

OPSB Stakeholder Workshop

January 29, 2016 10 a.m.

Katie Elsasser

Finding (18) of the Nov. 12, 2015 order in case number 12-1981-GE-BRO, points a, d, k, and n.

My name is Katie Elsasser and I am speaking today on finding 18: a, d, k and n, specifically health and safety issues, property line setbacks and reconstruction.

I strongly support recommendations by Union Neighbors United (UNU) in regard to health and safety. I also want to bring to the Board's attention the lack of a standard on infrasound. Current law [R.C. 4906.20(B)(2)] states that that the Board must have regulations regarding noise but there is no provision that defines noise as solely "audible"; worldwide it is clearly established that "inaudible" noise is present and can be harmful. I strongly encourage the Board to acknowledge infrasound as noise and establish a standard of measurement; it is, after all, defined and addressed by wind companies in documents submitted to the Board on a regular basis. For example, in Case No. 13-0990-EL-BGN, Greenwich Windpark it states that: "... infrasound is defined as sound energy that is lower in frequency than 20 Hz, which is the typical lower limit of human hearing."<sup>1</sup> Although it is often denied by wind developers and dismissed by those in regulatory authority positions as causative, those affected by infrasound make claims that they experience chronic sleep disturbances, nausea and vomiting, headaches, tinnitus, and sensations of pressure in the head and chest, just to name a few complaints easily found by an online search. Here is another definition to consider:

**Acoustic, Infrasound.** Very low-frequency sound which can travel long distances and easily penetrate most buildings and vehicles. Transmission of long wavelength sound creates biophysical effects; nausea, loss of bowels, disorientation, vomiting, potential internal organ damage and death may occur. Superior to ultrasound because it is "in band" meaning that it does not lose its properties when it changes mediums such as from air to tissue. By 1972 an infrasound generator had been built in France which generated waves at 7 hertz. When activated it made the people in range sick for hours.<sup>2</sup>

This definition comes from *Nonlethal Weapons: Terms and References*, from the USAF Institute for National Security Studies. Yes, infrasound discussed for use as a nonlethal weapon, yet we are lead to believe it is harmless because it is generally inaudible and because there is not a large enough body of research to confirm what many people claim; however, there are numerous studies that have been undertaken to help residents living in the shadows of industrial wind turbines decipher what is happening to them and to family members who have been impacted by infrasound. A study from Australia states: "The important point here is that something is coming from the wind turbines to affect these people and that something increases or decreases as the power output of the turbine increases or decreases."<sup>3,4</sup> A similar study at Shirley Wind Farm in Brown County, Wisconsin specified: "The four

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<sup>1</sup> Certificate of Environmental Compatibility & Public Need, p. 104.

<http://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=7b6a0221-160c-4439-b7de-d700eb961c8e>

<sup>2</sup> *Nonlethal Weapons: Terms and References*, from the USAF Institute for National Security Studies (INSS Occasional Paper 15, 1996)

<sup>3</sup> Lloyd, Graham. Unseen, unheard wind farms a blow to health. February 14, 2015. Attached.

investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN [low frequency noise] and infrasound as a serious issue, possibly affecting the future of the industry. *It should be addressed beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies.*"<sup>5</sup> (Emphasis added.) I have no doubt the Board has seen many of these studies but perhaps now, with a renewed definition of infrasound that is tied to nonlethal weaponry, the Board will look at these studies with fresh eyes. Surely the residents of Flint, Michigan could not hear nor see the lead in their water, yet we are all watching the results of that grave oversight. My hope is that when the Board looks at these studies again it cannot come to any other conclusion than that of the Board of Health in Brown County, Wisconsin who declared a health hazard of the Shirley Wind Farm: "Ultimately, the board's ruling was based on a year-long survey which documented health complaints and demonstrated that infrasound and low-frequency noise emanating from the turbines was detectable inside homes within a 6.2-mile radius of the industrial wind plant."<sup>6</sup>

I also support recommendations by UNU concerning property line setbacks. Unfortunately for many residents in Ohio, they are subject to old siting rules which site turbines from homes, not from property lines. The continued struggle to understand how a neighbor can lease their ground and waive their rights to legal setbacks yet nonparticipating residents experience loss of property is a major concern of mine. How would you explain to someone that the ground they purchased and planned to put a home on is now less than the minimum safe distance from a proposed wind turbine because their neighbor signed a contract? What would you say to someone who wants to construct a pond on family property that surrounds their home, but it will now be "built at their own risk" because the setback to the turbine is measured from their home, not their property line? What is frustratingly obvious to me is the very real lack of property rights those who are nonparticipants in a wind project have.

