come out to, say, per acre or something like that for Charles Mix County, taking into consideration all those trust lands that aren't taxed?

MS. AGRIMONTI: Objection.

THE WITNESS: This is not even relevant to this. We're on a whole new ground.

MR. FUERNISS: Okay. I'll withdraw the question it if that's the proper thing to do.

Thank you.

MR. DE HUECK: Ms. Jenkins?

MS. JENKINS: No questions.

MR. DE HUECK: Ms. Pazour.

MS. PAZOUR: I have a question, but I would like to ask Ms. Edwards because I'm not sure on how to ask it.

MS. EDWARDS: Can we take 30 seconds? I can't give legal advice, but I can see what you want to know from me.

MR. DE HUECK: Yep. Go ahead.

(A short recess is taken.)

MR. DE HUECK: Ms. Pazour, go ahead.

RECROSS-EXAMINATION

BY MS. PAZOUR:

Q. Did you have any public meetings outside of the Commission -- Commissioners meetings with Prevailing

Winds?

A. No. I stepped out of that meeting with Mr. Peter Pawlowski, but no other meetings, other than public meetings.

Q. Like in the beginning of August?

A. I did not.

MS. PAZOUR: Okay.

MR. DE HUECK: With that, Mr. Mushitz.

THE WITNESS: Mushitz.

MR. DE HUECK: Mushitz. Thank you for your testimony, and you may step down.

(The witness is excused.)

MR. DE HUECK: We will move on to Staff's witness. He was scheduled today so that's why we're breaking the order for Mr. Almond at this time allowing Staff's witness to take the stand.

MS. EDWARDS: Staff calls David Hessler.

David Hessler,

called as a witness, being first duly sworn in the above cause, testified under oath as follows:

DIRECT EXAMINATION

BY MS. EDWARDS:

Q. Mr. Hessler, welcome back to South Dakota. Will you please introduce yourself for the record.

A. Yeah. My name is David Hessler. I'm an acoustical

consultant with Hessler Associates, and I've been asked by the Public Utilities Staff to provide impartial technical advice on noise for this project.

Q. Did you submit prefiled testimony in this docket?

A. Yes, I did.

Q. Have you testified before this Commission before?

A. Two previous times.

Q. Have you reviewed the other testimony submitted by other witnesses in this docket?

A. Yes, I have.

Q. Both direct and rebuttal?

A. Yes.

Q. Have you also reviewed all responses to data requests?

A. I believe I've read most of them, if not all of them.

Q. Did you rely upon that information when formulating your opinion?

A. Yes.

Q. Are you familiar with the testimony of Mr. Howell, Chris Howell?

A. Yes. Mr. Chris Howell, the -- he's the acoustical engineer for the project.

Q. Would you agree that it is -- based upon his testimony yesterday, would you agree that it is either

inappropriate or impossible to assess the potential noise impact on the -- strike that.

What is your over all assessment of the positions and arguments advanced by Mr. Howell in his testimony?

A. Well, I think what you were getting at there for a minute was the first point, which is he contends that it's impossible to predict or assess the public reaction to a project, and so their study focused entirely on simply demonstrating whether the project was going to meet the 45 dBA Bon Homme County noise limit.

But they did no work or -- evaluating what the predicted sound levels meant or looked into any kind of low frequency issues. None of that. So I was critical of the -- of Mr. Howell's work in that regard.

Q. Now just now when you stated "their study" are you referring to that of the Applicant?

A. Yeah. The Applicant's noise study, which was prepared by Mr. Howell.

Q. Are you familiar with a Mr. Steven Cooper?

A. Yes.

Q. And who is Steven Cooper?

A. He's an acoustical engineer out of Australia who with relevance here has recently done some experiments that I find very convincing that demonstrate that people with certain sensitivities are affected by extremely low

frequency pulsations from wind turbines.

He did a blind study where he recorded sound at a wind farm in Australia and then replicated that sound in a laboratory setting, and people with known sensitivities, people that lived on the site that were bothered by it, could tell when this completely inaudible sound was played with 100 percent accuracy; whereas, a group of other people didn't hear anything.

Q. So then is it your testimony that certain people would be more sensitive than others?

A. **I believe some people do have a sensitivity to the pulsations produced by all wind turbines really, every model, every size. It's just the nature of the thing that it produces a pulse around just under 1 hertz, which is extremely low and well below the capability of any conventional sound instrument to measure.**

Q. If you had -- based upon your training and experience, if you had to guess, without anybody talking what's the noise level in this room today?

A. **I would say with the fan going it's maybe 40 dBA. In fact, I have a sound level meter on my phone if you -- can I?**

Q. I'll take your word for it.

A. **Okay. All right.**

Q. Are you familiar with Mr. Howell's Rebuttal

Testimony as it relates to the testimony of Mr. Richard James?

A. **Yes, I am. And I have to say I agree with Mr. Howell on his comments there, that -- in most instances counter to what Mr. James was putting forward.**

Q. How about Mr. Howell's testimony as it rebutted that of Mr. Jerry Punch?

A. **I actually did agree with Mr. Howell there because what he was talking about was Dr. Punch was recommending that the noise limit for the project should be expressed in terms of an LAmax statistical noise level.**

That sounds good. That makes sense on paper. But that's coming from someone that's never measured a wind project.

If we were to put a sound monitor at the site today when there's no project, the Lmax would go over 40, 45, or even 50 a thousand times a day. Every dog bark, plane flying, everything would cause an exceedance of that level.

So it's not practical to use that to actually measure a complete project.

Q. Have you read the Direct and Rebuttal Testimony of Intervenor witness Professor Alves-Pereira?

A. **Yes.**

Q. And what is your opinion of that?

A. **Well, her area is physiology and that sort of thing. It's out of my area, but I would -- there was another witness, Mark Hopkins, I believe, who reviewed her testimony. And he's a physiologist and answered her point by point, and I had to agree. I found his testimony very compelling.**

Q. Would you be referring to Dr. Mark Roberts?

A. **Mark Roberts. Thank you. I drew a blank there for a moment.**

Q. What statistical descriptor would you associate with the 40 dBA noise limit?

A. **If there were to be a 40 dBA limit on this project or any other project, the only practical descriptor would be a long-term average measured over a period of days or weeks.**

And the reason for that is that the sound of the project varies with wind and atmospheric conditions so a short measurement of 10 minutes wouldn't tell you anything. The project might not even be operating.

So what we found from many years of experience testing completed projects is that you have to monitor for usually two weeks and then try to determine what the project alone level is exclusive of the background level. The background level's very significant in these projects. It's as high as the project many times.

For example, in our assessments we'll usually monitor for about two weeks prior to any construction, and what we find is that the sound level is directly -- directly correlates to the wind speed. And so when it's windy the sound level's 45, 50 dBA before anything's built.

So when the project comes in you have to be careful not just to accept the level that's measured as being completely from the project. A lot of times that's only one component of it. So the difficulty is separating the two, and that's why a long-term measurement campaign is needed, supplemented by monitors that are miles from the project recording the simultaneous background level. It's not an easy thing to do.

Q. Ballpark number, how many wind farms have you evaluated?

A. **Well, one of the Intervenor data requests was exactly that question so I had to go back and look. We've measured 15 newly operational projects all over the country, one in Jamaica, and what we have done in all of those cases is performed these two or three-week surveys with background monitors. And it's not easy, but you can tease out what the project level is doing on a long-term average basis.**

Now one point I'd like to make about that is when we

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do these tests the methodology is kind of up to me because it's never prescribed anywhere. So what I like to do is we ask the project who has called or complained or who's upset about this project in any way, and we're going to monitor at their houses.

Now that -- in every case I can think of that's a number between zero and three. Usually there's about maybe two people. And most of these projects cover 25 square miles. They involve hundreds of houses. But that's what we find.

So we measure at those locations, and then I pick five to seven other locations that are on the sound map the locations of the houses that are receiving the maximum sound level, and so we set up instruments at all of those locations.

In doing that, we can talk to all of those people. So I've heard the grievances of people that don't like it, and then I've also talked to the people at all these other houses that are receiving sound levels of 46 and 47 dBA and most people just say it's -- it's nothing. You hear it. Nothing.

So my impression after 15 wind projects of seeing that same thing repeated is that there's going to be some people very upset. It's going to be a small number. There's a few projects that everybody to my knowledge is

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fine with. But most people aren't that bothered. And that's kind of the facts on the ground.

Q. What is your overall recommendation, having heard the testimony and read all of the filings?

A. Well, the project was designed to the county 45 limit and is meeting that. I think the highest predicted level at anyone's house right now is 41.9.

Now there's been an extraordinary pushback from folks that don't want this project so -- you know, normally we recommend 45 independent of what the county says. Now we think 45 is a fair limit for most projects just based on our experience and seeing how many complaints there are and what the levels are at those houses.

But, at the same time, we've recommended for many years that every project should shoot for an ideal design goal of 40. That would serve to much better protect the community against complaints and annoyance.

