

Wisconsin
Wind Siting Council

Minority Response

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Wind Turbine Siting-Health Review

Wind Turbine Siting-Policy Update

and

Recommendations for Legislation

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(As presented in Appendix F of the Wind Siting Council October 2014 Report)

Executive Summary

In 2009, Wisconsin Act 40 directed the Public Service Commission of Wisconsin (Commission or PSC) to appoint a Wind Siting Council (Council or WSC) to provide advice to the PSC during the rule-making process for the siting of wind turbines. Act 40 also requires that Council to submit a report to the Legislature every 5 years to provide updated information about health research and regulatory developments, as well as to provide recommendations for legislation if needed.

Act 40 specifies the makeup of the membership of the Wind Siting Council and it created a bias in the form of a majority made up of several pro-wind energy interests and pro-wind environmentalists versus a minority of others who would focus on safety and health. Because of that built-in pro-wind bias, the Council's minority created this Minority Report to reveal the information that the Council majority omitted from the Wind Siting Council report to the Legislature.

The pro-wind bias, as found on the Wind Siting Council, is found on the PSC staff as well. One reason for the PSC's bias is that it seems they deem that the statute for Renewable Portfolio Standards requires them to "go easy" on safety and health restrictions for wind energy projects. This bias has created wind siting rules in Wisconsin that are not as protective as they should be. Wisconsin's wind siting law and rules (PSC 128) require local units of government to process applications for all but the largest wind projects. These wind projects are extremely complicated and are often unique to the local land features. But local governments are not allowed to consider safety and health protections that are more restrictive than PSC 128. So, they cannot require protections to suit the local circumstances, to adopt the recommendations of their medical or technical experts or engineers, to accommodate the latest science, or to require the latest protective technologies. Wisconsin law and PSC 128 require local government units to approve these wind projects with noise restrictions and setbacks that the Council's current regulatory review would consider to be some of the least protective in the country.

This Minority Report highlights areas in PSC 128 that differ from health standards and best practices found in the documents reviewed by the Council for the Majority Report, differences that were downplayed by the pro-wind Council majority. These health standards and best practices are designed to protect non-participating homeowners' health and property rights. These best practices strike a balance between protecting residents and creating a regulatory environment that the wind industry can use to get approvals that work for both the industry and the communities where they are built.

Because Wisconsin's wind siting law is so dysfunctional, wind turbine development plans are met with great opposition by the communities where they are proposed. The communities that object are aware of the health concerns that are described in the Minority Report. Wind turbine noise is linked to chronic sleep disturbance, which is linked to more serious physical maladies. Wisconsin law does not allow setbacks that adequately prevent harmful noise impacts to homeowners. Officials are not permitted to set wind turbine setbacks any farther than an arbitrary 1250-foot or 3.1 times the total height, whichever is less, from a neighbor's occupied structure.

The Council's regulatory review also found that, because Wisconsin's setback is from a wind turbine to a neighbor's occupied structure, some of that neighbor's land is now inside the "safety setback" distance from the wind turbine. This "safety setback" can overlap as much as 800 feet of that neighbor's property. This is a "taking" of the owner's property right to use their land for intended purposes because it is no longer possible to build with local building setbacks near their property line and stay outside of the "safety setback" due to a turbine being located nearby. In other states there is a trend to create setbacks a safe distance from the neighbor's property line instead of the neighbor's structure.

A significant study done by a member of the Council showed that the towns in which wind projects have been built in Wisconsin have population densities generally much higher than towns or townships in neighboring states where similar projects have been built. Couple this with the fact that the wind resource in Wisconsin is much less than in these neighboring states, and it is like forcing a square peg into a round hole, whereby there is likely to be some severe damage. Wisconsin's existing wind projects have been permitted in our more populated areas, and thus, are more often too close to residences with more resultant negative health impacts than in other states.

This Council minority concludes that Wisconsin's wind siting law needs revision for noise protection and property rights protection. Also, a restructuring of the Wind Siting Council makeup is needed to eliminate bias, as is a restructuring of what information the Council is allowed to review in order to advise the Legislature about wind energy systems. Rewriting the wind siting laws to offer better protections for non-participating residents and correcting the bias of the Wind Siting Council will restore the public trust in the wind-siting laws of Wisconsin, creating a win-win situation for both the wind industry and non-participating residents.

To proceed wisely, the minority, the majority and numerous technical and public policy experts agree that more acoustic and epidemiological studies are needed. Wisconsin wind projects are ripe for such studies before more damage is done, but government funding is needed.

Also, Wisconsin needs a process to compensate those citizens who had to abandon their homes to get relief from negative health effects, who have not moved and suffer negative health effects, or who have taken a financial loss due to a neighboring wind project.

Please read the full Minority Report for the complete details and conclusions.

