whether running faster would cause more noise in somebody's house we don't know, correct?
A. Yeah, we do know that. Again, the turbines reach a maximum speed, and noise level is

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related to the speed of the blades, so they don't get any faster when the wind blows hard.
Q. Oh, so 5 meters per second is the maximum fast as the turbine will turn?
A. Well, I mean that's a wind speed and the turbines have a rotational speed, but, you know, from that same table that you were referring to, you'll see that some of the lower speed -- we have a lower wind speed on the ground, I believe on page 27, and you'll see that many of the lower ground wind speeds correlate that the turbines were operating at full, full capacity, full speed, so we know how loud they are when they are operating at full speed.
Q. Okay. So if somebody hired you to figure out -- like you're a sound guy, they hired you to figure out, you know, there's a noise source in the area they want to build their house, so they want to say I want to put my house a certain limit away from this noise source so that I can sleep at night. Would you do a study for them finding if it meets the IPCB limits or would you use something else?
A. Certainly start with the IPCB limits because that's what the source could operate at.

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Q. Right. So then you would say here's how far you should put your house because at this point it's within IPCB limits so you should be able to sleep at night?
A. Whether or not somebody can sleep at night is probably beyond my expertise.
Q. Yeah. Well, let's say something is right at the IPCB limits, which in different octave bands there's different decibels. What's the average -- if you take and you do the average, what's the average decibel level that something meeting the IPCB limits would be at?
A. Well, that -- I believe if you take, if you assume that a source is operating right up to each of the band limits.
Q. Or let's say the turbines when you were testing them they were right at the limit, what's the A-weighted decibel?
A. Right, it's about 45, 46 dB(A).
Q. Okay. So when a guy who works on windmills says these are quiet, there's no noise in the house, and you're saying you've measured 45 you said?
A. Yes.

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Q. Who's not telling the truth here?
A. 45 decibels is what you could receive at a house, so --
Q. And that's not a quiet --
A. I don't know what the guy that works on the turbine, you know, was talking about, so --
Q. Okay, thank you. Let's see. Now, you said that when you add up -- this is switching slightly to the ISO model that you used to calculate the sound model. Basically takes each turbine's distance into effect, adds up all the turbines for a given receptor, and says that's your result of sound for that receptor, right?
A. Yeah, that's a fair summary.
Q. So you add up a bunch of numbers, and for the 8,000 hertz in the Pleasant Ridge application sound study, they came out negative. How do you add up a bunch of sound contributions and then you end up with a negative volume at 8,000 hertz?
A. Well, decibels are relative to a reference quantity, which is .00002 pascals, and if your sound -- if your pressure level that your turbine is putting out is below that, you'll get a negative number. It's -- in the decibel world, a negative number simply means you're below the reference quantity. So it's not an invalid result; it's actually meaningful.
CHAIRMAN CORNALE: This is a good opportunity to stop right here.
MR. SLAGEL: Is it?
CHAIRMAN CORNALE: It is. I promised you. Okay, I've got 7:45.
MR. SLAGEL: Is he going to be back?
CHAIRMAN CORNALE: You're going to finish, you're going to get more questions, we're just going to take five minutes worth of break. Okay, I've got 7:46. Okay, 7:51 come on back.
(Recess at 7:46 p.m. to 7:56 p.m.)
CHAIRMAN CORNALE: All right, if we can make our way back please. All right, Mr. Slagel, I believe you had some additional questions for Mr. Hankard; is that correct?
MR. SLAGEL: Yes.
CHAIRMAN CORNALE: All right.
BY MR. SLAGEL:
Q. Okay, back to the Pleasant Ridge application. Can you explain to me why in the initial application for the GE 100 turbines and the

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supplemental application there was an entire row of the estimates that was completely different for the sound levels?
A. Could you give me some specific reference?
Q. Well, hold on. Yes, in the 31.5 hertz column between the initial application and the supplemental, there's -- I'd say the majority of those numbers are completely different.
A. Could you pick one receptor and tell me what it was before and what it was after? I don't have that information right in front of me.
Q. I don't have it in front of me neither. So you're not aware of that?
A. I mean I know that the different -- like LNTE blades have changed, you know, the numbers have certainly changed with each different submission, so it doesn't surprise me that there was a change.
Q. No, this is pretty much the entire 31.5 column and no other numbers were changed between the two applications. My point being one or the other is pretty much wrong. I want to know which one is wrong.
A. Right. And again, without looking at it, I don't know what you're referring to offhand, I'm

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sorry.
Q. And you're the guy that said, "When I'm hired, it's me, I design, conduct, stand behind, I don't ask how to do the study until --"
MR. BLAZER: Mr. Chairman.
CHAIRMAN CORNALE: Mr. Slagel, questions.
MR. SLAGEL: Okay.
CHAIRMAN CORNALE: Questions for him, thank you.
BY MR. SLAGEL:
Q. Why did you only include the worse 107 sound receptors in the submitted application? It seems a very odd number, very close to 100, which is even.
A. Well, the idea is that the number -- the noise levels at all of the receptors are lower and so we're just looking at the highest. JoAnne came up with that, JoAnne Blank from Stantec. Perhaps she chose a certain -- two decibels under the limit or something will include, you know, everybody that's so close to the limit, and it just came out to 107.
Q. Okay. And how many sound receptors were there total?

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A. I believe it's in the 750 range.
Q. Would you be willing to give out like the next couple hundred?
A. Is -- I forget if all that information is in an appendix in the report or if it's just --
Q. It's not. There's just the 107.
A. Just the 107. I personally have no reason to not release any such information.
Q. The reason I would like to see it is because if you ask these 107 worst ones, of them, there was, let's see, can barely read the numbers, 45 of them were zero decibels less than the limit, the state limits, correct?
A. I think there was at the limit.
Q. Right, plus or minus .49. 42 of them were one decibel below the limit, correct?
A. I haven't looked at the table in a while, but that could very well be.
Q. 17 of them were two decibels below the limit, 2 of them were three decibels below the limit, and 1 of them was seven decibels below the limit. And that's where the sound study stopped. I would like to see some that were actually considered good not the worst because these all seem pretty bad.
Okay, in comparing California Ridge to Pleasant Ridge and the given placement of the turbines, do you think there will be fewer or more noise complaints and why?
A. I have no ability to predict the number of noise complaints.
Q. Okay. The turbine placement, technically Invenergy could have placed these things three times the height or approximately 1300 foot from homes. You guys only placed two of them less than 1600 foot. Is that because you couldn't put them any closer without hitting the IPCB sound limits?
A. Well, I believe there's a number of factors that determine where a turbine can go, noise limits being one of them, wetland areas, turbines can only be so close to one another. I'm not privy to all of the issues that the people that site these projects have to deal with, so whether or not noise was the controlling factor in all cases, I don't know.
Q. Okay. During the California Ridge sound testing, are you aware of any turbines that were shut down during that time?

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A. There's always a turbine here or there for maintenance. We were definitely aware of all of -- the operation of all the turbines in the immediate vicinity of our testing, and as noted in the report, there was a curtailment that occurred in the early months, which was actually they were shut -- the turbines were shut down under low wind conditions and allowed to run under high wind conditions.
Q. Okay.
A. But short of that, I'm not aware of any turbines that were shut down.
Q. Okay. Have any been shut down in that area because of noise complaints ever? Not just during the test.
A. I believe prior to our testing Invenergy was working with the landowner on shutting certain turbines down. I was not involved with that, so --
Q. Okay. On your -- the sound study, when you do -- when you add up the contribution from each turbine to figure its contribution to the noise, how many -- how far out do you go with the number of turbines impacted? Do you add all the turbines?
A. We do.
Q. Okay. When you -- you said when a wind

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speed gets high --
A. If I may, I'd like to clarify. That's a question for JoAnne. I know it was at one point in the analysis where we had limited it to, let's say, 10,000 feet, almost two miles, and then we discussed increasing that. So whether or not every single turbine gets added into each house, I mean you have to understand that once you get beyond 5 or 10,000 feet, you know, the atmosphere dissipates this noise. So these really, really distant turbines are not contributing anything of any significance to the level.
Q. Okay. I don't think we were allowed to ask JoAnne any questions about sound stuff, only flicker and comprehensive plan stuff.
When the wind speed does get over, say, 5 meters per second or whatever would spin the blades too fast, how do you slow them down?
A. They're slowed down by pitching the blades, which is turning the blades out of the wind.
Q. So like rotating the things so they're out of the wind or pitching them like an airplane?
A. Each blade can pitch, can turn, so that when it's at, say, zero degrees it's capturing the

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full force of the wind and at 90 degrees it would be capturing minimal force of the wind.
Q. Okay. Wouldn't that cause a louder sound to emit at that point?
A. No, it doesn't. It -- and then the testing confirms this; that, you know, again it's all about the speed, it's all about the tip speed, which means how fast is it going. So if you pitch the blades out to maintain a certain speed, you're going to maintain the noise level. That's been borne out by the testing that the manufacturer does.
Q. Who made the decision on the submitted application sound study to only study the center of homes not the entire Class A property as specified in the state pollution laws?
A. If you look at case law, I'm not a lawyer, but the case law of Illinois states that it's the dwelling is the Class A land and the other land is not necessarily Class A, so that's why we -- we're predicting the levels at Class A land which is basically the house itself.
Q. You're saying the grass that you mow around your house isn't considered Class A?
A. You know, historically what we've done as