Now here, because almost all the houses are already below 40, it seems to me that it's -- wouldn't be inconceivable to modify the project slightly so that -- so as to achieve the 40 here. I think there's 11 houses that are over right now, and many of those are just over by a tenth or two-tenths of a dB, which isn't significant. So I would like to see the project shoot

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for this 40.

Q. Were you present in the room this morning for all of the testimony?

A. This morning, yes.

Q. Did you hear the back and forth about whether there may or may not have been a suggestion for a 35 dBA at some point?

A. Yes. I did see that, and I did see a copy of that e-mail the day before yesterday, basically stating that the wind turbine developer at that time, that fellow, Roland Jurgens, I think, said the 35 was a great idea and that would protect everyone.

Well, that's true. 35's extremely quiet and no one would be bothered but I'm not sure he knew what he was advocating for because the setbacks to achieve that would be huge and most of the projects I'm familiar with just wouldn't be viable with that kind of a limit.

Q. When you say "huge," what are -- what are you talking, generally speaking?

A. Did I say huge?

They would be on the order of a mile and a half or something like that.

Q. Okay.

A. And most projects are not that sparsely populated that that's doable.

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Q. Okay.

A. And I would further add I talked about the background level a few minutes ago. When the wind is blowing, and the wind has to blow for the project to operate, the background level is fairly high. It's between 40 and 50. So to design to 35 would be -- there's really no need for that.

The background level's going to cover up the project at that kind of a level. All you're going to hear is the wind blowing in the trees. There's kind of a bottom limit to how quiet you need to make it, and, generally speaking, we find that's around 40. Once you go below that, there's diminishing returns. You're not getting any further improvement really.

Q. Okay. I'm going to draw your attention to Exhibit A33, which I'll provide for you.

Mr. Hessler, are you familiar with that exhibit? Take a minute to look at it.

(Witness examines document.)

A. Well, it's the first time I've seen it. Let me just look at it for a sec.

(Witness examines document.)

A. Okay. Yeah. 45 dBA.

Q. Can you identify what the title of that exhibit is for the record?

A. **The Applicant's proposed conditions.**
Q. Is that an exhibit that you -- or a proposal that you weighed in on or had any input on prior to today?
A. **I haven't seen this exact document, but I understood from the beginning that the Applicant had committed to meeting Bon Homme County 45 noise limit, not only in that county but the other two counties in which the project was sited.**

MS. EDWARDS: Thank you. No further questions. I will tender him for cross.

MR. DE HUECK: We're going to take a recess at this point for our court reporter. Let's come back at 10:30.

(A short recess is taken.)

MR. DE HUECK: We're back in session.

Mr. Hessler is on the stand and now subject to cross-examination. And you're still under oath, Mr. Hessler.

Prevailing Winds, you may proceed.

MS. SMITH: Thank you.

CROSS-EXAMINATION

BY MS. SMITH:

Q. Good morning, Mr. Hessler.
A. **Good morning.**
Q. As I understood your written testimony, you did not

take issue with the noise modeling methodology and assumptions that were used by Burns & McDonnell in preparing their analysis for the project; is that correct?
A. **That's correct. They used the same assumptions and even modeling software that I used.**
Q. Okay. Thank you. And you also agreed that the modeling showed compliance with the Bon Homme County requirement of 45 dBA?
A. **That's correct.**
Q. You mentioned a criticism of not taking into account community perception. Is that accurate?
A. **That's correct.**
Q. And community perception would be a subjective analysis; is that true?
A. **In general, yes. But it is possible to make a judgment as to how impacted people are likely to be.**

For example, when we do impact assessments, and we've done probably over 70, we do a thorough background study for a matter of weeks and correlate the sound level to wind speed measured at the top of the met towers to get the wind speed at the turbine height and then predict the project level under identical wind conditions. And it's the differential between what's there now and what's going to be there at the project that really determines

the possible impact.
Q. And you indicated that ambient noise levels vary from 40 to 50 typically when the wind is blowing in your Direct Testimony just now; correct?
A. **That's right. And the background studies that we do, we find that just about in every site the background level ranges from 20 to 50, purely a function of wind speed. So when wind is blowing there's a significant background noise that's often overlooked by a lot of people that are opposed to wind turbines.**

They think the background is 30 dBA or 25 dBA. But that's when it's calm and the project is not operating so it's not relevant.
Q. And as far as community perception when you're talking about your ideal limits, the concept is to avoid complaints; correct?
A. **That's correct.**
Q. Is it true in your testimony that you noted that there isn't really a regulatory sound level that would satisfy everyone?
A. **Yeah. That's correct. You can never sit back and be comfortable and everybody be all right with a wind project.**
Q. So someone may complain regardless of how low the level is that is set; is that correct?

A. **I have seen instances of that.**
Q. In this case you stated in your testimony, and I believe you restated here, that 45 dBA is an appropriate, reasonably fair noise limit for wind projects at nonparticipating residences; is that accurate?
A. **Yeah. We consider that a reasonable limit under normal circumstances. When there's not a lot of opposition.**

Now here I would lean more towards our ideal recommendation of 40.
Q. And that's just simply based on complaints that have been lodged in advance of the project being constructed?
A. **Those numbers come from our experience at completed projects. Like I briefly described, we measure at the complainant locations and a number of other locations so we know what the sound level is at the people that are complaining. And that's why we say it's -- the situation is generally okay up to 45. Not ideal. But below 40 we see very few complaints.**
Q. When you -- in your own testimony, your written testimony, you indicate that a lot of fear and resistance to wind projects is created during the development phase by -- largely attributable to highly biased, even scary anti-wind websites.

Do you remember that testimony?

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A. Oh, yeah. That's absolutely true. All you have to do is Google wind turbine noise, and it's horrific.

Q. And you noted that once those projects are operational and you also testified here today that most of those fears are found to be unfounded.

Is that accurate?

A. That has been my experience, yes.

Q. What's been proposed on Exhibit A33 -- and do you still have that in front of you? It's that one sheet --

A. Yes, I do.

Q. -- of the Applicant's proposed conditions?

A. Yes.

Q. You indicated you had seen similar language before. Is that accurate?

A. I had seen in the noise study where it summarized what the applicable regulations were, which was the 45 in Bon Homme County and then the voluntary agreement to that in the other two counties.

Q. You also testified on behalf of the Staff in the Crocker Wind Farm docket and the Dakota Range Wind farm dockets; is that right?

A. That's correct.

Q. And in those matters there was a condition agreed to among Staff at 45 dBA for nonparticipating residences; is that true?

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A. That's correct. And I think on one of them the area was so sparsely populated that I think all the predicted levels were below 40 to begin with so the 45 limit was largely irrelevant.

Q. And on this case it would be reasonable for the Commission to impose a limit of 45. That would be a reasonable and fair limit in this case as well, would it not?

A. In what I would call normal circumstances it's a reasonable and fair limit, but where there's quite a bit of opposition, as there obviously is here, I think further consideration should be given to that.

Q. Was there not opposition in the last two dockets?

A. Not to the extent of this case.

Q. And you're basing that on simply numbers? Are you aware of the number of Intervenors, I guess I should ask?

A. I'm basing it on the amount of time it took me to read all the Intervenor submittals.

Q. So it's based on anticipatory complaints for the project?

A. Yes.

Q. With respect to the potential for health effects, you referenced an article regarding -- or by Steven Cooper; is that correct?

A. Correct.

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Q. And it talked about the potential for a small minority of people to be susceptible to vertigo and nausea symptoms due to wind projects; is that true?

A. That's correct.

Q. And are you basing your statements regarding potential health effects solely on that article?

A. That article I found to really put me over the -- I've read a lot of articles and attended a lot of conferences where this issue has been discussed, but I find that to be pretty unequivocal, that experiment that he recently did.

So to me it's very clear that some people are susceptible and are very adversely affected, but it's a very small minority.

Q. You're not making a medical judgment here? You're not speaking as a medical practitioner regarding that topic; is that true?

A. No, not at all. I'm -- in my mind I'm thinking of the Shirley Wind Project in Wisconsin that I went to, and we did a study there to try to figure out what was driving the complaints there, the nausea and the ill feeling complaints.

And we went to the houses of those people. We talked to them. We took measurements. They weren't making it up. And so something's going on.

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And what we found in that study was that you could detect the wind turbine blade passing frequency, which is, as I mentioned, around 1 hertz but the magnitude of it is incredibly small and it's really hard to believe that that has any effect but I'm convinced from Cooper's work that that's what it is.

Q. So just to make it clear, you're convinced based solely on Cooper's work that that's the --

A. I think he finally made the link. Or demonstrated the link.

MS. SMITH: I don't have any further questions.

MR. DE HUECK: Mr. Almond.

CROSS-EXAMINATION

BY MR. ALMOND:

Q. Just following up on that last question, what did Cooper demonstrate the link between?

A. That the extremely low frequency pulsations produced by wind turbines can be -- they're completely inaudible -- can be perceived by people who have a sensitivity to it but not by everybody.

