STATE OF ILLINOIS)
)SS
COUNTY OF LEE)

In the Matter of the Petition

of

BSW DevCo, LLC, Big Sky Repower

Lee County, Illinois

Testimony of Witnesses Produced, Sworn and Examined on this 14th day of March, A.D., 2019, before the Lee County Zoning Board of Appeals

Present:

Craig Buhrow
Mike Pratt
Gene Bothe
Glen Hughes
Rex Meyer
Bruce Forster, Chairman

Alice Henkel, Secretary
Dee Duffy, Zoning Enforcement Officer

Honorable Judge Tim Slavin, Facilitator

APPEARANCES:

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INDEX

Witness: DAVID MEYER

Examination	Page
Attorney Streicker	6
Mr. Gonigam	32
Ms. Gonigam	34
Mr. Buhrow	36
Mr. Pratt	37
Mr. Meyer	38

Witness: CHRIS HOWELL

Examination	Page
Attorney Streicker (Direct)	40
Mr. Gonigam	76
Ms. Gonigam	79
Attorney Klahn (Cross)	81
Mr. Buhrow	86
Mr. Pratt	88

EXHIBITS

Exhibit	Marked
Petitioner's Exhibit Number 14	7

Certificate of Shorthand Reporter 95

In Totidem Verbis, LLC (ITV)

JUDGE SLAVIN: All right. Ladies and gentlemen, I -- it's 7 o'clock, so we can begin. It looks like all parties are present.

Ms. Reporter, for the record, all of the august members of the Zoning Board of Appeals are present and in place. The Applicant is here by their attorney, Mr. Streicker. The County and its officers are here by Mr. Klahn. The Honorable Dee Duffy is here as Zoning Officer. And I think that completes my introductions.

Mr. Streicker, you're in the midst of presenting your evidence, and you may continue.

MR. STREICKER: That's correct. Thank you, Judge.

JUDGE SLAVIN: These aren't on though, are they?

MR. STREICKER: No. I don't know.

JUDGE SLAVIN: That's okay. If someone -- seriously, if someone in the audience can't hear, please tell us, and we'll turn these back on. Please do.

MS. DUFFY: Come closer.

MR. STREICKER: Thank you, Judge, staff, members of the ZBA. Again, David Streicker, and

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we look forward to presenting two witnesses this evening.

Judge, a couple of housekeeping matters.

JUDGE SLAVIN: Sure.

MR. STREICKER: One, I believe at the last hearing I admitted Exhibits 8 through 12 but neglected to admit Exhibit 13 --

JUDGE SLAVIN: That's my notes.

MR. STREICKER: -- Mr. Crossland's PowerPoint.

JUDGE SLAVIN: Yup.

MR. STREICKER: I'd like to admit that now. Thank you.

And secondly, Judge, there was one question that Mr. Crossland could not answer in his testimony, and that was whether our land leases in Lee County specified any specific removal depth for the wind energy systems. Both Natalie McCue and I have gone personally through these, and I can state that the leases do require removal to a depth of 48 inches. If any questions should arise, we can put Ms. McCue back on the stand to testify.

JUDGE SLAVIN: It's up to you, but okay.

In Totidem Verbis, LLC (ITV)

MR. STREICKER: With that, Judge, I would like to call David Meyer to the stand.

JUDGE SLAVIN: Mr. Meyer, if you'll step up somewhere in here and raise your right hand, please.

(David Meyer was duly sworn.)

JUDGE SLAVIN: Have a seat right up next to me.

DAVID MEYER,

having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. STREICKER:

Q. Mr. Meyer, would you state your name and spell it for the record, please.

A. Sure. It's David Meyer, D-A-V-I-D, M-E-Y-E-R.

Q. Mr. Meyer, would --

JUDGE SLAVIN: Your cousin is the gentleman in the last seat there. Long-lost cousin.

MR. MEYER: Spelled the same.

Q. (By Mr. Streicker:) Well, Mr. Meyer, if you could give us your business office address, so we can differentiate you?

A. It's 19700 Janelia Farm Boulevard, Ashburn, Virginia, 20147.

(Petitioner's Exhibit Number 14 marked for identification.)

Q. Mr. Meyer, I'm going to present you with what's been marked as Petitioner's Exhibit 14. If you could take a look at that for me, please.

Mr. Meyer, do you recognize this document?

A. Yes, sir.

Q. Can you tell us what it is, please?

A. My resumé, which details my experience in the telecommunications industry and specifically in areas involving the wind energy services.

Q. Okay. And did you personally prepare this document?

A. Yes, sir.

Q. Is everything true and accurate, up-to-date on that document?

A. Yes, it is.

Q. Thank you.

And then, Mr. Meyer, just for the members of the Board, could you briefly describe your educational background?

A. I have a master's degree in business

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administration from the University of Maryland University College; I have a bachelor's degree in business administration from Strader University; and I also have two years of undergraduate study in chemical engineering from New Mexico State University.

Q. Thank you.

How are you currently employed?

A. Currently I'm a senior manager of the Spectrum Engineering Group of Comsearch.

Q. And what are your duties in that position?

A. I lead a team of six engineers in the -- primarily focused on the generation and technical review of all wind energy studies. This includes establishment of technical processes, the evaluation of procedures, the interpretation of data integrity, the quality control reviews, and implementation of any study-deliverable updates or improvements as things happen over time.

Q. How long have you been in that position?

A. I have been a senior manager in the Spectrum Engineering Group since 2010. I have been at Comsearch since 1985, and in a variety of

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technical and managerial positions relating to the impact to and from telecommunications systems.

I have only -- I'm a little bit late to the game, when you consider I have been in the company since '85, to wind energy. I only got involved in that in 2012. But, again, it was a natural flow of how everything went, because my focus was telecommunications. So determining how the wind -- the installation of wind turbines was a natural progression in that industry.

Q. Okay. And, Mr. Meyer, have you done any research related to wind projects or your work on wind projects?

A. Yes.

Q. Can you tell us about that, please?

A. The -- we have worked on hundreds of wind projects over the last seven years that have been managing the group. The research we have done in them has pretty much laid the foundation for the reports we generate. We provide the technical basis for understanding how the telecommunications work and how they're impacted

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by changes in the environment, whether it's wind turbines or other sources.

Q. Okay. And then tell us about the content of these reports. What are you typically asked to do with regard to wind farms specifically?

A. Typically what we are asked to do is focus on certain areas of telecommunications, whether it be, for instance, point-to-point microwave paths that are a -- the backhaul system of most cellular networks. You know, would be essentially tasked with pulling all the existing records from the FCC's information, we correlate that with databases that are proprietary to Comsearch, and we essentially study each as a class of telecommunications to look at the impact that it is going to have or not, depending on the circumstance with the -- you know, with the wind farm.

The biggest thing that we try and do, as a telecommunications company, which is the basis and what Comsearch has been in business for since the mid-'70s, is we want to be able to technically show when things are going to be an issue or not. We typically get involved early

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on in the wind project so that the developer can make changes if needed to avoid any issues that may show up on the initial analysis and adjust so that when they do go in and become operational, their problems are hopefully very few with telecom involved.

Q. Mr. Meyer, when you're talking about issues, are you talking about signal interference issues that would arise because of the location of the wind farm?

A. Yes, there are certain aspects where a wind farm could negatively impact telecommunications, but a lot of that can be handled by proactive siting, if you will, of the turbines, you know, to avoid near field areas, to avoid, you know, blocking a microwave path, as I mentioned before.

So what we try and do is, is in any telecom area that we're asked is, provide the details on the best approach that the wind developer can take to avoid creating issues, to avoid creating interference problems.

Q. Okay. And is it fair to say that your work typically is on a two-prong approach, one

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working proactively with the engineering team for the wind farm to design it in a way to minimize signal interference? Is that the first prong?

A. Yes, is it.

Q. Okay. Would the second prong be then after the wind farm is constructed?

A. Yes. We have -- we also get involved if there is -- for instance, there is an issue or an issued identified, you know, we can provide, you know, consulting services on, you know, how to fix the problems, we can talk to them about even doing, you know, measurements in certain circumstances. You know, there are steps that can be taken, you know, beyond, you know, what you would see upfront initially.

But the real key is, what we try and base our studies on, is the best proven approach to making sure that there are no issues.

MR. STREICKER: And, Judge, it is our intention this evening to offer Mr. Meyer as an expert on signal interference issues.

JUDGE SLAVIN: I don't find expertise in this; that's up to the ZBA to determine. But

In Totidem Verbis, LLC (ITV)

having said that, I'll admit the CV.

MR. STREICKER: I would also note for the record that Petitioner's Exhibit 1, which is the application, did include a CV for Mr. Meyer's company, Comsearch. It was Dennis Jamero -- or Jimeno, excuse me, and Mr. Jimeno is no longer able to work on this project, which is why we offered Mr. Meyer for testimony this evening.

JUDGE SLAVIN: Fine.

MR. STREICKER: Thank you.

Q. (By Mr. Streicker:) Mr. Meyer, let's get into the project at issue, the Big Sky Wind Farm Repowering. Can you tell us what the purpose of your testimony here is this evening?