1.0 Purpose:

The purpose of this report by the Council minority is to challenge the reader to take a second look at all of the available data on the subject of wind turbine health impacts and evaluate this data in a more critical light. To ensure that the economic interests of wind turbine project developers were protected in the recommendations made to the Legislature, the Council majority opinion sided with pro-wind factions to minimize any impediments to the construction of wind turbine projects.

The Council minority consists of six (almost half) of the fourteen participants in the Wind Siting Council, including both Public Members, the Towns member, both Realtor Members, and one Landowner Member.

Ultimately, the Council majority found secondary in their report the importance of the proper siting of wind turbines and the direct impact these turbines have on the health and welfare of citizens. The Council minority opinion takes a more cautious and concerned approach to wind development, placing a priority on the siting rules of wind turbines and the health and welfare of people over the interests of wind energy developers and system operators. This Minority Report will reveal the shortcomings of Wisconsin's current statewide wind siting law under which the rules (PSC 128) were promulgated and recommend areas where the law and, thus, PSC 128 should be improved.

2.0 Applicable Statutes and Limitations:

2009 Wisconsin Act 40 directed the Public Service Commission of Wisconsin (Commission or PSC) under Wis. Stat. §15.797 to appoint a Wind Siting Council (Council or WSC) to provide advice and counsel to the Commission during the rule-making process for the siting of wind turbines. In addition, the Council under Wis. Stat. §196.378(4g)(e) shall report to the Legislature every five years after surveying health research and regulatory developments and shall make recommendations for legislation, if any.

Wis. Stat. §15.797(1)(b) contains statutory guidelines that favors a Council heavily weighted towards wind development. Recognizing that, in the Council's current composition, a bias exists in favor of wind energy interests and that members in the majority of the Council have made great efforts to disqualify and discredit documents linking wind turbines to negative health effects, there exists a justifiable rationale for the necessity of this Minority Report to supplement the Council majority's findings.

Further limiting the WSC's scope on reviewing the health impacts of wind turbine development is the fact that the Council majority interpreted Wis. Stat. § 196.378(4g)(e) as directing the Council to survey *only* peer-reviewed scientific research regarding the health impacts of wind energy systems and to review *only* U.S. state and national regulatory developments regarding the siting of wind energy systems. Consequently, the Council has considered only a microcosm of relevant studies and policies that by themselves do not reveal all of the factors vital to protecting human health and safety.

Although Wis. Stat. § 196.378(4g)(e) does list the type of documents that the Council must consider, we, the Council minority, do not consider that list to be exclusive of other relevant data. We find that the inclusion of other credible research, empirical evidence, and affidavits is in the best interest of the public. Inclusion of such documents will provide the Legislature and the PSC with a more complete and better representation of the effects that wind turbines have on human health.

It is the responsibility of the Legislature to address the experiential realities of citizens affected by wind turbines and it is the Council's responsibility to provide the Legislature with pertinent information that addresses all health concerns that may affect the quality of life as it relates to siting a wind turbine near residences.

3.0 Minority Review of Majority Health Summary

In its summary of *Key Findings from Wind-health Literature*, the Council recognized several trends in its review of the selected literature since the Council's 2010 recommendations. Of primary concern on the matters of health are cross-sectional surveys that show evidence of individuals living in the proximity of wind turbines experiencing elevated levels of annoyance and sleep disturbance due to wind turbine noise while the turbines are in operation. Two studies showing cause for alarm are Janssen et al. (2011) and Bakker et al. (2012) that found a staggering *40 percent and 66 percent (respectively) of individuals* studied reported to be both annoyed or highly annoyed by wind turbines producing outdoor sound levels over 45 dB(A).

It should be noted that stress from annoyance and sleep disturbance may be related to chronic health conditions and that individual perception may increase or decrease the severity of reported conditions. The long-term effects of chronic sleep restrictions and deprivation have been thoroughly studied and have been identified by the American Academy of Sleep Medicine to include symptoms of depression, anxiety, fatigue, high blood pressure, obesity, heart attack and diabetes. Coupled with these medical and mood conditions are performance reductions including attention deficits, longer reaction times, increased errors and distractibility. Severe drowsiness can be a safety hazard, causing traffic crashes and workplace injuries, among other incidents.

In their conclusion of key findings, the Council found that some individuals residing in close proximity to wind turbines perceive audible noise and find it annoying, that these individuals report that this noise negatively affects their sleep, and that these events may result in other negative health effects. The Council minority concurs in this conclusion, illustrating the importance of effective siting laws to protect residents from the negative health effects of wind turbines.