I also find the Board's interpretation of an "amendment" filed in any wind case to be subjective. This enables the wind developer, through the use of a "motion", to obtain approvals that would otherwise be an "amendment", triggering property line setbacks. I am concerned that residents in Ohio have been denied due process by giving a subjective interpretation to what an "amendment" is. This is unjust. The technology used in today's turbines with large rotor diameters should always be considered as part of an amendment process. At some time in the future a developer will seek to repower the turbines – we know their life expectancy is short lived – and they will inevitably have larger rotors as well. Neither rule 4906-4-8, nor Board rules filed with JCARR, address reconstruction or enlargement of turbines. How will residents be protected then? Will that trigger new setbacks ten years from now? Will you be prepared to deny repowering in the future and possibly leave the developer no choice but to use outmoded technology? Using outmoded technology will only cost taxpayers more money when it could have been spent elsewhere on more worthwhile options.

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<sup>4</sup> Hessler Associates, Inc. Comments on the Cooper Study at the Cape Bridgewater Wind Farm and Wind Turbine Infrasound by George Hessler, 3/9/15. Attached.

<sup>5</sup> Walker, Dr. Bruce. A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin. December 24, 2012. Attached.

<sup>6</sup> Spencer, Jack. Wisconsin Wind Turbines Declared Health Hazard. November 8, 2014.

<http://www.michigancapitolconfidential.com/20690>

In conclusion, I strongly encourage the Board to acknowledge infrasound as noise and establish a standard of measurement, to adopt recommendations made by UNU regarding health and safety and property line setbacks, and I implore you to cease the subjective interpretation of amendments so that those forced to live inside industrial wind projects have some level of protection, no matter how small it may seem to you.

# Unseen, unheard wind farms a blow to health

<http://www.theaustralian.com.au/news/health-science/unseen-unheard-wind-farms-a-blow-to-health/story-e6frg8y6-1227219122344>

- [The Australian](#)
- February 14, 2015  
12:00AM

## Graham Lloyd

Environment Editor  
Sydney

**GROUNDBREAKING** Australian research has established a “cause and effect” existed between wind farms and health impacts on some nearby residents, a peer review by one of the world’s leading acoustic experts says.

The review of a study by Steven Cooper of residents living near Pacific Hydro’s Cape Bridgewater Wind Farm was undertaken by Paul Schomer, standards director of the Acoustical Society of America.

Dr Schomer’s research has been used to define the dose response and acoustic criteria for road traffic, rail traffic, aircraft traffic and shooting.

As a result of the Cooper research, Dr Schomer said wind farm developers should now say “We may affect some people”.

He said regulators charged with protecting health and welfare “will not be able to say they know of no adverse effects”.

Pacific Hydro has said previously it did accept the Cooper research had established a cause-and-effect link, a claim that was not made in the report.

The National Health and Medical Research Council this week said there was no consistent evidence wind farms caused adverse health effects and further research was needed.

The NHMRC did not review the Cooper research.

Dr Schomer said the Cooper work had shown clearly there was “at least one non-visual, non-audible pathway for wind turbine emissions to reach, enter and affect some people”.

The six people from three households involved in the study had recorded the timing and level of effects they were experiencing.

Their notes had shown that impacts corresponded with wind turbine power changes. The subjects did not know what was happening with the wind turbines when they recorded their notes.

“This study finds these six people sense the operation of the turbine(s) via other pathways than hearing or seeing, and that the adverse reactions to the operations of the wind turbine(s) correlates directly with the power output of the wind turbine(s),” he said.

“The important point here is that something is coming from the wind turbines to affect these people and that something increases or decreases as the power output of the turbine increases or decreases.