A. Primarily what I'm focused on are four main areas: it's the potential impact of the project on the emergency services networks in the county; the potential interference involved with the project and TV reception; the potential of interference with broadcast AM and FM radio; and finally, the potential interference or impact on the mobile phone systems.

Q. All right. Great.

Let's talk about -- you mentioned

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emergency services first, so let's take that first. Can you tell us about what you did with regard to looking at that project initially and the downstream with regard to potential interference with any emergency services networks? And then speak a little bit about, you know, what's really encompassed by the term you used, emergency services. What types of services are under that umbrella, if you will?

A. When we look at -- define emergency services from our standpoint, what we are looking at is the first responder entities: the police, fire, emergency medical services, the emergency management, hospitals, public works, transportation, and other State, County and municipal agencies, as well as the 911 operators.

And the real key there is getting all the data. You know, any technical report is only as good as the data you use, and, you know, we have developed a series or a process of pulling this data to make it as complete and as accurate that the FCC has, which is the one that licenses all these communications systems.

In Totidem Verbis, LLC (ITV)

Q. Okay. And do you look at the type of infrastructure as part of this study that these emergency responders use to communicate?
A. Yes, we definitely do. Now, all of these entities use land, mobile, and emergency services. When we did the study in this particular project, we found that there were 32 site-based licenses that were found in and around the Big Sky Wind Project area. And, again, that was pulled from the Federal Communications Commissions Universal Licensing System and also from the FCC's Public Safety and Homeland Security Bureau.

Now, each of those operate in different frequency ranges, provide different types of services. They include voice, data, video. Essentially, in layman's terms, these networks are the means by which the responders get messages to one another when they get -- when they're called out in the case of an emergency.
Q. And, you know, I hear the term line of sight come up all the time with regard to communications systems. Can you talk about that term and how it may impact anything that you

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look at?

A. Line of sight typically is much more focused on point-to-point microwave systems, because essentially you've got two antennas that are pointed directly at each other, communicating back and forth. With emergency services, the -- by design, these networks are set up to become reliable in a non-line-of-sight environment.

You know, they are designed where, you know, there are multiple base stations covering a large area with overlap, because they have to hand off signals between sites, they have to operate in environments that would not necessarily have a repeater station close or would have a transformer close, but they're designed to be able to operate in these conditions.

By non-line-of-sight, I mean they don't -- they clearly don't see everything. You know, two -- the two antennas may not see each other, but through using reflections off of the environment and everything involved, they would be able to reach and talk to each other.

So when you equate that to a wind farm,

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you know, based on the frequencies and the design of these networks, you know, we have found that we don't anticipate in this case any harmful effects due to the presence of the wind farms, because any signal blockage that may occur would be more than compensated by the actual structure of the networks themselves.

Q. You talked about you found 32 site-based licenses; is that correct?

A. Yes.

Q. And how do those licenses help you make the determinations? Do they tell you where the location of the non-line-of-sight modes of communication are?

A. Yeah, they essentially tell us where the license transmitters are. And, again, from a network basis, the emergency services, they're built to work as non-line-of-sight, but you also have to be considerate of locating the turbine too close to a transmitter.

We also evaluate, and I believe the -- we have a certain setback distance based on that distance, which essentially avoids electromagnetic issues between the transmitter

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and the turbine. Not so much a direct interference issue, but actually avoiding causing problems just because of the proximity.

Q. And was the research that Comsearch did with regard to the Lee County emergency systems, was that similar -- was that the same pattern you'd follow with any other wind farm as far as identifying, in this case, where the 32 site-based --

A. Yes.

Q. -- nodes are?

A. Yes.

Q. And then using that infrastructure to model where you may or may not see interference from the turbine?

A. Yes.

Q. Okay. Is it correct to say that after you conducted the study, you did not find or do not believe that the turbines, as currently placed -- or as currently proposed in Lee County, would cause any interference with emergency management systems?

A. That is correct.

Q. Okay. Mr. Meyer, let's turn our attention to

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the second topic you mentioned, which is television interference. Tell us what you're looking for when you go into a situation and you're reviewing a wind farm against potential television interference issues.

A. Essentially what we start with is, we draw a 150-kilometer circle around the wind project area, and we pull in every television station within that area. That is essentially a first cut to take a very large look, if you will, of the project area and what's involved.

Okay. We then, in this particular case, we found that there were 77 stations which were currently licensed and operating within that 150-kilometer radius. Of those 77 stations, 30 of them were low-power stations, meaning they were typically installed in areas to provide a very local coverage. They weren't full-power TV stations. They were, like, repeaters, if you will.

That was kind of our first-cut when we looked at it.

Q. Of the 77 stations that you referenced, do you anticipate or did you find that the wind

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turbines as proposed and as currently existing would cause any television signal interference issue?

A. What we do when we take the study is, we further investigate those 77 stations and look at their contour, which essentially is defined by the FCC on the area that they are going to cover. Every station is slightly different depending on the power, location, you know, where that is.

And we identified that there were 14 stations out of that 77 whose contour intersected, or the wind power AOI, or area of interest, was within the contour for that. So out of that 77, 14 we came up with potentially could be impacted by signal scattering as TV signals, you know, are affected by rotating wind blades or could be.

Q. And you used the term contour. If you could describe that for us, why it's significant to you, what the term is and potentially why that is significant?

A. Essentially contour is the television station. It's -- you know, if you have a very-high power

In Totidem Verbis, LLC (ITV)

station with a very high antenna, mounted very high -- I know I said high twice. I apologize -- then the area it would cover would be much larger than a low-power station at a smaller center line.

And those calculations are based on what the FCC has set up as the contour -- coverage contours for each station. Those are accessible at the FCC. You can look them up for any specific station, which gives you their coverage contour, if you will.

Q. Okay. And in layman's terms, would that be -- as far as coverage contour, that is the area around the high antenna within which somebody would expect reasonably good television reception?

A. That is correct.

Q. And of the 14 stations that you mentioned that potentially could be impacted by the turbine placement here in Lee County, are there any solutions or preventive measures that could be taken to either make sure there's no impact or lessen the impact of the turbine?

A. The introduction of the -- and the conversion

In Totidem Verbis, LLC (ITV)

of most TV stations to digital was a significant improvement in mitigating any effects of signal scattering, which is the impact that wind farms could have on a TV station signal. So when used in conjunction with a directional antenna, it becomes even less likely that signal scattering from wind farms could interfere with the digital TV reception, because it's a much more robust signal coming through to the end receiver.

Q. And of the 14 stations you mentioned, are those digital broadcasting stations?

A. Yes, they are.

Q. And you used the term signal scattering. Could you describe that a little more for the Board and what that is?

A. Typically when there are issues with a TV reception, what is happening is the homeowner or business, whoever is trying to receive the signal, is usually on the edge or close to the edge of the contour. So their signal's level may be lower than if you were much closer to the city where the station was.

And if you have a situation where the wind turbines essentially are more prominent than the

In Totidem Verbis, LLC (ITV)

TV station, meaning the homeowner has line of sight to the wind turbine but may not necessarily have line of sight to the TV antenna, then it's possible they'll get a scattering effect caused by the signal hitting the wind turbines and the receiver actually picking up that signal instead of what's coming from the television station directly.

Q. All right. And is it correct to say that a scattered signal, in layman's terms, would just be a weaker signal?

A. It -- generally, yes, it is a weaker signal, and it essentially would cause -- since it's a digital signal, would cause pixelation, not even -- you know, signal droppage is what would occur.

Q. You're just getting a worse picture?

A. Yes.

Q. Thank you.

That's a good transition to what I wanted to talk about next, which is, if a local landowner is experiencing weak signal, signal scattering, generally not the picture quality that they're used to or looking for, once the

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wind turbines are repowered and operating, is there a solution at that point? How do you fix a problem that happens on the back end?

A. In general, we have found that it would start with an onsite investigation at the receiver endpoint. You know, look at the antenna involved, the -- you know, the connections, the -- you know, the television set, you know, look at the path that the signals -- at the end. Because as I said, you know, with the digital conversion, the signals have gotten more robust as far as being received. That would be a starting point.

So, you know, we have seen in the past where replacement of an antenna is all that's required or an update for an antenna. You know, those costs are typically a hundred dollars or less if you're replacing a digital antenna for somebody.

You know, connection or cabling, usually those costs are low as well. You know, and as a last resort, there are other service options. You know, it may be cable, satellite, or some other avenue to get the signal to the homeowner

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that wasn't constrained by the altered-area antenna.

Q. Is there a scientific way to tell if signal scattering is occurring at someone's house or business?

A. Yes. You can do onsite measurements to determine, you know, what signal levels are typically with television reception. What you're concerned with is not only the level, but the signal-to-noise ratio. And you can do measurements to actually determine what that is and kind of track back and determine whether it's an issue with the receiving equipment or if the signal getting there is just too low or scattered where it's unusable.

Q. Okay. And is it -- well, if you could, summarize for us what Comsearch's findings were with regards to television signal interference, any potential issues that would be caused by Big Sky Repowering.

A. Well, based on what we studied here, we don't anticipate any big impact to the television reception in the area. And if there is an impact, we do think there are solutions, viable

solutions, that could help fix it.

