December 18, 2019

Daniel Wolf, Executive Secretary
Minnesota Public Utilities Commission via email and eDockets
121 – 7th Place East, Suite 350
St. Paul, MN  55101

John Wachtler, Energy Program Director via email and eDockets
Commerce – EERA
85 – 7th Place East, Suite 500
St. Paul, MN  55101

RE: Improper Ground Factors Skew Modeling and Misrepresent Probability of
Compliance in ALL 13 Projects Identified by EERA as “LWECS In
Permitting Process” or “LWECS Permitted”
Nobles 2 (WS-17-597)
Freeborn (WS-17-410)
Blazing Star (WS-16-686)
Lake Benton II (WS-18-179)
Community Wind North (WS-08-1494)
Jeffers Wind (WS-05-1220)
Fenton Wind (WS-05-1707)
Buffalo Ridge (WS-19-394)
Three Waters (WS-19-576)
Plum Creek (WS-18-700)
Mower County (WS-06-91)
Dodge County (WS-17-307)
Bitter Root/Flying Cow (WS-17-749)

Dear Mr. Wolf and Mr. Wachtler:

In reviewing the EERA 2019 Project Status handout for the Power Plant Siting Act Annual
Hearing,¹ I’ve noticed that every project listed by Commerce-EERA as “LWECS Permitted” and
“LWECS in the Permitting Process” all utilize, improperly, ground factors of 0.5, and in three

¹ https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={90D27E6E-0000-C116-8738-B4CA09BD8487}&documentTitle=201911-157604-01
instances, an absurd 0.7 ground factor. This is not acceptable. Why is this occurring? It’s not hard to guess. In both Minnesota and Wisconsin, projects utilizing the appropriate ground factor of 0.0 were not able to demonstrate compliance with the states’ noise standards, and subsequently, the developers provided modeling at 0.5 ground factor in those dockets rather than adjust the design of the project to allow for compliance with state law. **This is particularly important where the turbines are now larger and noisier than those of Bent Tree, where exceedences were demonstrated at 1,150 and 1,525 feet.**

A ground factor of 0.0 is to be used for wind modeling because the wind noise source is elevated high in the air, and ground conditions do not impede the direct path from a greatly elevated source to the “receptor.” See attached testimony of Dr. Paul D. Schomer, from the Highland Wind CPCN proceeding (WI PSC Docket 2535-CE-100) and testimony of Mike Hankard, from the Badger Creek Solar CPCN proceeding (WI PSC Docket 9697-CE-100).

Below are the 13 projects listed in the “EERA 2019 Project Status” handout for the PPSA Annual Hearing, pps 3-4 (not including the withdrawn Bitter Root project), and I’ve listed the dockets, by name and number, the ground factor used, and the citation:

<table>
<thead>
<tr>
<th>Name</th>
<th>Docket</th>
<th>G.F.</th>
<th>Cite</th>
<th>eDockets ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nobles 2</td>
<td>WS-17-597</td>
<td>0.5</td>
<td>p 3, Appendix C</td>
<td>201710-136496-03</td>
</tr>
<tr>
<td>Freeborn Wind</td>
<td>WS-17-410</td>
<td>0.5</td>
<td>p 7, Attachment E</td>
<td>20198-155331-04</td>
</tr>
<tr>
<td>Blazing Star</td>
<td>WS-16-686</td>
<td>0.7</td>
<td>p 52, Attachment B</td>
<td>20189-146376-01</td>
</tr>
<tr>
<td>Lake Benton II</td>
<td>WS-18-179</td>
<td>0.5</td>
<td>p 6-4, Appendix C</td>
<td>20185-142740-01</td>
</tr>
<tr>
<td>Community Wind</td>
<td>WS-08-1494</td>
<td>0.5</td>
<td>p 2, Appendix F</td>
<td>20193-151362-03</td>
</tr>
<tr>
<td>Jeffers Wind</td>
<td>WS-05-1220</td>
<td>0.5</td>
<td>p 2, Appendix F</td>
<td>20193-151486-04</td>
</tr>
<tr>
<td>Fenton Wind</td>
<td>WS-05-1707</td>
<td>0.5</td>
<td>p 2,4 Attachment 6</td>
<td>20191-149027-08</td>
</tr>
<tr>
<td>Buffalo Ridge</td>
<td>WS-19-394</td>
<td>0.5</td>
<td>p 6-5, Appendix C</td>
<td>20197-154454-07</td>
</tr>
<tr>
<td>Three Waters</td>
<td>WS-19-576</td>
<td>0.7</td>
<td>p 8-13, 43, Appendix D</td>
<td>201910-156475-03</td>
</tr>
<tr>
<td>Plum Creek</td>
<td>WS-18-700</td>
<td>0.7</td>
<td>p 48, Appendix B</td>
<td>201911-157475-05</td>
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<tr>
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<td></td>
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<td>201911-157475-06</td>
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<tr>
<td>Mower County</td>
<td>WS-06-91</td>
<td>0.5</td>
<td>p D-5, Appendix D</td>
<td>201912-157979-03</td>
</tr>
<tr>
<td>Dodge County</td>
<td>WS-17-307</td>
<td>0.5</td>
<td>p 6-4, Appendix C</td>
<td>201910-156623-03</td>
</tr>
<tr>
<td>Bitter Root</td>
<td>WS-17-749</td>
<td>0.5</td>
<td>P 8, Part 4</td>
<td>20184-141999-08</td>
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<td>20184-141999-04</td>
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Below is a lightly edited summary of the wind modeling ground factor that I’d filed earlier in the Power Plant Annual Siting Act Annual Hearing record, explaining why ground factor matters:

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I. BECAUSE NOISE MODELING WOULD DEMONSTRATE LWECS IN THE SITING PROCESS ARE LIKELY TO VIOLATE STATE NOISE STANDARDS, DEVELOPERS ARE USING WRONG GROUND FACTOR FOR MODELING, GIVING FALSE IMPRESSION OF PROBABLE COMPLIANCE.
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Freeborn Wind (PUC Docket 17-410) was the first wind project to be sited acknowledging application of the PPSA, and more importantly, the first contested case for siting. Two prior
contested cases were held on wind projects, one a territorial dispute between developers circa 1995, and more recently, the Goodhue Wind project and applicability of county ordinance under Minn. Stat. §216F.081.

The ALJ’s Recommendation in the Freeborn Wind case was that the permit be denied:

**SUMMARY OF RECOMMENDATIONS**

The Administrative Law Judge concludes that Freeborn Wind has failed to demonstrate that the proposed Project will meet the requirements of Minn. R. 7030.0040, the applicable Minnesota Noise Standards. Therefore, the Administrative Law Judge respectfully recommends that the Commission either deny Freeborn Wind’s Application for a Site Permit, or in the alternative, provide Freeborn Wind with a period of time to submit a plan demonstrating how it will comply with Minnesota’s Noise Standards at all times throughout the footprint of the Freeborn Wind Project.

The wind promotional lobby was horrified that they might have to demonstrate compliance with the rules, and flat out stated they could not:

**Judge's ruling against Minnesota wind farm causes alarm for advocates**

From that article:

_Freeborn Wind’s developer, Invenergy, has objected, saying Schlatter’s interpretation of state noise rules would be “impossible” to meet. Last week, two wind-industry trade groups and three of Invenergy’s competitors also filed objections to Schlatter’s recommendation, as did four clean-energy and environmental groups._

_The judge’s “interpretation of the Minnesota Pollution Control Agency’s (MPCA) noise standards would have a detrimental impact on other current and future wind-energy projects throughout the state,” the Minnesota Center for Environmental Advocacy wrote in its objection._

**Wind industry says Minnesota pollution control stance will stifle its growth**

And from that article:

_The wind-energy industry said an opinion filed by Minnesota pollution-control regulators defining wind-turbine noise will stifle its growth._

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The Minnesota Pollution Control Agency (MPCA) said the state’s limit for wind-farm noise applies not only to sounds from turbines but also should include background noise such as road traffic, said the filing with the Minnesota Public Utilities Commission (PUC).

The MPCA comment, filed September 11, 2018, and referred to in this article is attached below.