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acoustical consultants is look at, you know, you could have a deck. Again, this is -- we're dealing with nighttime limits, so you would want to reasonably say what do people do at night. And so, yeah, you could be on a deck next to the house, but for the most part you're in or near your house in the wee hours of -- well, between 10:00 and 7:00.
Q. Right. So -- well, I guess I need to ask it as a question, but do the sound, Illinois sound limits, do they pertain to people or property lines?
A. They pertain to the land use.
Q. Right, but what is the -- like the -- let me find my paper here. So in the IPCB requirements or whatnot, it says -- the entire Part 901 is called sound emission standards and limitations for property line noise sources, so it's dealing with the sound that crosses over a property line, correct?
A. Yeah, it is dealing with sound over a property line.
Q. Okay. And more so, we could actually read the 901.102.B which says, "When measured at any point within such receiving Class A land, provided, however, that no measurement of sound pressure

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levels shall be made less than 25 feet from such property-line-noise-source."
So talking again about the grass versus patio, it seems to me a Class A land is the entire Class A property that your house is on, so I'd like to hear more about what you're saying the case study in Illinois that...
A. Right, that the Pollution Control Board has taken up this very issue in the past and they have determined that it is -- that the use of the land is not the property line per se. So the Class A land, a residential property, would be the area around a house, not the -- not the entire extent of the platted land.
Q. Okay. I think we're about done here. Just give me a second to look through.
MR. SLAGEL: That is it. Thank you.
A. Thank you.
CHAIRMAN CORNALE: Thank you. Were there any other additional questions for Mr. Hankard while we have him here? I don't see anybody out there. It's important if you have your questions to ask them when you have them or when the witnesses are here.

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MR. HAYES: Can I ask one more real quick or not? If you don't want me to, that's okay.
CHAIRMAN CORNALE: You had your opportunity.
MR. HAYES: Okay.
CHAIRMAN CORNALE: Okay, all right, I'm sorry. Okay, Mr. Hankard, thank you.
MR. LUETKEHANS: If I may, first of all, I would like to officially, pursuant to what Mr. Griffin said, reserve my right to question about this new information. I don't want my silence to be seen as I'm not going to be cross-examining Mr. Hankard about this new information. And I have other things I want to say about this issue, but Mr. Hankard doesn't have to sit here while we do it.
CHAIRMAN CORNALE: Okay. We can agree to that provided that it's pursuant to the 16A submittal. Do you agree?
MR. LUETKEHANS: Pursuant -- excuse me, it's pursuant to the 16A submittal and Pleasant Ridge Exhibit 131. Both of those are new items that none of us have heard or seen.
CHAIRMAN CORNALE: Fair enough, okay.
MR. LUETKEHANS: And there will be -- I

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don't think Pleasant Ridge Exhibit 16A is sufficient, and we'll talk about that in a minute, but things that arise out of 16A I'd agree.
CHAIRMAN CORNALE: Okay, all right. One other thing I want to take care of. I believe in the audience there's a member that has a question for Mr. Parzyck. I disallowed it the first time. I want to stress the importance to everyone out there to please ask the questions as they -- as these witnesses are here. I understand schedule impediments, whatever. We're here. If you guys really -- try your best to make it.
I believe the individual has represented himself as a school board member. If he's willing to come forward and represent yourself as a school board member, school board official, I will allow this question because -- in the greater interest of the community, all right?
So, Mr. Parzyck, if you could come forward and we'll take this question. And please identify yourself and the government body that you represent.
MR. MARK SLAGEL: Okay, thanks. Okay, thanks for letting me come back up here. I wasn't here the last time when he was here at this meeting.

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I apologize for that, but I have a pretty busy schedule too.
QUESTIONS BY
MR. MARK SLAGEL:
Q. My name is Mark Slagel. I'm a member of the Prairie Central School District, and my questions are really concerning the batch plant. From my understanding, it's located across the road from our Prairie Central Junior High?
MR. BLAZER: I'm sorry, the batch plant?
MR. MARK SLAGEL: Yes.
CHAIRMAN CORNALE: The concrete batch plant.
MR. MARK SLAGEL: Is there a problem with that?
MR. BLAZER: No.
CHAIRMAN CORNALE: The siting of the -- of the batch plant, is that correct, the scope that you're asking?
A. (by Mr. Parczyk) I don't -- I know that the proposed location of the batch plant is within Forrest off of 47. I'm not quite sure where it is with respect to the school.
Q. Okay. Well, who would know the proposed

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location of it?
A. It's in the application.
Q. Okay. And where is that?
A. I just --
Q. The proposed site.
A. I mean I just said it's -- the proposed location, it's in the application, it's online, it's -- as I understand it --
MR. BLAZER: If I may, Mr. Chairman, there's a map in the record that specifically identifies where, the proposed location of the batch plant.
MR. MARK SLAGEL: Okay.
CHAIRMAN CORNALE: And I believe his question is site specific to that.
MR. MARK SLAGEL: Yes.
CHAIRMAN CORNALE: Okay, we've identified -- we've identified where the batch plant is going. And you believe from the maps that it is --
MR. MARK SLAGEL: Yes.
CHAIRMAN CORNALE: -- within the general proximity of the junior high school?
MR. MARK SLAGEL: Yes.

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CHAIRMAN CORNALE: Okay.
BY MR. MARK SLAGEL:
Q. And so my biggest concern is it's -- from what I understand, it's directly across the road from the -- or maybe not directly across the road, but your entrance to get in and out of the batch plant could be directly across the street from our junior high entrance on and off the highway.
And at certain times of the day when school's letting out or when school is starting, that's a terrible busy road and concerns with safety of the children and the bus routes and stuff. Are you going to have some type of a traffic plan in place to help that?
A. Yes, we will. We would work -- we would work with the school, if that's the case, to make sure that certainly the students and anybody working with the pick-up of students, et cetera, is safe. So we would have a traffic plan, we'd work with the school for that plan.
Q. Something that would assure us that we don't have any concerns as far as your trucks in and out.
A. Yes, sir.

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Q. Okay. Do you have any idea how many trucks you'd be having in and out of there in a day's time? I'm sure it varies but --
A. It certainly does vary and it would depend on the time of the year and when the pour is, so I couldn't say exactly how many trucks it would be. And I would have to -- you know, I would have to be able to sit down with our project manager and the contractor that we subsequently identify and identify, you know, what that flow would be and then how that relates to, you know, the occupancy and the hours of the school.
Q. Okay. And that plan, is that something that will be available to us?
A. That plan will -- as we progress with our construction planning, would be something that we would sit down with the school and that plan would be available to the community, yes.
Q. Okay, thank you.
MR. MARK SLAGEL: And thank you for letting me come up here.
CHAIRMAN CORNALE: Thank you for coming back up and taking care of that.
Okay, I believe at this time, Mr.

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Luetkehans, you have with you an individual, Mr. -- Dr. Punch; is that correct?
MR. LUETKEHANS: Yes, we have Dr. Punch. I do want to make a record here of a couple things that just happened with Mr. Hankard though.
One, it became pretty obvious during his questioning that many of the questions were provided to Invenergy or at least a line of questions was provided to Invenergy beforehand. I honestly do not think that's proper without giving those to both sets of counsel in this case, and I feel like I'm the only one in the room that didn't know that this was going to happen since we already have modifications to the plan that are now proposed that I've obviously never seen before.
Second, the 16A. What we still don't have on 16A and what we had for all the other turbines, or at least 107, was the actual numbers that the test results turned out to be. I -- that's not provided in here. All we know is they're, quote, well below their respected criteria. I don't know what well below means, and before cross-examining Mr. Hankard on that, I'd like to see those numbers. And I'd also like to see the test results for these

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numbers, which I asked for and received from Mr. Blazer and I appreciate that. The backup is what we received before the hearing the first time.
This puts us in a position where my experts, one of which is flying in -- scheduled to fly in Thursday, has little or no time to rebut this information. And in fact, you know, in my mind and I know -- I'll make this objection for the record, I know I'll be denied, but we have statutory notice of at least 15 days on zoning hearings on things that are provided or going to be heard. Now we have, in essence, what is a new application with new types of blades, new types of results, and we don't have that opportunity to really examine and get that 15 day notice.
I don't want my clients to have to reschedule Mr. Rand's testimony, but we've put ourselves in a place here where we have significant changes to the application after they were done with their testimony and while I'm in the middle of my testimony. And I don't have a problem with people asking questions, but I do have a problem changing this application after two and a half months of testimony or two months of testimony. That's what

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we've done here.
And not only that, we've changed it after the county passed a moratorium on wind turbines, which is what I understand they did on January 15th. So we've really created a record here that has a lot of -- I have a lot of concerns about and a lot of problems with in our ability to properly prepare a case. I mean I have clients who have paid for a study, which I was about to turn over in the next day or two, for Mr. Rand that now I don't even know if it's the right study because I don't know what these results are relating.
Also -- I also do want to -- besides reserving the right to cross-examine Mr. Hankard, I also want to reserve the right to cross-examine Ms. Blank because, as we heard today, many of the information we now have was not done by Mr. Hankard, it was done by Ms. Blank, and as someone mentioned, we were not able to cross-examine Ms. Blank on sound at all. Those questions about sound were objected to, and we now understand that she did much of this study.
So those are my objections for the record. And for the record, I would move that Pleasant Ridge