The other thing is, since it's a repower project, the changes that are being made wouldn't dramatically change the situation that's already been in existence for 15 years.

Q. Thank you.

Then let's turn our attention to your third category, which was radio signals, if I recall correctly. Is it correct to say that you have reviewed the project layout and the current project as it exists to examine whether there could be any effect from the project on radio signals?

A. Yes. We began by reviewing all AM and FM broadcast stations whose service could possibly be affected in Bureau and Lee County. We found five database records for AM stations within approximately 30 kilometers of the project and nine database records for FM stations within 30 kilometers of the project.

Q. Okay. And let's take AM and FM differently, just because I know those signals are different. I'll let you describe how they are different, but will any of the AM radio stations that you

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reviewed be affected?

A. No. Geographically, the closest AM station to the project, any of the turbines in the project, is 20.9 kilometers from the closest turbine. 3 kilometers is the maximum possible exclusion zone from an AM station. This distance is determined and set by the FCC. They have studied the impact of large objects within the close proximity of an AM station, and the absolute worst case that they have defined is within 3 kilometers.

So in this particular case, we have the closest AM station is 20.9 kilometers, and so we have almost 18 kilometers' separation, if you will, between the point there would be any possible issues. So, no, we don't see any issue with the AM station.

Q. And, Mr. Meyer, you used the term exclusion zone. If you could describe for us a little more what that means with regard to AM stations?

A. What the FCC has determined is, if -- and, again, the largest distance is 3 kilometers. For some AM stations, it's actually much smaller than that. But essentially, if you put a large,

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typically, metal object, which would be pretty much the base of the turbine, or a large object, within that distance, what it will do is, it actually can detune the AM station. It impacts the coverage, if you will.

The -- we talk about coverage contour for television stations. Radios have a similar coverage concept. But essentially it will change their antenna path. So areas that they may have reached before, they may no longer be able to reach. So as long as you stay out of that distance, then you will avoid there being an antenna issue.

Q. Okay. For purposes of AM stations, there's no turbines proposed that are within the exclusion zone of Big Sky?

A. No. As I said, they are at least 18 kilometers beyond the exclusion zone.

Q. Mr. Meyer, let's turn our attention to the FM stations. Did you review FM stations? And if so, will any of those be affected?

A. We found in this particular case, no. And, again, generally FM stations are not susceptible to interference caused by wind turbines, similar

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to AM stations, primarily because of the frequency. You know, once the signals get away from, you know, the FM or the AM radio station, they typically will go around through pretty much anything. You know, otherwise we couldn't receive radio within our house or, you know, going down the road or whatever, because we're always dealing with that situation.

So in the case of FM stations, they're rarely affected by large objects. What is important for an FM station is to stay out of the near field of the antenna. Because similar to an AM station, in an FM station, if you get in the near field of the antenna, you have the potential for impacting their antenna path. So they may -- you know, somebody that they used to reach further out, they may change the pattern if you are within that near field.

For the five -- the nine stations -- FM stations that we found, the closest station to the project is approximately 13.6 kilometers away, and that is more than adequate to avoid radiation pattern distortion. The near field distance varies depending on the antenna size,

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but it's typically in the, you know, 200-meter to a thousand-meter range.

And in this particular case, the closest one is 13.6 kilometers away. So there's no issue with it being in the near field.

Q. Okay. So I know you said you don't think there will be an issue, but if a landowner did think that he or she had an issue with either AM or FM radio reception, is there a way to test for that and correct any problems that may arise?

A. Yes. Similar to the TV coverage, you can check signal level, you can measure what's being received. And, again, the focus would be on the receiver. You know, you could make changes to the antenna, to the equipment, or something involved to pull that signal in at a higher level. But, again, we have not seen any issues as far as, you know, the wind turbines creating that type of issue.

Q. All right. And lastly, Mr. Meyer, let's turn our attention to mobile phones, because I know that's an area that's not only of significant importance now but will likely continue to be of importance into the long-term future.

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Have you reviewed whether the project will cause any signal interference issues with mobile phone connectivity? And if so, what were your results?

A. What we did was, we pulled in all of the cellular phone licensees, the various bands, the types of services that they're using. We have found that cellular -- mobile phone propagation is typically not affected by the physical char- -- by physical structures. Not just wind turbines. We're talking, you know -- you know, anything that's, you know, large poles, you name it, because the beam widths of the radiating signals from the base stations in the mobile units are very wide, and the wave length of the signal is generally long enough to essentially wrap around objects as it's being transmitted, such as wind turbines and blades.

The other thing is, cellular network -- cellular networks consist of mobile base stations -- I'm sorry, mobile -- multiple base stations. They have to have, because they hand off -- as you travel down the road, they hand off from site to site, from base station to base

In Totidem Verbis, LLC (ITV)

station. And they're designed to work in congested areas with physical structures. You know, we couldn't even use -- we couldn't use the cell phones in cities if they weren't. That is how they're designed.

And the introduction of wind turbines is going to be much less severe of an impact than an urban area, and they do work there. And from everything we have studied as far as the cellular phone frequencies, we see no issues with the wind turbines.

Q. Thank you.

MR. STREICKER: Judge, that completes my direct examination of Mr. Meyer.

JUDGE SLAVIN: Very good. Thank you. Interested parties. Mr. Gonigam?

MR. GONIGAM: Yes.

EXAMINATION

BY MR. GONIGAM:

Q. You said that the turbine could scatter the signal or make it low for digital TV. What scale would you measure that with?

A. Typically what that is going to do is, reduce the signal strength coming to the receiver.

So --
Q. Would that be measured in decibels?
A. Yes, it would be.
Q. And how would you determine a baseline to measure those decibels?
A. There are -- there are theoretical measurements that have been performed. I think if -- and, again, I'm going off of memory, but I believe a typical signal, the noise ratio is about 15 to 17 dB for a television signal to come in strong to a receiver.
Q. Nonpixelated?
A. Correct.
Q. And from that baseline decibels, how many decibels below would be considered scattered?
A. Again, it depends on the individual's setup. Because there are some, you know, television sets, antennas, arrangements, that may be able to handle a much lower signal-to-noise ratio than others.

MR. GONIGAM: No more questions.

JUDGE SLAVIN: Thank you.

All right. Other interested parties besides Mr. Gonigam? Folks, raise your hand or

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somehow indicate.

Yes. Would you help us by stating your name, please?

MS. GONIGAM: My name is Pam Gonigam.

JUDGE SLAVIN: Okay. Very good. Go ahead.

MS. GONIGAM: And we live at 169 Downey Road --

JUDGE SLAVIN: You don't have to give your address, but thank you.

MS. GONIGAM: Just to kind of give you a general idea where we live.

EXAMINATION

BY MS. GONIGAM:

Q. We were wondering if these larger would have the same effect as the smaller ones?

JUDGE SLAVIN: Larger what?

MS. GONIGAM: Turbines.

JUDGE SLAVIN: Do you understand the question?

THE WITNESS: Yes.

JUDGE SLAVIN: Okay.

A. Can I restate it?

Q. (By Ms. Gonigam:) Sure.

A. Are you asking if the impact would be different or worse with the larger ones?
Q. Yes.
A. It's probably theoretically hard to say, to be honest, because the other thing that comes into play when you're talking about telecommunications and the impact is the materials involved and, you know, the speed of the blades, the -- you know, all of those -- all of that comes into play. And when you're repowering a site and putting in newer turbines, you know, it changes the equation, if you will.
Q. So there's no set ratio size to how much --
A. No. No, because the end result is it's not only the turbine and the size, but it's where is the receiver and where is the television transmitter? It's -- all of that has to be taken into account.
Q. So it's unknown?
A. [Nods head.]

MS. GONIGAM: Thank you.

JUDGE SLAVIN: Thank you.

Other interested parties? Again, please give me a signal somehow.

In Totidem Verbis, LLC (ITV)

(No verbal response.)

JUDGE SLAVIN: All right. Seeing none, Mr. Klahn, I'll turn to you, on behalf of County officers and the County.

MR. KLAHN: Thank you, Judge. I have no questions for this witness.

JUDGE SLAVIN: Okay. Mr. Forster?

CHAIRMAN FORSTER: No questions.

JUDGE SLAVIN: Mr. Buhrow?

EXAMINATION

BY MR. BUHROW:

Q. We're talking about signal interference on this issue. The blades are fiberglass then on these windmills that we're talking about?

A. I believe fiber- -- I mean, they're a combination of materials, but primarily, yes. They're not -- they're usually not metal.

Q. Anyway, you mentioned that the digital signals now that the TVs have been using in the last few years work better with any interference. The newer the TV also, is that less interference than the older models?

A. We have found that they're more in sync, I guess, if you will, because they're designed to

In Totidem Verbis, LLC (ITV)

handle, you know, the digital signals better. They coexist better, I guess.

Q. Okay.

A. Work together.

MR. BUHROW: Okay. That's kind of where you were going with, you know, the technology today versus what we had seen, well, when this project maybe was put in ten years ago or whenever it originally started.

I think that's all for me.

JUDGE SLAVIN: Mr. Bothe?

MR. BOTHE: I have none.

JUDGE SLAVIN: Mr. Pratt?