3.1 Minority Reaction to Council Review and Significance of Annoyance

The term "annoyance" is used widely in the literature reviewed by the Council, and thus, is also used in the Council's report. The definition of annoyance selected by the Council majority is that referenced in a World Health Organization's (WHO) publication regarding occupation noise (*not* a peer-reviewed document reviewed by the Council), namely, "a feeling of resentment, displeasure, discomfort, dissatisfaction or offence which occurs when noise interferes with someone's thoughts, feelings or daily activities."

The Council minority does not believe this definition accurately represents the physiological response recognized by numerous studies showing an effect on human health. A paper published by the World Health Organization in 2011 states that WHO's definition of health *implies that noise-induced annoyance may be considered an adverse effect on health.* (Miedema, H. et al, *Burden of disease from environmental noise, WHO, 2011*).

As explained by Suter, A., (1991) "Annoyance" has been the term used to describe the community's collective feelings about noise ever since the early noise surveys in the 1950s and 1960s, although some have suggested that this term tends to minimize the impact. While "aversion" or "distress" might be more appropriate descriptors, their use would make comparisons to previous research difficult. Suter continues to expound on this thought, noting:

It should be clear, however, that "annoyance" can connote more than a slight irritation; it can mean a significant degradation in the quality of life. This represents a degradation of health in accordance with the WHO's definition of health, meaning total physical and mental well-being, as well as the absence of disease. (Suter, A., Noise and Its Effects, Administrative Conference of the United States, Editor. 1991).

Other reputable studies reviewed by the Council, including Ellenbogen et al. (2012) and Shepherd et al. (2010), define "annoyance" as "a mental state characterized by distress and aversion, which if maintained, can lead to a deterioration of health and well-being", while Taylor, S. (2013) defines "annoyance" as connoted in contemporary medicine as being, "used as a precise technical term describing a mental state characterized by distress and aversion, which if maintained, can lead to deterioration in health and well-being".

Again, erring on the side of caution, the Council minority in its review of definitions of "annoyance", finds that the use of this term should be elevated to recognize its status as a technical term identifying events relating to the physiological definition of a medical condition with the potential to cause long-term chronic conditions.

3.2 Minority Reaction to Council Review on the Survey of Peer-reviewed Literature

The Council completed its initial survey of peer-reviewed wind-health literature and made recommendations to the Commission regarding wind siting rules in 2010. At that time the majority of the members recommended siting measures, including 50/45 dB(A) day/night noise limits, 1.1 times the maximum blade tip height setback and less than 40 hours of shadow flicker per year for non-participating residences. These recommendations were modified by the PSC and codified in *PSC 128, Wind Siting Rules*. A minority of the 2010 Council members strongly disagreed with these conclusions however, and their concerns were presented in Appendix E of the 2010 *Final Recommendations To the Public Service Commission: Wind Siting Rulemaking Pursuant to 2009 Wisconsin Act 40*. (see http://psc.wi.gov/apps35/ERF_view/viewdoc.aspx?docid=136311). The current Council minority affirms that position, and further asserts that these siting measures are recurrently inconsistent and outdated with developing research, noting that wind turbines generate sound that has components not even measured by the usual sound level meters when using a scale for normal audible sound, i.e. the dB(A) scale.

In their review of over 400 wind turbines installed throughout Wisconsin, the Council noted that some members of the public who reside near wind turbines have continued to complain about adverse human health impacts attributed to wind turbines. Unfortunately, the Council came to the incorrect and unsubstantiated conclusion that the level of public concern and amount of

scientific or technical research associated with potential negative health impacts have diminished due to lack of interest or formal complaints. After complaining for a number of years and getting inadequate or no resolutions of the problems, residents have abandoned their homes or suffer in frustrated silence. The majority members of the Council did not allow reference to the complaint affidavits and local government resolutions in the Majority Report as requested by the minority members. Additionally, although PSC 128 requires wind project owners to maintain complaint logs and to submit them to the PSC upon request, the PSC has never requested such complaint logs and has not done so for this health review, although requested to do so by the Council Chairman, a minority member. Therefore, while PSC 128 directs all complainants to direct their complaints to the project owner, all such complaints have not been reviewed by the Council.

If proper weight were given to the empirical and anecdotal evidence of adverse effects of wind turbines on human health, we believe that the volume of reports of potential negative health impacts have not in fact diminished, but instead have increased, with any appearance to the contrary being the result of previous reports having either been disregarded or being submitted to the PSC and not acted upon.

When individuals report harmful effects or violations of the existing standards, no measure of accountability exists in Wisconsin law to ensure wind turbine operators are pursuing corrective action processes, thus resulting in an underreporting of noise violations. In order to better represent the true conditions under which adverse health reactions may in fact occur, a more efficient and comprehensive monitoring system of these noise levels, and a more responsive corrective action system, must be established to protect residents from noise violations.