Q. And you believe that study gives credence to the complaints of the Shirley Wind individuals and their complaints of -- I guess I'll let you say the complaints because you're the one that was there but --

A. Yeah.

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Q. What were the complaints?
A. That they just felt some funny feeling and had a little dizziness and vertigo and just couldn't take it and had to leave their houses. They couldn't get relief until they left the project area.
And but out of the 15 projects we've gone and measured that's the only one where that complaint, that specific kind of complaint, was made. At all the rest of them it was simply the audible noise, thumping noise. You could hear it at night. It was bothering me, that kind of thing. There was no health complaints at any other site.
Q. And did you listen to Mr. Fuerniss's testimony in this matter?
A. I have not heard -- I believe I read the written testimony. Is that what you're referring to?
Q. Are you aware of the physical symptoms and the complaints that Mr. Fuerniss has been -- has been feeling the last 18 months? Have you read anything about that or heard him testify about that?
A. No. That's news to me.
Q. You stated that you believe that the number of individuals affected by this inaudible infrasound is quite small, and that's based off of the fact that you've studied -- what's that based off of?

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A. It's based partially off of the sites that I've been to and talked to everyone, but more than that, it's there's 90,000 megawatts of wind power in this country right now. That's over 50,000 turbines. And the only -- and we're still talking about Shirley, which was from six or seven years ago.
If this problem were common at all, it would be in the forefront of every project's Application and would really be a totally disruptive issue.
Q. So if I'm understanding -- maybe I'll just ask you. Are you aware of any literature or research that discusses people making the same types of complaints as those made in Shirley in other wind farms around the world?
A. Yeah. I'm only familiar with a handful of sites. I think Falmouth in Massachusetts. I'm having a hard time -- I'm thinking there's just a couple.
Q. Just so we know about the complaints that were taking place in Shirley and that you're saying aren't a national or worldwide significant number of, what are those complaints specifically?
A. Well, as I mentioned, they described it as just kind of a dizziness, a mild nausea, and it was particularly -- one woman said right here in this corner of the kitchen in that chair it's real bad. So I sat there the whole

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night, but I couldn't hear anything at all. I couldn't measure anything. But, you know, she wasn't just saying that. She must have just had a sensitivity to it.
Q. Are you aware of any studies that have actually measured the number of people that have that sensitivity to infrasound?
A. No. That would be good to know, but, no, I don't know of any organized or scientific counting.
Q. And given this missing link that was found by Mr. Cooper, do you anticipate those types of studies will start being performed in the near future?
A. I think work will continue along those lines because it's a big issue. And up until that work the discussions mainly centered around theories about the inner ear and -- but nothing that was demonstrable.
But now I've found that work to be excellent, and, yeah, I would expect it to continue.
Q. And to date aren't most studies talking about wind farms and adverse effects, aren't they typically talking about annoyance?
A. Well, there's really two things going on. There's audible noise around the mid-frequencies, 500 hertz, a thousand hertz. That's just the sound of the blades squishing, and it sounds like a -- like a washing machine, kind of.

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And then there's low frequency, and that's completely at the bottom end of the frequency spectrum. It's a totally separate issue.
Q. Yeah. As far as your opinion that you don't believe many people are affected by the infrasound and the sensitivities to it, would you agree that that -- the population hasn't really been studied -- or the wind farms haven't been studied to actually determine what percentage of people are affected by infrasound?
A. Well, I think when they are affected it's -- it becomes known. And the fact that it does not appear to be a problem at 95 percent of operating projects tells me it must be rare.
Q. So you're saying you have knowledge that 95 percent of projects these complaints of nausea, dizziness, vertigo haven't taken place, or you just haven't heard of it?
A. I haven't heard of it.
Q. Okay. And in the academic literature about adverse effects caused by wind turbines, isn't what people are asked about annoyance and they aren't specifically asked about nausea, dizziness? I mean, large studies determine population amounts and --
Do you understand the question I'm asking?
A. It sounds like you're maybe talking about the Health

Canada Study. It was a large study about the Canadian Health Department.

Q. Well, most of the studies I guess I have read -- and, again, correct me if I'm wrong -- is that when they go out and study and survey the population they ask them basically are you annoyed by the project.

Would you agree that that's how most studies are created or the method most studies that are analyzed for the purposes of the peer review stuff?

A. **I would say that was the case some years ago when some of the studies in Sweden were -- survey kind of studies. That's the way their questions were posed.**

It wasn't until later that this infrasound issue started emerging.

Q. Right. So if people responded they were annoyed, they may have been annoyed because of nausea, dizziness, whatever, or they may have been annoyed because they just didn't like it; right?

MS. SMITH: Objection. Calls for speculation.

MR. DE HUECK: Can you rephrase?

MR. ALMOND: Yeah.

Q. Based off your review of the studies that have been performed and how they've been conducted, isn't it true that when they've asked whether or not an individual's been annoyed, there's no distinction about where the

annoyance comes from, whether it's nausea, dizziness, vertigo, or just they don't like the project?

A. **Yeah. I guess I would agree with that.**

Q. Can you get Exhibit A33 back in front of you.

A. **Okay.**

Q. And that's the Applicant Proposed Condition -- specifically Proposed Condition No. 27. And I want to talk to you a little bit about the measurement of this condition. And it's over a two-week period; right?

A. **That's how long we normally measure for because then we're assured of getting periods of high wind, calm wind, different atmospheric conditions.**

Q. Have some of your colleagues suggested a method, an on/off compliance test?

A. **I don't know about colleagues, but we do that ourselves.**

Q. What's an on/off compliance test?

A. **When the wind is blowing and the project is operating at or near capacity, in many cases we'll get to the test location and then radio in for them to turn off all the turbines and then take measurements of what's happening without the project.**

And I will add it is amazing that it sounds the same.

Q. Would you agree that that would maybe be a better

way to measure compliance with a 45 or a 40 or whatever noise standard?

A. **To my mind it's a more -- it's a simpler, more unequivocal way of doing it. The problem is that a lot of projects aren't happy about turning off the turbines.**

Q. But it's for a short amount of time to get the measurements; right?

A. **Yeah. I know. That's what I tell them.**

Q. Earlier you were testifying about how the background noise, specifically noise caused by the wind, often masks the noise created from the turbines.

Do you recall that testimony?

A. **Yes. That's what I was just alluding to on these on and off tests. When you arrive at the site it sounds tremendously loud. I'm thinking of one case in particular. And they turned off all the turbines. The level was the same. It sounded exactly the same. It was just the trees around the house blowing.**

Q. And in terms of complaints from those individuals living around projects regarding wind turbine noise, in your experience have you found most often the complaints come at night?

A. **Yeah. Yeah. It's --**

Q. Rather than --

A. **It's audible at night and I can hear it and it's**

bothering me and never heard anything about a daytime issue.

Q. And is there a reason we would expect more complaints to happen at night?

A. **Well, people are trying to sleep and want it to be quiet.**

Q. What about the atmospheric conditions that frequently exist at night? Can that lead or is that perhaps an explanation for why we see more complaints at night?

MS. SMITH: Objection. Vague. I don't know what he means by atmospheric conditions that frequently occur at night.

MR. DE HUECK: Either do I, but maybe Mr. Hessler does.

A. **Yeah. Yeah. At night sometimes there's temperature inversions and things that enhance or allow sound to propagate more easily. But it's not every night. Sometimes that happens.**

But, no. I don't think that's the reason. It's just at night people have the expectation of quiet. If they have the windows open and they hear -- it sounds like a washing machine going, they don't like it.

Q. What are stable atmospheric conditions?

A. **That's when it's cold or above the surface warmer --**

excuse me. I always get this mixed up. It's hot above and cold below.

Q. And in stable atmospheric conditions is the wind typically stronger the higher you go up?

A. No. Actually to get truly stable conditions you need very low wind speeds to stratify the atmosphere thermally. But in stable conditions it's warmer above so that the speed of sound is faster so it refracts the sound waves so they travel more easily.

But in windy conditions that kind of atmosphere can exist, and windy conditions are when turbines run.

Q. Is it common for the atmospheric conditions to exist where it's calm at ground level but there are strong enough winds at the height of a turbine that the wind turbine's still operational?

MS. EDWARDS: I'm going to object simply because we did not proffer him as a meteorological expert.

MR. DE HUECK: I'm going to overrule your objection, allow you to answer.

A. That does happen, but I wouldn't call it common. I think it happens seasonally, more commonly than other times, but it's not an every day or every week occurrence, I don't think.

Q. And in a given year how frequently?

A. It depends on the site and everything else.

Q. And under that scenario the sound around a residence would be -- the sound created from the wind at least would be relatively quiet or nonexistent because the wind wouldn't be blowing at ground level; right?

A. Yeah. That scenario is brought up in every project. That happens occasionally, but I wouldn't base the entire design on that or anything.

Q. And during these very quiet ground levels and if --

MR. ALMOND: Well, you can strike that, Cheri.

Q. If you have a rural community like we have here in this project and if those conditions exist, what would you expect would be the largest generator of noise?

A. It would depend on how far away you're observing the turbines. If you're very far away, the turbine sound signal's so weak that it doesn't make any difference. If you're very close at a 1,000-foot setback, then you'd notice. You'd notice it more strongly.