EXAMINATION

BY MR. PRATT:

Q. Mr. Meyer, do you know who did the study for the first petition when this was built the first time around?

A. I do not know offhand.

Q. Do you think they would have found any different results than yours?

A. Again, I don't know what basis they did the study on. It very well could have been Comsearch, I just simply don't know

In Totidem Verbis, LLC (ITV)

historically. I did not look back.

But the real key is, when you do these studies, you're looking to give the wind farm developer a set of parameters to avoid issues, and, you know, they -- if they came in before they even put turbines in, you know, they probably gave them, Hey, you know, if you stay away from these areas, you're going to minimize the impact.

From what I can tell from the studies here, the existing locations appear to do a very good job of that. You know, they avoided closely locating to the radio stations, the land mobile emergency services. So I think they approached it from the standpoint of avoiding the problem and doing all they can so they can work with the environment.

MR. PRATT: No further questions.

JUDGE SLAVIN: Thank you.

Mr. Hughes?

MR. HUGHES: No questions.

JUDGE SLAVIN: His namesake, Mr. Meyer?

EXAMINATION

BY MR. MEYER:

In Totidem Verbis, LLC (ITV)

Q. You said there were 32 licensees for the emergency service --
A. Yes.
Q. -- operations in the area. How many other licensees were in the area that weren't emergency services?
A. That includes emergency --
Q. That includes, okay.
A. -- and nonemergency.

The way the FCC license is, a lot of those systems is just a land mobile license. Essentially, it's giving them a license to operate a base station and removable remotes that, you know, communicate with it and with a network. So that did include some nonemergency users.

MR. MEYER: Okay. No other questions.

JUDGE SLAVIN: How about you, Ms. Duffy?

MS. DUFFY: Nothing, Your Honor.

JUDGE SLAVIN: Any follow-up, Mr. Streicker?

MR. STREICKER: No, Judge.

JUDGE SLAVIN: Thank you. You may step down. Travel safely.

In Totidem Verbis, LLC (ITV)

MR. STREICKER: Judge, we're ready to go. Okay. Judge, at this time we would like to call Chris Howell to the stand, please.

JUDGE SLAVIN: Mr. Howell.

(Chris Howell was duly sworn.)

JUDGE SLAVIN: Have a seat, please.

CHRIS HOWELL,

having been duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. STREICKER:

Q. Good evening, Mr. Howell. Could you please state your name and spell it for the record.

A. Yes. Chris Howell, C-H-R-I-S, H-O-W-E-L-L.

Q. And could you provide us with your business address, please?

A. Yes. It's 9400 Ward Parkway, Kansas City, Missouri, 64114.

Q. Mr. Howell, if you could, please briefly describe for the Board what your educational background is.

A. Yes. I have a bachelor's of science in mechanical engineering from Kansas State University. I have taken graduate level

In Totidem Verbis, LLC (ITV)

courses, including acoustics courses. I have taken quite a bit of professional courses on modeling, monitoring, on-the-job training, and things like that.

JUDGE SLAVIN: And congratulations to Kansas State. They are turning into a basketball state.

THE WITNESS: They used to be a basketball state. They're coming back again. Yes, thank you.

Q. (By Mr. Streicker:) Mr. Howell, I'm going to present you with what's been marked as Petitioner's Exhibit 13. If you could take a moment to review that document, sir?

JUDGE SLAVIN: Thank you, sir.

Q. (By Mr. Streicker:) Mr. Howell, are you familiar with this document?

A. Yes.

Q. Mr. Howell, did you prepare this document?

A. I did.

Q. Mr. Howell, can you describe for the Board what this document is?

A. This is a quick presentation that I intend to give here.

In Totidem Verbis, LLC (ITV)

Q. Okay. Mr. Howell, how are you currently employed?
A. I am a project manager in our environmental services group at Burns and McDonnell. I am the noise lead of our section in our air and noise permitting group. I also lead several large permitting projects.
Q. In one of your PowerPoints you mentioned a little bit, but are there any other duties in your current position with respect to that?
A. Just generally, I lead several teams of large permitting projects.
Q. How long have you been in that position?
A. I have been in that position for ten years. I have been with Burns and McDonnell for 16 years. I have been out of school for 18 years doing professional consulting.
Q. Mr. Howell, am I correct that your curriculum vitae was a part of the application, which is Petitioner's Exhibit 1?
A. Yes, it was.
Q. Have you reviewed that CV?
A. I did, unfortunately it was slightly out of date.

In Totidem Verbis, LLC (ITV)

Q. Okay. Can you describe for the Board, it's up to date to what period and then whatever else might need to be in?
A. It was up to date until 2016. There's been quite a few projects since 2016 that we had performed, specifically for wind projects, as well as others. In general, the gaps in 2016 to 2018 is similar-type projects, similar-type effort.
Q. Okay. So the only gap would be your experience on project work related to --
A. Right, yup.
MR. HUGHES: Excuse me. Mr. Howell, could you speak up a little? You tend to be trailing off as you're speaking. I can hear you here, but I'm guessing that they are having a little difficulty out there.
THE WITNESS: Sorry.
Q. (By Mr. Streicker:) Mr. Howell, are you a member of any relevant professional organizations?
A. Yes. I am an elected member of the Institute of Noise Control Engineering. It requires considerable amounts of professional and

In Totidem Verbis, LLC (ITV)

academic background research. I have to be an elected member. It requires an existing member to recommend my election to the Board there.

Q. And, Mr. Howell, how much experience do you have working on wind farms?

A. I have been working on wind farms since 2008. I have done roughly 20 different wind farms, seven specifically in Illinois, multiple phases on those projects in Illinois as well. In general, you know, probably 5 gigawatts' worth of development for wind farms. I have reviewed between 10 and 15 gigawatts of other projects that I did not do, seeing how they're done, how the industry is supposed to do it, things like that.

Q. And what type of work do you specifically do on wind farms?

A. In general, I do acoustics for wind farms.

Q. Okay. And if you could describe for the members of the ZBA, when you're talking about when you do acoustics, what type of things are you concerned about? What are you reviewing? What are you looking for?

A. Yeah. So a typical project for a wind farm

In Totidem Verbis, LLC (ITV)

would entail regulations research. So we'll find out if there are town, County, State, different regs like that, that are applicable to the project itself. Then we will develop a strategy for the client in which they can help plot their facilities.

So we will go out and we will take ambient measurements in the area. You can't canvas the entire project, so we select points that are representative of larger areas in general, similar backgrounds, say, the same distance from a highway or same distance from existing industry or something like that.

And then from there, we would do modeling studies, we look at modeling studies, that allow us to determine future impacts for the area.

Q. And is it fair to say, when you're talking impacts, you're talking about noise impacts? That's what you do, is noise studies, correct?

A. Correct.

Q. And that would be for all the wind farms you have worked on, your aspect would be --

A. My aspect would have been noise, yeah.

Q. Mr. Howell, let me turn your attention to the

In Totidem Verbis, LLC (ITV)

exhibit that you prepared. I see the first slide is marked Agenda. Could you briefly describe for the Board what the substance and purpose of your testimony is going to be?

A. Yeah. Just give a quick background on acoustics in general. The first slide is going to be about myself, then about acoustics in general. Then I will detail the specific criteria for this project. I'll detail how we did the sound measurements for this project, detail the predicting modeling that we did, and then discuss the modeling results that we got.

MR. STREICKER: Okay. If we could turn to the next slide, please.

And I know, Mr. Howell, you have already covered a lot of your credentials.

Judge, it would be our intention to offer Mr. Howell as an expert to the Board.

JUDGE SLAVIN: I don't really go through that formality. It's up to the Board to consider how much weight they put on any particular witness.

Q. (By Mr. Streicker:) Let's turn to the next slide, please. You have this labeled as

In Totidem Verbis, LLC (ITV)

Acoustical Terminology. If you could, take us through generally how you start one of those projects, how you look at a wind farm in relation to noise.

A. Yeah. I'll step back a little bit further, just because there's different terms that get used and they can be inflated and confused and things like that.

Sound and noise are generally used interchangeably. Noise is often described as unwanted sound. To describe sound, we talk about sound power level and sound pressure level. These are different things. Sound power is the physical energy of the equipment. Sound pressure are the airwave fluctuations that are caused by that power. Sound pressure is measured at a distance from a source. Sound power is the physical source's energy.

We talked about decibels, we talked about A-weighted decibels, things like that. A decibel is just a measure of -- it's a logarithmic measurement. It's a comparison to a pressure wave -- unknown pressure wave. It's a ratio of a known pressure wave to a measured

In Totidem Verbis, LLC (ITV)

pressure.

And then the decibel scale is a compressive scale so that the numbers are manageable. Otherwise they would be very large.

A-weighted decibels are the replication of the human hearing. The American National Standards Institute has determined that there are curves to set up, and the A-weighting curve replicates how human ears respond to sound.

It often gets used throughout the country for discussing sound levels in terms of 40, 50 dBA, 60 dBA, things like that, as a standard reference. However, on this particular project, all of the regulations are in standard dB, not A-weighted. So from here on out we'll mostly talk about dB instead of dBA.

Frequency is the measure of the sound -- sorry -- the sound's wave length. It's generally the inverse of the wave length -- sorry. My throat is a little dry.