In the study Pedersen (2011), the Council highlighted that although annoyance, sleep disturbance, and stress were linked to environmental noise, these effects are only attributable to wind turbines when they are generating sound levels over 40 dB(A). Yet, Wisconsin's wind siting rules allow daytime noise to be up to 50 dB(A) and nighttime noise to be up to 45 dB(A). Both are above the levels that were attributed to marked reactions in survey participants. As a point of reference, every step increase of 10 dB(A) results in a doubling of sound impact, i.e., 40 dB(A) is perceived as twice as loud as 30 dB(A) while 50 dB(A) is perceived as 4 times as loud as 30 dB(A).

Bakker et al. (2012), a separate analysis on a subset of the data from Pedersen (2011), found 23 percent of respondents reported annoyance from wind turbine noise to some degree while outdoors and 14 percent reported annoyance from turbines while indoors. This annoyance was directly related to noise level, with approximately 4 percent of annoyed respondents reporting annoyance where sound levels were less than 30 dB(A) and approximately 66 percent when they were above 45 dB(A), a trend that is also supported by experimental evidence in Ruotolo et al. (2012).

Sleep disturbance was reported by approximately 33 percent of respondents and it increased with greater environmental noise levels. The authors found that respondents were more annoyed by wind turbine noise than by road or rail noise when above 40 dB(A) and aircraft noise when above 45 dB(A). This occurs because of the unique characteristics of wind turbine-generated noise, which is long in duration (often 24/7) and has an amplitude modulated, or impulsive

cadence. This constantly changing sound increases attention and cognitive appraisal and reappraisal, inhibiting acclimatization to the sound.

Janssen et. al. (2011), also concluded that annoyance from environmental noise increases rapidly as sound levels exceed 35 dB(A) outdoors and 40 dB(A) indoors. The study's authors found this to be especially true for wind turbine noise, with a large number of individuals reporting to be both annoyed or highly annoyed by wind turbines producing noise outdoors (approximately 40 percent of respondents) or indoors (approximately 18 percent of respondents) when sound levels are above 45 dB(A).

Furthermore, in Shepherd et al. (2011), the authors found that individuals residing in close proximity to turbines reported reductions in sleep quality, energy and overall quality of life. Nissenbaum et al. (2012) also showed similar results. Krogh et al. (2011) found that 94 percent of respondents self-reported altered health or quality of life specifically, and that 72 percent of participants reported experiencing stress, depression and sleep disturbance directly due to wind turbines.

Finally, the Council majority report omitted highly relevant facts from several studies that it relied heavily upon for its conclusions, including studies by Taylor, Crichton, Chapman, Katsaprakakis, and Mroczek, some of which also had serious design flaws. For specific examples of such reports, see Footnote 1 at the end of this report. Regrettably, and to the detriment of the reliability of the Majority Report, the Council majority voted to prematurely adopt the Wind-Health Report draft “as-is” prior to any adequate discussion of it in Council meetings. This barred correcting the deficiencies noted above.

It is important to note that it is incredibly difficult to design a control group in which there is no simulated placebo. The Council found that the limitations of available research confined the Council to only seven, unbiased, cross-sectional studies, of which three use the same data set. Again, the Council minority supports and recommends that more studies be commissioned in order to preserve and expand the diversity of data, but recommends, based on the evidence provided from available survey data, a highly cautionary approach to wind siting regulations.

3.3 Minority Reaction to Council Review on the Survey of Regulatory Developments

Besides the interpretation of the Council's majority that state and national regulatory developments shall not include those of foreign states or nations and shall not include results of studies commissioned by state or national government entities, even if in the U.S., the Council's majority also did not allow the Majority Report to include reports on the actions of various Wisconsin county boards, county boards of health, town boards and the Wisconsin Towns Association. These entities have passed resolutions or, otherwise, requested the PSC or the state to conduct additional studies to evaluate the health impact of wind turbines on the public. The PSC has not responded to these local government entities.

Similarly, the Majority Report does not include reference to the numerous complaints, affidavits, and testimonies of Wisconsin citizens regarding their health issues since wind turbines were put in operation near their homes. If the PSC would follow-up on these complaints in the field, as well as review complaint logs of wind project operators as mentioned above, a meaningful

appreciation of the actual negative impacts upon people and an evaluation of the responses of wind project operators would significantly add to the PSC's body of knowledge and perhaps help mitigate the complaints.

The Council reviewed a summary of state regulations for wind turbine siting. Compiling such data is challenging since such regulations are often in a state of flux, state regulations often do not preempt local governments from having their own siting restrictions to suit local situations, and certain wind turbine siting regulations may be preempted by other state regulations regarding safety.