For Freeborn Wind, ground factor, a primary input assumption for noise modeling, was set at 0.0, and all evidence and testimony regarding the predictive modeling was based on this 0.0 ground factor. In an apparent admission that these many wind projects cannot comply with noise standards and cannot demonstrate compliance through modeling utilizing a 0.0 ground factor, the industry is now uniformly improperly utilizing a 0.5 or 0.7 ground factor. Why is this improper? Because wind turbines are elevated, and the sound goes directly to the “receptor” on the ground:

Ground factor represents conditions on the ground and things that can come between the noise source and the “receptor.” See ISO 9613-2 (standards for noise modeling):

7.3 Ground effect ($A_{gr}$)

7.3.1 General method of calculation

Ground attenuation, $A_{gr}$, is mainly the result of sound reflected by the ground surface interfering with the sound propagating directly from source to receiver.

From ISO 9613-2. Here’s a depiction of how that works, from ground source to ground receptor:
As the chart on page 2 above shows, 0.5 and 0.7 are currently being used in all projects before the Commission. The use 0.0 of ground factor for wind is what should be standard practice, and a 0.5 ground factor is NOT appropriate for wind because the source is elevated. Use of a 0.7 ground factor is not scientifically justified.

That use of a 0.5 ground factor is not appropriate for wind turbine noise modeling was inadvertently confirmed by Applicant’s Mike Hankard in the Badger Hollow solar docket, also in Wisconsin (PSC Docket 9697-CE-100)⁴:

| 7 | A  | The model that we use has been shown to predict conservatively with 0.5. I mean, 0.5 ground factor is used in probably -- well, with the exception perhaps of wind turbine projects which are different because the source is elevated. But for projects like a typical power plant, a solar plant where the sources are relatively close to the ground, I would say 90 to 99 percent of the studies use 0.5. And when consultants like myself go out and measure these plants after they’re constructed to verify our modeling assumptions, that assumption checks out as being, if anything, overpredicting the levels. So there’s no need to -- there would be no justification to use something like a .2 or .3 which would predict yet higher levels because we’re already demonstrating that the model is probably overpredicting. So that would not be justified for those reasons.
| 15 | MR. NOWICKI: Thank you. No further questions. |

The testimony of Dr. Paul D. Schomer in the Wisconsin Highland Wind docket⁵ elaborates on the development of ISO 9613-2, that it is for measuring a ground source to a ground “receptor,” and not designed for elevated noise sources with a direct path to “receptors,” the purpose and use of the ISO 9613-2 standard and modeling assumptions, and the inappropriateness of use of a 0.5 ground factor for modeling predicted noise from wind turbines. Attached. I have also attached the AFCL Comment in the Freeborn Wind docket (WS-17-410) that addresses 0.5 ground factor improperly used in that docket.

⁴ [http://apps.psc.wi.gov/vs2017/dockets/content/detail.aspx?id=9697&case=CE&num=100](http://apps.psc.wi.gov/vs2017/dockets/content/detail.aspx?id=9697&case=CE&num=100)
The statements of probable compliance and justifications made in the noise modeling “studies” for the projects listed above are false and misleading, as are any statements that 0.5 is the generally accepted ground factor.

Like the Freeborn Wind project, the Highland Wind project could not meet Wisconsin’s state noise standards (45 dB(A) in Wisconsin) using the 0.0 ground factor assumption, and so the developers moved the goal posts and produced noise modeling using a 0.5 ground factor with a claim that the project did meet state noise standards. This is deception, garbage in–garbage out modeling, backwards engineering, moving the goalposts until the desire result appears.

I have asked the Commissioners, on the record, whether they understand what 0.5 ground factor means, and have received repeated, and feisty, assurances that yes, they do know what it means. If Commissioners do understand, they are accepting this deception, and by permitting projects that likely will not comply, they’re inflicting sound exceedences on those living near the turbines.

In Bent Tree, we’ve seen buyouts of two landowner families due to noise exceedences at 1,150 and 1,525 feet from the nearest turbine. The buyouts were hammered out only after SEVEN years of complaining with no action by the Commission until pushed by landowner persistence. Unfortunately, the rights of landowners are funneled through an ineffective and inadequate Complaint process, reliant on repeated landowner complaints and extreme efforts, rather than the Commission holding applicants to state standards at the outset, in permitting. By allowing use of a 0.5 ground factor, by issuing permits for projects despite developer unwillingness and/or inability to demonstrate that they can meet the noise standards, the Commission is inviting further legal action.

