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Cardiologist investigation and response to industrial wind turbines in the rural residential countryside regarding concerns of adverse health effects

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Executive Summary

While ongoing for decades, more recently recorded consecutive years of rising oceans and mean global temperatures with increasing patterns of intensifying storms and fires have only heightened Man's resolve to fundamentally change worldwide dependence on fossil fuels. We are now responding with a sense of urgency. "Renewable" energies, particularly wind and solar, among other renewable sources, have been promoted as "winning solutions". Photovoltaic (solar) energy has become more affordable and is utilized more in sunnier locales. Commercially, beginning in northern Europe, Industrial wind turbines have, over three decades, spread rapidly across the globe. With increases in size to achieve increased power generation capacity, they appeared in the U.S. initially as a novelty but have been rapidly proliferated without a "proper introduction". Seemingly simple and intuitively harmless in design and implementation, when placed too close to human habitation, serious problems have occurred. It is as though we "leaped before we looked".

I am a Cardiologist who specialized in heart rhythm problems and I am providing a personal statement primarily focused on the adverse health effects (AHEs) arising from industrial wind turbines (IWTs).

A bit of history ties my interest to this concern

Over two years ago, the "legitimacy" of industrial wind turbines as a source of SAFE and sustainable electricity was suddenly thrust into my life. This appeared as a "benign letter" from a local energy provider. Proposed, was a 52-turbine farm to be erected close to my property... a place protected by a conservation easement for having a few remnant prairie hillsides. In the surrounding miles, grazing and row-crop agriculture was the focused livelihood. These communities are the definition of an extremely quiet "rural residential" landscape. I knew almost nothing about wind turbines and, like nearly everyone, thought they were quiet, good for the world and assumed they were safe. In the ensuing weeks, public meetings were held where

interested citizens had a chance to voice their opinions and concerns. Despite very time-limited presentations, it became obvious that opinions had rapidly polarized, shifting the debate from county vs an outside faceless large corporation to neighbor vs neighbor. Mid-American Energy (MAE), the Wind contractor, was there to answer questions but provided no hand-outs nor substantial didactic information. They sat in a group being largely silent, they only returned brief, limited answers when questioned. There was an industry physician-consultant from Boston who presented his opinions but no facts or data, and directly dismissed that noise related complaints were "real". Instead, (he implied) that those complaints were mostly imaginary physical or mental consequences from the presence of the IWTs. Any reasonable person present walked away after the meetings having no idea what health ramifications from IWTs might occur. The word "obfuscation" (the action of making something obscure, unclear or unintelligible) appeared in my mind.

Wind Energy's position about adverse health effects

In these initial Board of Adjustment, and then later Board of Health meetings, Wind Energy maintained their "position":

1) that Industrial Wind Turbines are safe – yet without qualifications of how that self-designation of "SAFE" was given" – no studies, records and evaluations of structure failures, etc. They almost always follow the "safe statement" with boasting of the number of IWTs they have placed in Iowa and the revenue to the state, jobs created, and on and on, but never have provided evidence that scientifically proves "they are safe". Wind energy has limited "original" investigative research. Often a panel judges whether existing data supports the assertions by scientists that IWTs do cause AHEs. The subsequent peer review become akin to judging "opinions with opinions". Importantly, "indirect" impacts, which Wind Energy routinely ignores, are just as significant to the people who are impacted as are "direct" impacts. In fact, there is an enormous amount of data linking IWTs noise emissions to direct and indirect AHEs. Thorough and objective reviews of Wind energy's claims have been challenged and previously "debunked" (Punch and James, 2016). When challenging Wind Energy's representatives with the assertion that "industrial wind turbines have never been proven or shown to be safe", the don't respond – almost as a "taught response". Yet, after a Board of Health meeting, even one of the "pro-wind" Iowa Environmental Council academic speakers did agree with me that IWTs have not been proven to be safe.

2) that they (MAE) receive very few complaints... eventually they resolve. They contend that the "nocebo effect" accounts for most resident complaints. In this context, the nocebo effect is the association of symptoms and complaints "brought-on" by existing negative attitudes toward IWTs.

3) that there is no credible evidence that IWTs cause cardiovascular disease or metabolic disease.

4) that they reluctantly admit that some of "their studies" show that IWTs cause "annoyance" but reflect that it has no substantial health impact. Wind Energy, never comments about IWT-associated "severe annoyance" that causes resident evacuations of their home (which is also considered an adverse health effect).