So the inverse of the wave length is generally the frequency -- thank you.

(A discussion was held off the record.)

In Totidem Verbis, LLC (ITV)

A. Generally, the lower the frequency, the longer the wave, the longer they can travel. The higher the frequency, the shorter the wave, and the quicker they decay.

The equivalent sound level is a standard way of discussing a sound level that's constantly changing. It's basically the way to put a single number on a sound level that's all over the place. So if you're out and about in the community somewhere, the sound level is almost never 100 percent stable, but to describe that as a single number, generally take the average of that over that time period, and that's the equivalent sound level.

To then discuss the -- you know, the quality of that sound, exceedance metrics have been developed. These exceedance metrics can be anywhere from L1 through L99 or L100. That is the percentage of time that a certain sound level is exceeded during the time period.

Often the L90 is used to describe ambient sound levels, and what that does is, it generally filters out all of those other transient sound levels. Like a car passing by

In Totidem Verbis, LLC (ITV)

or a dog barking or something like that, it will discount those from the measurement itself, because that's not really what you're interested in. You're interested in stable background sound levels.

So L90 is often used as the ambient background sound level.

Q. Mr. Howell, let's turn our attention to the next slide, if we could.

You have entitled this Sound Level Criteria. And what I would like to start off with is, can you explain to the ZBA, how is noise regulated in the United States? In Illinois, and then specifically in Lee County, what types of things or what criteria, regulations do you look for when you're coming into a new area with regard to a wind farm?

A. Oftentimes we get asked, what are the federal limits for our project? A lot of times our projects are large, and there will be federal agencies involved in one thing or another. However, there are no federal criteria for an industry like this. There's railroads, airplanes, roads, things like that, but for

In Totidem Verbis, LLC (ITV)

power plants, wind farms, things like that, there are no federal regulations for those.

So then you would next step to the State level, because the EPA has delegated authority to local entities through the Noise Act.

Q. When you say EPA, is that that federal United States --

A. Federal EPA, yes. So the federal EPA originally had a Noise Control Act, and that Noise Control Act established general criteria that they thought should be looked at and things like that. They then decided that they did not want to regulate it at the federal level, it was better handled at a local level. Let the people regulate themselves, generally is what it was.

So they then passed that authority on to States, Counties, cities. You can even have a subdivision that has noise criteria, if they want to.

Illinois specifically does regulate noise. The Illinois Pollution Control Board has very well-defined criteria. I believe it came out of a series of lawsuits and/or projects with forging, impact forging, from -- not sure

In Totidem Verbis, LLC (ITV)

exactly what it was, I believe it was the '70s, I'm not positive. But they came up with very well-defined criteria for establishing how much a specific source could emit noise and the State would be acceptable with that.

They broke it down even further than just, say, a single overall number. They looked at individual frequencies. So at 31 and a half hertz, 63 hertz, et cetera, on up to 8,000 hertz, all have individual noise limits in the state of Illinois. There's a daytime limit and a nighttime limit, with the nighttime limit being quieter because people are more susceptible at night.

So it's a very well-defined limit. They include -- I mentioned it was set up for impact forging. So they have criteria for impact noises and things like that, which aren't applicable here, but all of that is in the rules.

They have something else in the rule called prominent discreet tones, which is something that is more applicable to, like, a substation or something like that, where you

In Totidem Verbis, LLC (ITV)

have a single tone coming out of the substation. However, it is something that would be addressed for a project like this, to ensure that it would comply with that criteria.

So then from there, you look to see if Lee County has a more stringent level that you would have to meet. And in this instance, Lee County specifically states it meets the Illinois Pollution Control Board limit.

Q. And specifically states, would that be in the Ordinance you looked at?

A. I'm sorry?

Q. Where is it specifically stated?

A. Yes, in the Lee County's Ordinances. Yeah, their Zoning Ordinances.

Q. And then, Mr. Howell, your next bullet point is, Limits based on land classification. If you could describe for the Board what you mean by that?

A. Yeah. So every type of land that you can think of has been classified by the State of Illinois, running from, you know, a popcorn vendor to a house to a saw mill to something like that. There are different types of classifications

In Totidem Verbis, LLC (ITV)

that your specific industry, residence, parks, things like that, would fall into.

Class A is considered residential, hospitals, things like that; Class B is generally commercial; and Class C is typically unclassified and would not have any rules.

Q. Okay. Let me ask a question. Would agricultural land -- where would that fall into?

A. So agricultural land is unclassified. Typically the way it has been enacted in the past is, they would consider the residence itself a Class A land, and the land around it is Class C Unclassified.

Q. Okay.

A. So then you would apply residential limits to the actual house itself.

Q. The farmhouse would have residential limits, and the land that was being tilled or used for agriculture would be the Class C Undefined; is that correct?

A. Right.

Q. All right. Then, sir, the next bullet point you have is, Octave Band Limits. If you can describe for us what that means, please?

In Totidem Verbis, LLC (ITV)

A. Yes. So the octave band limits, that was referring to -- when I was referring to frequencies earlier, each of these are a center frequency. Sound does not necessarily occur at 31 and a half hertz. It will occur from 30, 30.0 to 30.03, et cetera, on up to 40, 50, 60, and that all gets lumped into 31 and a half per ANSI standards and ISO standards and various acoustical Society of America standards and things like that.

So what they have determined is this center band frequency, 31 and a half hertz, covers that grouping. 63 covers the next grouping, et cetera, on up to 8,000.

So then these limits here cover any sound that occurs in that group for each of those frequency bands. So if you have a source that is operating, you know, a substation, which would be 125 hertz roughly, is where most of the sound would be coming from. On a 60-hertz system, 120 hertz would stick out.

So you would then have to comply with the 125-hertz frequency for a substation, would be the dominant frequency that you would be

In Totidem Verbis, LLC (ITV)

concerned with.

For a wind farm like this, the dominant frequency of concern is typically 1,000 hertz.

Q. Okay. And where does that noise emanate from on a wind farm, this thousand hertz we just discussed?

A. So the overall structure itself, the blades will create noise, they will create an aerodynamic noise, typically referred to as a whoosh. As you get closer to them, you will hear the whoosh, whoosh, whoosh. That is an aerodynamic noise caused by the whoosh of the blades themselves.

The nacelle is the hub of -- the center of the wind turbine. It has mechanical pieces in it that are -- that have all been upgraded over time from past history. All of the companies have learned to put vibration, isolation mounts, noise reduction technologies within them to seal them. So there's not really as much mechanical noise in those devices as there used to be.

But generally, all of this noise gets incorporated into a single overall source sound. There is a standard, IEC 61400-11, is an

In Totidem Verbis, LLC (ITV)

international standard for determining sound levels off of a wind turbine. That standard is used by all of the wind turbine vendors to develop an overall sound level for their piece of equipment based on wind speed, of heights, all those kinds of things.

It's a standard method that they all use. They have done it theoretically, they have done it through practical application, test cells, all that kind of stuff, to verify that they are predicting the worst-case noise emissions off of the turbines themselves.

Q. Let's turn now to talk about the impact a turbine may have on someone's perception of sound or noise. How do you determine the process of determining what, if any, impact a turbine would have with regard to sound?

A. So, in general, to determine if they have an impact from sound, what we would do in these types of projects, where there are clearly-defined noise emitted, we would do a predicted noise model to determine what the sound levels are at discreet receptors and also over a gridded pattern. We'll show a contour here in a

In Totidem Verbis, LLC (ITV)

little bit.

But in general, the sound would be propagated out from -- of the turbine. Generally the further you get from a source, the more it looks like a single point in space.

Q. Let's turn to the next slide.

I wanted -- I think you used earlier the term baseline study, and I wanted to get into what that -- I wanted to ask you, what is a baseline study? What does that mean to you? And has there been one done in this case?

A. Yeah, so a baseline study is generally quantification of the existing sound levels in the area. We performed that type of study on November 15th and 16th of last year. Over four different time periods: morning, noon, evening, and midnight. We had four different crew members running out and about in the community, 13 different locations. 15-minute measurements for each of those four time periods at each of those points.

The crew members observed the sound, they listened and took notes of what was there, documented all of that, and generally came up

In Totidem Verbis, LLC (ITV)

with overall values for the area, generally getting rid of the cars and getting rid of barking dogs and things like that, came up with a consensus that at certain points the sound levels -- even though, if you get rid of all that stuff, the sound levels still vary quite a bit.

They came up with at midnight, sound levels ranged anywhere from 36 to 49, I believe were the online values.

Q. This midnight, 36 to 49 dBA, would you consider that the noise or sound baseline for the region for the project?

A. Yes. Generally, for this area that has wind turbines already, has traffic periodically, has wind, has other things in the area, that was what I would consider the baseline for this area.

Q. And is it fair that this was a specific study done for the Big Sky Repowering? It was done in your direction; is that correct?

A. Correct. And those 13 points were chosen specifically -- I believe it's on the next slide --

In Totidem Verbis, LLC (ITV)

MR. STREICKER: If you want to turn to the next slide.

A. Those 13 points were chosen specifically for replication of where potential turbines could be and where residences are currently located. And again, we couldn't take a measurement at every single house, so we chose representative points.