Worse yet than acceptance of modeling based on a 0.5 ground factor is the utter absurdity of use of a 0.7 ground factor, as is seen for the Three Waters (WS-19-576) and Plum Creek (WS-18-700). There is no excuse for this.

The Power Plant Siting Act’s directive regarding public participation, applicable to siting of wind projects, is particularly important, as the Commission is failing to deal with the need for compliance with noise standards, leaving it to the public to address this failure. Also a problem is moving the filing of noise, shadow flicker, decommissioning and complaint process to “compliance filings,” after a permit has been granted. At that point, the public is shut out, and there’s no iterative substantive or critical review of the filings. Landowners and residents are at a severe disadvantage, as most members of the public have no way to identify these problems, and certainly cannot afford to intervene, much less hire expert witnesses to address these issues.

I am filing this letter in all of the above-identified dockets to provide actual and constructive notice of the deceptions present in each of the projects utilizing other than 0.0 ground factor. Minn. R. 7829.0250.
It should not fall to the public to spot this, or other, deceptions and inadequacies – that is the job of the Commission and Commerce-EERA. Further, no project should be permitted without agency vetting, independent verification of studies, particularly noise, shadow flicker, and decommissioning, etc.. The Commission should hold public and contested case hearings for discovery and cross-examination of witnesses presenting the studies and application.

Wind projects can be designed to comply with Minnesota’s noise standard. It is the Commission’s job to regulate utilities, to assure that projects comply with state law. The Commission must not site non-compliant projects, must require demonstration of probable compliance, and must use precautionary and preventative siting to avoid impacts and consequences. Once a turbine is up and not in compliance, then what? There aren’t many options other than removing the turbine or buying out the landowner. With Bent Tree exceedences at 1,150 and 1,525 feet, careful siting makes good sense.

Very truly yours

Carol A. Overland
Attorney at Law

cc: All parties to all above-identified dockets via eDockets
Doreenne Hansen, Association of Freeborn County Landowners
Marie McNamara, Goodhue Wind Truth
September 11, 2018

Daniel P. Wolf, Executive Secretary
Minnesota Public Utilities Commission
127 7th Place East, Suite 350
St. Paul, MN 55101-2147

Filed electronically via edockets.state.mn.us

Re: In the Matter of the Application for Freeborn Wind Energy, LLC for a Large Wind Energy Conversion System Site Permit for 84 MW in Freeborn County Docket No. MPUC IP-6946/WS-17-410

Dear Mr. Wolf:

Freeborn Wind Energy, LLC (Freeborn) and others have filed comments in this docket regarding the interpretation of Minnesota’s noise standards, as applied to Large Wind Energy Conversion System (LWECS) projects. The Minnesota Pollution Control Agency (MPCA) has the authority to adopt or amend state noise standards (Minn. Rules Ch. 7030) under Minnesota Statutes 116.07. This letter is intended to help the Commission understand the MPCA’s position regarding the application of the state noise standards to LWECS projects.

First, Freeborn and other wind developers contend that LWECS projects meet the state noise standards in Minn. Rules Ch. 7030.0040 as long as the noise generated from any individual turbine, or a combination of turbines, is below the applicable noise standard, absent the consideration of other sound or noise sources. The MPCA disagrees with this position. The plain language of the adopted standards support the MPCA’s position, as the scope of the standards reads “These standards describe the limiting levels of sound established...for the preservation of public health and welfare.” (Minn. Rule 7030.0040, emphasis added). This position is consistent with the letter sent from the MPCA to the Department of Commerce (DOC) on October 8, 2012, where the MPCA states our interpretation of standards as health-based standards for total, ambient sound. Thus, the MPCA recommends that the Commission should determine compliance of LWECS projects under the state noise standards by determining if total sound levels at nearby residences or other receptors — that is, existing sound levels plus the additional noise from a given turbine or LWECS project — exceed the standards in Minn. Rules Ch. 7030.0040.