3.4 Majority Survey Conclusions and Minority Response

In their final review, the Council *unanimously* agreed that wind turbines have a physiological effect on some populations when in operation. The Majority Report stated:

What is not under dispute between these two groups is that wind turbines produce environmental noise, that some individuals find that noise annoying, and that environmental noise may cause sleep disruption if the sound levels are high enough. There is, as a result, a consensus that proper wind turbine siting is imperative when designing wind generating systems to reduce the impacts of noise on people.

The Council suggests two pathways by which adverse health impacts may arise, including the stress/annoyance indirect pathway as well as the direct pathway of physiological perceptions and adverse reactions to inaudible infrasound and low-frequency noise (ILFN). Inaudible infrasound is generally considered to be sound below 20 hertz (Hz) while low frequency sound is generally considered to be sound in the range of 20 to 200 Hz. Note that infrasound and low-frequency noise (ILFN), when compared to audible noise, travels much farther, reflects more readily off the atmosphere and terrain, travels easier through walls, and resonates inside of buildings. It is important to observe that the current regulatory guidelines in Wisconsin do not regulate, monitor, or allow limits to infrasound and low frequency noise (ILFN).

Scientific measurements of infrasound and low frequency noise (ILFN) emissions by wind turbines have been thoroughly documented in studies such as the Shirley Wind Study (2012) commissioned by the PSC. Unfortunately, and to the detriment of studies regarding the adverse effects of wind turbines on human health, these acoustic measurements are not included in the WSC report simply because the measurements are only data sets and not considered peer-reviewed research. This acoustic testing in the Shirley Wind project was done by acoustic experts and could be considered more relevant than some peer-reviewed research. Significantly, the joint conclusion of the report states: *“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.”*

Although studies have shown infrasound and low frequency noise (ILFN) are harmful and have adverse health effects, a majority of those studies are not eligible for inclusion in this report due to the Council majority's interpretation of Wisconsin's statutory limits on scientific research to only include peer-reviewed data. Again, the Council minority disagrees with the Council

majority's conclusion that there are no significant ill or adverse health effects, while such effects *are* indicated in both the literature reviewed by the Council *and* in a greater body of information excluded from review by the Council majority.

From the collections of data sets that are available, we can see infrasound and low frequency noise (ILFN) emissions from wind turbines have been identified, and that these emissions have the potential to cause physical harm in persons who are exposed to said sounds. Collaborative efforts from across many fields of science have discovered causal evidence of symptoms relating to wind turbine developments, thus requiring further analysis and study. Such studies must be carefully designed due to the challenges of structuring an experiment that involves an operating wind energy system in conjunction with human subjects. Wisconsin is an ideal place to conduct such studies due to the level of complaints and its relatively denser populations near wind turbines than in other states.

In their final conclusion, the Council minority and many subject experts disagree with the Council majority and believe there is sufficient data to infer that wind turbines have a direct and negative effect on human health based on their survey of applicable literature.

3.5 Minority Conclusion to the Health Section

The overwhelming empirical evidence from the peer-reviewed literature surveyed by the Council shows that when certain people are near operating wind turbines they become ill, but when the turbines are stopped, their conditions subside. Regardless of the reasons why, the law regulating the siting of turbines must protect the human rights and well-being of those living nearby and provide protection for innocent populations who are harmed by wind turbines sited too close to their homes - even if the mechanism of the harm is not yet fully understood.

The point is, there is enough causal evidence for alarm. We wholeheartedly agree with the Council majority opinion that more studies need to be commissioned to better understand the science surrounding these negative effects on human health. Also, the WSC's methodology for evaluating the litany of surveys and data sets every five years for the Legislature needs to be retooled to include previously excluded research and documented observations of human health impacts.

We must rethink setting maximum limits on regulation of wind turbines when the science has not been fully settled. The Hippocratic Oath, a physician's rite of passage states, "I will prescribe regimens for the good of my patients according to my ability and my judgment and never do harm to anyone". In the case of wind turbine siting, we must take a precautionary stance to preserve the health and well-being of all those who might otherwise suffer undue harm and not put limits or maximums on wind turbine regulations that have not been proven to be adequate.

In conclusion, existing evidence of physical harm caused by infrasound and low frequency noise (ILFN), coupled with the evidence that all wind energy systems emit infrasound and low frequency noise (ILFN) that is measurable at the homes of victims who report symptoms of low frequency noise, creates enough of a relationship that the Legislature and the PSC should act

immediately to mitigate, through curtailment and other mandates, the harmful effects that have already been reported in Wisconsin. Most importantly, the Legislature and the PSC need to commission acoustic and epidemiological studies, conducted by independent experts, near Wisconsin wind turbine installations prior to construction of future systems to ensure that Wisconsin's regulations are not responsible for more harm to the health and safety of people living near wind energy systems. The four independent acoustic experts who conducted the acoustic study in the Shirley Wind project recommended "additional study on an urgent priority basis".