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Exhibit 16A either be stricken or that this hearing or that the application be denied because we now have a new application and this process is completely messed up.
MR. GRIFFIN: Let me address the assertion which was incorrect. None of the questions I asked tonight were provided to Pleasant Ridge prior to tonight. I did ask that Mr. Blazer make these two witnesses available because I had questions about financial assurances and I had questions about the rounding issue which was discussed.
And the reason I told him that those were the lines of questions I intended to ask is because I wanted his witnesses prepared to give answers and not simply state that they don't have the information. So I want to make the hearings productive and so I did not want to be told that they would have to get back to me at a later date with those.
MR. LUETKEHANS: Mr. --
MR. BLAZER: My turn.
MR. LUETKEHANS: No, could I just say one thing? I would ask that in the future that those questions or lines of questions be shown to me as

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well so I have some idea what we're coming back about because it really turns into trial by ambush. Thank you.
MR. GRIFFIN: If I have questions for your witnesses, I will give you the lines of questions that I intend to ask so that your witnesses are prepared to answer those.
MR. LUETKEHANS: And I guess I would ask that if you do, that those also be presented to Mr. Blazer. I mean that's only really the fair way to do this.
MR. GRIFFIN: No, it doesn't have anything to do with fairness. It has to do with providing the county information that the county staff wants.
MR. BLAZER: And if he has questions for any of your witnesses, I have no objection to not being told about them. I know how this process works. But with that being said, this is the second time that Mr. Luetkehans has tried this in this process. This is not a new application. This is not a modification of the application.
In response to -- actually to Mr. Luetkehans's questions when he first cross-examined Mr. Hankard about rounding, we provided additional

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information, which we could have done in the case of rebuttal, but since we understood that Mr. Hankard was going to be asked questions about rounding, I thought it better to simply do it all now rather than wait for rebuttal. Nor would counsel for the objectors have had notice of anything I might intend to do in rebuttal.
So his suggestion that this is trial by ambush is simply his obvious effort, as he clearly stated on the record, his effort to make a record for some other hearing body sometime in the future. That's fine, he can do whatever he wants. This isn't a new application. The law on these issues is very clear. This isn't a modification. This is additional information in the event someone decides that rounding is inappropriate. These are the LNTE turbines that would address that issue. Rounding is appropriate according to Mr. Hankard, but as you have seen in this case, we don't intend to leave any stone unturned. So if this board ultimately decides to recommend approval with a condition that, rather than accepting 41.1 or 41.2, that they all have to be at 41 or under, this is the way to do that.
So Mr. Luetkehans has made his record. He

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can do what he wants with that. I have nothing else to say.

CHAIRMAN CORNALE: All right. First thing, Mr. Luetkehans, I'm going to deny your objection to forego the hearings, okay? Mr. Blazer, I believe that it is fair and correct that the test results for these additional towers be presented to us.

MR. BLAZER: And we've already agreed we're going to do that.

CHAIRMAN CORNALE: Okay, fair enough. Okay, the question with JoAnne Blank and the original report --

MR. LUETKEHANS: If I may -- if I may just on that one question, I apologize to interrupt, but my -- I would like the same test results in the same format that I received them the last time before the hearing started, just so the record is clear. And I apologize for interrupting.

CHAIRMAN CORNALE: That -- is that within the possibility of happening before tomorrow?

MR. BLAZER: Candidly, I have no idea, Mr. Chairman. I'll have to check tomorrow, then get back to Mr. Luetkehans, and --

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CHAIRMAN CORNALE: Okay. Mr. Luetkehans, your witness that addressed this or possibly addresses this will be the following week or is actually with us now?

MR. LUETKEHANS: No. Right now, he's scheduled for a week from tomorrow.

CHAIRMAN CORNALE: Okay. Can we have them by early next week?

MR. BLAZER: I'm going to do everything I can to get them either tomorrow or Friday, but it's not up to me, so I will find out first thing tomorrow morning.

CHAIRMAN CORNALE: Okay, we need to make sure he gets them by early next week. Mr. Luetkehans, will that be enough time if he gets them early in the week?

MR. LUETKEHANS: I honestly have no idea. I mean the results the last time we received these, and there were more, don't get me wrong, I'm not trying to -- but I just don't know. I don't know what his schedule is. I do know that he ran many, many tests and revised these numbers, and, you know, that was provided to us in I want to say November, and I'm now just seeing some of those test results.

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So I'd love to say yes. I just have no idea, Mr. Chairman.

CHAIRMAN CORNALE: Okay.

MR. BLAZER: Well, just to be clear, Mr. Chairman, the -- what we gave Mr. Luetkehans in I believe it was October, it might have been November, was everything. No data has been changed. The results are what the results are. Nothing has been changed.

All we've done here with Exhibit 16A is say for the ones that the test -- the model said somewhere between 41 and 41.4, adding these LNTEs, if you decide rounding is inappropriate, drops it down. The data hasn't changed; it's everything that he got, that Mr. Rand has been reviewing for the last three months. So what he's going to get is exactly what he already has.

MR. LUETKEHANS: We just heard that you reran the data with the LNTEs. I need -- I want to understand what the results of that data were. We just heard Mr. Hankard say Ms. Blank ran all that again and he wasn't even sure what the numbers were. I may be wrong, okay, but --

MR. BLAZER: You are.

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MR. LUETKEHANS: Thanks, Mike.

MR. BLAZER: You are. You've had the data --

CHAIRMAN CORNALE: Okay, you guys.

MR. BLAZER: -- since November.

CHAIRMAN CORNALE: Okay, Mr. Blazer, you need to do your best to get him the data first thing.

MR. BLAZER: Absolutely.

CHAIRMAN CORNALE: By the first part of the week.

MR. BLAZER: Okay.

CHAIRMAN CORNALE: Mr. Luetkehans, if you could get that to your individual. If he needs more time, then we may have to delay him coming and we can do that. We'll just have to -- we'll have to move a witness around or do something with respect to that.

MR. BLAZER: But let's be clear, Mr. Chairman. Again, the data he's going to get on these 20 or 24 locations are simply the data that his expert already has but with -- and let's remember one thing. Let's say, for example, it's the 100 turbines, which is the 24. That includes

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the original 11. There's just 13 more. But the data itself, the results of the model, hasn't changed.

MR. LUETKEHANS: So the results of the model that was 41.4 is still 41.4? That's just what you just said. Obviously that's not the case. The LNTE you're saying modifies the results. I want to see the results. Maybe the data doesn't change, but I'm not in a position to know that without talking to experts because, unlike you, I'm not an acoustician.

MR. BLAZER: Well, see, but --

CHAIRMAN CORNALE: Okay, you guys, neither one of you are acousticians we can all agree. Okay, you're both lawyers, we can all agree with that too. Okay. So we need to get the data, Mr. Blazer. This is a change or a modification by changing these to LNTEs. He deserves to get the data. We all deserve to see the data.

MR. BLAZER: I've said repeatedly he can get it.

CHAIRMAN CORNALE: We can assert from Mr. Hankard's testimony that the dBs may decrease by three. That's an assertion by me. Until we see the

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data, we can't -- we can't validate it. He deserves to validate it, so you are going to provide that.

MR. BLAZER: Absolutely.

CHAIRMAN CORNALE: With respect to the JoAnne Blank running these numbers, I don't know what we do now with that, I mean honestly, because we didn't allow her to answer any questions regarding sound.

MR. BLAZER: The report that's in the record, Mr. Chairman, is from Stantec. It's not from Hankard Environmental.

CHAIRMAN CORNALE: Okay.

MR. BLAZER: So that shouldn't come as a surprise to Mr. Luetkehans. She didn't testify about it because, as Mr. Hankard testified, he was -- he's the acoustician who oversaw it all. She just simply ran the model. If you look at the report that's in the record, it's a Stantec report.

CHAIRMAN CORNALE: Okay.

MR. BLAZER: This didn't come as a surprise to anyone.

CHAIRMAN CORNALE: So let's -- in an effort to streamline this and save ourselves the questioning of Blank here, and I think this would be

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all right with counsel, let's formally write these questions down, submit them and have her respond in writing. We'll put it in the record so that we can clarify. I know one of the questions was how close the turbines are and did we continue to add turbines, I -- it was something with regard to that.

MR. BLAZER: Absolutely.

CHAIRMAN CORNALE: We need to know for the record. We'll get it in writing. And, Mr. Luetkehans, if you do have questions along those lines, if you can submit them to us, we'll submit them to the applicant, she'll respond. Is that -- is that within reason?

MR. LUETKEHANS: Honestly, right now I don't know what my questions are, so let me look at that and advise you. I'm not -- I mean, you know, Ms. Blank -- his name is nowhere on this report just for the record, and we tried to ask questions about sound and Mr. Blazer objected.

CHAIRMAN CORNALE: And I probably objected as well because I -- she didn't testify to having any sound capabilities.

MR. LUETKEHANS: I -- and I understand why you ruled the way you did. Let me just -- let me

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look at the questions. I didn't -- you know, let me see the transcript from tonight and understand it because I was --

CHAIRMAN CORNALE: Fair enough. That's all we can ask. Okay.

MR. LUETKEHANS: Thank you.

CHAIRMAN CORNALE: With that, let's move on because I believe you have a witness here and we do want to hear from him.

MR. LUETKEHANS: Yeah, we would call Dr. Punch. We're going to move this table, if that's acceptable, just so he can see the screen.

CHAIRMAN CORNALE: Whatever you need to do. Could you please raise your right hand, sir?

(Dr. Jerry Punch was duly sworn.)

CHAIRMAN CORNALE: Could you please state your name for the record?

DR. PUNCH: Jerry Punch, Jerry L. Punch.

CHAIRMAN CORNALE: Thank you.