We understand that the Commission and the DOC may have, or appear to have, applied the state noise standards in Minn. Rules Ch. 7030 differently in the past for some LWECS site permit actions. Nevertheless, as stated above, the MPCA has historically, and consistently, interpreted and applied said noise standards for total sound. The total sound levels at a residential receptor, or any receptor, should meet state standards as laid out in Minn. Rules Ch. 7030.0040, regardless of the source(s) contributing to the total sound levels.
The MPCA also recommends that the Commission continue to include compliance with the state noise standards in its site permits for LWECS projects. Maintaining the compliance provision ensures that a state agency retains regulatory authority to compel compliance with the state noise standards. Since the MPCA for noise standard exceedances would be very difficult. Currently, the MPCA only engages with facilities on compliance with noise standards for facilities that have an air quality permit from the MPCA. In the case of LWECS projects, we do not have a regulatory relationship with LWECS project developers or owners, and would have a very difficult time enforcing the state noise standards on LWECS project developers or owners. The Commission’s siting permits include a provision requiring compliance with the state noise standards, which provides a direct mechanism to ensure ongoing compliance.

Finally, the MPCA finds that the Department of Commerce’s proposed a reasonable “cause or contribute” approach to address compliance in situations where ambient/background sound is already near or exceeding state standards at one or more nearby residential receptors. The MPCA worked with the Department of Commerce on the approach, and it represents the approach the MPCA uses for the consideration of total, ambient sound standard. Noise from individual wind turbines, LWECS projects in general, or other non-natural sources may only comprise a small fraction of the total sound level; completely restricting noise from these projects would, therefore, be an undue burden to developers and utilities. We believe EERA’s proposed approach, which allows individual turbines or LWECS projects to contribute to a total sound of no greater than one dBA above the relevant noise standard (as described in Minn. Rules Ch. 7030.0040), is reasonable and appropriate, and that the Commission should apply the approach to siting permits, going forward.

The MPCA appreciates the opportunity to provide this feedback. If you have any questions, feel free to contact me directly at 651-757-2500 or Frank.Kohlasch@state.mn.us.

Sincerely,

Frank L. Kohlasch, Manager
Air Assessment Section
Environmental Analysis and Outcomes Division

FLK:cbg

cc: John Wachtler, DOC
Louise Miltich, DOC
David Thornton, MPCA
James Kelly, MDH
Jessie Shmool, MDH
A  Yes.

MR. REYNOLDS:  Okay.

EXAMINER NEWMARK:  And these Exhibits 1 through 4 as well?

MR. WILSON:  Your Honor, I think given the discussion of this document, it probably ought to go in as an exhibit.

MR. McKEEVER:  Yes.

MR. LORENCE:  I'm going to ask a couple questions on it, so you may want to hold off on that.

EXAMINER NEWMARK:  Okay. Let me just have him answer. Are Exhibits 1 through 4 -- sir? Mr. Schomer, Exhibits 1 through 4, were they filed -- are they correct to the best of your knowledge?

THE WITNESS:  I'm sorry?

EXAMINER NEWMARK:  Your Exhibits 1 through 4, are they correct to the best of your knowledge?

THE WITNESS:  Yes.

EXAMINER NEWMARK:  Okay. Thanks.

All right. Commission staff.

CROSS-EXAMINATION

BY MR. LORENCE:

Q  Dr. Schomer, on page 12 of your surrebuttal
transcript, and I'm looking on lines 6 through 8.

A Uh-huh. I guess I'm not fast enough. All right. I
got to page 12.

Q On lines 6 through 8 you say, ISO 1996 requires what
is termed "downwind" or weather-enhanced propagation
conditions so that model predictions are only
infrequently exceeded. Do you see that sentence?

A Yes.

Q I have never seen ISO 9613-2 before today. Could you
tell me where that's required in this -- in this ISO
9613?

A Those are the questions we just answered, but I can
go through it again.

Q Well, you talked about the downwind stuff, but you
say it says that it's only infrequently exceeded, and
I'm wondering if it says that in here anywhere?

A That's what the downwind nomenclature means, and I
believe it's in either 9613 -- I know it's in either
9613 or in 1996, which 9613 incorporates by
reference.

Q I have one more question, and again this shows my
complete ignorance on this standard. In Section 7.3,
that's called ground effects, and again there's not a
page number here, but if you could turn to that.

A Okay. 7.3. 7.3, ground effects, yes.
Q  Is this section equivalent of the ground factor that we've been talking about the last two days?