Q. And at what distance would you be able to start noticing the turbines?

A. I can't say.

Q. Can you give us a rough distance?

A. Are you asking when they first become fairly audible over the background as you approach a project, for instance?

Q. Yes.

A. I'm going to say -- it's hard to put a specific number on. When we do operational surveys we put monitors that are a minimum of two miles away from the nearest turbine to get the background noise, and that's what we get. There's no turbine influence at that level.

And so maybe a mile. You might be able to discern the project under certain conditions.

Q. In changing gears here, during your testimony earlier you said that one-and-a-half-mile setbacks basically -- generally make projects not viable.

Do you recall that testimony?

A. Yes. Yes.

Q. Have you analyzed this project to determine whether or not a mile and a half setback is viable for the project?

A. No.

Q. Okay. And have you seen any evidence in the record that suggested that if anyone tried to implement a mile-and-a-half setback to this project?

A. No.

Q. So just as a general notion, mile-and-a-half setbacks aren't typically that viable?

A. Yeah. Most project sites are fairly densely populated, and there's just not that much room between houses.

Q. Do you think it would be more viable if you were to separate a mile-and-a-half setback or distinguish a mile-and-a-half setback for nonparticipants versus participants?

A. I would like to see that. In fact, I thought about advocating for that here, but that would create a precedent for all future projects. All you have to do is be an Intervenor, and you can get all kinds of elbow room so it's not really a practical suggestion.

Q. But you thought about advocating for a mile-and-a-half setback?

A. Two-mile.

Q. You thought about advocating for a two-mile setback for --

A. For Intervenors. But that's not a practical suggestion.

Q. Well, if there was a waiver system that allowed nonparticipants to waive the setback requirement, what would be impractical about it?

A. Yeah. I'm not sure I follow the question. But what I was suggesting was that for those that were clearly unhappy with this project, I thought it was a good idea if the project -- if we could appeal to the project to try to increase -- to maximize those setback distances for those individuals that -- but on further reflection,

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you can't give special treatment to certain people. It's just -- it would set such a precedent that it would happen in every future project.

Q. But a situation in which a two-mile setback with waivers existed wouldn't give preferential treatment to certain people, would it?

A. I'm not sure I follow the waiver aspect of that question. What waiver?

Q. Well, if an individual can waive that setback, for example. In this project I don't know if you're that familiar with it, but certain individuals have waived setback requirements.

Have you seen that?

A. Not here, but I know of that.

Q. You're aware of the wind industry there are agreements where individuals waive setback requirements?

A. Yeah.

MS. EDWARDS: Objection. This is outside the scope of his direct. He didn't testify about setbacks.

MR. DE HUECK: Sustained.

MR. ALMOND: In his direct this witness has testified about proposed regulations. He's given opinions on some distances, setback distances, et cetera.

I think talking to him about setback distances in this hearing and setback distances with other

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projects, especially given that he's testified at other projects are what he's using as support -- partially as support for some of his opinions, is fair game to talk with him about his experience with those setbacks.

MR. DE HUECK: Which I think you've done, and now we've moved into some sort of abstract personal feeling regarding outside the scope of Direct Testimony.

Q. In your past experience looking at wind projects, are you aware of -- are you aware of good neighbor agreements?

Do you know what that term is?

MS. SMITH: Objection. This is also outside the scope of his testimony.

MR. DE HUECK: Correct.

Q. With the Applicant's medical experts there was a lot of discussion about that Massachusetts study. Are you familiar with the Massachusetts study?

A. Which Massachusetts study?

Q. Talking about health effects of wind turbines, the Massachusetts government got a panel together to study wind turbines.

Are you familiar with that Massachusetts study?

MS. SMITH: Objection. This is outside the scope of his testimony as well. He's not testifying as a health expert.

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MR. ALMOND: I'm merely asking if he's familiar with the study.

MR. DE HUECK: Are you familiar with the study?

THE WITNESS: Somewhat.

Q. And we heard from Dr. Roberts and Dr. Ellenbogen in that study the Massachusetts government got everyone together and studied wind farms, and the purpose of which was to see what regulations should be put in place.

My question to you, because nobody else has been able to answer it, is what is Massachusetts's regulations as far as noise limits on wind farms?

A. The Massachusetts noise -- state noise limit is to measure the background L90 statistical. That's the near minimum background level. And then the project can be 10 above that.

So it starts at a very low level, and then they have a big adder. It's unusual.

Q. So whatever the L90 level is, the project can go 10 above that?

A. That's right.

Q. How far does the type of infrasound and low frequency noise that Steven Cooper was studying travel?

A. That's a good question. It travels very far. Miles.

Q. Miles?

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A. Yeah.

Q. Again, shifting gears, going back to this Shirley project that you've studied, what was the regulatory limit in that Shirley project?

A. I don't recall. And the reason is it was irrelevant to the problems there. They were merely about the low frequency content, which isn't represented or captured in any way by the A-weighted limit.

Q. If I were to give you the report that was generated from that project, would that help refresh your recollection?

A. As to what the A-weighted limit was?

Q. Yeah.

A. I think it's in the report. I don't know if it was mentioned.

Q. After conducting your study in Shirley did you give a recommendation? What was the body that was overlooking the Shirley project, the governmental body?

A. The Wisconsin Public Service Commission. By the way, that study was -- the whole impetus of that study was from my recommendation to study it during a hearing for another wind project.

They planned to use the same turbines, and people from the Shirley site were at this hearing saying, you know, look at our site. You know, watch out, and don't

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let this happen again.

So I said, well, it sounds like, you know, we need to investigate what's going on at Shirley. So that was the impetus for the study and that it was, I think, funded by the Public Service Commission.

And it was a very unique test in that it was done cooperatively by four different acoustical consulting firms, some with kind of known opposition views.

Q. So just so I understand correctly, the Wisconsin Public Service Commission was considering whether or not to approve a wind farm project. And before it was doing that -- before it would do that you recommended that we should go study this other project?

A. **That's right. And what I expected to find was that the low frequency signal was extremely strong at that site or something odd was happening there. But the signal was detected but at incredibly low amplitude.**

Q. I just handed you a document titled The Cooperative Measurement Survey and Analysis of Low Frequency Sound and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin.

Is this the report that was generated following the study of the Shirley Wind Farm we've been talking about?

A. **I think this was the final version. There was a lot of drafts.**

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Q. And if you turn to page 8, please.

A. **Okay.**

Q. What ultimately did you recommend to the Wisconsin Public Service Commission in terms of a noise limit?

A. **I don't really remember recommending much of anything. We couldn't really determine what was going on at that site.**

Q. Do you see the third paragraph where it says, "Hessler Associates recommends approval of the Application if the following noise condition is placed on approval"?

A. **Okay. Oh, that's right. Yeah. We -- this number comes from talking with Paul Schomer, who was one of the other guys there.**

Yeah. It's 39 and a half is the number in here, which is essentially 40 or the 40 limit that we've been recommending all along as an ideal goal.

Q. I want you to flip to page 9. Is that your signature there on the bottom?

A. **Halfway down, yes.**

MR. ALMOND: At this time I'd like to offer and move for the admission of Exhibit I-36, the document entitled Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County.

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MR. DE HUECK: Any objection?

MS. SMITH: No objection.

MS. EDWARDS: No objection.

MR. DE HUECK: And I have no objection other than I think maybe next time hand a copy to me. That would be good.

MR. ALMOND: Very sorry.

MR. DE HUECK: No. It's okay.

So I-36, is that what you said?

MR. ALMOND: Yeah.

MR. DE HUECK: Will be admitted. Thank you.

Q. Let's step away from the Shirley project.

I want to talk a little bit about what you started with Ms. Edwards talking about in terms of the community response to a project.

Do you remember that part of your testimony?

A. **Yes.**

Q. And there are ways in which to gauge how a community's going to respond to a project when it comes to noise and how that noise is going to affect the community; right?

A. **I believe so, yeah.**

Q. And are those -- and do the ANSI standards talk about what calculations should be done to gauge community response to a project?

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A. **There is an ANSI standard that addresses that, but it wasn't written with wind turbines in mind. It was picturing some coal plant or a gas turbine or something, which is a much simpler situation.**

Our approach is, as I went through before, was to do an initial survey, find out what the background is going to be at the wind speeds required to operate the project, and then see how the predictions under those same wind speeds compare. And depending on that differential, you can get an idea of whether it's going to be very audible or inaudible.

Q. Has that type of study been conducted for this project?

A. **No. No. That's completely missing from the Applicant's noise study.**

Q. And you would like to see that type of study in order to gauge the community's response to a project; correct?

A. **I think it's the duty of the engineer to do that. I don't know why it keeps getting left out of these. This is the third one in a row.**

Q. And without doing that, do you think we're able to gauge whether or not this project's going to injure the social condition of those living in it?