“It really does not matter what the pathway is, whether it is infra-sound or some new form of rays or electromagnetic field coming off the turbine blade. If the turbines are the cause, the wind farm is responsible and needs to fix it.”

Dr Schomer said criticism that only a small number of people were involved in the study was not relevant. “One person affected is a lot more than none; the existence of one cause-and-effect pathway is a lot more than none.”

The peer review was co-signed by George Hessler, the president and principal consultant for US acoustics specialist Hessler Associates.

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**Hessler Associates, Inc.**

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**Comments on the Cooper Study at the Cape Bridgewater Wind Farm and Wind Turbine Infrasond by George Hessler, 3/9/2015**

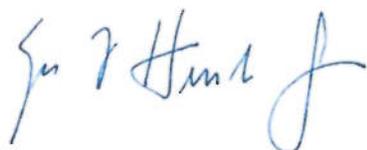
I agree with and have endorsed my colleague Paul Schomer's review of the subject Cooper report except possibly that there is an *unseen and unheard* path to the receivers since this could not be controlled in any way and it appears both paths can be observed, at least at the closer residences. Even so, Paul and I, for years now, have done all we could possibly do to encourage and promote objective scientific research into this most perplexing issue and the Cooper Study is undeniably an important step.

It is a pity and it is apparent that such an important issue cannot be debated civilly and objectively. In my opinion, Pacific Hydro should be commended for making the Cooper Study possible. Instead, they are vilified for doing nothing more than their charter to create clean energy in accordance with all the substantial applicable regulations imposed by permitting authorities. Likewise, wind turbine proponents should acknowledge the study has merit and join the call for additional research to get to a solution that all can accept and move on.

In my opinion, the only solution is a field or laboratory simulation of wind-turbine specific and broadband infrasond in general played to large unbiased subject groups all over the globe. This is technically challenging to say the least, but the results could establish a Threshold of Perception and a Threshold of Annoyance for both types of infrasond sources (broadband and tonal). There is also a Threshold of Pain that can be experienced simply by lowering the rear windows of a typical automobile at highway speed to experience very high levels of infrasond. Just as important, the simulation testing may show that there are a small percentage of subjects that are extremely or acutely sensitive to wind-turbine infrasond. If this is known and it can be documented for individuals, wind turbine sites could still be permitted economically, but with just consideration for acutely sensitive neighbors that may elect to uproot their homes. Another colleague, Dr. Bruce Walker is at the forefront of the simulation approach.

I understand the passion and acknowledge the suffering of some at wind-farms. At one home occupied by a young couple and baby, the baby awakened screaming on windy nights, but never away from home. The home was mistakenly (50 dBA target) sited much too close to wind-turbines. The wife was seriously annoyed while the husband was not annoyed at all. This one case demonstrates the complexity and seriousness of the wind-turbine health effects issue. The couple solved the issue by relocating at their great personal expense.

Probably naïve and preachy to say, but if we all lower the rhetoric a little, maybe we could all start finding a solution.



Report Number 122412-1

Issued: December 24, 2012

Revised:

**A Cooperative Measurement Survey and Analysis of  
Low Frequency and Infrasound at the Shirley Wind Farm in**

**Brown County, Wisconsin**

Prepared Cooperatively By:

Channel Islands Acoustics, Camarillo, CA

Principal: Dr. Bruce Walker

Hessler Associates, Inc., Haymarket, VA

Principals: George F. and David M. Hessler

Rand Acoustics, Brunswick, ME

Principal: Robert Rand

Schomer and Associates, Inc., Champaign, IL

Principal: Dr. Paul Schomer

Ex-CW-Hessler-6

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1.0 Introduction

Clean Wisconsin is a nonprofit environmental advocacy organization that works to protect Wisconsin's air and water and to promote clean energy. As such, the organization is generally supportive of wind projects. Clean Wisconsin was retained by the Wisconsin Public Service Commission (PSC) to provide an independent review of a proposed wind farm called the Highlands Project to be located in St. Croix County, WI (WI PSC Docket 2535-CE-100). Clean Wisconsin in turn retained Hessler Associates, Inc. (HAI) to provide technical assistance.