MR. LUETKEHANS: Mr. Chairman, before he starts, I have two exhibits to hand out, both of which obviously I've given to Mr. Blazer ahead of time, but I will do that now.

CHAIRMAN CORNALE: Very good. For the

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record, the county will accept UCLC Exhibit 17, Can Wind Noise -- Can Wind Turbine Noise Harm Human Health, produced by Jerry Punch, Ph.D., Professor Emeritus, January 2015.

MR. LUETKEHANS: I do want to say that I apologize. Some of the pages, due to my copying not due to Dr. Punch, are not exactly lined up, but I think they're all legible, so I apologize for that.

CHAIRMAN CORNALE: Yeah, looks like we can make everything out pretty well. All right, for the record, county will accept UCLC Exhibit 16 as references Can Wind Turbine Noise Harm Human Health, again Jerry L. Punch, Presentation to Livingston County Zoning Board of Appeals January 2015, and it's a work sited five page summary, six page summary.

MR. LUETKEHANS: And one last thing, not to take up any more time, I apologize, Mr. Schopp advised me that we have two Exhibit 14s and 15s, and for that I apologize. We would ask that the Hewson report, which I think was the later of the two, be listed as Exhibit 114 and then the c.v. of Mr. Hewson be listed as 115. We'll just add a one if that's acceptable to the board.

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CHAIRMAN CORNALE: Yeah, that's a good solution. So Hewson vitae is 115 and Hewson exhibit is 114; is that correct?

MR. LUETKEHANS: I'll be honest, I believe that's right. Mr. Schopp might have a better handle, but I just heard it was the same thing, so I'm trying to resolve it the best I can.

CHAIRMAN CORNALE: All right, they'll take a look at that, and if we need to clear that up later, we'll get that taken care of. You can go ahead, Mr. Luetkehans, with Mr. Punch.

MR. LUETKEHANS: Mr. Punch will be doing his own presentation via PowerPoint, so there will not be a direct examination.

DR. PUNCH: Thank you for reminding me that I have a remote in my pocket. I think I have to point like this.

I thought before I would begin with the substance of my presentation, I would tell you a little bit about myself and sort of where I came from or come from.

Professor emeritus basically means I'm retired from the faculty at Michigan State University. If you are familiar with military lingo

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if you were in the military, basically I was discharged honorably essentially. That's why I use the emeritus title.

There are a lot of possible titles for this presentation. Basically I'm going to look at the relationship -- I was to consider the relationship between wind turbine noise, both audible and inaudible, on health, basically the adverse health effects that have been reported and so on.

I have to get used to this. And I'll try to get through these as fast as I can. I have more slides than I would like to present in one sitting, but I will get through them expeditiously as possible. Some of them are only pictures which I'll talk briefly about.

I don't believe my remote -- my fault, I had it backwards. Let's try it again. Well, I think it might have died already. Can you roll the slides from back there?

Okay. Educationally, I have a degree in psychology, a bachelor's degree, from Wake Forest University, a master's in hearing and speech sciences from Vanderbilt University, and a Ph.D.

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from a little school up the road, Northwestern University, in audiology.

I have been all my career and continue to be clinically certified to practice audiology, certified by the American Speech-Language-Hearing Association, abbreviated ASHA. I did retire in 2011, May of 2011, from faculty. I still maintain an office and work out of that office part-time. I have over 40 years experience as an audiology clinician.

I'm a teacher, researcher, I've been an administrator, chair of a department for six years, that is a speech and hearing department, I worked at a professional association for about four years in my career early on, I worked in a hospital setting and I have worked in an industrial setting. I've spent the last 25 years, however, as an audiology faculty member at Michigan State University.

Next slide please. A little bit about my experience, and I really think it's important to understand how I got into this. At the request of Rick James, and I know he hasn't testified here but a lot of you have heard his name -- I should say, first of all, that I have known Rick James for about

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20 years. He taught some classes in a course I myself taught on hearing conservation or hearing loss prevention, basically occupational hearing loss.

And Rick asked me in about 2000 -- I think it was early 2009 to accompany him on a trip to the first wind farm ever installed in the state of Michigan in Huron County. Basically that's the thumbnail of the thumb of Michigan.

At that point, again it was the first -- the first farm so-called, I say so-called because I don't look at this as farming, but first wind project in the state. And there was a family up there who were having complaints about the wind turbines nearby, they had been installed for many months, and they found that they needed to go to a motel and live, and basically didn't abandon their home, but they couldn't live in it, they couldn't sleep in it. The husband, the wife, two -- I believe two teenaged daughters, they all just got up and left any hour of the night when they found they couldn't sleep.

I went with a very open mind, I want you all to believe that, because I really was very

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suspicious of these kind of complaints about wind turbines, although I had no reason to believe one way or the other. I'm very much a wind advocate or at least not a wind advocate so much as a green energy advocate. But Rick just assumed as an audiologist I might have an interest because I have had an interest in community noise for many years and have done some work in that area.

I was -- I came back and wrote an article, I'll get into this a little more later, Rick and I wrote an article along with a student on -- really on wind turbine noise because it was apparent to me that -- let me go backwards. I'll get to this point in a couple slides down the road. I just want to go through this list really quickly.

After we wrote this article, I was asked to chair a committee, a technical work group, in the state of Michigan to come up with some guidelines, siting guidelines for onshore wind turbines in the state. They had a guideline that allowed 55 dB(A). And I was asked to chair that meeting. And after that -- that went on for a year and a half or so, and after that I was asked to present some comments and make some presentations to various zoning boards

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and commissions in several Michigan counties.

More recently, I've published an invited blog which summarizes some of our views. That is with Rick. Also asked him to be a coauthor on that set of articles as well.

I've been a witness as a health expert, not necessarily a medical expert because I'm not a medical doctor but as one who has an interest in health, particularly as it relates to the ear and hearing, in legal cases in, including Illinois, six states. You can see the list there.

I continue to do ongoing literature review. Just today I discovered another article that I wasn't aware of. It happens to be a 1985 article, but that's neither here nor there. Let's see if this works now.

My first view of a wind turbine was in Huron County on this trip with Rick James. Rick was driving, he stopped his van, and down the road, I don't know how well you can see this slide, but I could count maybe five, four or five wind turbines in the -- straight down the road in the distance. He asked me how far away do you think those turbines are, and I said -- pretty naively, I said maybe a

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mile, mile and a half. We clocked it on the odometer and they were five miles away, okay?

This particular project had 46 turbines, total of 69 megawatts, and pretty much what you see in the slide is what we saw, turbines with interspersed farms, some houses not very far away from some of the turbines.

Again, I'm having a little problem with my technology here.

This family that I told you about earlier that abandoned their home on certain evenings to sleep in a motel didn't really do a lot of farming. They owned a farm, they had spent many thousands of dollars on renovating the house, particularly on the inside, and were -- it was a family lot and family home and they wanted to raise their daughters there. Actually he's a businessman and he doesn't really get income from farming but rather from his business in which he hires a number of people in this area of Huron County.

Looking to the left, you can see some -- several turbines. I count maybe four or five. In a very clear representation of this slide, I can count five or six.

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Looking again to the left about, I don't know, maybe 80 yards away or so, this is the home, the outside of the home. 1350 feet from the residence was the nearest turbine. It basically abuts the back yard of the property. You're looking I guess at what's the front of the house or side of the house.

After making that trip, we interviewed -- I interviewed the family very informally and just asked them about their issues and didn't really take notes. I wasn't asked to do anything other than observe on that trip. Rick made some sound measurements and later we talked about those, but basically I came back fairly intrigued with how can someone suffer the problems that they talked about. Mostly it was sleep disturbance, there was some other issues relating to maybe headaches and queasiness and those sorts of descriptions, but Rick and I again wrote this article, published it in Audiology Today. It made the cover of the journal. That was in the July/August issue of 2010.

Since that time, we've published this three part series. Again, this is a review article. These are not I will say original research, these

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are review articles, but the Audiology Today article, I'm looking at it now, is pretty basic because we only touched the surface in that article, we only had a certain amount of space to do so, but I think there was only one article that mentioned infrasound. And since that time there's been a lot of information that's become available on infrasound or sound that we really can't hear or interpret as sound. There's -- for anyone who wants to look at that, the upper URL is the place to start to get to the three part series if you're interested.

Okay. So I want to try to address basically seven questions. These were largely developed as a result of my having read the -- what I'll call the deposition testimony of Drs. Roberts and Ellenbogen. Different hearings call for different kinds of information, but these are the ones that I think were emphasized and which I think I can respond to in a reasonable kind of way.

One issue is: Is annoyance really a health issue? Because it seems very simple, everybody gets annoyed at a lot of things in life. Why is annoyance a health issue as many of us are saying and not simply a nuance issue?

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Secondly, can -- I think Dr. Roberts might have said this. Is it possible that just because we can see the turbines we have negative reactions to them and complaints about them? A study by Pedersen in the early 2000s basically claimed that that was true. And the wind industry in general, I don't mean Pleasant Ridge, I don't mean Mr. Blazer, I mean the wind industry in general, has made a point that that is the case. Because people can see it, that they're annoyed by it, even though we're talking about noise annoyance.

Thirdly, we heard mentioned tonight nocebo effects and psychological expectations really explain adverse health effects from wind turbine noise. You'll see AHEs throughout this presentation. Always means adverse health effects.