MS. SMITH: Objection. Calls for a legal

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conclusion.
MR. ALMOND: It's a question.
MR. DE HUECK: Well, you're basically asking it will comply with that regulation.
MR. ALMOND: And experts are capable of testifying to that.
MS. SMITH: He's not a legal expert. He's here to talk about sound studies in his analysis that he's conducted.
MR. ALMOND: It's an ultimate conclusion opinion. Experts are offered to provide ultimate conclusions, ultimate opinions. That's what I'm asking him to do.
MR. DE HUECK: But not as to whether or not they will be in compliance with a particular law.
MR. ALMOND: I have not asked him about a law. I've asked him a question.
MR. DE HUECK: It sounds like it.
Ask again, Reece. Or maybe --
MR. ALMOND: Cheri, can you just repeat the question so we can hear what I asked again.
(Reporter reads back the last question.)
MR. DE HUECK: So asking if it will comply with the law.
Can you --

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MR. ALMOND: I have not referenced the law. I'm not asking if it complies with the law. I'm asking that question.
MS. EDWARDS: I guess I would just object as vague and ask maybe the inquirer to be more clear on the social condition.
MS. SMITH: And I'm going to object because it is --
MR. ALMOND: I'll rephrase the question.
MS. SMITH: May I object?
It's basically stating 49-41B-22.1 -- or 2. Excuse me. And so he's basically asking him to opine on the statute compliance.
MR. DE HUECK: Yes. So let's sustain the objection.
Ask another question.
Q. How the community responds to a project deals with the social well-being of the community; right?
MS. SMITH: Objection. That's not why he was brought here to testify, on the social feelings of the community.
MR. ALMOND: He's been testifying about community response. I'm just trying to figure out why we're curious about the community response and why it's important to look at that.

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He's offered opinions that this Applicant should have done that. I'm curious as to why.
MR. DE HUECK: Just go ahead and answer this one.
A. **Well, when I do an assessment I think the purpose of it is to assess what's going to happen, not just to find out if it's going to be in compliance with some regulatory limit. That's one paragraph from our 26-page report normally.**
No. I think you want to model the project, see what the sound levels are going to be at people's houses. And I always say I think -- I think there's going to be a problem or I think it's a low probability of complaints, a high probability. Whatever it is goes into my report.
My clients aren't often happy with my reports, but that's the purpose of an assessment.
Q. All right. Shifting gears again, you've reviewed the modeled limits provided by Burns & McDonnell; correct? Mr. Howell?
A. **Yeah. I looked at the -- at the noise prediction, the sound contour map, yes.**
Q. Yeah. That was a poorly asked question.
A. **I knew what you were talking about.**
Q. The predicted sound measurements.
A. **Yeah.**

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Q. Would you agree that the modeled levels can have spikes in the order of 15 to 20 dBA above the model levels?
A. **Yes.**
Q. So if you're looking at a modeled level of 35, you could experience spikes up to 55 dBA?
A. **Well, not 20, but -- yeah. Wind turbine noise is highly variable. And depending on, you know, the wind's not blowing in a nice laminar manner, it's turbulent, it changes all the time.**
That's why in every test you can only test over a long-term average. You can't capture every exceedance.
Q. Well, the on/off condition test we don't need to measure over a long period of time; correct?
A. **No. No. Most of the time the noise is fairly steady, but it does -- it certainly does vary over time.**
Q. Have you written a paper on recommended noise level design goals for wind turbines?
A. **Yes.**
Q. And what was the purpose of that paper?
A. **To recommend noise design goals, which namely are 45 under most normal circumstances and an ideal target of 40.**
Q. And you didn't attach that paper to your testimony, did you?

A. No. I don't think so.

(Exhibit 37 is marked for identification.)

Q. I'm going to hand you what has been marked as Exhibit I-37. What is exhibit -- what is -- I just handed you what has been marked Exhibit I-37. What is that?

A. You know, it's an article that I wrote in collaboration with my dad who's also in the company in 2010 that was published in the Noise Control Engineering Journal, January 2011.

MR. ALMOND: At this point I'd like to move for the admission of Exhibit I-37.

MS. EDWARDS: No objection from Staff.

MR. DE HUECK: Any objection?

MS. SMITH: No objection.

MR. DE HUECK: It will be admitted as I-37.

Q. Can you turn to page 97 of that paper for me. What is that Table 1 at the top of that page?

A. It's titled Typical Worldwide Wind Turbine Noise Limits.

Q. And it looks like the different jurisdictions are all outside the United States in that table. Would you agree?

A. They are, yes.

Q. And if you flip back to the previous page, it

states, "Wind turbine development in European countries and in other parts of the world has been proceeding for some time now while widespread development has only really started in the U.S. within the last five years or so."

Do you see that language?

A. Yes. Uh-huh.

Q. So would you agree that it would be appropriate to look to other jurisdictions and European and other countries to see what's going on when it comes to wind regulations?

A. Yeah. That's why we did that, this paper.

Q. Precisely.

And looking at Table 1 for one example, for example, at the very top is Alberta, Canada. It says, "Criteria values, 50D/40N."

What does that mean, the 50D/40N?

A. 50 during the day, and 40 at night.

Q. And the D and N, is that what it means for the entire list of --

A. Yeah.

Q. Are you aware of any regulations on this project that deal with infrasound or low frequency noise?

A. No. There are none on this project or any other project I can think of.

MR. ALMOND: Thank you, Mr. Hessler. I don't have any other questions for you.

THE WITNESS: All right. Thank you.

MR. DE HUECK: Mr. Fuerniss.

CROSS-EXAMINATION

BY MR. FUERNISS:

Q. Hello, Mr. Hessler. You and I have one thing in common. At least we both have had the privilege to work with our fathers in the business.

That's kind of a neat thing, don't you think?

A. I think it's great.

Q. I just have one question. This goes way back earlier in your testimony. You talk about some people being much more sensitive than others.

Does that sensitivity -- can that increase with prolonged exposure, or do you have a level of sensitivity and that's it or --

A. I'm not sure that's really known or understood. I think I've seen papers speculating or thinking that maybe the more exposure the more sensitivity would develop. But I don't know myself.

MR. FUERNISS: Thank you.

THE WITNESS: Sure.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: Yes. I have some questions.

CROSS-EXAMINATION

BY MS. JENKINS:

Q. Yes. I have some questions. On your Direct Testimony, your prefiled, I was looking at your resume, and at the very end of that section is -- you talked about a project in Maine? Freedom, Maine?

A. Was it Clinton, Maine?

Q. Freedom.

A. Freedom.

Q. It was called the Beaver Ridge Wind Project. Maybe let's find the exhibit. It's Exhibit DMH-1 in his --

MR. ALMOND: S3.

MS. EDWARDS: S3.

A. Okay. All right. It's pretty bad when I have to be reminded of my own resume.

Yeah. Yeah. I remember that project. That was in the town of Clinton, Maine, I believe.

Q. Can you just tell a little bit about what your -- it looks like you appeared before the Maine State Government of Energy and Utilities Committee. It says, "A peer review of operational sound testing by others."

A. Oh, yeah. I remember that one now.

Yeah. I was engaged by the state, very similar to this case, to look at somebody else's Application, the noise study for an Application for this wind project, and

give my opinion on it.
Q. And do you remember any specifics like the size of the project?
A. **I think it was fairly small. All I remember was the panel. It looked like a bunch of sea captains up there in Maine.**
Q. Can I refresh your memory?
A. **Please do. The whole project is kind of vague to me now.**
Q. Okay. I believe it was three turbines?
A. **Yeah.**
Q. By Patriot Renewables?
A. **Okay.**
Q. Maybe they built it and sold it. I'm not sure. Starting to sound familiar?
A. **Go on.**
Q. Well, my understanding is that there were four different -- I believe it was four, might have been three, different residences that were experiencing either health concern or not being able to sleep on their top floor.
And so a sound study was done there, and that must be this study that you peer reviewed?
A. **What I recall is it was a noise study prepared for the permitting application, and I just reviewed it and**

commented on its shortcomings or good parts. That's all I remember about it really.
Q. Okay. The project was built in 2008, and the study -- your peer review was in 2013.
A. **Okay.**
Q. Still nothing?
A. **Yeah. That just goes to show how many wind turbine projects I've been mixed up in.**
Q. Okay.
A. **Yeah. I'm not recalling the situation you're talking about with people having problem -- I don't remember anything about that.**
Q. Okay. The reason it came up was -- when I saw you were going to testify, I was looking for your most recent note on your resume, and that was in 2014. And so I researched it a little bit.
A. **Yeah.**
Q. And the reason I bring it up now is that you said that it was just a handful of people that are having health concerns. And in this -- in my research I just went to the --
MS. SMITH: I'm going to object. At this point it sounds like Ms. Jenkins is testifying. Unfortunately, I think we have to interrupt.
MR. DE HUECK: Yeah. Go ahead, Staff.