A  This section is -- makes use of the ground factor. It's not equivalent. This is where the ground factor comes in. What you have is on the next page there's graphs showing the -- what the sound propagation is in different octave bands. And then in the implementation there's a table on the next page, Table 3, and in Table 3 if you look in there, there's A sub S or A sub R in the middle column at the top, and that's for the source or receiver region. We've been talking about there's really three factors, the .5 or the zero whatever. You have a factor for the source region, a factor for the middle, and a factor for the receiver region. And if you look at the formulas under A sub R of the middle column, you'll see a G. That's the ground factor that goes between zero and 1.

Q  And that's the ground factor we have been talking about for two days?

A  There's three of them technically: one for the source, one for the receiver, and one for the middle.

Q  So if we turn back one page where it begins with the letter A, then it says hard ground.

A  Hard ground, yes.
Q  That first paragraph ends -- it says, for hard ground
   G equals zero.  So this is the ground factor zero
   that we've been talking about, correct?
A  Correct.
Q  And then for porous ground in B, it's G equals 1?
A  Correct.
Q  And then for mixed ground, it says it's someplace in
   between zero and 1.  Do you see that?
A  I see that.
Q  So this is the ground factor we've been talking about
   here?
A  Yes.  But to understand that is a question that was
   earlier.  You've got a source up in the air and not
   on the ground, so does this standard really apply.
   And my answer was, it's the best we have, but you
   can't apply it exactly the way you would if it was on
   the ground because the source is as high in the air,
   it changes what the propagation is.  So that the
   definition of what is hard and what is soft, you have
   a source that's 100 meters in the air on average.
   That's not on the ground as one of the other
   counsel's pointed out.
Q  But it has to get to the ground -- the sound has to
   get to the ground eventually, doesn't it?
A  It has to get to the ground eventually.
Q    And once it's on the ground, won't it travel along
    the ground?

A    No. It's only -- the only thing you have is an
    effect of the microphone height at your receiver.
    The other -- it doesn't -- it doesn't come down to
    the ground and then travel across the ground like
    this. It doesn't do that. What you're interested in
    is the path that goes straight from this up in the
    air source to your receiver, which may be near the
    ground, but you don't have any other path. If you
    do, it's because you don't have good propagation.
    Then it's poor propagation conditions.

    MR. LORENCE: Thank you. I have no
    further questions.

    MS. BENSKY: Your Honor, can I follow up
    on that? This is really important, and I want to
    make sure I understand.

    RECROSS-EXAMINATION

    BY MS. BENSKY:

Q    So are you saying that if we have a flat -- if we
    have a flat ground, if there's a source that's close
    to the ground emanating sound, that sound can just go
    and be absorbed in the ground, correct?

A    Ground absorption -- what happens, and this is more
    related to people's experience. You know, if we went
through all the details, it would be complicated, but 
I think people's experience is useful here. First of 
all, the first rule is that if you're downwind, it's 
loider than if you're upwind, and there's -- the 
reason is the downwind, and this is going to seem 
strange, we think of sound almost as rays, sound rays 
rather than waves.

And let's put it this way. Let's say you 
were behind the barrier. You expect it to be 
quieter. It's quieter because there's no direct path 
from the sound to you. It has to come around the 
corner just like if you had a -- something to stop 
the sun or a reflector of light. You go behind it, 
it's not as light as in front of it. Sound is the 
same thing. If you have a barrier or something that 
prevents the sound from getting to you, it's quieter 
than if you don't have that. Well, on a sunny day 
and you're upwind, you don't hear things. But if 
you're downwind, you do.

Another thing -- example, if you're out in 
a boat, do you hear things far away out in a boat? 
You've seen that? This is the hard surface of the 
water, and frequently above the water there's a 
temperature inversion because of the cooling and 
heating of the water. And those two can form two
layers that the sound gets trapped in, and then you have very -- you hear the people whispering on the shore, and it's like they're 10 feet away from you. I'm sure many of you have experienced this. This has to do with the propagation downwind versus upwind, has to do with the propagation.

The physics is complicated, but the effects -- same thing. Ever hear sources very early in the morning? You wake up at 5:00 a.m. and you hear a distant train or horns or the wheels? Have you experienced that? That again has -- at that time of day, you've got a direct path from the source, which is -- you don't hear the rest of the day to you. It has to do with the physics of the situation.

I'm not going to attempt to go into the physics, but I'm trying to give you different examples out of your daily life that show you this is what goes on. We don't want to really go into the details of what's going on.