Fourth, what evidence is there? And I think this is the key and the substance of -- the most substantive of my talk is about the fourth question. What evidence do we have that noise generated by wind turbines leads to adverse health effects in humans? How is it possible that sounds we can't hear, that is, infrasound, can hurt us? That's been the subject of a lot of controversial

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debate recently. What basis is there for medically diagnosing adverse health effects from exposure to wind turbines? I've heard said that, well, doctors don't recognize it, physicians don't recognize it as a diagnostic entity; therefore, it really has no meaning. So I'm going to address that just briefly tonight.

What -- finally, what minimum setback distances and maximum-allowable noise levels are recommended to prevent adverse health effects? And I want to rely for most of or all these -- most of all these questions on peer reviewed literature, although I will say that there are some that aren't really in peer reviewed literature that are in other sources, like government reports, conference presentations by reputable -- what I would deem to be reputable professionals, scientists. And finally, I'll talk just -- I'll give you really a quick wrap-up of what our take-away messages are just by giving you a short summary.

Just preliminarily, I think there are at least these groups of people in the world. Pro-wind folks talk about let's install wind turbines wherever possible, wherever it's feasible. There's

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really no scientific evidence saying that these turbines cause health, adverse health effects. Besides, what you can't hear with respect to infrasound, you can't be hurt by that.

Anti-wind, and I think we all would agree that there are at least these two groups, don't install wind turbines anywhere. Wind really isn't an economically viable source of renewable energy anyway when you look at the financial aspects of it, and all the government subsidies should just simply stop.

I think there's at least a third group. I'd like to put myself in this group. After coming back from that Huron County trip and doing all the review of literature that I've done trying to remain as objective as possible, I don't take any view on pro versus anti except to say that if we're going to install wind turbines, let's do so where it's feasible but not too close to people. Let's don't hurt people.

In my view as an audiologist, it's a behavioral scientist, and I would say that what really matters is a human receptor, not necessarily always sound level meters and models and those sorts

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of things, although I don't discount the necessity of using models in some situations.

A pro-health person would say that there is sufficient anecdotal and scientific evidence existing to say that wind turbines either directly or indirectly cause these adverse health effects, and we believe what you can't hear can hurt you.

I found it interesting. Looking at the Wisconsin Wind Siting Council report, there are two quotes I'd like to take from that and just briefly mention them. The majority report, one of the statements in that report said, "The majority of individuals living near utility-scale wind systems do not report stress, sleep deprivation or chronic adverse health effects attributed to wind turbines."

I think that's true. The majority of people really don't complain. I don't know that that means they don't have a problem or they're just -- and they're just unwilling to report it, but it's true that they don't report, the majority really don't report it. And if you looked at the situation in total, I think it looks like the majority really doesn't have a problem, okay?

The minority report said that, "After

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complaining for a number of years and getting inadequate or no resolution to the problem, residents have abandoned their homes or suffer in frustrated silence." And I believe that is true. I know that is true because I've talked to a number of families, not in Wisconsin, but in Iowa, in Michigan, and in Oregon I believe. Oregon, yes.

And I know there's hundreds and even -- well, I won't say thousands, I haven't counted them, but there are at least many, many hundreds of reports of people abandoning their homes because of wind turbine noise, presumably noise. Some say it might be electrical magnetic fields, but those are very rare reports, and the studies don't really support that nearly as well as they support wind turbine noise being at the crux of the problem.

First question. Why is annoyance a health issues and not simply a nuance issue? People who believe that annoyance is just a simple everyday affair might tell you that -- well, I know it's been said in this set of meetings that everybody gets annoyed, there are things that annoy us all the time, but I'm here to tell you I believe, and I will tell you why, that it's -- it really is not simply

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nuance. It can lead under certain conditions to health problems. I don't know about you, but I thought that was a rather funny slide.

There are two opposing views on noise annoyance and health, and I don't want to sit here and read these slides, but basically I'll try to paraphrase at least. The industry in general admits that they're annoying because there's studies by Pedersen and others that talk about annoyance. They measured the percentage of people who were very annoyed and annoyed by wind turbines, and the wind industry has basically accepted that. It was even in the Colby, et al., report, which is typically referred to as the AWEA and CanWEA report, in 2009, which the wind industry has repeatedly talked or quoted from to support its view that wind turbines are not causing health problems although they are annoying in fact.

Another view is the effects of annoyance, and this is by -- at least one study, in addition to the World Health Organization, puts annoyance at a very higher level by saying that there are physiological, biochemical responses that involve heart problems, including blood pressure and -- high

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blood pressure and even heart disease that start with annoyance. So it looks to be a little more serious matter than we might be led to believe.

I can go through this quickly by pointing out just the italicized words in this slide. There are a number of studies and I've given you the references here. Please feel free to go to them and make your own interpretation.

Amplitude modulated noises and impulsive noises. You all know very well what impulsive noises are. Noises that -- thumping noises, whooshing noise, noises that are very transient, very short-lived, or impulse noises, are more easily heard and annoying than constant level sound. That's been known for many years. I knew that when I was in my master's program back in I guess the '60s.

Tonal sounds. Sounds that contain tones are more annoying than sounds that contain energy across a broad range of frequency, which we really define as noise. Unpredictable and uncontrollable sounds are more annoying than other sounds. Nighttime certainly sounds are more annoying than daytime sounds.

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And sounds in the countryside, in the rural countryside, are more annoying to people than urban noise. People who move to the countryside like peace and quiet. People get used to the city. I've lived in both cities and country and I much prefer country, but I actually could live in the city, but it takes a while to get used to it. Once you move to the country, you don't want the kinds of noises that might be produced even by a wind turbine.

Just some data real quickly. Studies. This was one study, Pedersen again, the Journal of Acoustical Society is a very highly referenced journal, and again the wind industry cites these data as well as people on the other side.

A Dutch set of data was compared with a Swedish study, and at levels above 35 decibels, 9 to 30 percent of people said wind turbine noise is annoying; 5 to 20 percent, depending on the country and the level, said that it's very annoying. And these numbers are mutually exclusive. So from, if you add the first two numbers, 9 and 5, 14 percent to 50 percent of people find it annoying, okay. And the wind industry doesn't really point that fact

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out, but that's what the data tells us.

Look at this as more a -- it does have numbers on it, but look at this figure as a figure that compares annoyance from wind turbines with annoyance from different transportation noises. And you'll see that it takes much less sound level to produce or to -- well, to produce annoyance, to cause annoyance from wind turbines than it does from other sources.

I've just listed here, certainly not going to name them or list -- I mean read them, a lot of research links annoyance and low frequency noise. We know that wind turbine noise contains very, very low frequencies, from around measurable levels, measurable frequencies around .2 or .5 hertz, less than 1 hertz, up to 3 or 400 or even up further than that, like 300 to 400 hertz, very significant amounts of energy.

Some of these are earlier studies. A few were on -- one was on hearing -- excuse me, heating, ventilation and air conditioning systems. One was on occupational setting noises. The others are all on wind turbines per se. Okay, so there is a lot of data, I think almost all of it in the -- I think

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Harrison was a literature review. The other studies were, at least in the right column, were peer reviewed, peer reviewed journal studies, published in peer reviewed journals.

I found it interesting, here again, that in Exhibit 55 and 63, I believe those numbers still stand here in this set of meetings, the Pleasant Ridge exhibits included one by Masotti and Hodgetts; another, the Health Canada study most recently. If you look at what they conclude, that is, the studies themselves, the reports themselves, and what the reports actually contain, there is some -- a discrepancy in the details of the report and the actual overall conclusions drawn from the report.

In the first study, they say that research links noise to adverse health effects, including sleep deprivation and headaches. Sleep deprivation itself, of course, can lead to other more serious problems, including cortisol level changes that are measurable physiologically, inability to concentrate, mood changes and so on.

The Health Canada study admitted or said that the wind -- that wind turbine noise, they abbreviate it WTN, annoyance was statistically

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related to measured long-term cortisol levels and systolic and diastolic blood pressure. So they had some physiologic studies that they reviewed, and they basically are saying that, yeah, annoyance does relate, in fact, to health problems. That's the Health Canada study which is being purported to be a very much pro-wind type of study.

Quickly, the definition of annoyance. You can get all kinds of definitions depending on which dictionary, but I pulled them from several different dictionaries. An unpleasant state, you can talk about irritation, frustration, anger and even violence in some cases, can certainly lead to a deterioration of health and well-being.

Get my slide up. The World Health Organization has defined since the 1940s health as being not just the absence of disease or infirmity, but a complete physical, mental and social state of -- complete physical, mental and social well-being. So according to the World Health Organization, basically there is support for saying that annoyance can lead to a deterioration of health.

One theory and one model, if you will, one

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illustration of how noise can cause health problems is illustrated here in this particular slide. There are several examples and I thought this one was pretty understandable and is consistent with the World Health Organization model or definition of health.

Noise can cause annoyance, whether you measure it or just take subjective readings of it from people, and that can lead to health problems, which might consist of things like burnout, sleepiness, depression and so on. You can measure -- with annoyance, you can typically measure cortisol, elevated cortisol levels, which are an indication of stress.

You can have all kinds of -- and see the relationships here? The one at the top is effort-reward. This particular study contained people in preschool teaching careers basically. It says -- and this, again, is consistent with World Health Organization. If you like your job, you can tolerate a lot more of occupational noise than if you don't like your job. I think we all kind of can believe that.

So I'll leave you with this idea that

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noise and -- that is, health and noise may not -- annoyance from noise may not be in all cases a direct relationship, but certainly there is an indirect channel to be followed there between the two.