MS. EDWARDS: I guess since it's my witness, I should probably attempt to weigh in.
Because we are a neutral party, I attempt to afford a great deal of latitude. I would say this is impeachment but going down that track going a little too far.
MR. DE HUECK: So, Ms. Jenkins, it is as if you're introducing your own testimony as to what you think happened out in Maine into the record now so we want to avoid that.
Additionally, the witness has basically told you he's got no clue and doesn't look very successful in remembering it.
Q. Okay. So I'll just summarize that, that you earlier said that you have witnessed only a handful of people with health effects, complaints, out of all the projects in the United States --
A. **Yeah.**
Q. -- and you don't remember this project, your latest one that you reviewed. I'm sorry. I'm not trying to be unkind. I'm just trying to --
A. **No. You have every right. I'm so sorry I can't remember that project.**
Q. Okay.
A. **It was a very small project, and I think I just**

looked over someone's work and testified for 10 minutes on it. I never went to the site or anything. I don't know too much about it really.
Q. So to do a sound study or to peer review a sound study you don't need to see the site or know the complaints or anything?
A. **I'm fairly certain that this study had nothing to do with the complaints. I don't remember anything about that. I would remember that. If there was problems, somebody went out, did a survey, tried to understand the problems. That doesn't ring any bells at all to me.**
Yeah. I'd have to pull out the file for this project, and I just don't remember it.
MR. DE HUECK: Ms. Jenkins, do you actually have a copy of what it is you're referring to?
MS. JENKINS: Well, I could go to the website where the -- where the people in the community were attempting to get their sound levels up to the state level.
MR. DE HUECK: Okay. I think we have just a bit of confusion going on. I'm not sure. But I think we should just move on.
MS. JENKINS: Okay. Let me just make sure there's nothing else I can ask.
MR. DE HUECK: Go ahead.

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(Pause.)

Q. Okay. I think my last question would be, just to understand the process, if you do a sound study, you don't necessarily -- or peer review a sound study, you don't necessarily have to go to the project site?

A. No. Like in this case there wasn't a whole lot of need to go to the site.

Q. And can you tell me how you can deduce that if you don't remember the project?

A. Well, the noise study is supposed to explain and show you what the site is like. Like in our reports we put a site description. We have maps. We show what's going on at the site, where the houses are, where the turbines are. You know, it's supposed to explain it to the degree where you don't have to go out there and find out for yourself.

Now this report was very vague on that. The sound contour map was printed on a white paper. There was no map. I couldn't tell where the houses were, whose house was which, so it was a shortcoming of the study.

Q. Okay. And you don't remember testifying before the board or at that hearing -- before the Maine State Government Energy, Utilities, and Technology Committee on behalf of Patriot Renewables and the Beaver Ridge Wind Project in 2014?

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A. Yeah. I remember being there and I remember what the room looked like but I forgot what the substance of the testimony was about.

Q. Okay. So you don't really remember the case?

A. I don't remember the case. It was --

MS. JENKINS: Okay. Thank you.

MR. DE HUECK: Ms. Pazour.

MS. PAZOUR: No.

MR. DE HUECK: That will bring us over here to Commission questions. I'm down here with Commissioner Nelson.

I have a quick question if that's okay.

Help me understand this because the Cooper study's got me thinking. And I think I recall you saying that often -- whether on or off, the wind turbines, the sound can be the same just due to the wind itself.

So a noisy night, you could turn off the turbines, and you're still going to be at, say, 45 dBA just based on the wind itself. And the turbines don't run unless it's windy; correct?

THE WITNESS: That's absolutely correct. It was surprising even to me.

MR. DE HUECK: Yeah. That is. So does wind itself carry these sound we can't hear? Infrasounds?

THE WITNESS: They're not carried on the wind.

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They just radiate out from the source.

MR. DE HUECK: So could the wind itself be the source of infrasound?

THE WITNESS: No. For example, in the Shirley study we used very specialized instrumentation to be able to detect the blade passing frequency. And that's every time a blade goes by the tower, of the three blades, so that the frequency of that is about .7 to 1 hertz. And that was detectable.

And I think it's the repeated pulsations of that, those waves going out, that some people are sensitive to. It's like on a boat, you know, and seasick. Just kind of that low rocking. I think it's related to that.

MR. DE HUECK: I understand that it could be related to that. But so does the wind -- let's say we remove the turbines, and we still have -- it's a windy night. And could infrasounds from the wind --

THE WITNESS: No. No. It takes this specific source to generate it. No. Wind noise is very broadband.

MR. DE HUECK: Okay. Thank you.

THE WITNESS: Okay.

COMMISSIONER NELSON: Thank you, Mr. Hessler, for being here to help us sort this out.

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THE WITNESS: Always a pleasure.

COMMISSIONER NELSON: Looking at your Direct Testimony on page 8, there was a question about -- I think Mr. Fuerniss had recommended that sound levels be measured using C-weighted sound levels, and you said, no, no, no, that that would be inappropriate.

So my ultimate question is how is infrasound measured? What is the scale? What is the instrumentation? Have you done it? Help me understand all of that.

THE WITNESS: Yeah. No. That's a very good question.

You know, it's extremely difficult to even detect. That's why there's no practical way to put a regulatory limit on it. C-weighting only goes down to 10 hertz, and this is happening at less than 1 hertz. So it's off the chart. So C-weighting is not going to capture it or do anything.

How it is measured is to use very specialized low frequency microphones that can measure down to less than 1 hertz and very specialized instrumentation. It's also complicated by the fact that whenever you try to measure sound in windy conditions the wind blowing over the microphone creates a false signal, and that happens in the low end of the frequency spectrum.

So it's very easy for any kind of measurement to get completely covered up by nonrelated, self-generated noise. Very difficult to measure. So there's no way I could think of to place a regulation or a limit on it.

COMMISSIONER NELSON: So we've heard reference to dB(G). Is that the measurement that is used for infrasound?

THE WITNESS: It can be. That's essentially not putting any weighting on the frequency spectrum, not subtracting some number. But it's very, very difficult in practical terms to even detect.

In that Shirley study we had to measure in the middle of the night, inside the houses, out of any wind. And even then it was hard to pick up.

COMMISSIONER NELSON: And so you have attempted to measure it. Is that --

THE WITNESS: Oh, yes.

COMMISSIONER NELSON: Do I take it from your testimony that using the Shirley example that you weren't comfortable that you accurately captured what was going on?

THE WITNESS: Yeah. You could see a little blip, but it was so small that we said how is this a problem? It's orders and orders of magnitude below the

threshold of human perception. But evidently it's the -- the frequency of the pulses that go out apparently have an effect.

COMMISSIONER NELSON: Within the last week I saw a presentation on the folks that are trying to capture neutrinos, and when I read through this I, for some reason, thought of that. And we're trying to capture something that's apparently very difficult.

THE WITNESS: Yeah. It is.

COMMISSIONER NELSON: Did you read through Dr. Roberts's Rebuttal Testimony?

THE WITNESS: I did read through it, yes.

COMMISSIONER NELSON: Could you pull out Exhibit A5-1, which is Exhibit 1 attached to his Rebuttal Testimony.

Yes. A5-1.

And if you could go to page 10.

THE WITNESS: Okay.

COMMISSIONER NELSON: In the lower left corner there's a bullet point, and this is talking about the results of some work that was done in Germany. And that bullet point says, "At a distance of 700 meters from the wind turbines it was observed by means of measurements when the turbine was switched on the measured infrasound level did not increase or only increased to a limited

extent." And then it says, "Infrasound was generated mainly by the wind and not by the turbines."

There's two things here that contradict what you have said already today. And I'm trying to sort this out. I mean, at some point infrasound has to dissipate. This study seems to indicate that by 700 meters it has dissipated. I heard you testify today that infrasound travels for "miles."

So that's my first question.

THE WITNESS: Okay.

COMMISSIONER NELSON: Help me understand how far this travels.

THE WITNESS: Well, it can travel for long distances. Not always. The conditions have to favor it and so on.

COMMISSIONER NELSON: So help me -- unpack that.

THE WITNESS: Yeah. Well, I can see in the picture here, in the lower left picture titled C, they've got a black dome sitting on the ground on a white circle.

Do you see that?

COMMISSIONER NELSON: Yes.

THE WITNESS: That is a method that we use to measure wind turbines outdoors where the microphone is laying horizontally on this reflective surface, and then this huge wind screen is put over it.

Now that only works to a certain extent, and it does not allow measurements down at 1 hertz. That's all covered -- even with this setup the measurements are blown away by wind self-generated wind noise. Because I've used this exact equipment before.

That's why they say all they measured was wind. Because you really can't pick it up. But no. I think it can travel 700 meters or more under other circumstances.

Let me see. At Shirley one of the houses was very far from any turbines. Miles away. We did measure inside of that house out of the wind to avoid this contamination. I don't think we were able to detect anything at that house, though.

COMMISSIONER NELSON: So I'm --

THE WITNESS: That doesn't --

COMMISSIONER NELSON: -- going to press you a little harder because this is terribly important to me.

So somewhere between 700 meters and your quote, "miles," this dissipates. So help me understand what's going to determine how far it goes and what causes it to dissipate, and how can we quantify that?