5) that they will not admit that IWT noise causes sleep disruption. Strongly connected to this is their assertion that infrasound and low-frequency noise (ILFN) as a product of IWTs, accounts for a small part of the IWT noise and that infrasound cannot be heard and therefore cannot cause harm. Indeed, they firmly contend that ILFN is of no concern and strongly insist it should not be regulated.

I have carefully reviewed Wind Energy's position on all these adverse health effects. I have searched for definitions, textbooks, articles, and the presence and quality of reported peer-review. When defending their assertion that IWTs are safe, Wind Energy speaks both slowly, and definitively then "hides" behind the spoken words "no credible evidence". A reasonable person would ask "What would Wind Energy consider as credible evidence" and, as a concerned resident, what "credible evidence" have you produced that proves that IWTs are safe?

Purpose of this manual

In this manual, I have collected information – first for myself – to clarify and resolve my questions and concerns. As the answers became evident (though admittedly difficult to find, clarify and integrate), the story of how this "intrusion" happened became clear and I share it with you. This manual will hopefully later serve as a resource for all who will question what health risks (as known in 2020) may be associated with living close to industrial wind turbines. This information took several years to collect. The process by which Wind Industry acquires county permitting is "rushed through" in literally only several weeks making this information, given that inconsiderate timeline, virtually unobtainable.

In this manual, I present evidence supporting my opinion that Industrial Wind Turbines (IWTs) will cause adverse health effects when located near residential properties in formerly quiet rural residential communities. Beyond the potential serious health implications... we all need to fully understand and reflect carefully on the full implication of what these behemoth oscillating blades mounted high on towers will do to our personal and social and environmental communities.

I present relevant aspects of IWT-generated noise – including noise classification and its quantitative labeling through frequency and decibels measures and types of weighting through various filter types and how accurate noise exposure quantification is affected by filtering choices. The unique characteristics of IWT noise are reviewed and compared with other environmental noises. I will review the categories of noise frequencies across the entire range of emission of IWTs and important aspects of noise propagation and attenuation. Please view the table of contents for contained subjects; ALL of these subjects are relevant. The reader must NOT stop at the simple debate of "he said vs she said" about health impacts. I found the answers largely in what "wasn't said" and past "acoustical history" and current corporate behavior.

I will highlight important historical events that add to the context of today's IWT regulation. For example, we need to be fully aware that VERY in-depth evaluations were done in the mid-1980s by NASA and the Dept of Energy-funded research. Scientists (N.D. Kelley, et. al.), in their thorough (basic science-level) investigations, were asked to evaluate the potential possible implementation of IWTs for adverse impacts. Their focus was on understanding the physics of wind turbine operation and energy production. They also studied noise types produced by IWTs and observed and reported on the first confirmed cases of adverse health effects that developed with IWT prototypes up to 4 MW in generating capacity. Their initial determinations of ILFN and associated serious AHEs were first raised then and remain relevant to this day, although ignored by Wind Energy and its proponents. Also revealing is the history of acoustical evaluation of health-impacted occupants of some newly erected buildings from the 1970s to 1990s that was characterized as "sick-building syndrome". Recognized in affected subjects, were similar symptoms connected to working near gas-fired turbines. Careful evaluations confirmed that ILFN from indoor HVAC (heating/cooling units) produced the symptoms. Fortunately, buildings can be re-designed, defects in air ducts fixed, and additional sound insulation placed, but the only way to eliminate ILFN from IWTs is to turn them off or distance them from residents and their property far enough away that the ILFN can no longer be heard nor "perceived".

There are other issues besides adverse health effects

It is important to ask questions and demand that they be answered; DO NOT assume that what Wind Energy is telling you is correct. Questions, such as "where did these setbacks come from? How, based on what we know, can we have setback distances that are so close and still be considered 'safe'? Whose responsibility is it to review these setbacks and decide if they are safe? How did Wind Energy's proclamation that ILFN 'is not a health concern' ever become "accepted?" Why is potentially harmful noise pollution allowed to trespass across the private land of non-

participating neighbors – particularly when pollution regulation for other industries occurs up to/at the property line?" I still ask whether the MAE's land easements (for the entire host property) and the value of that land is used as collateral for the financing of the purchase and erection of the wind farms? If it is, what happens to that land ownership in the event that America comes to: 1) reject the denial of Wind Energy's adverse health consequences, and also 2) see that Wind Energy is not "green" and requires concomitant availability of back-up natural gas-burning that essentially negates any "renewable" aspects and 3) realize that the real cost of that electricity is roughly 3 times the cost of conventional electric power/kw of energy produced once the subsidies are factored out. Shouldn't we be building energy power plants that work nearly all the time (instead only one-third) and have a productive life of at least 40-50 years and 4) understand the extraordinary expense not only to maintain a functioning turbine but also related to eventual turbine/site decommissioning and non-recyclable blade disposal costs.