Q. (By Mr. Streicker:) And did your study, the study area that you looked at, was that all 114 of the existing Big Sky turbines? Was that -- tell us about your study area and what it encompassed?

JUDGE SLAVIN: Mr. Streicker, may I interrupt?

MR. STREICKER: Yeah.

JUDGE SLAVIN: I'm thinking this may be a good time for a quick break, just because you're going to get into the specifics and it's a good break point. Let's take ten. See everybody at 8:15.

(A recess was taken at 8:04 p.m. and proceedings resumed at 8:17 p.m.)

JUDGE SLAVIN: All right. Ladies and

In Totidem Verbis, LLC (ITV)

gentlemen, if we can retake our places.

All right. You may continue.

MR. STREICKER: Thank you.

Q. (By Mr. Streicker:) Mr. Howell, we left off with your PowerPoint, and specifically Exhibit 4.1. Can you describe for us what this exhibit is -- or excuse me, what this depiction is here on Figure 4.1?

A. Yes. This figure is the measurement points that we took for the facility.

Q. And were these measurement points used for the baseline study that we discussed?

A. Correct.

Q. Before we turn from the measurement portion to modeling, I want to present you with what's been marked Petitioner's Exhibit 1. This is the Special Use Petition for Lee County. I have tabbed for you -- feel free to look at it, but can you tell us if you were personally involved in the preparation of any parts of this application?

A. Yes, I was. I oversaw or performed the -- all of the portions of the sound study, as well as the sound sections of the application.

In Totidem Verbis, LLC (ITV)

Q. Okay. And would this sound study, would that be entitled Revision Zero, dated January 29th, 2019?
A. Correct.
Q. All right. Thank you, Mr. Howell.
All right. If we could turn to the next PowerPoint slide, please. After you performed your baseline study, what's your next step with regard to what you do with wind farms, and specifically this one, the Big Sky Repowering?
A. Yeah, so then typically for a wind farm we would receive either one or two or three layouts from a developer. However, for this specific type of project, where they're repowering an existing facility, the locations of turbines are set. There's not a whole lot of movement. There's not a whole lot of much we can do about siting them in general.
So in that scenario, we take the layout as is. And in this case, there was 114 turbines, and we use a noise model called CadnaA. That's an industry standard model based on international standards, ISO 9613-2, that allows us to propagate sound out from different types

In Totidem Verbis, LLC (ITV)

of sources out to distance.

We include a lot of different things in the model to make the predictions as real-life as practical while maintaining conservativeness to account for exceptional situations.

In this instance, we used a ground absorption of 0.5, which means that the ground was treated as half-reflective, half-absorptive. This is pretty conservative, especially for an area that has a lot of farm ground. Farm ground is typically very soft and would be higher than that. However, when it's frozen, it would be around there, possibly a touch lower.

Q. Okay. That's input that you put into your model; is that correct?

A. It's input we put into the model. It is a standard value that is used across the industry. Some states specify this value. Model noise ordinances across the country, several of them have this specific value in it as the standard value to use.

So what we would do is, we would then put that value in there. We would take into account things such as terrain or terrain features in

In Totidem Verbis, LLC (ITV)

the area that would cause sound levels to either reflect or diffract or various other phenomena. So we would include the actual terrain in the area using digital elevation models, input into the model itself. Each individual turbine and the specific location is input in the model, with a specific sound level and a specific propagation type.

Q. Let me ask you, where is the terrain data derived from? Is that from visual inspection? Do you get it off the Illinois State Geological site?

A. No. It's USGS digital elevation models. So that data actually comes from the United States government.

Q. And this would be high-precision data; is that correct?

A. Yes. Yes, it is.

It wouldn't account for somebody leveling something that we didn't know about, so there are some potential nonconformance --

Q. But this is the U.S. --

A. In general, it's very accurate, yes.

Q. This is the geological survey telling you what

In Totidem Verbis, LLC (ITV)

they found out there, correct?
A. Correct, yes.
Q. Let's talk about the other inputs to the model. I take it the turbines themselves are one of the inputs; is that correct?
A. Yes. So every single turbine, all 114, are input into the model in their specific locations down to one-one-hundredth of a meter. The sound level is applied. And in our specific instance, especially because the limits are octave band-based, all of the octave band data from the vendor are input into the model.

These -- again, these are IEC values that they have derived through actual testing, through theoretical modeling, things like that.
Q. So the inputs you're getting from the vendor are inputs that they -- the vendor derived from doing industry standard-type testing; is that correct?
A. Correct.
Q. Okay. So you're getting hard data from the vendor that's, again, one of the inputs to your model?
A. Correct. And that data is supplied to us in

In Totidem Verbis, LLC (ITV)

tabular format per wind speed at the hub height, and it will vary from, you know, 1 meter per second up to cut-out speed for the turbine, I believe, which was 12 or might have been 18 per second, I'm not sure exactly on this turbine.

Q. Well, which vendor in this case provided you with this data?

A. GE, General Electric, provided this data. And they provided us two different sets of data; they provided a 2.5 machine and a 2.3 machine. We looked at those data sets, compared them, and the GE 2.3 machine is actually slightly louder. You know, it's a function of the blades and things like that. They're spinning faster because they are smaller blades.

And because it is a louder turbine than the 2.5, we applied the 2.3 values to every single turbine across the entire wind farm, which is ultra conservative, meaning they can place the loudest turbine anywhere in the wind farm and they'll get these results or lower at all times.

Q. Okay. And you have a bullet point there, Point Source . Can you describe for us what that

In Totidem Verbis, LLC (ITV)

indicates?
A. Yes. So I kind of started talking about it earlier. The further away you get from anything, the more it looks like a single point in space. That is the industry standard for modeling wind turbines generally because of the distance from the source itself to the receivers; in this instance, residences.
That distance is sufficient that it doesn't really matter if you model it as a circle or single point or anything like that. And it generally makes the analysis easier for everyone involved, and it applies the IEC values correctly that way.
Q. Your next bullet point, the 107.6 dBA sound power level, if you can describe for us the significance of that?
A. So, again, that's -- this is one of the reasons I brought up sound power versus sound pressure earlier. This is the physical energy of the unit. It's not a pressure wave that's measured at a distance. This is the energy that is radiated off of, generally the hub and the blades themselves. That sound power level would

In Totidem Verbis, LLC (ITV)

then propagate out to a distance, would encounter things -- atmospheric conditions, it would encounter temperature differences, it would reflect off of things, et cetera.

So that sound wave would then be a sound pressure wave at distance that would be measured, and those measured values are what we use for complying with this.

Q. Was that input provided by the manufacturer?

A. The sound power level was, yes.

Q. Okay. Then the last bullet point, you have the 82-meter hub height. Where is that coming from?

A. So that is a specified value by also the vendor and/or the developer. They can choose a different hub height based on different criteria with the vendor.

Q. And everything that we just talked about, from topography to vendor inputs, are there any other inputs that you use to make your model for a turbine noise model?

A. In general, we allow the sources to radiate in all directions at all times. This creates a nonrealistic, worst-case scenario, which basically means every single residence is

In Totidem Verbis, LLC (ITV)

downwind of every single turbine. So if you have a house that's between two turbines, it's like the wind is blowing directly at the house at all times.

Q. So you're modeling for at- -- or one of the inputs to your model is atmospheric conditions?

A. There are generic atmospheric conditions for specific regions of the country, and we use the defaults in the model that replicate average conditions here.

Q. Here in Lee County?

A. Uh-huh.

Q. And is it fair to say when you modeled those average conditions -- did you say you modeled for worst case, for instance, wind direction or something else?

A. So we don't specify wind direction, to let the model account for the fact that two turbines could blow at a house at the same time. It's actually significantly worse than if the wind was always blowing in one direction.

Q. Talk to us a little bit more about how atmospheric conditions can affect sound coming out of wind turbines and/or your model.

A. So the wind itself, you know, the faster the wind blows at the hub height, the faster the turbine is going to spin. The faster it spins, the louder it is.

The -- there are other factors that come into play, such as inversions in the atmosphere, where there's a temperature differential between ground level and cloud cover, generally. This can cause sound levels to carry further than typically expected.

One of the benefits of the model that we use, the ISO standard dictates a moderate ground-based inversion is occurring at all times. So the sound levels that we predict not only are worst-case wind blowing, they're also worst-case and inversion occurring at the same time. It's generally not a very realistic situation from atmospheric conditions, considerations, but it allows for us to predict worst-case sound levels off of the units and be very confident that they're conservative.

Q. Let's turn our attention to the next slide and talk about the results of the modeling you did here.

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Your first bullet point there is, the impact to models at all identified receivers. If you can tell us what receivers you're referring to, and then the identification criteria.

A. So a list of occupied residences was supplied to us. That was used as our impacted -- or identified receivers. So those were then input into the model as all having 1.5 meters, basically 5 feet, hearing height on the exterior of the house where they would be impacted most by the wind turbines.

You know, again, we assume all directions are downwind. So that's another of our conservative assumptions that we make.