THE WITNESS: It travels a long distance. I can't put a number on it for you. These are the kind of frequencies that -- like elephants communicate with each other over huge distances, if you've ever heard about

that. This is as low as it gets in terms of frequency.
So in theory it takes a very long time. Now how far, I don't know. Can't help you.
COMMISSIONER NELSON: Well, ultimately, I have to make a decision here based upon how far this could travel and how far it's going to affect folks, if it affects folks. I mean, that's a whole nother question.
THE WITNESS: Right.
COMMISSIONER NELSON: I'm trying to just figure out how far does it actually go.
THE WITNESS: I wish I could give you a figure on that. I know it would be useful to you.
COMMISSIONER NELSON: Okay. Thank you for that.
Shifting gears just a little bit. Can a sound be heard without that sound changing the ambient dBA level?
THE WITNESS: Yes. If the sound has a distinctive character to it, then you can identify and pick it out even though the magnitude of it, whether it's on or off, may be about the same.
COMMISSIONER NELSON: Like a wind turbine.
THE WITNESS: Yeah. Which has a -- that washing machine sound. Yeah.
COMMISSIONER NELSON: So we had -- well, Ms. Jenkins, Intervenor, testified yesterday, again

contrary to what I heard from you this morning, that her house is three miles away from a wind turbine, and inside of her house she can hear the wind turbine three miles away.
THE WITNESS: That's surprising to me.
COMMISSIONER NELSON: Okay. So we'll set that aside. But it would be -- let's say you're outside. It may be possible to actually hear a wind turbine because of the unique sound, even though it doesn't raise the dBA level. Is that accurate?
THE WITNESS: Right. If you're able to identify that distinctive sound and you know what you're listening for and so on.
COMMISSIONER NELSON: Just so I'm clear, changing again, you've recommended for this project an ideal design goal of 40 dBA, and that would be measured over the two-week period that the Applicant has proposed; is that correct?
THE WITNESS: Right. I don't know of any other way to do it.
COMMISSIONER NELSON: You talked earlier about the fact that that might impact 11 different receptors based on their sound study. I just quickly looked at their revised sound study, and it looks like it would only impact two of the nonparticipants.

Did you separate out participants and nonparticipants as you looked at that?
THE WITNESS: At least in my copy it doesn't distinguish between who was who.
COMMISSIONER NELSON: And were you looking at the revised -- the latest sound study?
THE WITNESS: Yes. I saw one Intervenor house identified in the table in the back, but that's the only one. And that's what I was looking for when I wrote my Direct Testimony. I wanted to know what the levels were at the Intervenor's house, but I couldn't tell which house was which.
COMMISSIONER NELSON: I think -- I hate to let you go, but I think that's all -- only because what I really want to know I haven't found out, but that's all the questions I've got.
Thank you.
THE WITNESS: You're welcome. Sorry I couldn't help you with that one.
MR. DE HUECK: Chair Fiegen. No questions.
Commissioner Hanson, any questions?
COMMISSIONER HANSON: Yes, I do.
Good almost afternoon, Mr. Hessler. You came out swinging in your remarks at the beginning. At least on page 3 you faulted the Applicant for the graphical

presentation, called it fairly primitive, and said you can't even distinguish -- identify where the specific residents are.
You faulted the study for focusing entirely on the noise limit of 45 dBA rather than assessing, addressing in any way. So you said, Focusing entirely on the dBA and not assessing or addressing in any way the other aspects, potentially low frequency and sound emissions. And I appreciate the questions that Commissioner Nelson asked in regard to that and the others.
I'm curious. You said -- I also appreciate the way you tried to be fair. I think that you placed a lot of weight on the other side of the scale as well, almost to the point to which you seemed to favor wind farms and wanted to support them and so I -- I'm trying to figure out where that scale lands but --
You said you sat in a home I believe it was in Wisconsin, was it, and listened -- sat there all night or -- I don't know if it was all night --
THE WITNESS: Hours.
COMMISSIONER HANSON: And that the husband could not hear it, you could not hear it, but the wife could hear it.
THE WITNESS: That's right.

COMMISSIONER HANSON: I don't want to sound misogynistic here, but isn't it somewhat typical especially on a farm that work with machinery -- even though wives work beside their husbands on farms and such, is that men typically lose their hearing a little bit before women do?

THE WITNESS: Well, this wasn't audible sound from the project. It was just a sensitivity to a feeling of low pressure, low frequency pulsations. Nobody could hear anything. Everybody admitted that. It was the sensing of it.

COMMISSIONER HANSON: Interesting.

My wife is 220 miles away, and she can hear my thoughts right now.

THE WITNESS: I know. Mine too.

COMMISSIONER HANSON: She'll call me up and tell me I'm wrong without --

Are you familiar with kids in school who carry phones and they have the frequency dialed so that people over 40 or 50 years old cannot hear the frequency but they can?

THE WITNESS: I did hear about that.

COMMISSIONER HANSON: And that's fairly typical. So kids would be more sensitive, would one assume, than adults would to the challenges that low frequency would

have from wind turbines? I mean, that's just one premise but --

THE WITNESS: Well, it's -- the phone thing is ultrasound. It's very high frequency sound, and that is usually the first thing to go as people age. So that's why there's a built-in advantage there to that whole concept.

But we're talking about the other end of the frequency spectrum, and that typically does not decay with age.

COMMISSIONER HANSON: Interesting. So higher frequency, have you studied that from wind turbines, from --

THE WITNESS: No. There's no high frequency.

COMMISSIONER HANSON: There's no high frequency.

THE WITNESS: No. Most of the noise, the churning sound, is about 500 hertz to 1,000 hertz. That's in the middle of the audible frequency range. Above that there's no significant noise.

COMMISSIONER HANSON: Interesting. Appreciate that.

You spoke also at adverse health effects such as sleep disturbance and vertigo, which really can be crippling to people from the standpoint of going through their lives.

THE WITNESS: Yeah.

COMMISSIONER HANSON: What about children with ADHD? Have you studied any of that or familiar at all with those effects?

THE WITNESS: No. I don't know about that, but I wouldn't be surprised.

COMMISSIONER HANSON: You wouldn't be surprised what?

THE WITNESS: If they were sensitive to it or affected by it.

COMMISSIONER HANSON: You state about the very small minority of the people and that it is extremely rare, small handful of sites, quite rare, et cetera. Again, very small. And yet it's very real. At least you express that it's very real.

So in balancing that are we to assume that for the greater good some people are going to suffer?

THE WITNESS: Yeah. That's -- that's up to you guys. Yeah.

Well, just to reiterate, you know, if this commonly happened, it would be all over the news. It would be well understood, and everyone would know that a new wind project was going to cause this.

But that's not the case. It's only occurred at certain specific sites out of many, many, many projects.

So based on that alone, I'm concluding that it must be a rare sensitivity.

COMMISSIONER HANSON: Commissioner Nelson would love to sit and chat with you an extended period of time. Enjoy the conversation and what we're learning here.

For folks who have lived out in the country for a long, long time and just simply enjoy the -- enjoy the sound of the wind going through the trees, granted turbines may be at a similar volume but of a different pitch and so they hear it instead of the -- it starts to irritate them.

For those folks who live out in the country I'm going to assume they would be far more susceptible to hearing noises and problems and being discomforted by them than folks who live in the city.

THE WITNESS: Well, every wind project that I can think of that we worked on has been in a rural area.

COMMISSIONER HANSON: Right.

THE WITNESS: Probably very similar to this.

COMMISSIONER HANSON: So is my assumption correct that folks who live out in the country are going to be bothered more by noise -- by a new introduction of a new noise than folks in the city, for instance?

THE WITNESS: Oh, yeah. Definitely.

COMMISSIONER HANSON: I grew up three houses

away from a railroad track, and I can sleep through the horns and a thunderstorm and everything else, but a clock ticking on the wall or a water dripping really bothers the heck out of me.

So with that type of a challenge, I can go move that clock. I can fix the water faucet. Do we suggest earplugs for the folks out in the country?

THE WITNESS: No. And, as I mentioned, there's always -- I can't -- there might have been one or two that there were no reported complaints. But there's always a few people that are bothered, and they're really bothered. Really bothered.

COMMISSIONER HANSON: In your experience, do most of the people who are bothered at first adapt to it?

We're talking about the people who are really bothered. Do they ever adjust to it, or do they -- as you suggested, some people move?

THE WITNESS: I think people end up getting used to it like your railroad, but I don't know. I've never done any follow-up study to see if people are still upset about it years later. I don't know.

COMMISSIONER HANSON: All right. Thank you very much for your testimony. Appreciate it. And enjoyed it. Thank you.

THE WITNESS: Okay.

COMMISSIONER NELSON: And an additional question. If I'm standing a mile away from an operating wind turbine, I can hear the whoosh, and I know what it is. I know where the whoosh is coming from.

If you're measuring infrasound or attempting to measure infrasound, how can you tell the origin of it? Or can you?

THE WITNESS: Well, this infrasound has a distinctive frequency signature. It would be a .7 hertz, which corresponds to the -- how often the blades go by the tower. So you would look -- you would see it in the industry.

COMMISSIONER NELSON: Thank you.

THE WITNESS: Yeah.

MR. DE HUECK: Well, I think -- Reece, how long is your -- well, okay. Do you have -- how long would your redirect be? How long -- a while? Should we break for lunch?

Okay. It's 12:07. 1:30 we come back?