Where does all that money come from? Fifty-eight-year leases are a long time – generations come and go, political party majorities and Presential decrees that control the narratives keep flipping and MUCH better power production sources will become available. We need to think more about this before "leaping further."

I include in "Part 9" important findings while searching for an explanation of why inflicting harm on people living in host communities is "acceptable". To understand why things don't make sense you often have to explore the motives of – (in this case, including, but not limited to) Wind Energy. Beyond the motives, are the real actions and developed agendas that allow an industry to secure, maintain and perpetuate "their narrative." I have included several examples of what some would call "blatant" deception. For example, there is a formal presentation made by a Danish healthcare practitioner (Dr. Johansson) to Vestas' executives where "the truth was told" but his warnings were ignored. I will leave the reader to draw his own conclusions. Sadly, the whole process continues largely unchanged. Wind Energy apparently deems their current approach as a successful business plan and continues their practices largely unchanged. We, as the users who consume electricity, have a right to know the truth behind the industry's talking points.

It would be unfair to criticize wind energy production as an answer to global warming without offering other solutions. That said, one might assume that if an obvious better choice was available without all the problems and negative health impacts as I have reviewed, it would've been pursued. However, there are alternatives that are ignored. My comments are listed in part 10, "Carbon Management".

Stay focused on the "broad" definition of health

When the public or politicians are asked if wind turbines are dangerous or cause health problems, they sometimes "mentally imagine" the worst – post-apocalyptic or post-wartime images or even human suffering with death and hospitalization of the order we now see with the Covid-19 pandemic. Even "captured" politicians, proponents, and/or Wind Energy trade organizations couldn't sell that when subjected to any scientific scrutiny. Instead, we need to remain "broad-minded" to what health actually is – which is NOT limited to a defined set of continuously disabling symptoms that evolve in everyone over the short term and likely affects everyone the same. It is also not limited to a health effect that is progressive until death develops or when eventual disease syndromes become established with an established diagnosis. Adverse health consequences of environmental noise can be the asymptomatic (unrecognized) development of hypertension or vascular atherosclerosis or insulin resistance or can be much simply defined as the "the loss of wellbeing". Indeed, some of the most common and impactful adverse health effects may come "as" headaches, tinnitus, dizziness, subtle confusion, unexplained loss of ambition or productivity, emotional lability or obvious or subtle depressive symptoms. Noise adverse health effects may initiate and accelerate disease progression, that may, when combined with genetic or known "accelerators" of disease (smoking, alcohol abuse, etc.) over a life-time, manifest as a recognized cardiovascular disease event – stroke, fatal or nor-fatal heart attacks.

The World Health Organization (WHO) defines "health" as a state of complete physical, mental and social wellbeing... The WHO definition links health explicitly with wellbeing and conceptualizes health as a human right requiring physical and social resources to achieve and maintain. Mental and physical health are inextricably connected, thus highlighting that "annoyance" – at almost any level – can contribute to adverse health effects (AHEs). As described by DeFrock (Australian), "Annoyance is a non-quantitative word that implies mildness in common use. A more accurate general descriptor would be mild, serious or 'intolerable' impacts." In the context of this report, "annoyance" generally means "High Annoyance" where it can result in indirect adverse health impacts. But even "mild" annoyance can create a negative or disagreeable reaction (which is NOT the nocebo effect) that can create a loss of wellbeing. Wellbeing refers to a positive rather than neutral state, framing health as a positive aspiration. Wellbeing is defined as "the state of being comfortable, healthy or happy". Shouldn't we protect an individual right to health and happiness – that defines wellbeing – by limiting intrusive noise pollution at one's private property line?

Cardiovascular disease explained (simplified)

In the Cardiology world, "atherosclerosis" is a term describing the development of (lipid (fats)-filled plaques) that get sequestered within the superficial inner layer of

arteries that is contained by a "thin fibrous cap". These are initiated and develop through a complex process simply characterized as "inflammation". Standard cardiac "risk factors, e.g. smoking, diabetes and others) facilitate atherosclerosis development. As plaque evolves, there is a complex action via cellular and neurohumoral processes that appear to be quite similar to those seen originating from other triggering sources. Some of those sources include small-sized air pollution particulates, PTSD, and of particular importance, environmental noise. In my medical practice I treat atrial fibrillation. Nearly half of those patients also have obstructive sleep apnea (OSA) which is thought to have significant adverse inflammatory triggering that may promote concomitant ischemic heart disease, hypertension and insulin resistance. Although likely less intense as a "stressor" than OSA, I believe IWTs act similarly through a stress related inflammatory pathway to promote cardiovascular disease.