Q. That's a worst-case assumption you're putting in?

A. Correct.

The model will calculate the combination of the impact of every wind turbine at every receiver. So each receiver will have a calculation that has 114 turbines added up on their impacts to it. Some turbines are extremely far away, so they'll have negligible

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to zero impact and they won't contribute at all. There could be a turbine right next to it and it will dominate. There could be two turbines that are close and they have equal contribution. In that situation, you would possibly get -- in this example, 35 and 35 from those two turbines would equate to 38 decibels of impact because it's logarithmic. You don't add 35 to 35 and get 70. You would add them logarithmically and get 38.

But that logarithmic condition is done for every receiver for every turbine, and also for every individual octave band frequency.

Q. And then if you could summarize for us or tell us, did your model find any impacts -- or noise impacts with regard to specific turbines or any turbines that were over and above the State regulatory limits?

A. Yes. There were quite a few that were impacted that had either very minor, or in some cases a couple of decibels over the specific 1,000 hertz frequency was exceeded. The IPCB regulation was set up that way such that the most dominant frequency that we hear has one of the hardest

In Totidem Verbis, LLC (ITV)

limits to meet, which happens to coincide with the worst frequency for turbines in general as well.

So meeting the 41-decibel limit -- I should say 41 dB, not dBA, I apologize -- 1,000 hertz is our frequency that determines the compliance for us generally. And there were --

I don't remember the exact number. I would have to look at the report, but of the impact to participating and nonparticipating residences, there were quite a few nonparticipating residences that exceeded, I believe it was 30-something. However, I do understand that the Applicant is seeking noise waivers with those specific residences at this time.

Q. Okay. So the Applicant, or Petitioner, is using the modeling data that you have supplied to --

A. Correct.

Q. -- determine when and where waivers are necessary --

A. Correct.

Q. -- at least to your knowledge?

In Totidem Verbis, LLC (ITV)

And, Mr. Howell, with regard to your experience in Illinois wind projects generally, are there often exceedances of the 1,000-hertz baseline that you talked about, or State criteria?

A. It depends. You know, for participating residences, there are quite frequently exceedances of those values. For nonparticipants, they generally become participants through contractual means. If they do not become a participant through contractual means, then there is either de-rating of the turbine to reduce the sound levels off of that specific turbine, or in an instance like this, where they may not build 114 turbines, they may choose to not build that specific turbine that's causing that problem.

Q. If we can turn our attention to the next slide, please. This is the slide that --

A. So this is --

Q. Let me just say for the record, it's Figure B3. Can you describe for us what that is, please?

A. Yeah. So this is the specific 1,000-hertz frequency model results. Generally you can see,

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pretty apparent, the yellow line there is the 41 hertz. The little fan-looking things are the wind turbines -- the existing wind turbine locations. These are the new wind turbines in the model. And all of the pink/purple boxes are residences in the area.

Anybody that falls within that yellow amoeba is exceeding the 41-hertz criteria at this point.

Q. Okay.

A. So you can see there's quite a few. Now, a good chunk of those are participating residences. They know that there's a turbine on their property, they have agreed to these terms, et cetera.

Q. Mr. Howell, at the beginning of your testimony you talked about how wind turbine manufacturers have gotten significantly better at reducing mechanical noise from the turbines; is that correct?

A. Yes. They have also gotten significantly better at reducing aerodynamic noise off of the turbines. They do various things, such as pitching the blades. They didn't used to do

In Totidem Verbis, LLC (ITV)

that. That helps quite a bit to feather the blade itself in the wind, reducing that aerodynamic noise but still allowing the blades to spin and capture the wind for power.

There are various other techniques like that as well that can be used, and the -- generally the newer turbines are operating at equivalent or lower sound levels to older turbines of even lesser rating values.

Q. I think you mentioned that the turbines you studied here -- well, specifically the GE 2.3, but there was also a 2.5 -- GE 2.5 that you were provided data for?

A. Yes.

Q. Would those two turbines be considered newer turbines, under the definition you just laid out?

A. Yes. They would be newer, yes.

MR. STREICKER: Thank you very much, Judge. I have no more questions.

JUDGE SLAVIN: Thank you, sir.

Interested parties, we'll start with Mr. Gonigam.

EXAMINATION

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BY MR. GONIGAM:

Q. When you had the PowerPoint up of your one, what goes into your model, you had 107.6 dBA?

A. Correct.

Q. Was dBA correct or should that have been dB?

A. So that is correct, that is dBA for that one. That's how the vendor supplied the value.

Q. Is it true that a dBA could be up to 40 decibels off from a dBC measurement because of the lower frequencies used?

A. So a dBA value is directly translatable to a dBC value, if you know the frequency components. In this instance, we know the frequency components of the turbine itself. The vendor supplied even one-third octave band, not just an octave band. So the 31 and a half hertz value that they provided us is actually a 20-something hertz, 31 hertz, and 40-something hertz.

Q. Oh.

A. So we actually know quite well the frequency distrubution of the turbine.

And there are no specific frequencies that stand out to cause what would be a prominent tone by Illinois. However, for the low

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frequency noise, as you're asking, I think what you're asking is when a source has a very heavy low frequency component, there will be a difference between its measured dBA and dBC value. So that's how you determine if there's a low frequency component, comparing the two values to each other.

Now, for something like this, where we know the frequencies of it, we can directly translate it between the two and determine if there is a low frequency component. And this turbine does not have significant low frequency problems.

Q. I know you probably don't have your predictive modeling thing here, but if this turbine was, we'll say, 700 feet from the yard of a residence, how often would that turbine have to be curtailed to meet noise pollution -- Illinois noise pollution standards?

A. So that's -- there's no direct way to answer that question. The -- if the wind is blowing a hundred percent away from that house, it probably wouldn't exceed ever. If the wind is blowing directly at that house, you know, it

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would depend on the specific wind speed, it would depend on barometric pressure. I mean, there are quite a few things that would play into it as to if it would need to be curtailed at all or some percentage.

I can't really give you that answer directly. I apologize. I understand the question, but I --

Q. I understand you not being able to answer completely.

MR. GONIGAM: No further questions.

JUDGE SLAVIN: Thank you.

Other interested parties, raise your hand.

Yes, Mrs. Gonigam -- Ms. Gonigam?

EXAMINATION

BY MS. GONIGAM:

Q. These new proposed windmills are going to be larger than the ones that are there right now?

A. Yes.

JUDGE SLAVIN: Wait. Is that correct?

Q. (By Ms. Gonigam:) Is it?

A. I believe they are taller.

Q. That's what I thought.

A. Yes, I believe they're taller. I don't know

In Totidem Verbis, LLC (ITV)

the exact numbers. I believe the hub height was roughly 10 feet taller. I believe the tips are maybe 50 feet taller. I'm not exactly sure.

Q. Can you tell me, are they going to be louder than what we have now?

A. So we took some -- we obviously took ambient measurements while we were out there. The wind turbines were operating. We measured values anywhere from 36 to 49, I think was our ambient.

You know, we're predicting very much in that same range of operational sound levels for the new turbines on a worst-case scenario. On a day-to-day basis, the data from manufacturers suggest that these are much quieter than the older turbines. On a maximum wind day, et cetera, I would expect it to be roughly the same, possibly less.

Q. So I could expect them to be less noisy than they are now?

A. On a day-to-day basis, I would say that that's probably true.

Q. Okay. Thank you.

A. I can't guarantee it. Based on the wind, based on et cetera, I don't know. But on a general

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basis of looking at the data, that's what it looks like, yes.

JUDGE SLAVIN: Other interested parties?

(No verbal response.)

JUDGE SLAVIN: All right. Mr. Klahn?

MR. KLAHN: Thank you, Judge.

CROSS-EXAMINATION

BY MR. KLAHN:

Q. You have described different inputs into sound modeling, as you have done the study here. Is that your general methodology in trying to form an opinion of what the sound levels -- or predicting the sound levels?

A. Yes. So we run autonomously from the developer on these sound models. We understand they're trying to meet the limits and all of that, but we don't change the model to show they pass. And obviously, in this scenario we're saying that there are some that exceed and they need to take care of that.

Q. Sure.

A. So yes, our general approach is to put all of the inputs into the model, let it do its magic, and then come up with representative values for

In Totidem Verbis, LLC (ITV)

worst-case scenario. You know, we then take those values, we compare them to the Illinois criteria, which is -- I'm not sure if I was clear on this earlier, but the Illinois criteria is specific to the source. It excludes background sources and things like that. So then we would compare these levels directly to the Illinois criteria and show that they pass, don't pass, et cetera.

And if you look at the back of the report, I believe it's Appendix C, there's a detailed listing. We did look at all of the frequencies. We didn't just look at 1,000 hertz. So we went through and looked at participating, nonparticipating, individual frequencies, how did they meet the limits, yes, no, things like that.

Q. Now, these models or methodology used, have they been tested?

A. Yeah.

Q. Has that been subject to peer review --

A. Yes.

Q. -- within this field?

A. The ISO 9613 standard is very well-developed.

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It's been around for 20-plus years. They have continually tweaked it. They have different issue dates, things like that. And from time to time they will incorporate something new that they haven't in a long time.

There's -- the IEC standard is verified.

Our prediction methods that we do, we will do probably 50 compliance demonstrations this year. I believe we did 47 to 52-ish last year of verification of our modeling. And in all but one of those cases we came in high on our modeling. So we got out there and measured lower.