Second question, and this is a very short answer, I'll give you one or two slides on this one, Can visibility account for negative reactions to wind turbines? What makes this difficult is as you get closer to homes, wind turbines are more -- yeah, are more visible, but the noise levels are also louder. So as distance decreases, annoyance increases, whether you're talking about visibility or noise annoyance. So it's difficult to separate them for that reason.

Noise annoyance seems to be worse when there's also visual annoyance, and certainly it's more -- it's worse when there are sound characteristics that make it annoying.

One recent study is interesting to me. I just came across this about a month ago. It's a 2012 study. The conventional case that people are annoyed because of visibility only gets turned on its heels a little bit because this study, I believe

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Italian study, said that -- what they did, basically they used pictures and sound, audible sound, from wind turbines in a laboratory. And they used auditory only, visual only and auditory-visual combined as their conditions.

They found that seeing the wind turbine may actually reduce or mitigate noise annoyance while hearing it may increase the visual annoyance, which is kind of the opposite of the conventional view, suggesting a need I think to reconsider that view.

I like this one. It's now a mantra of the wind industry that, well, people just are psychologically upset by wind turbines. They're given bad information. There's a lot of really negative information about wind turbines on the Internet and they're getting all their information from that, those sources; and therefore, the reason they have these, quote, health effects is because they have these psychological expectations and these negative impressions of wind turbines.

There are four studies, all conducted in 2013, at least I believe two or maybe three of them are in peer reviewed journals, and I don't want to

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go into the conditions because it will take me quite a while, but basically it's a study by Chapman in Australia. Chapman and colleagues in Australia compared wind company data with government reports of complaints.

Crichton and colleagues in New Zealand did two studies, one is based on high and low expectancy groups who were told, who were told -- were given information from the Internet that either wind turbines cause problems or that they don't cause problems. Low expectancy of problems versus high expectancy of problems, okay?

And the other study by -- I think it was definitely in the same year, I think it was a later study in that year, showed or rather studied the effects of psychological expectations, a very, very similar kind of set of conditions. Taylor and colleagues in England looked at the issue of whether people with negatively-oriented personalities tend to regard what they call nonspecific or unexplained, nonspecific symptoms, their euphemism for wind turbine syndrome, whether they regarded a situation differently based on their personality types. And the wind industry is using these studies to make the

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case that it's all psychological basically, it's all in your head.

I just have one slide showing the criticisms that I would have of these studies, and I don't mean to -- I'm not cherry picking. These are the studies that the wind industry is using mainly. There might be a few that I haven't really seen or heard about, but I think these are the main ones because they were in -- at least two or three of them in peer reviewed journals.

So very quickly, Chapman, basically because residents are typically discouraged by the wind companies from complaining and because any complaints that come forward tend to be delayed, the records that they chose to look at were probably not reflective of all the complaints, so it was a very limited observation study.

Crichton studies, both of them, really did not even use infrasound in a laboratory setting that they purported to be using. They didn't use infrasound because their speakers wouldn't produce it. They didn't produce any graphs of it. They didn't describe the equipment, but a studio woofer does not produce sounds below about 18 hertz at

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best. They didn't get down to a low level enough even to give the subjects in their study, who happened to be college students, real infrasound to which to compare with the so-called sham conditions where they really weren't given any infrasound at all, any purported infrasound.

Another problem I had with that study is that university students are probably the least vulnerable group to these kind of problems we hear about. They're not young, very young, they're not very old, and they're not very sick. And these are the groups that the World Health Organization says are the most likely to be sensitive to wind turbine noise or to noise.

Actually the World Health Organization does not address wind turbine noise per se, they address noises from other sources, but because infrasound is now known to be a more deleterious kind of noise to be exposed to than some of these other low frequency sounds, even the World Health Organization's lower limits might need to be reduced for wind turbines.

Finally, Taylor did not even use wind turbines on an industrial scale size-wise. Nobody's

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ever said, that I know of, that noise from small scale wind turbines below -- well below sometimes 1 megawatt capacity, causes any problems at all. So they were kind of addressing a problem that isn't even talked about. So I don't find it surprising at all that people with negative personality types would tend to say they cause problems.

By the way, they viewed DVD material instead of Internet material, pretty much like the first study that Crichton did. I'm sorry, the DVD was in the second Crichton study. It doesn't matter here. But basically it's not surprising to see results from the Taylor study come out the way they did because we know that there is a power of suggestion. We know that there is personality type data all over the place in psychological literature that says a negative person is going to be negative about anything basically; a positive person is going to be positive about most things.

So those studies to me seem very weak. And I would say in all the jobs I've taken in places, mainly in the Midwest, I've always done some teaching and some research and I view myself as a researcher. I sit on the board of the Institutional

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Review Board reviewing research grants at Michigan State University. As a researcher who has published -- I won't go into that here, but who has published quite a bit in the literature, peer reviewed literature, in audiology particularly, I don't find those studies very convincing. So I don't think that they're very valid studies, the ones that I just went through. I hope you've read that by now because I've read enough of these too.

What evidence is there that noise from wind turbines leads to adverse health effects? And again, we're talking just about humans here. Well, there is a lot of anecdotal evidence and I know that's pooh-poohed by the wind industry, but every -- every known health condition in the world starts with adverse health effects. Or reports, adverse health reports let's say.

And there are lots of them on the Internet and newspaper articles, and in two -- at least two documentary movies, Wind Fall and Wind Rush. I urge you to watch those if you care to. I know Wind Fall I believe is on Netflix. I don't know if you can go to the theater and see those movies, but you can certainly find them on the Internet, at least one of

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them.

Some of this evidence is in expert testimony in legal proceedings, although I don't have any of that information to go through tonight. It's too tedious.

Government documents, some of which was sanctioned by the Department of Energy, some of it early on and some more recently, some by the military.

Then we have scientific and professional presentations at conferences. Basically these are typically scientists or many times leading scientists who will later publish their reports, but not all the material presented at -- well, you probably know this -- at these kind of meetings is published, but we do have peer reviewed scientific literature that supports the view that there is a relationship between wind turbine noise and adverse health effects.

Another fussy slide, but I put together some basic quotes from a person from Ontario who saw what was happening in Wisconsin. I testified in that hearing and I looked -- one day I decided to look randomly through the public comments and this

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is what I came up with and this is totally random. I thought, though, it expressed the issues very well from the standpoint of a layperson who has lived around wind turbines for a number of years. They're all over -- there are a lot of -- there's a lot of development in Canada in the wind industry, probably ahead of the U.S., although I can't really comment on that with authority.

She said, she or he, I think it was a she, said I've been involved with and witnessed firsthand the heartbreak, she mentioned heartbreak, of abandoning homes. People can barely function in their lives. Some had to stop working at their jobs. Some people had a loss of sense of balance, but there was -- this comes up a lot. When people leave the environment, then they tend to get better. Fortunately these effects tend to be temporary, and when you go back into the situation, they tend to recur.

Quality of life is affected. We came here to hear the birds and bees and the frog calls and the insects buzzing, and now we get passing -- and we occasionally have passing cars and dogs barking, but this is really different. Wind turbines are a

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really different experience. It's turned a pastoral existence into a ghetto nightmare. That was just her comment.

The World Health Organization recognizes the risks of noise, the health risks of noise in general. As an audiologist, I don't believe and I don't think anybody believes or is proposing that wind turbine noise causes hearing loss. We do not believe it does, okay? It takes about 85 dB(A) on a daily basis for possibly years before hearing loss occurs. So hearing loss is really not a big issue here, but these other things that went with wind turbines tend to be coming up over and over again in other reports.

Academic performance of children in schools. I was interested in the comment tonight about turbines located near a school. Please don't. Not too close to schools. Kids are trying to concentrate and I think it's a bad thing. Particularly with very young kids. I think these kids may be a little older than young. I think junior high kids are in the, what, seventh to ninth grade or sixth to ninth or something like that.

Dr. Nina Pierpont always comes up, and you

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have heard her name before I'm pretty sure, a practicing pediatrician. She's a Fellow of the American Academy of Pediatrics. She described symptoms of 38 members of ten families in New York who came into her practice, either children were having problems or the adults in the family were having problems. She published a book, and yes, it was self-published, the wind companies like to point that out, in 2009 coining the term wind turbine syndrome. And I ask the board, maybe have you seen this list of symptoms before? I don't want to go through them.

But she named ten symptoms, some of which tend to be linked to the vestibular system. We now think that not only the vestibular but the cochlea, or the hearing component of the ear, the inner ear, is being stimulated, particularly in the case of infrasound produced some of these adverse health effects. I've heard over and over people say I feel a pain or pressure that's really hard to describe. Some people have ear sensations. They can't really point to wind turbines as a problem, except when they leave the area, they tend to get over the problem.

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I basically have given you already this information, particularly at the bottom. I will say relative to the middle bullet point that the industry has been very critical of Pierpont. They basically are critical based on the fact that she published a book and not a scientific paper. It was, though, a credible epidemiological study if you consider, and I do, case series as a starting point for reporting conditions that may have widespread applicability in the population.

I interviewed a Michigan family, not the family that I talked to you about in Huron County but another family, which filed a lawsuit last year I believe. The family, there was a female adult, a male adult and a male child. I think he was about 11 years old at the time. Construction worker, built his own home. And a picture window, he was building a -- renovating his home to add kind of an A-frame picture window room, which was a rec room, combination of other kinds of rooms as well, and they've had to abandon their home.

When I interviewed them and I compared their -- these are very detailed answers to a questionnaire that I developed with Rick James,

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but -- and with Wisconsin folks who've dealt with this issue for a while. I won't go through the list obviously, but the female had eight of the ten symptoms of wind turbine syndrome, the male adult six symptoms, and the child six as well.