During the course of the hearings, attorneys representing groups opposed to the Highlands project, presented witnesses that lived near or within the Shirley Wind project in Brown County, WI. The Shirley

wind project is made up of eight Nordex100 wind turbines that is one of the turbine models being considered for the Highlands projects. These witnesses testified that they and their children have suffered severe adverse health effects to the point that they have abandoned their homes at Shirley. They attribute their problems to arrival of the wind turbines. David Hessler, while testifying for Clean Wisconsin, suggested a sound measurement survey be made at the Shirley project to investigate low frequency noise (LFN) and infrasound (0-20 Hz) in particular.

Partial funding was authorized by the PSC to conduct a survey at Shirley and permission for home entry was granted by the three homeowners. The proposed test plan called for the wind farm owner, Duke Energy, to cooperate fully in supplying operational data and by turning off the units for short intervals so the true ON/OFF impact of turbine emissions could be documented. Duke declined this request due to the cost burden of lost generation, and the homeowners withdrew their permission at the last moment because no invited experts on their behalf were available to attend the survey.

Clean Wisconsin, their consultants and attorneys for other groups all cooperated and persisted and the survey was rescheduled for December 4 thru 7, 2012. Four acoustical consulting firms would cooperate and jointly conduct and/or observe the survey. Channel Islands Acoustics (ChIA) has derived modest income while Hessler Associates has derived significant income from wind turbine development projects. Rand Acoustics is almost exclusively retained by opponents of wind projects. Schomer and Associates have worked about equally for both proponents and opponents of wind turbine projects. However, all of the firms are pro-wind if proper siting limits for noise are considered in the project design.

The measurement survey was conducted on schedule and this report is organized to include four Appendices A thru D where each firm submitted on their own letterhead a report summarizing their findings. Based on this body of work, a consensus is formed where possible to report or opine on the following:

- Measured LFN and infrasound documentation
- Observations of the five investigators on the perception of LFN and infrasound both outside and inside the three residences.

- Observations of the five investigators on any health effects suffered during and after the 3 to 4 day exposure.

- Recommendations for the existing Shirley project

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## 2.0\_Testing Objectives

Bruce Walker employed a custom designed multi-channel data acquisition system to measure sound pressure in the time domain at a sampling rate of 24,000/second where all is collected under the same clock. The system is calibrated accurate from 0.1 Hz thru 10,000 Hz. At each residence, channels were cabled to an outside wind-speed anemometer and a microphone mounted on a ground plane covered with a 3 inch hemispherical wind screen that in turn was covered with an 18 inch diameter and 2 inch thick foam hemispherical dome (foam dome). Other channels inside each residence were in various rooms including basements, living or great rooms, office/study, kitchens and bedrooms. The objective of this set-up was to gather sufficient data for applying advanced signal processing techniques. See Appendix A for a Summary of this testing.

George and David Hessler employed four off-the-shelf type 1 precision sound level meter/frequency analyzers with a rated accuracy of +/- 1 dB from 5 Hz to 20,000 Hz. Two of the meters were used as continuous monitors to record statistical metrics for every 10 minute interval over the 3 day period. One location on property with permission was relatively close (200m) to a wind turbine but remote from the local road network to serve as an indicator of wind turbine load, ON/OFF times and a crude measure of high elevation wind speed. See the cover photo. This was to compensate for lack of Duke's cooperation. The other logging meter was employed at residence R2, the residence with the closest turbines. The other two meters were used to simultaneously measure outside and inside each residence for a late night and early morning period to assess the spectral data. See Appendix B for a Summary of this testing.

Robert Rand observed measurements and documented neighbor reports and unusual negative health effects including nausea, dizziness and headache. He used a highly accurate seismometer to detect

infrasonic pressure modulations from wind turbine to residence. See Appendix C for Rob's Summary. Paul Schomer used a frequency spectrum analyzer as an oscilloscope wired into Bruce's system to detect in real time any interesting occurrences. Paul mainly circulated around observing results and questioning and suggesting measurement points and techniques. See Appendix D for Paul's Summary. Measurements were made at three unoccupied residences labeled R1, R2 and R3 on Figure 2.1. The figure shows only the five closest wind turbines and other measurement locations. All in all, the investigators worked very well together and there is no question or dispute whatsoever about measurement systems or technique and competencies of personnel. Of course, conclusions from the data could differ. Mr. M. Hankard, acoustical consultant for the Highland and Shirley projects, accompanied, assisted and observed the investigators on Wednesday, 12/5.