Also, the Legislature and the PSC should act to establish relief for those citizens who have been harmed by existing wind turbines in Wisconsin.

4.0 Minority Reaction to the Wind Siting Policy Update

Under s. 196.378(4g)(e) the Wind Siting Council is charged with reviewing developments in wind siting policy and providing a report with recommendations to the Legislature. Erroneously, the Council majority interpreted this charge to mean only regulatory developments from within the United States, and excluded review of regulatory developments in any other country.

Even within the narrow scope of this review, several key findings showed that Wisconsin's regulatory framework is unusual and does not do enough to protect the health of people living near wind turbines or the property rights of non-participating property owners in Wisconsin.

Wisconsin's regulatory environment is unusual in that regardless of the specific protections that might be appropriate for a proposed wind energy system, Wisconsin's wind siting rules create maximum limits that are more in line with most states' minimum standards and prevent Wisconsin local officials from offering ANY restrictions that would be more protective. In other words, Wisconsin's standards are the maximum protections that officials can impose, which is the opposite of how most regulations are written. Officials can never be more restrictive than these maximum protections for any reason under Wisconsin's wind siting rules.

4.1 Findings from the Regulatory Review

The Council did not acknowledge many regulatory developments in their Majority Report, but did rely heavily upon the 2012 National Association of Regulatory Utility Commissioners (NARUC) report. Several of the NARUC recommendations illustrate areas where Wisconsin's wind turbine siting regulations are inadequate even under the less than cautionary approach of NARUC's consultant who wrote the report.

Wind turbines in Wisconsin are allowed to subject people to audible sound levels that are twice as loud as the 2012 NARUC report recommends. NARUC recommends that 40 dB(A) should be an ideal design goal while Wisconsin law does not allow any restrictions to limit the noise below 50 dB(A) during the daytime. Because the dB(A) scale is a logarithmic scale, a 50 dB(A) sound is perceived as twice as loud as sound that is 40 dB(A) in amplitude.

The NARUC report recommends that noise standards should be based on land use. The report argues that doing so would incorporate background noise when considering siting, as the noise levels that may elicit annoyance may be washed out to some degree by background noise and thus not be as noticeable. However, PSC 128 does not consider background or ambient noise levels as some states do by setting their noise limit at 5 or 10 dB(A) over ambient, even though rural areas in Wisconsin where wind turbines are sited typically have nighttime ambient noise levels near 30dB(A).

The NARUC report also recommends that a clear monitoring, arbitration, and mitigation process be implemented to deal with resident complaints. Wisconsin's regulations are very lacking in this regard. While scores of Wisconsin residential complaints have been reported and logged by the PSC, the follow-up has generally been by phone calls. We are unaware of any official monitoring, in-field measurements, arbitration, or verified mitigation of any of the complaints. The NARUC report elaborates further that it is important for wind project developers and local officials who are approving the projects to have a transparent complaint review process that explicitly defines protocols for noise monitoring and mitigation. Wisconsin's wind siting laws forbid this, as any monitoring or mitigation requirements imposed by local jurisdictions would be stricter than the rigid framework that the current rules allow. PSC 128 does not require any noise monitoring, and consequently, PSC staff has explained that when noise violation complaints are received there is usually nothing they can do because there is no concurrent monitoring data to verify the noise violation. Additionally, PSC 128's complaint review process fails to make clear that unresolved complaints can be appealed to the PSC and how complainants are to make such an appeal. Finally, lacking any penalties for violations, PSC 128 provides no compliance incentive.

Accompanying greater experience with ever-larger wind turbines, the Council minority has observed a regulatory trend to create greater setbacks and lower noise limits as well as basing these limits on *property lines* rather than residence locations, even while Wisconsin continues to maintain 1250 feet or 3.1 times the total height, whichever is less, as the maximum allowable setback from a non-participant's *home*. States are beginning to learn the health impact lessons already learned in European countries and are slowly beginning to make necessary policy changes to protect public health.

Because the setbacks in Wisconsin are set from turbine to occupied structure, some property owners find that their buildable land is now within the 1250-foot setback, and they are no longer able to use their own property the way they wish due to health and safety concerns. This constitutes a "taking" of the non-participating landowners' property, and there is no protection from this scenario in Wisconsin's regulations. Regulations should protect non-participating property owners from being forced to place structures too close to wind turbines on adjacent properties, as the state of Ohio did in 2014 by now measuring their setback from the property line instead of from the residence.

Besides the setback from non-participating residences, PSC 128 limits the setback from participating residences and road right-of-ways of 1.1 times the turbine's total height to protect host or participating property owners from ice or turbine blade failure debris. This setback is

inadequate. A review of actual incident reports of ice and debris throw indicates that a setback of at least 1.5 times should be a minimum. Engineering calculations have shown the possibility of broken turbine blades flying even much farther. The Council minority recommends that this minimum setback be established at 1.5 times the total height, not a maximum of 1.1 times to provide a logical distance and to allow for larger setbacks when circumstances require such.

