From: Punch, Jerry [mailto:jpunch@msu.edu]
Sent: Tuesday, January 15, 2019 5:15 PM
To: Puco ContactOPSB <contactopsb@puco.ohio.gov>
Subject: Attached File

This is to request that the attached file, a 4-page letter written by me on behalf of James Dillingham, be submitted as a public comment with regard to Case 18-0488-EL-BGN, the Seneca Wind Project. My PUCO case number is 00247264. Thank you for your assistance in this matter.

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January 15, 2019

To Whom It May Concern:

At the request of Mr. James Dillingham of Scipio Township, I write this letter to express concern for his health as it relates to sPower's proposed Seneca Wind Project. The emphasis of my concern is the low-frequency noise and infrasound emitted by industrial wind turbines, which is known to lead to, or exaberate, a variety of adverse health effects. Mr. Dillingham is a U.S. Army veteran who has been diagnosed by the Department of Veterans Affairs with chronic vertigo, among other service-connected disabilities. Vertigo can be either *objective*, in which stationary objects in the environment appear to be in motion or spinning, or *subjective*, in which the individual has a sensation of rotating or spinning. During severe episodes, vertigo is an aggressively debilitating condition during which an individual is in a state of dysfunction and must remain motionless until the episode passes.

As a retired, certified audiologist with 50 years of clinical, research, teaching, and administrative experience in my profession, I am intervening on Mr. Dillingham's behalf because of my understanding of the anatomy and physiology of the human ear, and how sound is produced, propogated, measured, and perceived by humans. I have almost 10 years experience as a consulting expert witness in various legal cases on behalf of citizen intervenors who are concerned with the potential adverse health effects of wind turbine noise. I am not a physician, but given that Mr. Dillingham has already been medically diagnosed with vertigo and other chronic health conditions, he is not requesting that I diagnose his personal health status, but instead is requesting an evaluation of whether exposure to the proposed wind project has the potential to worsen his vertigo and possibly cause additional health issues. This type of evaluation is known as *causation assessment*, as opposed to *differential diagnosis*.

The World Health Organization states that individuals who are most vulnerable to the detrimental effects of environmental noise are the very young, the elderly, and those with chronic health conditions. Certainly, Mr. Dillingham falls into the latter category, and his concerns deserve special consideration. The WHO has established guidelines for limiting community and environmental low-frequency noise in documents published in 1999[1] and 2009.[2] In the 2009 guidelines, the WHO recommended that average, A-weighted noise levels outside a residence, designated as *LAeq,outside*, not exceed 40 dB to avoid substantial annoyance, sleep disturbance, and other adverse health effects. It established limits specifically for wind turbine noise for the first time in its most recent guidelines,[3] recommending that noise emissions from turbines not exceed 45 dB Lden. The Lden metric penalizes evening and nighttime noise levels by 5 and 10 dB, respectively, relative to daytime levels, and a level of 45 dB Lden is equivalent to an Leq of 38.3 dB. Levels

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between 38-40 dB Leq are in agreement with those recommended by Dr. Paul Schomer, a prominent acoustician who is the former Director of the Standards Division of the Acoustical Society of America.

It is important to understand that all of these metrics for reporting decibel levels are based on A-weighting, which is used for its convenience in expressing noise levels across a range of frequencies as a single number. A-weighting, however, effectively excludes infrasound and substantial amounts of low-frequency noise and is regarded by most independent acousticians as inadequate either to predict the level of outdoor or indoor infrasound or to reveal a definitive relationship with adverse health impacts. The effects of infrasound are best assessed by using narrow-band frequency analysis at frequencies below 20 Hz or by comparing A-weighted levels to C-weighted levels, the latter of which encompass more low-frequency information. The 1999 WHO community noise guidelines discuss in detail the fact that averaged levels do not adequately account for any momentary peaks of low-frequency noise and infrasound (such as those emitted by wind turbines). The amplitude modulation in wind turbine noise is believed to lead to extreme annoyance, sleep disturbance, negative sensations, and adverse health effects.

In 2016, I co-authored with acoustician Richard James an article titled *Wind turbine noise and human health: A four-decade history of evidence that wind turbines pose risks*.[4] In it, we reviewed the scientific literature that largely disputes many of the major postions taken by the wind industry with regard to the causative relationship between wind turbine noise and adverse health effects. Because of that article's length—55 pages of text and 17 pages of references—most people are likely to skim through it or ignore it completely, so I would like to summarize below our major conclusions, with special emphasis on those aspects that relate to Mr. Dillingham's health concerns.