With noise as the trigger, it is thought cardiovascular disease is promoted from "from an increased physiologic stress response" from noise levels "in excess of defined intensities". It appears there are noise thresholds (which the WHO has attempted to define). Similar to OSA, it may also occur indirectly through noise-associated sleep disturbance which then produces a "stress response" via the sympathetic limb ("fight or flight") of the autonomic nervous system. The autonomic nervous system can trigger vessel inflammation which then can promote atherosclerosis. In general, the more and longer the stress continues, the older the individual (with more time to develop larger and more "unstable" plaques), the more the likelihood that disease will become evident or "expressed". With often unpredictable sudden "stress response triggers and/or anatomical plaque instability," the plaque ruptures, exposing the lipid-rich core that initiates "local clotting" that may enlarge and propagate causing potential artery closure that quickly produces a state of deprived "down-stream" oxygen delivery. In the heart, when this happens, it causes a heart attack – termed "myocardial infarction". Health means living a life where such consequences become less likely through avoiding or mitigating "unconscious inflammatory bodily responses" that promote the genesis of disease states. Atherosclerosis development should never, minimally, suddenly or eventually be allowed to continue so as to produce cardiovascular disease "endpoints".

World Health Organization comments on wind turbines (2018 report)

Acceptable environmental noise exposure levels are defined in the Oct. 2018 WHO report for aircraft, rail, general industry, and road traffic sources, with "strong recommendations". That rating reflects the quality and the amount of the scientific data relevant to those studied noise sources. Also, in that publication – for the first time – a suggested "conditional" exposure level for wind turbine noise exposure

being expressed as "Lden" was published. Lden means average sound Level: day, evening, and night of AUDIBLE noise as "averaged" over a 24-hour period with penalties of 5 dBA for evening periods, and 10 dBA for nighttime periods. It is measured using an sound meter set to use the "dBA" filter and weighted by time of day for the penalties. That filter is the most common one promoted by Wind Energy in turbine acoustics and is "centered" around 1000 hertz. The problem with this is that it does not accurately reflect the acoustic energy of ILFN. The conditional wind turbine noise level exposure was a limit of 45 dBA Lden, equal to that of aircraft noise but substantially lower (more restrictive) than railway or road traffic. Assuming wind turbines operate 24 hours a day this limit is equivalent to a 38 dBA Leq 24-hour average sound level. The data review committee of the WHO document recommended "policymakers implement suitable measures to reduce exposure from wind turbines in that population exposure to levels above the guideline values". The "conditional" recommendation reflected that the data was not "robust enough (statistically, due to small numbers of subjects)" to support a "strong" recommendation. Importantly, they commented that there was no data suggesting that there was no risk. It is worth noting that the WHO's 38 dBA Leq 24 hour average is what would be calculated using the American National Standards Institute (ANSI) and Acoustical Society of America (ASA) Standard S12.9 Part 4 for assessing Land Use Compatibility. It is important to consider that the pre-specified health outcome evidence used was mostly limited to more serious adverse health consequences such as ischemic heart disease (atherosclerotic- disease related), hypertension (elevated sympathetic tone and acquired loss of normal vessel relaxation related) as well as the prevalence of highly-annoyed populations (outdoors). Because wind turbine sound fluctuates as much as 11 dBA above the average this level would not eliminate stress from moderate annoyance or sleep disturbance.

I have also included "noise response curves" for severe annoyance in the appendix of part 6 (Adverse Health Effects) from the Wind Farm Noise Textbook (Hansen, Doolan, Hansen, 2017) that show published data (2001, 2008, 2016) from several studies. These two graphs IMPORTANTLY reflect an even greater annoyance from IWTs (which is dominated by low frequency noise) than what is reflected by dBA measurements (measuring only audible noise) as was used in the WHO report. This highlights that IWT noise is commonly described as "distinctly annoying" and is composed of noise from nearly all portions of the noise spectrum, rumble, roar and whoosh type sound. Indeed, the omnipresent component of ILFN is a real and prominent contributor to increased annoyance from IWT noise. IWT noise can be even heard when below background noises like leaf rustle, comprised of mainly mid and high frequency sound in communities at night likely due our perception of that low frequency noise component. Annoyance derived across the "wide-range" of

frequency components of IWT noise NEEDS be accounted for when enacting "protective wind ordinances."

