

Also shown is part of a document our group prepared for use with WI legislators. It includes the wind project studies we discussed. . The links for the studies described should be live. You should be able to click on them and go to the full articles. The reference to 1250' is there because that is what WI has for a residential setback-something we are working on getting changed. The studies themselves demonstrate AHE (adverse health effects) well beyond that distance.

Let me know if you have any questions.

Jim Vanden Boogart
President: Brown County Citizens for Responsible Wind Energy

Studies and Articles - Below is a small sampling of the studies and articles demonstrating the harmful conditions around industrial wind turbines resulting in substantially negative health effects on persons residing beyond 1,250 feet - includes, but is not limited to, peer-reviewed material

A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin

Walker, Bruce; Hessler, George; Hessler, David; Rand, Robert; and Schomer, Paul, 2012

http://psc.wi.gov/apps35/ERF_view/viewdoc.aspx?docid=178263

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

Note: Duke Energy's wind turbines at Shirley Wind in Brown County have been declared a "Human Health Hazard" by the Brown County Board of Health. 3 families have vacated their homes at 1280', 3300', and 7100' in order to regain their health, while sworn affidavits representing over 50 others attest to the continued suffering around the turbines in homes that residents simply cannot afford to leave. Nearly all affected families reside beyond the PSC 128 allowed 1250 foot setback.

Effects of industrial wind turbine noise on sleep and health

Nissenbaum, Michael A.; Aramini, Jeffery J.; and Hanning, Christopher D., 2012

<http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2012;volume=14;issue=60;spage=237;epage=243;aulast=Nissenbaum>

Summary: Environmental noise is a public health concern, of which sleep disruption is a major factor. Participants living within 1.4 km (4593 feet) of an IWT had worse sleep, were sleepier during the day, and

had worse SF36 Mental Component Scores compared to those living further than 1.4 km (4593 feet) away. Significant dose-response relationships between PSQI, ESS, SF36 Mental Component Score, and log-distance to the nearest IWT were identified after controlling for gender, age, and household clustering. The adverse event reports of sleep disturbance and ill health by those living close to IWTs are supported.

Waterloo Case Series Preliminary Report

Mary Morris, Dip T Sc, Grad Dip Ag, Australia, 2012

<http://waubrafoundation.org.au/wp-content/uploads/2013/09/Waterloo-Case-Series-Preliminary-Report.pdf>

Summary: Population noise impact survey out to 10km (32808 feet), Waterloo. Found 27 of the 93 respondent households had one or more members who were having trouble sleeping, and documented the other associated symptoms which included the characteristic range of wind turbine syndrome symptoms. Upon examining the responses from within 5 km (16404 feet) of the turbines, 56 % of households were disturbed by day time noise, 56 % disturbed by night time noise and 39 % experienced sleep disturbance. Reported four of the homes had been abandoned because of the wind turbine noise.

Evaluating The Impact Of Wind Turbine Noise On Health-Related Quality Of Life

David McBride, Daniel Shepherd, David Welch and Kim N. Dirks, September 2011

<http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2011;volume=13;issue=54;spage=333;epage=339;aulast=Shepherd>

Summary: Statistically significant differences were noted in some health-related quality of life (HRQOL) domain scores, with residents living within 2 km (6561 feet) of a turbine installation reporting lower overall quality of life, physical quality of life, and environmental quality of life. Those exposed to turbine noise also reported significantly lower sleep quality, and rated their environment as less restful.

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Macarthur Wind Energy Facility Preliminary Survey

Anne Schafer, August 2013

<http://waubrafoundation.org.au/wp-content/uploads/2013/09/Macarthur-Wind-Energy-Facility-Preliminary-Survey.pdf>

Summary: The Macarthur Wind Energy Facility (WEF) is the largest WEF in the Southern Hemisphere. 96% reported disturbance by the turbines during the day and 100% reported disturbance during the night (10pm-7am). Of those households affected, 91% reported negative changes to their health. Of the 21 households reporting health changes, 19 (90%) reported sleep disturbance and sleep deprivation and 5 (23%) reported a sudden and alarming awakening during the night. Sleep disturbance and deprivation was the most significant impact reported by the majority of households.

Wind Farm Generated Noise and Adverse Health Effects

Dr. Bob Thorne, November 2012

<http://waubrafoundation.org.au/resources/wind-farm-generated-noise-and-adverse-health-effects/>

Summary: Persons interviewed live between 700 meters (2296 feet) and a distance of around 3500 meters (11482 feet) from the turbines, with an 'average' of 1400 meters (4593 feet). Twenty-one of the 25

respondents participating in the study reported severe to moderate adverse health effects. Reported adverse health effects include sleep disturbance, headaches, noise sensitivity, irritability, anxiousness, pressure on ear-drums, sinus problems, panic attacks, balance rotational problems, erratic/high blood pressure, tightened scalp / forehead, eye-strain and nausea. Nausea attacks are cited as being common, with some residents having to leave their home to sleep where there is no turbine noise.