A family in Iowa, this was a questionnaire interview that I did via mail, and then the family read what I had typed up as their answers to verify these are the correct answers. And what I got was, this is just a male and female, a farmer who -- the man's a farmer and I don't know the occupation of the female, but he's had to leave his farm. And he's coming back to work the farm, the animals are still on the farm, but he's coming back to work the farm periodically. But he suffers eight of the ten symptoms and that's a lot. A syndrome is usually three or four, maybe five symptoms. So this is consistent I think with wind turbine syndrome, if you want to use that term.

Very important to know that sleep disturbance, you probably already know this, is the most well-documented symptom. Even Leventhall back in 2003, who tends to testify in cases of wind development in favor of wind companies, has said

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that there is sleep disturbance. I've even seen an article more recently, not on this list, that he did in -- I forget, I'm sorry, I forgot the year, I think a little earlier than -- definitely earlier than 2003, in which he said it actually causes health effects, low frequency noise causes health effects.

Almost all these on the right column are very recent studies. There was a lot known even before I think 2003 about infrasound that we don't talk much about, but at any rate, a lot of this information has come from studies that have been done much more recently than the early ones.

The National Institutes of Health, NIH, lists the negative effects of sleep disturbance, very much health-related effects in some cases, learning and concentration, memory, heart disease, hypertension and so on, growth and development in children, even fertility in puberty, particularly when pregnant women are exposed to noise in general. I'm -- we're not talking about noise in general. We're talking about sleep disturbance.

I'm on 10:20 time, Eastern time, after driving all day, so I tend to have a few senior

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moments here, I'm sorry.
And there's a lot of research linking sleep disturbance and quality of life to low frequency noise. And those again all are studies, except maybe two or so. Two or three are on wind turbine noise per se and not just noise in general. Again, these are peer reviewed studies. I think Hanning in the upper right might have been a review paper quoting others, but Hanning is a well-known sleep expert, and he has said that there is a real link between quality of life and sleep disturbance due to low frequency noise.
Epidemiologists would say, well, you need some epidemiologically strong studies or designs to be able to call these effects real. There are some -- at least a few studies cross-sectional in design where you compare somebody who lives near and far from -- another group who lives far from wind turbines in New Zealand and Maine here in the U.S. and in Ontario. The Shepherd group looked at mainly quality of life issues, people living one and a half -- within, excuse me, 1.2 miles or 2 kilometers.
Nissenbaum in Maine, 1.4 kilometers or .87

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miles, which is what he had in his study, that was his study, cut-off point of groups that he studied, had worse sleep problems, sleepiness during daytime, as well as mental health of course, using a standardized questionnaire, set of questionnaires.
And Paller recently in Ontario for the first time showed a relationship between wind turbine noise and vertigo, tinnitus, even though that was in Pierpont's original list of wind turbine symptoms. So those are three pretty, I think, very solid studies that should cause us pause I think.
There's been sort of a recent concern expressed that people who live near wind turbines are essentially experiencing some of the same symptoms that people experience when they get motion sickness, even though it doesn't involve movement. We know about the inner ear and the fluids in the ear, they do move, and they stimulate what's called hair cells inside the inner ear, so you might get the same effects.
Kennedy did some -- with Naval pilots, did a study in which he found if he basically shook Navy pilots at .2 hertz, very slow like wave motion in the ocean, okay, on a ship, that that makes people

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seasick. And Schomer who I think most people have a high regard for, even on both sides of the issue in this room, at least two sides of the issue, believes that motion sickness is similar to these health effects that people report from being exposed to wind turbine noise, particularly infrasound, even though only acoustic energy and not bodily movement is involved. So it's an interesting hypothesis and that's -- that idea only got airing in 2013 I think for the first time.
So what we know and don't know. Certainly a significant number but -- a nontrivial number or percentage of the population suffers significant adverse effects from exposure. We don't yet know what percentage of the population suffers these health effects, and we certainly don't know what levels and durations of exposure result in these effects.
We do know that symptoms are highly variable. Any two people are going to have probably different symptoms. Sometimes you have a husband and wife at home. Husband -- as I showed you on the slide earlier, one has a problem, the other has virtually no problems. But if one has a problem and

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they have to move, typically the family's going to move with them.
This is a challenge. The fact that it's -- the symptoms are highly variable is kind of a challenge I think to epidemiological research. It could be done. We don't have to aim toward just dizziness, just headaches, just nausea, et cetera, but it is a challenge because it's so highly variable. It's a lot easier to study something when it's stable, and this is not necessarily a stable entity. There's very wide variation among people.
How is it possible that sounds we can't hear can hurt us? We're talking here of course about infrasound. And you all have heard about Salt and his work. I was going to mention it again here. I want to go through this more briefly. You have the slides, the board has the slides to refer to, and I stand by those statements.
We can -- there are things that we can't touch, taste, see or smell that definitely hurt us. Toxic fumes that we can't smell, for example, ultraviolet rays that we can't see and so on. There's a lot of those things. Why is it, then, that we can't believe that there might be things we

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can't hear that could hurt us?
Infrasound seems to be the root cause of many of the health complaints. It's understandable that audible sounds might keep a person from sleeping at night. I'm coming to believe, and this is just my hunch based on what I've read in the literature and how I interpret the literature, I think some of these symptoms that people report are coming from the infrasound as well. They might wake up disturbed at night and not even be able to identify a sound at all, and that's really what is at the basis of that statement.
So if you know about Salt, we'll go on from there. I think the thing that Dr. Roberts criticized that I take objection to is that the research that Salt's colleagues -- Salt and his colleagues have done at the Washington University School of Medicine in St. Louis is based primarily on guinea pig ears. It turns out that guinea pigs, gerbils, rhesus monkeys, cats, to a lesser extent dogs, have ears very similar structurally to humans. In fact, I talked to Salt on the phone and he says that rodents in generally tend to have very good similar structures, very similar structures to human

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ears.
We cannot subject humans to the kind of research that Salt and his team conducts, okay. If you would allow him to do surgery on your ear and put a probe, microphone or probe, let's say, a stimulus and a probe, a needle, if you will, into the inside of your inner ear, which is far back into your skull, two, one on each side of course, then you could volunteer, but I don't think you're going to find many humans are going to volunteer for that kind of research. We know a lot about what we know from animal research, because it's unethical or impossible to do research, these kind of studies, on humans.
So I'd like to try to -- if I can get the slide to come up, I'd like to -- can you advance the slide or do we still have a person in the control room? I don't know if that was me or you. I don't know if you've heard any of this before here. I don't think you have as a board. I will run through this as quickly as possible.
In the inner ear -- and we have the outer ear, the middle ear and the inner ear. In the inner ear, there are inner hair cells and outer hair

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cells. The inner hair cells are not big, are not constructed to be sensitive at all to infrasound, to very low frequency sound. It's a protective mechanism. But the outer hair cells are sensitive.
And Salt's work says that people -- not people. He's saying people probably but based on guinea pig research. He sees in these animals responses, physiological responses, electroacoustic responses in the ear at -- responses to infrasonic frequencies that are 40 dB below that that we interpret as sound, so 40 dB below those sounds that are heard, okay? And he believes infrasound, even below -- even though it's below the threshold of audibility, can be perceived. It's perceived as something else. It's perceived as a weird sensation based on the messages getting to the brain from the outer hair cells.
This is -- I don't know if you want to take the time to look at this closely or not, but basically the -- I believe I have a laser pointer here. This line is wind turbine noise, okay? It's two different studies. This is the sensitivity of the inner hair cells and the outer hair cell sensitivity. Any sounds above that, above these

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lines, can be heard, and these are well-known to be audible frequencies. As you get lower in frequency, particularly in the infrasonic range, you have a possibility that the outer hair cells are being stimulated here and could hear infrasound. So this is just another way to depict graphically what I've tried to say verbally.
The outer hair cells are picking up information. It's going to various areas of the brain, but probably not to the primary auditory center that interprets whatever stimulates it as sound. It's something else. It can be tinnitus possibly, it can be nausea, it can be dizziness, whatever.
This is, I think, an interesting thought. That Salt's work shows that there's a larger response to low frequency sounds when high frequency sounds are absent. He found that again in guinea pigs. And I know a lot of research has been done on guinea pigs that we know is now true in humans. I think this is probably also true in humans. That means that infrasound could have its worst impact at night when people are asleep in their bedrooms or trying to sleep at home. He thinks that vestibular

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physiology, the balance organism of the inner ear, could be responsible for some of these symptoms as well as the cochlea, the hearing component of the inner ear.

So his studies really establish a biological plausibility which is a first step toward epidemiological proof that infrasound reaches the brain even though we don't hear it. So he's says what you can't hear can't hurt you is false. What they say, okay?

Amplitude modulation. Again, Salt's laboratory work shows that he thinks, and this is his thought based on his research, that infrasound is the basis for complaints of people living near wind turbines primarily because of amplitude modulation giving a feeling in a lot of people of throbbing and rumbling sensations.

Low frequencies take lower sound levels to be amplitude modulated than high frequencies, and he even shows that low frequencies if present can modulate higher frequencies. So even if you don't hear infrasound, it can amplitude modulate sounds that are various sounds, okay? It's an interesting thought.

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This is very quickly just a schematic of the ear down in the lower left, the cochlea right here, up and through the brain stem, the mid brain and the cerebral cortex. Most of the information from the ear gets to the auditory centers, which is here and over here on this side, both sides of the brain.