It is remarkable (to my knowledge) that Wind Energy has not commented on these incredibly high-level scientific assessments of potential concerns of environmental noise. The WHO virtually echoes that IWTs have never been shown to be safe. The WHO also clearly moves toward the level of declaration I make in this manual: that IWTs have AHEs including possibly serious cardiovascular effects. In fact, there is strong credible evidence that IWTs produce serious AHEs.

I would suggest separate regulatory noise limits for both audible and ILFN noise exposures with both 40 dBA (for audible) and 60 dBC (for ILFN) noise limits – each expressed as "shall-not-exceed" dBA or dBC (Lmax(fast)). Compliance with these limits shall be measured by Class 1 sound level meters set to use the "fast" measurement circuits. Other circuits incorporate averaging which will understate the fluctuating character of wind turbines that is the likely cause of annoyance, sleep disturbance, and other AHEs. Despite that MAE would like to suggest otherwise, dBC measuring tools are "standard" on professional grade sound measuring equipment which can measure both at the same time. Noise levels can be easily obtained at the property line. Prior regulatory parameters of setback distances (e.g. 1500 feet) or 45 to 50 dBA as Leq averaged sound levels) will NOT be protective of human adverse health effects. They do NOT account for fluctuating audible and ILFN acoustic energy – that have been correlated to AHEs, or the location of non-participating residences on their properties. When any wind contractor sites a turbine, they should include a design safety factor to be certain that during periods of fluctuating sound emissions the project will not exceed either of those noise limits or it will be "out of compliance". If they are uncertain about audible and ILFN propagation/attenuation or the accuracy of computer modeling, then a greater distance-separation or use of a quieter wind turbine make and model should be used so as to completely eliminate the potential of harming residents". Sound limits are carefully defined to protect residents and should not reflect a compromise to facilitate industrial development. Non-compliance or less restrictive noise limits that result in resident harm is NOT acceptable as reasonable "collateral damage". Of note, George Hessler published a 2004 article that proposed dBC criteria in residential communities for low-frequency noise emissions from industrial sources that do not have fluctuating sound as a primary characteristic.

What are the noises that IWTs make?

IWT noise includes regular, dominant "pulsing" sensations perceived as either audible fluctuations in the sound or as bodily "pressures" due to air compression of the flowing air mass. These pressure waves are caused by changes in the lift of each

of the 3 blades as they pass in front of the huge supporting tower. Also, as the blades rotate through the frequently vertically-stratified moving air mass, they may, under heavy "loading" conditions, lose lift (or stall) producing perceptible rhythmic swishing/thumping sound to which residents can become sensitized. Residents can often perceive these fluctuations as "whooshes" or "thumps" at considerable distances, well over a half mile – which is quite disagreeable and difficult to block from one's awareness and may occur at a distance where the IWT cannot yet be seen, especially during the night when people are sleeping in quiet bedrooms. There is a rhythmic pulsation generated at the trailing-edge blade noise by the steady rotation speed that produces "blade-swish whooshes and thumps" and irregular, low-frequency "roar" from the blades due to in-flow turbulence. Collectively, there is a continuum of frequencies stretching from pressure pulsations at infrasonic frequencies 0.5 Hz (cycles per second) up through the normal hearing range of 1000 to 2000 Hz that are generated by each turbine. The sound immissions from each wind turbine also interact with nearby turbines to produce a constantly changing and distracting medley of fluctuating sound- called amplitude modulation. Depending on the frequency amplitude modulation of IWTs, ILFN is both heard and perceived and easily evokes mental and physical stress. Unlike "less complex" daily noises, IWT noise does not become "accepted" by our perception processes and then unconsciously ignored. The subtle but constant changes make it difficult to impossible to ignore. Further, residential construction of residential homes for sound insulation does not effectively block the lower frequency noises. Further, people have a right to sleep with open windows which effectively eliminate any protection offered by walls and roofs. Trying to mask IWT noise by producing bland artificial "background" noise inside a home can only mitigate some portions – but not all of "stress-creating" wind turbine noise. As coping residents engage in their daily tasks, while the turbines operate above, only a momentary lapse of that focus will remind them of the enveloping dome that separates them from the peaceful world they once enjoyed.

Included important historical insights into wind energy claims

I have included in Part 9 a number of related events, letters and a copy of a speech that unveil what Wind Energy (Vestas – largest worldwide producer of IWTs) has done to advance their "narrative" centered around the promotion of IWTs.