Case Series Cross-Over Study - submission No 13 to the Australian Federal Senate Inquiry into Rural Wind Farms and published in “Wind Turbine Syndrome, A Report on a Natural Experiment”

Dr Nina Pierpont, 2009

<http://www.windturbinesyndrome.com/wind-turbine-syndrome/>

Summary: Dr Nina Pierpont collected detailed information on the range and pattern of symptoms experienced by individuals from 10 families who had been so severely adversely impacted by wind turbine noise that they had had to move away from their homes for periods of time to obtain relief. By the conclusion of the study, 9 out of the 10 families had permanently moved away from their homes (most living further than 1250 feet from the nearest turbine). The turbine sizes ranged from 1.5 – 3 MW.

Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review

Jesper Hvass Schmidt, Mads Klokke, December 4 2014

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114183>

Summary: Exposure to wind turbines does seem to increase the risk of annoyance and self-reported sleep disturbance in a dose-response relationship. There appears, though, to be a tolerable level of around L eq of 35 dB.

Cullerin Range Wind Farm Survey

P Schneider, August 2012

<http://www.aph.gov.au/DocumentStore.ashx?id=18463b69-8a8c-4498-8b10-f2e195cfa6e>

Summary: At a distance out to 7.5 km (24606 feet) from the turbines, 76% of households reported sleep disturbance due to the wind turbines (71% survey response rate). For the population living within 7.5km (24606 feet) of the turbines, there were 24 households who were given a survey, and 17 responses, giving the response rate of 71%. In 2013, Schneider found a similar response rate out to 10km (68.5%) and that 91% of the households who responded out to 8km had noise and/or vibration impacts that were affecting their health. Of the 20 households in this group out to 8km, there were 50 residents, 49 of whom reported impacts.

Effect of Wind Turbine Noise on Workers' Sleep Disorder: A Case Study of Manjil Wind Farm in Northern Iran

Milad Abbasi, Mohammad Reza Monnazzam, SayedAbolfazl Zakerian, Arsalan Yousefzadeh, April 2015

<http://www.worldscientific.com/doi/abs/10.1142/S0219477515500200>

The results showed that there was a positive and significant relationship between age, workers' experience, equivalent sound level, and the level of sleep disorder. When age is constant, sleep disorder will increase by 26% as per each 1 dB increase in equivalent sound level. In situations where equivalent sound level is constant, an increase of 17% in sleep disorder is occurred as per each year of work experience. Because of the difference in sound exposure in different occupational groups. The effect of noise in repairing group was about 6.5 times of official group and also 3.4 times of the security group. It can be stated that this technology has health risks for all those exposed to its sound.

Wind Turbine Acoustic Investigation: Infrasound and Low-Frequency Noise - A Case Study

Ambrose, Stephen E.; Rand, Robert W.; and Krogh, Carmen M. E., August 2012

<http://bst.sagepub.com/content/early/2012/07/30/0270467612455734>

Summary: Wind turbines produce sound that is capable of disturbing local residents and is reported to cause annoyance, sleep disturbance, and other health-related impacts. During the study, the investigating acousticians experienced adverse health effects consistent with those reported by some Falmouth residents.

Systematic Review 2013: Association between Wind Turbines and Human Distress

Arra I, Lynn H, Barker K, et al., 2013

<http://www.cureus.com/articles/2457-systematic-review-2013-association-between-wind-turbines-and-human-distress>

Summary: Demonstrated the presence of reasonable evidence (Level Four and Five) that an association exists between wind turbines and distress in humans. The existence of a dose-response relationship (between distance from wind turbines and distress) and the consistency of association across studies found in the scientific literature argues for the credibility of this association.

Impact of wind turbine sound on annoyance, self-reported sleep disturbance and psychological distress

Bakker RH, E. Pedersen E, van den Berg, GP, Stewart RE, Lok W, Bouma J, 2012 Science of the Total

<http://www.ncbi.nlm.nih.gov/pubmed/22481052>

Summary: A dose–response relationship was found between emission levels of wind turbine sound and self reported noise annoyance. People living in the vicinity of wind turbines are at risk of being annoyed by the noise, an adverse effect in itself. Noise annoyance in turn could lead to sleep disturbance and psychological distress.