MR. ALMOND: As we discussed earlier this morning, we were hoping to have the telephonic witnesses start right after lunch so we can get them set up during the lunch break. If we don't want to finish, I get that we can take a break but --

MR. DE HUECK: Well, okay. That will work.

MR. ALMOND: I don't have very much.

MR. DE HUECK: Okay. Let's go ahead and do some redirect and recross.

MS. EDWARDS: All right.

REDIRECT EXAMINATION

BY MS. EDWARDS:

Q. Mr. Hessler, you stated there is a lot of opposition to this project. Was that based off of your knowledge of other projects you've worked on?

A. **Yeah. I would say there was a high level of apprehension about this project just by the sheer volume of all the testimony and Intervenor witnesses and so on compared to other projects.**

Q. You also stated once this morning that Mr. Cooper had finally demonstrated a link. Did you have reason to believe prior to that study that link was already there, or was this all new to you?

A. **Prior to that study I thought something was happening but wasn't entirely convinced what was going on, and that study kind of put me to the other side where it's pretty clear that those pulsations can be perceived by certain people.**

I mean, I thought that before, but there was never any evidence, although there's been many, many studies and papers about it.

Q. So with that in mind and with your testimony in response to Commissioner questions that it's a fairly small number of people, would you -- in the project that you've worked on have you seen it just -- people be irreparably split in the community and just fight in the streets forever or --

A. **Yeah. It is very divisive, yeah. Almost all projects, especially before they're built. At this stage there's a lot of dread and apprehension about it. That's mostly attributed to -- attributable to the internet sites.**

Q. In response to Ms. Jenkins's questions about that study in I believe it was Maine?

A. **Yeah.**

Q. There was some confusion about what your role was. Could there have been another sound expert that was involved that would answer what she was getting at and that was outside of your role?

A. **Well, what I do know about that is it was somebody else's work that I was asked to look at. I didn't do the study or anything. I just was commenting on it.**

Q. Do you recall based upon the noise assessments you reviewed what the max dBA was at a receptor?

A. **You mean what was the highest predicted on any other project?**

Q. This project.
A. On this project. Okay.
Right now I believe it's 41.9, which I would call 42.
Q. Would you expect 42 dBA would, in your experience, cause people to change their daily lives and behavior?
A. Hard to say. That's a pretty low level getting down towards the ideal point of 40. But there's still a possibility of complaints. In between 40 and 45 there's a definite possibility of complaints.
MS. EDWARDS: Thank you very much. I have no further questions.
MR. DE HUECK: Recross, Prevailing Winds?
MS. SMITH: No, I don't have any. Thank you.
MR. DE HUECK: Mr. Almond.
MR. ALMOND: Briefly.

RECROSS-EXAMINATION

BY MR. ALMOND:

Q. I think you were talking with Commissioner Hanson about the number of complaints with the physical symptoms of nausea, dizziness, et cetera that you talked about Shirley or attributed to this infrasound, that there are wind farms all around the country, you've studied 15 of them or maybe more but you haven't heard many complaints.

Wouldn't you expect that the number of complaints might be skewed if there are confidentiality provisions and certain contractual provisions that would prevent people from living around turbines from making such complaints?
MS. SMITH: Objection. This is outside the scope of his testimony.
MR. DE HUECK: I agree.
A. I would say that I've seen cases --
MR. DE HUECK: Dr. Hessler, I'm sorry. Don't answer the question.
THE WITNESS: Okay.
Q. Your opinion on the quantity of people affected by infrasound is based off of those -- is based off complaints that people have made; correct?
A. It is based off of our experience at Shirley and our experience at all other projects where we did not hear about that, and the fact that I have -- I'm not aware of any other projects where that was an issue, out of 50,000 wind turbines out there in this country.
Q. Are you aware of your other projects whether or not anyone was prohibited from making complaints?
A. I don't know, but my understanding is that participants --
MS. SMITH: Objection. This is speculation.

THE WITNESS: Yeah. Yeah. I would agree with that.
MR. ALMOND: Based on that, I don't have any other questions for you, Mr. Hessler.
MR. DE HUECK: Mr. Fuerniss.

RECROSS-EXAMINATION

BY MR. FUERNISS:

Q. Yes. Commissioner Nelson is trying to get at the bottom of how far this could go, the infrasound especially.
Could that be affected or enhanced by more or less hilly terrain, valleys, so forth? Would that make a difference?
A. In theory if the turbine were on a hilltop and there was a valley in between and your house or some point of observation was on the next hill, you would -- there would be a loss of ground absorption attenuation because of the valley in between so the sound would get over there more than it would over flat ground.
However, I don't think ground absorption has any real effect at that low end of the frequency spectrum. So now that I've reasoned it out in my head as I was talking, I would say it doesn't make too much difference.
Q. Okay. When you're talking 40 dBA or 45 dBA, which

metric are you using? Are you talking L90?
A. Well, that's interesting you should say that because that is the descriptor that we use to actually try to measure an operating project because it filters out cars going by and sporadic contaminating events and gets out the underlying steady -- and it is more or less steady sound level.
So we use the L90 at houses and then the L90 miles away as a background, and then we subtract the two to get what is the project doing. And if you try to use any other statistical like the average, the Leq or the L10 or the Lmax, you're getting progressively worse in your ability to detect the project alone and you're only detecting other things that are unrelated to the project.
Q. Okay.
A. That was a good question.
Q. Would it be appropriate to recommend different levels for time of day, daytime, evening, nighttime?
A. Well, the trouble with that, it's not practical to change the noise emissions in the project. They are what they are 24 hours a day. There's no way to substantially change the sound at night, for instance, to lower it, other than possibly putting some or all of the units in a low noise mode.

But the improvement in doing that isn't all that dramatic, in my experience.

Q. Are there some jurisdictions that do, in fact, require different levels from day and night?

A. Yeah. Many, many ordinances are -- expresses day/night. But when it comes to wind turbines you just have to take the nighttime level as the design and forget about the daytime. Because, like I said, the sound level is the sound level, and you don't have any control over it really.

Q. Okay. One last question. Are you familiar with bone attached hearing aids? And if you are -- one question at a time.

Are you familiar with those?

A. I'm familiar with hearing aids. My wife really relies on them, but I'm not an expert on it.

Q. Okay. So you wouldn't be able to address that for us then?

A. I don't think so.

MR. FUERNISS: Thank you.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: Just a couple questions.

RECROSS-EXAMINATION

BY MS. JENKINS:

Q. I'm sorry, but I missed. The Shirley Wind Farm when

you visited that, what year was that?

A. 2010 -- it's right here. December 24, 2012.

Q. Thank you. Can infrasound be measured inside a house?

A. That's probably the only place it can be measured.

Q. Okay.

A. Because you're out of the elements there.

Q. And was your -- the main project that I mentioned earlier, was your role at that project the same as your role is here? Did you review this sound study?

A. I reviewed a sound study. What it was about, I can't recall. I'm taking it off my resume.

Q. I'm sorry. You could just refresh your memory because you might need it again.

A. I'll have to pull the folder out back at the office. Big embarrassment.

Q. Yeah. When you do a sound study or when a sound study is ordered is it done at a certain time of year, or how do you choose when you're going to do a sound study?

A. You typically want to do them during the cold weather season of the year when the leaves are off the trees just to minimize the contamination from leaves rattling and -- and summertime you get crickets and all kinds of stuff that messes up the measurements. So

during the winter.

Q. Okay. When you do a sound study is there -- do you get a report from the -- like the operation maintenance facility of how the wind turbines are operating, meaning are they operating at the speed of the conditions or are they -- do you have proof of that?

A. Yeah. We get a log of what the megawatt output was for all the units as a function of time over the survey so we can identify if there's any down for maintenance or anything else.

Q. And can you tell whether they're operating at the normal level they would when they just do it on their own?

A. Yeah. Because we also get the wind speed throughout the survey, and once the wind speed gets above usually 7 meters per second, they're at full power.

Q. Okay. I think there's just one more.

MS. JENKINS: No. I have no more questions. Thank you.

THE WITNESS: All right. You're welcome.

MR. DE HUECK: Ms. Pazour.

RECROSS-EXAMINATION

BY MS. PAZOUR:

Q. I have a question for you. Like infrasounds next to a wind turbine, like with somebody that's sensitive to

noise, would that be more bothersome for them?

A. If that person had this particular sensitivity that we've been talking about, then yes.

Q. Like somebody with like a -- like a hearing aid.

A. No. No. I don't think that would make any difference.

Q. With the ear or nothing?

A. Huh-uh.

MS. PAZOUR: Okay.

MR. DE HUECK: Did you have anymore questions?

CHAIRWOMAN FIEGEN: She can just word it, and you'll make a decision.

MR. DE HUECK: Just throw it out there. Throw it out there.

Q. I guess, is it possible between infrasounds and reversible systems that the inner ear could feel infrasounds?

A. That sounds like a question for one of those doctors mixed up in this thing.

MS. PAZOUR: Okay.

MR. DE HUECK: Okay. Mr. Hessler, thank you for your testimony. You're excused.

(The witness is excused.)

MR. DE HUECK: We'll break for lunch and plan on getting things rocking at 1:45.