On the one that came in high, it was because the vendor that supplied equipment was louder than what they told us it was going to be. That was something they had to go back and fix. We did a second demonstration and they complied.

Q. Given your background, your education and experience then, are these methodologies you're testing generally accepted in the field of sound analysis and study?

A. Yeah, they -- ANSI, ISO, IEC, all of these very

In Totidem Verbis, LLC (ITV)

well-known, well-respected organizations across the world, these are the types of studies that they do using these methods specifically.

Q. I think you summarized this, but -- and I know you're not an Illinois resident, but it's your understanding that the Illinois Pollution Control Board would, for lack of a better term, police whether or not any of these turbines would be exceeding if they hadn't received some type of waiver?

A. So Lee County has its own Ordinance in place that says that you have to meet the Illinois standards. So Lee County could, in essence, police it themselves.

Q. Sure, okay.

A. The Illinois Pollution Control Board could police it, if they were asked to. They have a noise hotline, I believe. But Lee County typically would be the first responder to something like that, and then it would be advanced to the IPCB if need be.

Q. I appreciate that. I think that was a poorly-structured question as it was stated.

The Illinois Pollution Control Board,

In Totidem Verbis, LLC (ITV)

though, sets the standards?
A. Correct. Yes. Sorry.
Q. No, that was my fault. That was a bad question, the first one.

In the time that you have, again, been involved in the study with wind turbines and sound or noise issues, have you ever come across any study or case where someone's had some type of medical hearing condition because of turbines?
A. There are lots of studies and stories that you can find all over the place. Everything that I have read is generally anecdotal. They did not have legitimate study methods, et cetera. Basically someone complained that the wind turbine was causing them problems. They test the person. Oh, it's got to be the wind turbine.
Q. Oh, okay. So nothing was necessarily --
A. They are hard to -- there was no scientific method approached on those. So there's hundreds of good science out there, hundreds of bad science out there, and you have to filter through those.

In Totidem Verbis, LLC (ITV)

Q. Sure.
A. And what I have seen is that -- and I'm not a doctor -- health is not an issue from these types of wind turbines.
MR. KLAHN: No further questions. Thank you.
JUDGE SLAVIN: All right. How about you, Mr. Forster?
CHAIRMAN FORSTER: No questions.
JUDGE SLAVIN: Mr. Buhrow?

EXAMINATION

BY MR. BUHROW:
Q. I have got a question along with Matt's question, the same type of thing, because we have heard the same situation. You know, we have done a lot of these over the years. What frequency level is that or what type of frequency is that that causes people to have migraines or can't sleep or that kind of thing?
A. So that's kind of a loaded question. People can be affected by any different number of things. Everybody's response to sound is different. Generally your eardrum is not the same as their eardrums and their eardrums, and

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because of that, it has a different sensitivity to pressure fluctuations.

The wavelengths that cause pain and problems and things like that generally require an amplitude with them as well. A sound at a certain frequency doesn't necessarily cause you issues. It's when it has an elevated amplitude as well that causes you issues, unless it's the natural frequency of your eardrum, things like that. In that instance, it would still require a certain amount of amplitude to cause any damage to you.

The amplitudes that we're talking about here are less than anything that you experience on a normal, day-to-day basis. Your refrigerator causes more amplitude inside your house than this would.

Q. That's -- since you deal with this, that's what brought the question up. Because any of these cases we have had, it's usually --

JUDGE SLAVIN: Don't give him a speech. Just ask him a question.

THE WITNESS: I'll happily talk to you afterwards.

In Totidem Verbis, LLC (ITV)

Q. (By Mr. Buhrow:) Have you had any reports or -- through the company or anything of any complaints in the past, since these are operating windmills that have been out there for a while?
A. I specifically asked that question before we came in here, and they were not aware that there were noise complaints per se.
MR. BUHROW: That's all.
THE WITNESS: I am not aware.
MR. BUHROW: Okay. Thank you.
JUDGE SLAVIN: Is that it?
MR. BUHROW: Yeah.
JUDGE SLAVIN: Mr. Bothe?
MR. BOTHE: No.
JUDGE SLAVIN: Mr. Pratt?

EXAMINATION

BY MR. PRATT:
Q. So you did a baseline study, and you said you -- it was 36 to 49 dBA or dB?
A. So that's dBA.
Q. So that's over what the standards are?
A. No. So that is a single overall value which is an aggregation of all the frequencies into a

In Totidem Verbis, LLC (ITV)

single number. There's -- it's going to be a little confusing. There are adjustment factors for individual frequencies, and then you would logarithmically sum them all together to get a single overall value. And that's what that 36 to 49 dBA value is, is it's a single weighted logarithmic condition of all of the frequencies.

All of these added together for the State limit, if you were to properly weight them to dBA and add them together logarithmically, I believe is -- I don't remember exactly, but it's in the 50s, possibly 60.

So these values are below the recommended for overall level. However, if you look at Appendix C of the -- if you look at Appendix C of the report -- I'm sorry, Appendix -- it's in the report on the -- Appendix A, there is a listing of the octave band data for each of the measurement points. You can see in there, there are a lot of exceedances of the Illinois regs. Now, some of them have to do with cars passing by, some of them have to do with possibly the turbines that are there right now.

Q. That's my next question is, the turbines were

In Totidem Verbis, LLC (ITV)

running, this was a functioning wind farm when you done this?

A. Right.

Q. So years ago when we worked with IPCB, they talked about creating a baseline and then it couldn't exceed that baseline by a certain amount. Is there anything in the regs about that, now that you have created this baseline that you can go over that baseline?

A. So they do not have that in their regulations. That is a standard rule of thumb for when people are going to notice sound level changes. There are criteria out there that some counties have. However, in a situation like this, where you have an operating wind turbine that is going to be replaced by an operating wind turbine that has generally the same or lesser sound levels, adding the new project to the established baseline is double-counting. So we would have to somehow back out the existing wind turbines and add in the new wind turbines and come up.

Generally what I expect, based on the sound levels of this wind turbine versus sound levels of the existing wind turbine, is almost

In Totidem Verbis, LLC (ITV)

an apples-to-apples swap with possibly less on those.

Q. So what was the value of doing this baseline study?

A. In general, they want to know what it is. The IPCB requests that you do it. You can do a comparison -- it's more applicable in a situation where you're building a greenfield site, there isn't anything there, then you would add to the baseline.

It also comes into play when you're having to demonstrate compliance. And the limit is specifically for your source. It's not for your source plus the background. So then you would take the ambient, establish it, take your operational measurements and subtract out your ambient and then determine if you meet these limits.

Those are the two times when an ambient study is more applicable for IPCB regs.

Q. I understand.

So another question, these ones that are over the limits, you said they would curtail them to meet the limit?

A. So there are different ways to do that. There are noise reduction options that they can purchase for their equipment, which is generally a software package that integrates with the anemometers on each of the wind turbines and knows when certain wind speeds are occurring and it slows the turbine down.
Q. So they would do that, based on your study?
A. Generally --
Q. No --
A. -- that's what I understand. Now, I believe they are trying to get waivers from all of the neighbors first, as their first option. So then if they can't get a waiver, it would either be curtailed or don't build that turbine.

MR. PRATT: No further questions.

JUDGE SLAVIN: Mr. Hughes?

MR. HUGHES: No questions.

JUDGE SLAVIN: And, Mr. Meyer?

MR. MEYER: No questions.

JUDGE SLAVIN: Ms. Duffy?

MS. DUFFY: No questions.

JUDGE SLAVIN: Any follow-up?

MR. STREICKER: Just a 30-second break

In Totidem Verbis, LLC (ITV)

real quick.

JUDGE SLAVIN: Absolutely.

Have a seat.

THE WITNESS: Oh, I thought --

JUDGE SLAVIN: I thought you had more questions.

MR. STREICKER: If I could have a 30-second break. I just want to ask him one thing to see if I have more questions.

JUDGE SLAVIN: I'm sorry. I misunderstood.

THE WITNESS: I apologize for leaving.

JUDGE SLAVIN: No, my fault.

(A brief recess was taken.)

MR. STREICKER: Judge, I have no further questions.

JUDGE SLAVIN: Okay. Thank you, Mr. Howell.

And I assume no further witnesses?

MR. STREICKER: That is correct, Judge. We're ready to go on the 20th, with your permission.

JUDGE SLAVIN: Ladies and gentlemen, thank you for everybody being here. We will recess

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until March 20th, that's a Wednesday, at 7 o'clock here in the Old Lee County Courthouse. Have a safe weekend. Drive safely home. The wind is blowing hard, I think.

(A discussion was held off the record.)

JUDGE SLAVIN: Exhibit 15 is admitted.

MR. STREICKER: 14 and 15.

JUDGE SLAVIN: I already admitted 14.

MR. STREICKER: Oh, you did? Okay. I can get rid of that.

(The hearing was recessed at 8:54 p.m.)

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Now on this 14th day of March, A.D., 2019, I do signify that the foregoing testimony was given before the Lee County Zoning Board of Appeals.

Bruce Forster, Chairman

Dee Duffy,
Zoning Administrator

Callie S. Bodmer
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