When the state of New South Wales (NSW) in southeastern Australia approached Vestas about implementing IWT power, the state government presented to Vestas an initial draft of guidelines that contained low frequency noise regulation that outlined that state's proposed future "recognition, acceptance and treatment" of ILFN. In the beginning of that March, 2012 letter, Vestas in their "Executive Summary" response letter, immediately made clear their opinions about careful,

science-based, health-protective regulations that would govern implementation of a new energy technology in NSW. They bluntly summarized: "Vestas opposes the Draft Guidelines, primarily because of the sheer number of additional requirements and barriers that would be placed in front of the wind energy industry without any clear evidence, justification or demonstrated need for this additional regulation". By that time (2012), there had been several years of rigorous publications by scientific investigators and acousticians as well as likely thousands of reports of adverse effects including forced home evacuations. In general, NSW concerns were raised that mostly involved human health – in all forms. These included setbacks (proposed at 2 km), visual amenity, noise, health, decommissioning, auditing and compliance, environmental impact statements, property values, blade throw, conditions of consent and compliance as well as others. Vestas' extraordinarily self-serving retorts to each of these concerns were "abrupt and terse" (and without basis) – other than they are viewed as too restrictive to advance IWT introduction – which they admit was the primary issue. Comments about noise from NSW in the draft were recommended to "be deleted in their entirety" so as "not to give the impression that the NSW Government places any credibility in the false claims of the anti-wind activist groups on the topic of health impacts". Decommissioning concerns were raised by NSW. Vestas did support a decommissioning and rehabilitation plan in the environmental assessment report, however, did not support the requirement to provide a decommissioning bond, nor have periodic updates in anticipated costs and implied that wind farm operators would maintain their assets for as long as possible since wind is "free." Vestas did not support the adoption of the noise guidelines as they claimed they were: unnecessary, discriminatory, and unclear. Again, the word "obfuscation" comes to mind. It should remain absolutely clear to any entity regulating IWTs into their jurisdiction that all these topics (and more) raised here ARE relevant and need to be addressed in writing in any Wind Ordinance; if it is not clarified, then compliance cannot be enforced.

ILFN: convenient flip-flopping by wind energy for their agendas

Further, to have health protective IWT noise regulation, as noted many times, recognition and regulation of ILFN is "critical". It is also my opinion when reviewing several "lines of historical action and commentary by Wind Energy" that Wind Energy recognized (certainly no later than the mid-1990s) the "threat" of ILFN to their business. As mentioned earlier, N.D. Kelley clearly identified the existence and the health threat from ILFN in the mid-1980s. In the same letter (above) and then in another one just a year before, Vestas reveals that they knew "true implications of ILFN and its health concerns". In the response to NSW suggested guidelines, Vestas denied that ILFN was a cause of AHEs and proclaimed: 1) it is therefore unnecessary to require the prediction and monitoring of low frequency noise emission from wind turbines, 2) the existing and well- validated industry standard models for acoustic

propagation are not designed to deal with frequencies at the low end of the audible spectrum, specifically because noise emissions in this band are not considered to pose issues likely to affect the surrounding environment, 3) "accordingly" Vestas suggests the removal of the requirements to measure low frequency noise from the Draft Guidelines. Yet, less than a year earlier, Vestas AU had written a letter to the Danish EPA claiming that a new low frequency noise limit for wind turbines could not be met because there were no design changes to modern utility scale wind turbines that could further reduce wind turbine noise to meet the new low frequency limits. On the one hand they claim there is no problem, and on the other hand they claim that there is no solution to a problem that they admit is a characteristic of wind turbines. (My comment: There is something rotten in Denmark). It is clear to me that Vestas recognized that ILFN would be a defining concern for IWTs – particularly as power generating capacity increased (which Vestas was rapidly designing and implementing for future designs). The newer larger MW models use longer the blades and slower hub rpm. This results in more ILFN than for earlier lower MW models with shorter blades and faster rotation speeds. The Wind Industry has adopted Vestas' stance about ILFN importance. We, as the potential residents to be affected and possibly suffer harm, need to clarify for ourselves the true existence of and potential harm from ILFN and react responsibly by regulating these harmful emissions generated by IWTs – especially with increasingly larger models that are more often being "clumped" together.