The Noise from Wind Turbines: Potential Adverse Impacts on Children's Well-Being

Bronzaft, Arline L., 2011 Bulletin of Science Technology & Society

<http://bst.sagepub.com/content/31/4/291>

Summary: Based on our knowledge of the harmful effects of noise on children’s health and the growing body of evidence to suggest the potential harmful effects of industrial wind turbine noise, it is strongly urged that further studies be conducted on the impacts of industrial wind turbines on their health, as well as the health of their parents, before forging ahead in siting industrial wind turbines.

Infrasound from wind turbines: An overlooked health hazard

Enbom H and Enbom IM, 2013

<http://waubrafoundation.org.au/resources/enbom-e-i-infrasound-from-wind-turbines-an-overlooked-health-hazard/>

Summary: Infrasound from wind turbines affects the inner ear and is a potential health risk for people with migraine or other type of central nervous system. This understanding is also important for understanding how infrasound from wind turbines can affect health. Several studies have found that living near wind turbines often create severe sleep disturbance and depression. They have also found an increased incidence of dizziness, tinnitus, hyperacusis, headache, increased activation of the autonomic nervous system, etc.

Wind turbine syndrome: fact or fiction? Review Article The Journal of Laryngology & Otology

Farboud, A.; Crunkhorn, R.; and Trinidad, 2013

<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8853239&fileId=S0022215112002964>

Summary: Symptoms, including tinnitus, ear pain and vertigo, have been reported following exposure to wind turbine noise. There is evidence that infrasound has a physiological effect on the ear. There is ample evidence of symptoms arising in individuals exposed to wind turbine noise. There is an increasing body of evidence suggesting that infrasound and low frequency noise have physiological effects on the ear.

Wind turbine noise

Hanning, Christopher D. and Evans, Alun, 2012

<http://dx.doi.org/10.1136/bmje1527>

Summary: The evidence for adequate sleep as a prerequisite for human health, particularly child health, is overwhelming. Experts contend that the quantity, consistency, and ubiquity of the complaints constitute epidemiological evidence of a strong link between wind turbine noise, ill health, and disruption of sleep.

Industrial wind turbines and adverse health effects

Jeffery, Roy D.; Krogh, Carmen; and Horner, Brett, 2014

<http://www.ncbi.nlm.nih.gov/pubmed/24398354>

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Summary: There is sufficient evidence to support the hypothesis of Colby and colleagues that documented symptoms can result from annoyance to audible IWTs. Amplitude modulation of IWTs, audible LFN, and tonal, impulse and nighttime noise can contribute to annoyance and other effects on health. In addition, there is emerging evidence that suggests inaudible LFN or infrasound from IWTs may result in negative health effects.

Adverse health effects of industrial wind turbines

Jeffery, Roy D.; Krogh, Carmen; and Horner, Brett, 2013

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3653647>

Summary: Industrial wind turbines can harm human health if sited too close to residents. Harm can be avoided if IWTs are situated at an appropriate distance from humans. The documented symptoms are usually stress disorder-type diseases acting via indirect pathways and can represent serious harm to human health.

Properly Interpreting the Epidemiologic Evidence About the Health Effects of Industrial Wind Turbines on Nearby Residents

Phillips, Carl V., 2011

<http://bst.sagepub.com/content/31/4/303>

Summary: There is overwhelming evidence that wind turbines cause serious health problems in nearby residents, usually stress-disorder type diseases, at a nontrivial rate. The adverse event reports provide compelling evidence of the seriousness of the problems and of causation in this case because of their volume, the ease of observing exposure and outcome incidence, and case-crossover data. Moreover, though the failure of models to explain the observed problems does not deny the problems, it does mean that we do not know what, other than kilometers of distance, could sufficiently mitigate the effects.

Investigation of perception at infrasound frequencies by functional magnetic resonance imaging (fmri) and magnetoencephalography

Robert Kühler, Christian Koch et. al., July 16, 2015

http://s3.amazonaws.com/windaction/attachments/2475/Full_paper_Koch_V2-1.pdf

Using functional magnetic resonance imaging (fMRI) a significant response was detected which was localized within the auditory cortex and which was present down to the lowest frequency presented (8 Hz). Significant brain responses could be detected down to a frequency of 20 Hz. Within the test subject ensemble one person, however, showed a significant response also at 8 Hz.

The Problems with "Noise Numbers" for Wind Farm Noise Assessment

Thorne, Bob, 2011

<http://bst.sagepub.com/content/31/4/262>

Summary: The character of wind farm sound, noise emissions from wind farms, noise prediction at residences, and systemic failures in assessment processes are examined. The adverse effects on health of persons susceptible to noise from wind farms are examined and a hypothesis, the concept of heightened noise zones (pressure variations), as a marker for cause and effect is advanced. A sound level of LAeq 32 dB outside a residence and above an individual's threshold of hearing inside the home are identified as markers for serious adverse health effects affecting susceptible individuals.