While audible noise from wind turbines is known to disturb sleep, be extremely annoying, and substantially reduce quality of life, health symptoms such as headaches, dizziness, nausea, and motion sickness seem to be explained best by exposure to infrasound. Paller et al.,[5] in Canada, found a statistically significant association between wind turbine noise and vertigo, although few studies have established a direct causative relationship. Schomer and colleagues[6] have explained that the types of vestibular symptoms reported by individuals living near wind turbines, including vertigo, are similar to motion sickness, which is known to be induced by very low-frequency sources below 1 Hz—which modern wind turbines are known to produce. Their study indicates that the vestibular components of the inner ear appear to be central to motion sickness and other balance disorders reported by persons living near wind turbines. Dr. Nina Pierpont[7] has explicitly described the relationship between complaints associated with wind turbine noise exposure and migraines, motion sickness, vertigo, gastrointestinal sensitivity to noise and visual stimulation, and anxiety. Despite the wind industry's vigorous denials, recent research is largely consistent with Dr. Nina Pierpont's original description of symptoms resulting from exposure to wind turbines, which she termed *Wind Turbine Syndrome*.

Wind turbine noise has unique acoustic characteristics when compared to other environmental noises. Those characteristics include amplitude modulation with intermittent occurrences of tones that mirror the peak energy of the blade-pass frequency and the first several harmonics. Infrasound emissions from wind turbines can also resonate air inside closed rooms, effectively amplifying any acoustic energy that is present, and can resonate, or vibrate, organs and tissues of the human body.[8] The wind industry often states that infrasound from turbines is less intense than infrasound generated by other environmental sources or within the human body itself. Based on its anatomical characteristics, however, the inner ear

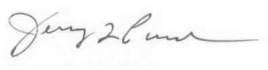
is capable of preventing internally generated sound, but not externally generated sound, from being perceived, which means that perception of wind turbine infrasound may be far more disturbing than any infrasound generated within the body. Also, infrasound is more perceptible when higher frequencies are absent, meaning that conditions are likely to be at their worst in a quiet bedroom at night, when higher frequencies are relatively attenuated by the surrounding structures of a residence.

Advocates of wind energy also take the position that levels of infrasound and low-frequency noise generated by modern wind projects are well below those that adversely affect health, and that there is no accepted physiological mechanism that explains how sub-audible infrasound can affect health. Wind advocates superficially reject the work of Dr. Alec Salt and colleagues, who have explained in detail the physiological mechanisms by which the cochlear and vestibular mechanisms of the inner ear process infrasound and how infrasound stimulates various regions of the brain to result in unpleasant sensations. Dr. Salt is a highly reputable scientist who is known as a preeminent investigator of the inner ear, and is a recipient of numerous grants from the National Institutes of Health. In laboratory studies of lower animals that have similar ears to humans, Salt and his colleagues have shown that low-frequency tones presented at moderate to moderately intense levels for no more than three minutes can induce endolymphatic hydrops, commonly known as Menière's disease, in which vertigo is a major symptom.

Noise reports conducted by wind industry acousticians frequently indicate that no scientifically valid studies have shown a causative or direct relationship between modeled or measured levels of wind turbine noise and adverse health effects. Such a conclusion reflects an overly narrow and self-serving understanding of causation, and ignores the role of mediators between noise and health, which include annoyance, stress, anxiety, and sleep disturbance. The Bradford Hill criteria[9] consist of rules by which evidence of causative relationships between diseases and environmental exposures should be established. Those rules include the notion that while epidemiologic research is helpful in that regard, evidence from other sources must also be considered. In addition to numerous anecdotal reports, researchers have provided a large body of scientific evidence in peer-reviewed journals, government documents, print and web-based media, and in scientific papers presented at professional meetings that indicates a general causal link between a variety of adverse health effects and noise emitted by industrial wind turbines. For detailed information regarding that evidence, readers can refer to the review article by Punch and James.[4]

In my professional opinion, Mr. Dillingham can be expected to experience worsened health symptoms if forced to live in close proximity to one or more wind turbines. If the proposed Seneca Wind Project is approved, I would urge that the approval process take extraordinary precautions to avoid exposing him to potentially devastating consequences to his health. The same concern should be applied to any other residents within the vicinity of the project who exhibit similar health conditions.

Respectfully submitted,



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Summary: Public Comment received via website electronically filed by Docketing Staff on behalf of Docketing.