The need for informed consent when *known* unknown risks exist

The proposed affected residents, by a super-majority, opposes the plan (for Arbor Hills Wind Facility, Madison County) based on concerns of adverse health risks. At the same time, only a small-minority of easement owners (22%) actually live on the property and would have to endure the same health consequences. Reportedly they are not allowed, by contract, to raise health-related concerns that might arise while residing at the property. How this affects people living on that property to farm the land is not known. Having spoken to residents about their "signing experience" with a wind industry, they didn't recall that the representative declared the turbines "safe". They did, however, clearly remember that there was no listing or mentioning of possible adverse events, reports of serious or mild annoyance nor potential longer-term cardiovascular consequences. This failure to disclose potential risks to the participating landowner OR the non-participating (but still noise-affected neighboring resident) is bothersome and reflects a lack of due-diligence, oversight, and protective jurisprudence. With decades of ongoing concern and innumerable science-supported reports of occurring harm and well-researched plausible serious adverse health effects being published, one could reasonably describe the omission of informed consent as a failure of duty of the party seeking the easement to properly notify the lease of known risks. (Writer comment: While I not an attorney,

very similar scenarios occur in human research where volunteers are asked to participate in a "condition" where there are unknown (or let alone known) potential health risks in return for financial compensation. To a reasonable person, such easement contracts demand greater transparency and much higher levels of subject protection. While it is true that Wind Industry contractors are not involved in a "medical study" per se, they are entering into a contract with potential known and unknown health consequences for which a consideration of payment is given in exchange for accepting the potential harmful consequences of exposure to that added risk, (IWT noise emissions).

This "manual" is to promote a clearer and accurate description of industrial wind turbines

I have written this personal statement for myself to collect, consider and organize the mass of information and misinformation present on IWTS. I personally have known the feelings of surprise, bewilderment, confusion, and hopeless frustration upon learning that a large industrial complex could be permitted into quiet rural residential locales that is zoned for agriculture. At county meetings where citizens voiced their concerns "on both sides" of the argument, there were some that mentioned it was their "right" to be able to earn income from the leasing of their property. Of those relatively few, there was no one that I can recall that said that it was acceptable that wind turbines could then produce noise that would actually harm their neighbors. None mentioned that their neighbors also have a "right" to enjoy the peaceful use of their properties. The authors of a comprehensive textbook "Wind Farm Noise" distilled all the conflicting pro- or anti-wind rhetoric in a simple declaration: "it is time to stop debating whether or not a problem exists. It is well known that wind farm noise does result in sleep disturbance and health effects for some people and the time has come to decide what to do about it. The fact remains that some people are so affected by wind farm noise that their health suffers and some are forced to leave their home in order to achieve an acceptable quality of life." We need to respect each other and look for energy solutions that make sense and most residents agree about. I have desperately sought for the truth as minimal information or, (upon fact-checking), frequently incorrect information was given by a power company who planned to produce a "secure profit". I hope this "true" version of truth is useful to those who need to make important decisions, protect themselves and their property and assist for clarification of concepts regarding Industrial wind turbine implementation and regulation. When finally understood in "all in its convoluted and conflicting enormity", it will hopefully be clear where the real questions remain.

Points to remember: Returning to my initial assumptions upon hearing that IWTs might be placed closely to my property, I mentioned that "I thought they were quiet,

good for the world and assumed they were safe". Exploring much further, I now know that NONE of those are true. IWTs make a lot of distressing noise, when examined as a "possible solution for climate change" they don't make sense given cost, limited life, intermittency, dependence on CO2-producing energy back-up and affordable and adequate battery technology is possibly "beyond reach" and, they are clearly NOT safe for myriad number of reasons which I tried to describe in detail. IWTs cause adverse health effects with that definition being consistent with WHO definitions and currently practiced health care. We are now in an era in science where we know that environmental factors – particular noise – can and does cause adverse health effects which can include serious cardiovascular consequences. Advances in understanding the consequences of disturbed sleep raise concern for contributing to the development of Alzheimer's disease. Shortened sleep duration has been highly correlated with cardiovascular disease development and endpoints of hypertension and ischemic heart disease.

We know the brain while "sleeping" can still be "aware" of noise (when it reaches a certain intensity (loudness) threshold and responds to it through body motility, even full awakening or "regressing" in its process of reaching various stages where vital restorative recovery of normal brain function occurs. Sleep disruption occurs with audible and, likely more importantly with IWTs, with lower frequency noise. The WHO has recently listed wind turbines as a potentially important source of environmental noise. While "high-level correlative data" does not exist yet, the WHO lists noise thresholds for potential disease development at levels lower than road traffic. Other analyses using severe annoyance metrics that include ILFN exposure drive the threshold noise levels much lower yet. Observing current, more inclusive definitions of health, IWTS do produce AHEs as annoyance (from mild to severe), and have been shown to disrupt normal sleep stage progression.