Some of that information from the outer hair cell can be traced, again at least in the guinea pig, and I think in human cadavers it can be traced, okay, so we know that's true in humans, it's going to other centers other than the primary auditory cortex where stimulation would occur as sound or it would be interpreted as sound.

And this is just a picture of the brain showing you some of those auditory centers. The primary auditory center is here. There are association areas that information is sent to. In general, we're -- we need multiple stimulation to the brain to accomplish almost anything we do. Even our left hand/right hand coordination when we drive a steering wheel -- when we drive a car using the steering wheel, the brain is telling the two how to act together.

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I even tried on the way here today to cross my hands on the steering wheel like this, and it was only a matter of a few seconds that I could easily. And you've done that probably. You could coordinate yourself. So I'm just making the point that stimulation from various parts of the brain doesn't just go to one part of the brain -- I'm sorry, from the various parts of the body, including the ear, not just goes to one part of the brain but to multiple sites in the brain. And these multiple sites can be interpreted because they are novel stimulated to the brain. They're not easily interpreted and meaningful.

I see that time is really short. I'm going to try to --

MR. LUETKEHANS: Mr. Chairman, it's 9:35. We're bringing back Dr. Punch tomorrow. I have no objection, you know, having him finish this first thing tomorrow night if that's what the board would like.

CHAIRMAN CORNALE: Okay.

MR. BLAZER: Mr. Chairman, my -- and I hate to ask, but our cross is going to be quite lengthy. I would hate to have to ask Mr. Luetkehans

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and his clients to fly Mr. Punch back after tomorrow. So it looks like he has about 20 pages left. I have a feeling most of it is summary. I would suggest we try and finish tonight if possible. And he's nodding at me he thinks that he can do this.

CHAIRMAN CORNALE: Okay, we run into a functional issue as far as we don't have the ability to present this in Fairbury with a projector and with --

MS. FEHR: Yes, they do.

MR. BLAZER: Again, I think he's indicating that he can finish tonight.

CHAIRMAN CORNALE: Dr. Punch, if you had to guess, and I really -- I don't mean to cut your presentation short because you have a lot of information in here. Are we looking at, you know, is it 20, 25 minutes more or -- I know it's hard for the audience, it's hard for everybody.

DR. PUNCH: Can we do it in ten minutes I think? I think I can do it in --

CHAIRMAN CORNALE: If you could do it in ten minutes, 10, 15 minutes, is that okay with the board? Guys?

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DR. PUNCH: I'll do my best.
CHAIRMAN CORNALE: All right.
DR. PUNCH: I don't see these last two questions taking very long.
CHAIRMAN CORNALE: Okay, okay, that's fine.
DR. PUNCH: So what medical basis is there for diagnosing these reported adverse health effects from wind turbine noise? There is a physician, Dr. Robert McMurtry. I sort of superimposed his credentials under biographical information here, this box with his picture. This is just a screen shot of the article in a peer reviewed journal, Bulletin of Science -- Bulletin of Science, Technology and Society. He does come up with some diagnostic criteria which can be used to diagnose what he calls health effects in the environs of industrial wind turbines. And I want to go through this as quickly as possible.
He says there are three sets of criteria, first, second, third order of criteria. If a person lives within 5 kilometers of an industrial wind turbine, if there's altered health status following exposure to the noise or wind turbines, and if there

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is a reduction or amelioration of symptoms when a person goes away from wind turbines, and the fourth one, if the symptoms recur when returning, then if you meet three out of four of those criteria, you're on your way to being able to diagnose wind turbine syndrome.
Now, he goes further than that. He says that if there's a compromise of quality of life, sleep disturbance, annoyance and simply a preference in some people to -- if there's a preference in a person to leave the residence either temporarily or permanently to get some sleep, then that's another sign. Three out of four of those meet the second order of criteria.
He lists a bunch of -- six categories, a bunch of symptoms under those. He says that if you meet at least three of these following symptoms, then you probably have what I will call wind turbine syndrome, okay. And these go on, and that's the six -- systemic is the sixth category. So these are the kind of symptoms. Again, very close but not identical mirror to Pierpont's wind turbine syndrome.
We don't have to worry about -- these are

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just a listing of -- oops, sorry -- the first and second order symptoms. The family I mentioned earlier in Michigan have all these symptoms, all three members of the family, of the first and second order symptoms or conditions. The third order, the female primarily had the most and -- or had the most conditions, and the male had a few. He was predisposed by having a hearing loss and he had surgery on his middle ears, so that might have been related to his problem. Even the child had a couple of these problems. And it goes on. This is the second part. I couldn't get it all on one slide.
These are symptoms that meet the McMurtry, Robert McMurtry's criteria for diagnosing wind turbine syndrome. The family in Iowa, the only difference is, and you can look just on the checked boxes on the right, both people, the adults in the family, reported both symptoms on this detailed questionnaire covering the first and second order conditions or criteria. And then the male, some on the first page; and male and the female, several symptoms. And remember, you only have to get three out of all these to be diagnosed under this third order according to this doctor who has a very good

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reputation as a physician and a health expert in Canada.
Our seventh and final question is: What minimum setback distances and maximum allowable noise levels are recommended to prevent adverse health effects? I can do this quickly. I'm just going to read the first part of this at the top. There are the studies underneath. There are probably a lot more. One or two of those I believe may be review articles, but there's some other epidemiological scientific studies there as well, particularly the last two. Distances recommended are between half a mile and 2.5 miles with 1.25 or one and a quarter miles, which is 2 kilometers, being the most common recommendation in the literature for distance, if you're going to use distance as a measure, as a means of determining where to site wind turbines in relationship to residences.
Noise level recommendations tend to be agreeing with the World Health Organization's numbers between 30 and 40 decibels on the A-weighted scale. Some put extra penalties for impulse noise, periodic noise, but basically the range is 30 to 40

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decibels, which is again in compliance with the World Health Organization guidelines which say that nighttime noise in the area, the range, of 30 to 40 dB(A) starts to affect sleep, particularly sleeping issues, including arousals and so forth, and it gets more serious, particularly for more vulnerable populations, with anything over 40 dB(A), and it gets really serious with over 55 dB(A).

Just conclude this by saying, I guess from an audiological point of view, you have people, behavioral point of view, there are plenty of places to put these wind turbines. I know that there are issues with regard to the capacity and the amount of electricity. We all need electricity. We all adore, I must say, electricity. My electricity went out for four days a year ago and I had to get out of the house basically. So we all want more electricity and more sources, but there are other places besides people's homes.

These are places that I would say do not put them. Cary Shineldecker's home on the left near Ludington, Michigan, I like the picture, it's a very pretty picture, the fog rolling in on the upper right, but it's too close to the home in my view, or

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it could be, it could be, in terms of health effects. And the one on the lower right has been abandoned completely.

What are our take-away messages? I think annoyance can lead to health issues based on particularly the World Health Organization's definition of health. That there can be some interaction between visibility and noise annoyance, but visibility alone does not seem likely as an explanation for why people are complaining about wind turbines. Psychological expectations as well don't appear to be adequate to explain these reactions and effects.

The fourth question. There's lots of evidence ranging from anecdotal peer reviewed literature that shows that there's a strong relationship between wind turbine noise and adverse health effects, and it could be the primary direct effect or it could be possibly an indirect effect.

Basically on Salt's -- based on Salt's work primarily, the fact that the inner ear responds to infrasound that's below what we can hear or interpret as sound suggests that the brain centers are receiving information that it has difficulty

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interpreting, therefore resulting in negative sensations.

There is a set of criteria by which wind turbine syndrome or adverse health effects from living near wind turbines can be medically diagnosed. In fact, Dr. Steven Rauch, R-A-U-C-H, in Massachusetts has begun to see patients and diagnosed them as having wind turbine syndrome.

Finally, the seventh point or the seventh conclusion here I've just quoted you earlier, so I won't have to go through them again. There are these ranges from .5 to 2.5 miles and 30 to 40 decibels on the A scale that have been recommended widely in the literature, including the World Health Organization, when it comes to siting near residences.

Thank you for your patience.

CHAIRMAN CORNALE: Thank you, Dr. Punch. Tomorrow evening as we get going, we'll certainly open the floor up for you for a few more comments that you might want to make if you didn't get -- if you think about something that you didn't talk about enough on here.

So with that, we'll meet again tomorrow

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evening 6:30 in Fairbury, so we'll be back at the Walton Centre tomorrow evening at 6:30. All right, need a motion to recess.

MR. VITZTHUM: I make that motion.

CHAIRMAN CORNALE: Vitzthum motions. Can I have a second?

MR. ZIMMERMAN: Second.

CHAIRMAN CORNALE: All right, Howard seconds. All in favor?

ALL MEMBERS: Aye.

CHAIRMAN CORNALE: Opposed? All right, see everybody back tomorrow night.

(Adjourned at 9:48 p.m.)

STATE OF ILLINOIS)
)SS
COUNTY OF FORD)

I, June Haeme, a Notary Public in and for the County of Ford, State of Illinois, do hereby certify that the following Livingston County Zoning Board of Appeals, Case SU-7-14 hearing was taken at the Pontiac Township High School, 1100 Indiana Avenue, Pontiac, Illinois, on January 21, 2015.

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

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

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 26th day of January, 2015.

JUNE HAEME, CSR
NOTARY PUBLIC

"OFFICIAL SEAL"
June Haeme
Notary Public, State of Illinois
My Commission Expires:
September 27, 2016

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