Both Watson et al. (2012) and the NARUC report emphasize that a “one size fits all” setback standard is inappropriate. Watson et. al. describes competing interests between wind developers and local populations as a reason to vary the setback distances. The NARUC report recommends having setbacks that would meet necessary noise and shadow flicker restrictions, arguing that avoiding actual impacts on residents is of primary importance, rather than imposing what may be an arbitrary distance.

The NARUC report recommends establishing clear triggers for decommissioning, in addition to requiring wind energy system owners to have an escrow account to cover decommissioning costs. PSC 128 does not require an escrow account for decommissioning, but rather allows the wind developer to choose from a variety of less secure financial instruments or an escrow account.

It is very significant that the review revealed that the population density, in general, is higher in Wisconsin towns where wind projects are located than in towns where wind projects are located in all of Wisconsin’s neighboring states. This should support the assertion that greater protections be provided to the people who are living near these Wisconsin developments, as more people are being impacted due to the higher population density and the consequent practice of locating wind turbines closer to non-participating residences.

4.2 Conclusion for the Policy Review Section

The Wind Siting Council’s majority members wrote in their conclusion to the Policy Review section nothing about the above discrepancies between Wisconsin’s wind siting laws and the NARUC recommendations, but instead wrote: “...Wisconsin should continue to provide a transparent regulatory and approval process for wind developers...”

The Council minority concludes instead that Wisconsin’s wind siting laws fall far short of the best practices that are recommended in the United States and falls even farther short of the best practices that are being implemented in other countries that have broader experience with wind energy than we do.

5.0 Minority Conclusion

The Council minority concludes that Wisconsin’s wind siting laws are not written to meet current standards or best practices to protect public health and safety, but instead are biased to favor wind project developers.

This bias is cemented by the statutory structure of the Wind Siting Council, seating several members who are linked either to the wind energy industry or to environmentalist groups that favor the green energy movement, leaving only a few members on the Council who aren't linked to those influences. This construct leaves the Legislature to be poorly advised by a biased Council majority.

This Council minority also asserts that PSC staff seems to also be biased toward the wind industry and PSC staff tended to downplay any dissenting reports that reflected poorly on Wisconsin's current wind siting laws. One reason for this seems to be that the PSC staff feels that the Legislature has given them a mandate to support wind and other renewables because of the statutory requirements for the Renewable Portfolio Standard (RPS) for utilities that are within the PSC's jurisdiction. The existence of the RPS creates a secondary status for health and safety.

It is important, both to the industry and residents, that residents have confidence in the wind siting laws of Wisconsin and that the laws are effective in protecting the health and safety of people who live near existing wind turbines. Effective laws help to reduce opposition to new projects.

6.0 Recommendations for Legislation:

Current Wisconsin law lacks an effective way for people who are suffering harm caused by existing wind turbines sited too close to their homes to seek effective mitigation or recourse. Wisconsin law needs to be changed to lay out a step-by-step complaint protocol with oversight by the PSC so wind turbine operators are held to the standards that are consistent with the standards and best practices highlighted in this Minority Report. PSC oversight is necessary to ensure accountability so complainants can expect resolution when a problem arises related to a nearby wind turbine.

It is important to change the current Wisconsin law that requires local officials to limit their protections for safety and health to the maximum allowed by PSC 128. Perhaps PSC 128 could become a model ordinance. Local officials should be able to meet their statutory obligation to protect the health and safety of the public and exceed limits of PSC 128 when such can be justified by qualified technical experts or licensed engineers. As studies reveal new standards and best practices or technology improves, officials should be able to require such to match the local conditions, such as geology, groundwater sensitivities, and population densities, or accommodate any unique specifications of the wind project to protect their residents.

Wisconsin law needs to change the local approval process for wind energy systems to allow local officials access to the PSC staff at no expense to the local unit of government. It is important to give local officials access to the same knowledge and experience that the PSC commissioners have when a wind siting application is considered. This assumes the legislature will clarify the PSC's role in protecting health and safety.

This Council minority strongly recommends acoustic and epidemiological studies be carried out, especially in Wisconsin where there are existing complaints of sleep disturbance, headaches, nausea, tinnitus, or much worse which appear to be related to existing wind energy systems. These studies should include measuring and analyzing the nature and effects of infrasound and low frequency noise (ILFN). If the studies find that negative health impacts are occurring when the wind turbines are operating within Wisconsin's current operation standards, a development moratorium should be enacted until the relationship between the wind turbine and the negative health impacts is fully understood. Until then, safe wind turbine siting standards are impossible to set. As the policy review highlighted, setbacks that avoid actual impacts on residents is of primary importance, rather than imposing what may be an arbitrary distance.