Utilizing metrics of biologic plausibility, as described by Sir Austin Bradford Hill, if met, can establish a "causal link" between WTN and AHEs for epidemiological purposes. As examined by Jerry Punch and Rick James in their 2016 comprehensive review (ref. in text), all 9 of The Bradford Hill criteria have been identified in the scientific literature as pertinent to the relationship between IWT noise and AHEs. Dr. Hill states, "None of my nine viewpoints can bring indisputable evidence for or against the cause-and-effect hypothesis and none can be required as a sine qua non. What they can do, with greater or less strength, is to help us to make up our minds on the fundamental question – is there any other way of explaining the set of facts before us, is there any other answer equally, or more likely than cause and effect?" In his final address observation, he asserts: "All scientific work is incomplete – whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to

ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time."

Finally, included at the end of part #15, Mathias Basner, MD, PhD – who is considered a world leader on health effects from environmental noise, produced an editorial (2019) where he reviewed the potential impacts of noise on our health. He acknowledged the problem of smaller populations in currently available studies which make statistical powering of conclusion difficult. He has stressed that NONE of the wind noise guidelines data from the 2018 WHO report found an "absence of risk". He finished his comments with "the fact that more studies are needed should not lead us to postpone the urgently needed protection of the population from noise." The knowledge we have acquired so far IS SUFFICIENT to take preventive actions and substantiate them with respective legal noise regulation.

We have all learned that all people suffer to some extent– it is part of being human. But to intentionally force suffering upon affected citizens for the financial benefit of others is immoral. To "mentally take refuge away from guilt" by assuming huge "pinwheels spinning in a neighbor's field are silent" and believing Wind Energy's mantra of 'no credible evidence' that IWTs cause human harm is patently disrespectful, unprofessional, immoral, and grossly irresponsible. We can and must do better.

Needed declarations

1) I am a Cardiologist who specializes in heart arrhythmias (Electrophysiologist) who focuses on abnormal fast and slow heart rates/patterns, implantable device (pacemakers, defibrillators) therapy, and have participated (investigated, published and presented) clinical research for decades. I also have been privileged to be involved with human research and served as the Chairman of the City-Wide Investigative Review Board overseeing the ethical conduct of ongoing local clinical trials. In those patient trials, high standards of participant protection and adverse event evaluation was paramount. I am drawn to understand the societal (local and international) impacts of IWTs – particularly health. I also felt compelled, through my years of human research experience, to protect the health, safety and welfare of myself and my fellow citizens.

2) I am not an Acoustician. An Acoustician is defined as an expert in the branch of physics concerned with the properties of sound. I have, however, corresponded at length with several Acousticians who have "specialized" their acoustical practice into the understanding, measurement and regulation of industrial wind turbine noise. They have shared with me their acquired in-depth understanding of IWT noise and its impact on people – from the details of measuring and interpreting

noise to the impacts of that noise on people's lives. They have directly talked and worked with the victims of IWT noise exposure. They have been invited into these unfortunate people's homes and first-hand have measured, experienced and, on several occasions, have themselves suffered serious adverse health events from those noise exposures. They, through their professional lives, have seen the unfolding of IWT introduction around the world, interacted with key both pro- and anti-wind experts, and from their unique vantage point, provided a clearer understanding of the "real issues" and the history behind those issues. They have presented at national societal meetings, offered insightful theories and clarifications to their worldwide colleagues, published peer reviewed papers, testified in court trials, and at the request of governments. They are members of the Institute of Noise Control Engineering (INCE) and/or the Acoustical Society of America (ASA). The INCE/ASA Member has experience in noise impact assessment, the effects of noise on people, and control (complaints, annoyance, noise specifications) and is committed to their Canon of Ethics for unbiased professional services whose first mission is to protect the public's health and welfare. They are motivated to move forward into the "headwinds of greed and misinformation" because as professional experts, "they care about people".

3) The origins of the information I have presented and summarized, I believe to be reliable, verifiable and accurate. I, in no way, have manufactured history, slandered nor created (recently popularized) "alternative facts". I have expressed personal opinions based on collected information that I believe to be factual. My "physician opinions" come from four decades of interviewing, examining patients and applying basic human physiology and medical science in the effort to protect and improve their lives. I have read and re-read reviews and individual papers from both sides of the argument. In the enormous "confusion" of pro- and anti- Wind information, I have tried to focus on the quality of data being mindful of bias and full disclosure of and composition of reported "peer review" entities. I have looked specifically for the origins of noise regulation and the process by which current IWT siting practices became established.

W. Ben Johnson, M.D.
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