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Figure 2.1: Aerial view showing sound survey locations

R3: 3820 SCHMIDT ROAD

R1: 6034 FAIRVIEW ROAD

R2: 5792 GLENMORE ROAD

Ref. WIND TURBINE LOCATIONS

7000'

3500'

1100'

WTG 3

WTG 7

WTG 8

WTG 6

WTG 5

ON/OFF MEASUREMENT LOCATION

(269m TO NACELLE)

MON 2-CONTINUOUS MONITOR

MON 1-CONTINUOUS MONITOR

(201m TO NACELLE)

WTG 1 AND 2,

11,200' SOUTH

OF REIDENCE R3

The four firms wish to thank and acknowledge the extraordinary cooperation given to us by the residence owners and various attorneys.

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### 3.0\_Investgator Observations

Observations from the five investigators are tabulated below: It should be noted the investigators had a relatively brief exposure compared to 24/7 occupation.

#### AUDIBILITY OUTSIDE RESIDENCES

##### Observations

Bruce Walker Could detect wind turbine noise at R1, easily at R2, but not at all at R3

George Hessler Could detect wind turbine noise at R1, easily at R2, but not at all at R3

David Hessler Could detect wind turbine noise at R1, easily at R2, but not at all at R3

Robert Rand Could detect wind turbine noise at all residences

Paul Schomer Not sure at R1 but could detect wind turbine noise at R2, not at all at R3

#### AUDIBILITY INSIDE RESIDENCES

##### Observations

Bruce Walker Could not detect wind turbine noise inside any home

George Hessler Could not detect wind turbine noise inside any home

David Hessler Could faintly detect wind turbine noise in residence R2

Robert Rand Could detect wind turbine noise inside all three homes

Paul Schomer Could not detect wind turbine noise inside any home

#### EXPERIENCED HEALTH EFFECTS

##### Observations

Bruce Walker No effects during or after testing

George Hessler No effects during or after testing

David Hessler No effects during or after testing

Robert Rand Reported ill effects (headache and/or nausea while testing and severe effects for 3+ days after testing)

Paul Schomer No effects during or after testing

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#### 4.0\_Conclusions

This cooperative effort has made a good start in quantifying low frequency and infrasound from wind turbines.

Unequivocal measurements at the closest residence R2 are detailed herein showing that wind turbine noise is present outside and inside the residence. Any mechanical device has a unique frequency spectrum, and a wind turbine is simply a very very large fan and the blade passing frequency is easily calculated by  $\text{RPM}/60 \times \text{the number of blades}$ , and for this case;  $14 \text{ RPM}/60 \times 3 = 0.7 \text{ Hz}$ . The next six harmonics are 1.4, 2.1, 2.8, 3.5, 4.2 & 4.9 Hz and are clearly evident on the attached graph below. Note also there is higher infrasound and LFN inside the residence in the range of 15 to 30 Hz that is attributable to the natural flexibility of typical home construction walls. This higher frequency reduces in the basement where the propagation path is through the walls plus floor construction but the tones do not reduce appreciably.

Measurements at the other residences R1 and R3 do not show this same result because the increased distance reduced periodic turbine noise closer to the background and/or turbine loads at the time of these measurements resulted in reduced acoustical emission. Future testing should

be sufficiently extensive to cover overlapping turbine conditions to determine the decay rate with distance for this ultra low frequency range, or the magnitude of measurable wind turbine noise with distance.

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The critical questions are what physical effects do these low frequencies have on residents and what LFN limits, if any, should be imposed on wind turbine projects. The reported response at residence R2 by the wife and their child was extremely adverse while the husband suffered no ill effects whatsoever, illustrating the complexity of the issue. The family moved far away for a solution.