Q So if there's a source up in the air that's emitting sound, the sound's going to come down and it's going to hit the receptor before it hits the ground and absorbs; is that correct?

A It's going to hit the receptor directly. There will be -- it gets confusing.
Q    That's for sure.
A    The ground is important only that it gives a
    reflection that can enhance or interfere with the
    direct path. But it does hit the microphone, that's
    the first thing it hits in time. The sound will
    arrive at the microphone before -- it comes directly
    from the source, so it will arrive first.
Q    So somebody standing outside near a wind turbine or
    any source up in the air, that sound wave is going to
    travel down, and it's going to hit that person's ear
    before it goes down to the ground and gets absorbed?
A    Well, won't be totally absorbed but, yes, it does hit
    you before it's absorbed. And I think your point is
    good, that as you're traveling along the ground, from
    ground to ground it will be absorbing some of the
    sounds, and that alone is -- that's part of the
    reason that the air-to-ground path is louder.
Q    And so do you think it's proper to assume no
    absorption and use that 0.0 coefficient for this
    reason?
A    That's part of the reason. Part of the reason is
    the -- in order to have a prediction that is what is
    called for in the standard, which is a prediction
    that is -- if you like the term conservative, a
    prediction that predicts what's going to happen 90
percent of the time or 95 percent of the time or some percentage of the time, I actually think that from the data that I know of, the prediction is probably the -- about 85 percent of the time would be included, and 15 percent of the time you would be above what's being predicted with the 0.00 prediction. It's not the most conservative prediction in the world by any means.

Q But considering we have to use this model because we don't have anything better, the best way to use this model for a source that's 100 meters in the air is to use that 0.0 coefficient?

A 0.00 is the best you can do with this.

MS. BENSKY: Great. That's very helpful.

Thank you.

MR. REYNOLDS: Couple questions on redirect.

REDIRECT EXAMINATION

BY MR. REYNOLDS:

Q Dr. Schomer, is it the heart of it that the challenge of creating a model to reflect what the citizens of Forest will actually experience, is that the heart of why it's better to have conservative estimates than not conservative estimates of sound? Because we're trying to figure out what's going to happen to the
citizens in Forest.

A I think there's probably lots of reasons I can think of for doing this. Again, we're dealing with a low frequency sound primarily. The A-weighted sound is going to correlate with it as it does with nearly all noise sources.

I think it's important to understand how the ear hears because that's all a part of this, and the ear doesn't hear all frequencies equally. It doesn't process all frequencies equally, and it gets very different at low frequencies. The ear gets very different at low frequencies, and this is one of the reasons I would say this is important. We -- I think Mr. Hessler testified that the threshold of hearing changes, or maybe it was in that paper that was passed out, but the threshold of hearing is very different from one person to another.

But what's even more important is that at the middle frequencies, like 1,000 hertz, a change of 10 decibels is a doubling or a cutting in half of loudness. At these low frequencies, like let's say 10 hertz, at 10 hertz, about a 2 dB change is a doubling of loudness. So at low frequencies, anything that you're off gets magnified by the ear. If you're off by 5 dB at low frequencies, that's a
factor of four in loudness. Whereas if you're off by
5 dB at a middle frequency in a prediction, that's
not even a factor of two in loudness. So errors get
magnified at the low frequencies just because of how
we hear.

Q That was one of the reasons for looking at the more
conservative model. Are there any others?

A Well, let's see. I've talked about the standard
calling for it. I've talked about it makes sense
from the -- from the way the rule is written.
Certainly it makes sense from being conservative from
just the standpoint of how the ear hears. I think
that just what we've talked about, the health effects
and the fact that there's people that may be affected
just like in one other community, somehow it seems
like it calls for us to be cautious.

I think that if -- if it were some other
area where government was involved directly, let's
say, we're going to install -- we're going to license
fire detectors that only work 90 percent of the time
and 10 percent of the time people aren't warned about
the fire protector, but that's good enough. People
wouldn't say that's good enough, so the fire
protection has to work all the time. And I think
when we're talking about people literally being
driven out of their homes, we have to be a little bit cautious.

MR. REYNOLDS: Thank you. I don't have anything else.

EXAMINER NEWMARK: Highland?

MR. WILSON: No.

EXAMINER NEWMARK: All right. What are we doing with our ISO 9613-2?