The legislature should develop a process to establish relief for those citizens who are verified to have been harmed by existing wind turbines in Wisconsin.

Wind turbine setbacks should also be set based on the distance of the turbine to a neighboring property line instead of the distance from the turbine to the structure of the neighbor's home. Wind projects with their multi-story heights and unique sound projections should follow the long-standing convention of measuring setbacks from property lines as with any other kind of structure or land use.

The statutory structure of the Wisconsin Wind Siting Council that creates the pro-wind bias within the Wind Siting Council must be changed through legislation. Also at issue are the statutory limits as to which studies and regulatory developments the Wind Siting Council may review when creating their report to the Legislature. Because of the bias and the limits in the document review to only include "peer-reviewed" studies, and regulatory review that is limited to only regulation changes from the United States, the Legislature gets a myopic view of the issues related to wind turbine siting.

This Council minority hopes this report and recommendations will help legislators create new wind siting laws that will restore confidence in Wisconsin's wind siting process.

Footnote 1 for Page 8

For example, the discussion of the favorable findings in the Katsaprakakis study left out the critical facts that the average distance from the 13 surveyed settlements to the small 0.5 MW turbines was over 4000' and the average noise level was only 32-36 dB(A). The majority report presents without qualification the obviously implausible findings of the Mroczek study - that respondents living nearest to wind turbines reported the highest quality of life while those living farthest away reported the opposite - but fails to mention the author's numerous qualifications regarding the probability that economic benefits were likely to be the largest factor affecting responses from participants, 48% of which were unemployed. The Taylor survey, which the majority report twice declares to be inapplicable to Wisconsin, considered 12 turbines averaging only 2 kw each (750 times smaller than a typical 1.5 MW Wisconsin turbine), yet included the article's findings in order to make the argument that reported adverse health effects are due primarily to negative attitudes toward wind turbines and not due to *real* health effects. The works by Crichton and Chapman, both advocates of the "it's all in your head hypothesis", are based on seriously flawed designs. For example, Chapman, whose "study" is very widely criticized as "junk science" by many highly qualified experts, relied almost exclusively on complaint logs from wind project owners to reach his conclusions.

Bibliography for Minority Report

Bakker, R. H., Pedersen, E., van den Berg, G. P., Stewart, R. E., Lok, W., & Bouma, J. (2012). Impact of wind turbine sound on annoyance, self-reported sleep disturbance and psychological distress. *Science of the Total Environment*, 425, 42-51.

Ellenbogen, J. M., Grace, S., Heiger-Bernays, W. J., Manwell, J. F., Mills, D. A., Sullivan, K. A., & Weisskopf, M. G. (2012). Wind turbine health impact study: Report of independent expert panel. *Massachusetts: Massachusetts Department of Public Health*.

Janssen, S. A., Vos, H., Eisses, A. R., & Pedersen, E. (2011). A comparison between exposure-response relationships for wind turbine annoyance and annoyance due to other noise sources. *The Journal of the Acoustical Society of America*, 130(6), 3746-3753.

Krogh, C. M. (2011). Industrial wind turbine development and loss of social justice?. *Bulletin of Science, Technology & Society*, 31(4), 321-333.

Nissenbaum, M. A., Aramini, J. J., & Hanning, C. D. (2012). Effects of industrial wind turbine noise on sleep and health. *Noise and Health*, 14(60), 237.

Pedersen, E. (2011). Health aspects associated with wind turbine noise—Results from three field studies. *Noise Control Engineering Journal*, 59(1), 47-53.

Ruotolo, F., Senese, V. P., Ruggiero, G., Maffei, L., Masullo, M., & Iachini, T. (2012). Individual reactions to a multisensory immersive virtual environment: the impact of a wind farm on individuals. *Cognitive processing*, 13(1), 319-323.

Shepherd, D., & Billington, R. (2011). Mitigating the acoustic impacts of modern technologies acoustic, health, and psychosocial factors informing wind farm placement. *Bulletin of Science, Technology & Society*, 31(5), 389-398.

Suter, A. H. (1991, November). Noise and its effects. In *Washington, DC: Administrative Conference of the United States*.

Taylor, J., Eastwick, C., Wilson, R., & Lawrence, C. (2013). The influence of negative oriented personality traits on the effects of wind turbine noise. *Personality and Individual Differences*, 54(3), 338-343.

Walker, B., Hessler, G., Hessler, D., Rand, R., & Schomer, P. (2012, December 24). A cooperative measurement survey and analysis of low frequency and infrasound at the Shirley Wind Farm in Brown County, Wisconsin. Retrieved from: http://psc.wi.gov/apps35/ERF_view/viewdoc.aspx?docid=178263.