A most interesting study in 1986 by the Navy reveals that physical vibration of pilots in flight simulators induced motion sickness when the vibration frequency was in the range of 0.05 to 0.9 Hz with the maximum (worst) effect being at about 0.2 Hz, not too far from the blade passing frequency of future large wind turbines. If one makes the leap from physical vibration of the body to physical vibration of the media the body is in, it suggests adverse response to wind turbines is an acceleration or vibration problem in the very low frequency region.

The four investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN and infrasound as a serious issue, possibly affecting the future of the industry. It should be addressed beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies.

## 5.0 Recommendations

### 5.1 General

We recommend additional study on an urgent priority basis, specifically:

- A comprehensive literature search far beyond the search performed here under time constraints.
- A retest at Shirley to determine the decay rate of ultra low frequency wind turbine sound

with distance with a more portable system for measuring nearly simultaneously at the three homes and at other locations.

- A Threshold of Perception test with participating and non-participating Shirley residents.

## 5.2\_For the Shirley Project

The completed testing was extremely helpful and a good start to uncover the cause of any such severe adverse impact reported at this site. The issue is complex and relatively new. Such reported adverse response is sparse or non-existent in the peer-reviewed literature. At least one accepted paper at a technical conference<sup>1</sup> has been presented. There are also self-published reports on the internet along with much erroneous data based on outdated early wind turbine experience.

A serious literature search and review is needed and is strongly recommended. Paul Schomer, in the brief amount of time for this project analysis, has uncovered some research that may provide a probable cause or direction to study for the reported adverse health effects. We could be close to identifying a documented cause for the reported complaints but it involves much more serious impartial effort.

<sup>1</sup> Ambrose, S. E., Rand, R. W., Krogh, C. M., "Falmouth, Massachusetts wind turbine infrasound and low frequency

noise measurements", Proceedings of Inter-Noise 2012, New York, NY, August 19-22.

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An important finding on this survey was that the cooperation of the wind farm operator is absolutely essential. Wind turbines must be measured both ON and OFF on request to obtain data under nearly identical wind and power conditions to quantify the wind turbine impact which could not be done due to Duke Energy's lack of cooperation.

We strongly recommend additional testing at Shirley. The multi-channel simultaneous data acquisition system is normally deployed within a mini-van and can be used to measure immissions at the three residences under the identical or near identical wind and power conditions. In addition, seismic accelerometer and dedicated ear-simulating microphones can be easily accommodated. And, ON/OFF measurements require the cooperation of the operator.

Since the problem may be devoid of audible noise, we also recommend a test as described by Schomer in Appendix D to develop a "Threshold of Perception" for wind turbine emissions.

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Bruce Walker

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George F. Hessler Jr.

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David M. Hessler

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Robert Rand

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Paul Schomer

Ex-CW-Hessler-6

**From:** Katie Elsasser [mailto:kme\_20@hotmail.com]  
**Sent:** Wednesday, April 06, 2016 2:37 PM  
**To:** Puco ContactOPSB <contactopsb@exchange.state.oh.us>  
**Subject:** RE: Stakeholder comments from OPSB informal workshop

I wish to make an additional comment on section (18) of the OPSB's [second finding and order](#) and recommended revisions to proposed Ohio Administrative Code 4906-4-08 as attached to the [order](#), in case number [12-1981-GE-BRO](#).

Several speakers discussed concerns about drainage due to wind project construction/installation/operation, and in particular, drainage issues that arise on nonparticipating properties in the wind project footprint. I believe that it is very important that specific terminology be used to describe drainage, such as surface drainage: water that flows on the top of the ground, i.e. runoff, waterways, ponding, etc. and subsurface drainage: water flow below the ground, i.e. tile under the ground. Drainage concerns should also not have time-limiting language to identify issues, report to OPSB, report to wind company, etc. due to the simple fact that weather is unpredictable. For example, the year a wind project is put in to service -- even including the following year -- may be very dry and drainage issues may not be observable due to the lack of rain. Including language that requires any type of complaint to be made within a limited time frame may not accurately reflect all problems.

Thank you for your consideration.

Katie Elsasser