MS. BENSKY: I'd like to move it into evidence.

EXAMINER NEWMARK: All right. Any objections?

MR. LORENCE: I guess I'd like to talk about that for a second.

EXAMINER NEWMARK: Okay.

MR. LORENCE: We've kept out all kinds of reports and exhibits today because they didn't come in at the proper time. Professor Schomer could have put it in at any time with his exhibits. I recognize that counsel here is not -- is not -- his witness is not asking this. But I guess I would ask the ALJ that under the theory that, you know, we've been keeping out late-filed things and this is awfully dense information, whether this should go in the record.
EXAMINER NEWMARK: Okay.

MR. LORENCE: And I just as a second aside for counsel, I'm not positive, but I think that these are usually under copyright, and is this something that we would be able to place on our website and make available to the world if -- I don't want to get you in any kind of copyright trouble if that's the case.

MR. MCKEEVER: I'll just say I got it on the internet.

MR. LORENCE: Yeah.

MR. REYNOLDS: And this is the standard that has been used by all the measurers of sound, so this is -- this is kind of the bible of sound measurement.

MR. LORENCE: And I guess that reinforces my question then. Anybody could have put it in. Any of the experts could have put it in from direct testimony on it. So whether we get it here at this late hour or not, I'll defer to the decision, but I'm -- given what we've done today with other things, I just wanted to raise that point.

MS. BENSKY: I guess the nature of this exhibit is totally different. This exhibit doesn't give any opinions. It's just a standard that
everybody -- all the sound people in this case have used and relied upon. So I think it would be helpful to have it in. And even if it wasn't in, I think it's the type of material that could be quoted and briefed anyway, so --

EXAMINER NEWMARK: Let's not get into that.

MR. WILSON: I think at the risk of making it look like Ms. Bensky and I are on the same team --

EXAMINER NEWMARK: We would like to see that.

MR. WILSON: I agree.

EXAMINER NEWMARK: Okay.

MR. WILSON: It should come in.

EXAMINER NEWMARK: I understand.

MR. WILSON: There's a lot of testimony on it.

EXAMINER NEWMARK: Let me say the overarching concern I have or rationale for letting it in is we've cited to equations and all kinds of portions of this document which I think can only be correctly or adequately explained or referenced by having the document. So for the abundance of caution for making the record even larger, I think
it would enhance the Commissioner's review of the
testimony we've just heard. So what's the number
for this one? It's 9, Schomer 9, is that --

MR. REYNOLDS: I thought it was 5.

EXAMINER NEWMARK: Well, I don't know if
we ever marked your other ones. I might have
mentioned on the record because Mr. Schomer, I was
not accepting his Exhibits 5 through 8, and I am
pretty sure I referenced that at the beginning of
the hearing. So we're just going to call this 9.

MS. BENSKEY: Okay.

(Schomer Exhibit No. 9 marked and received.)

EXAMINER NEWMARK: All right. I think
you're done.

THE WITNESS: Thanks.

EXAMINER NEWMARK: You're excused.

(Witness excused.)

EXAMINER NEWMARK: 3 o'clock. Let's take
15 minutes.

(Break taken from 3:05 p.m. to 3:20 p.m.)

EXAMINER NEWMARK: Well, got enough people
back, I guess. You want to start off the record?

MR. McKEEVER: Yeah.

(Discussion held off the record.)

EXAMINER NEWMARK: All right. Next?
A: I do recall that.
Q: Do you believe that it would have been appropriate to apply a ground factor of 0.2 or 0.3 to your analysis of the Badger Hollow project?
A: No.
Q: Why not?
A: The model that we use has been shown to predict conservatively with 0.5. I mean, 0.5 ground factor is used in probably -- well, with the exception perhaps of wind turbine projects which are different because the source is elevated. But for projects like a typical power plant, a solar plant where the sources are relatively close to the ground, I would say 90 to 99 percent of the studies use 0.5. And when consultants like myself go out and measure these plants after they're constructed to verify our modeling assumptions, that assumption checks out as being, if anything, overpredicting the levels. So there's no need to -- there would be no justification to use something like a .2 or .3 which would predict yet higher levels because we're already demonstrating that the model is probably overpredicting. So that would not be justified for those reasons.

MR. NOWICKI: Thank you. No further questions.