WHAT ESTABLISHED SCIENCE TELLS US ABOUT THE HEALTH IMPACTS OF GRID SCALE WIND TURBINES
AND
WHY THE PRECAUTIONARY PRINCIPLE SHOULD DRIVE PUBLIC POLICY ON THIS ISSUE

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Compiled by Wayne C. Spiggle, M.D.
<wspiggle@mac.com>

INTRODUCTION

I am a physician, retired from clinical internal medicine, and a former county commissioner in Mineral County, WV. During my tenure as an elected official, a proposal came forward to build 23 wind turbines along a ridge top of Green Mountain above the county seat. I objected to our county commission's support of this project because of its proximity to the people living along that ridge. Despite that, the necessary permits were obtained and the facility was built.

Immediately, many residents in the affected community discovered they could not sleep well because of noise caused by the wind turbines. The company refused to feather the turbines at night as requested by the community. They told the public that installing baffles on the turbines would fix the problem. This was done without significant affect. When the problem could not be fixed, 32 residents and a real estate business brought lawsuits against the builder. The suit was settled out of court with a gag order attached. The adverse health impacts continue.

This event prompted me to begin what is now a nine-year long study of the health implications of people living within 2 km of an industrial wind turbine. In addition to reviewing the scientific literature, I have interviewed more than twenty people whose lives have been changed because they live close to industrial wind turbines. In recent months, I have visited nine operating turbine sites and three proposed sites. Four have been in PA, three in western Maryland and five in WV. I've found that many times people are reluctant to speak out so most of my interviews have been with people who have contacted me. In addition, I have been in communication with people adversely

affected by projects in Ohio, Vermont, Maine and Canada. My effort to reach out to impacted people is ongoing.

As I talk to people, I connect with my experience as a physician and "take a history", noting not only the essential facts of their situations but how they feel, what their concerns are, and what they see as desired outcomes.

These interviews have a remarkable sameness. The themes are repeated over and over again. First, there is the lament that, "We can't sleep." "We can no longer live here." "We have to move." "We are worried about what is happening to our family." "We feel fatigued, have ringing in the ears, chronic sinus symptoms and general unhappiness." "We feel trapped." "We have a right to enjoy our home." "We have been lied to and we are angry."

These interviews reveal that an extreme injustice is being imposed on some citizens living with industrial wind turbines. The literature provides a solution for some of these impacts. Setbacks between industrial wind turbines and the noise levels they produce must conform to the mounting scientific evidence and growing consensus that to be safe, industrial turbines must be no closer to homes than 2km, approx. 6585 feet, and noise restrictions should follow WHO guidelines of <40 decibels or lower.

It is a good sign that certain enlightened jurisdictions have recognized this reality and have developed public policy appropriate to it. This research brief summarizes what is being done to make industrial wind turbines safer and it explores the evidence behind the above recommendations.

WHAT SOME INFORMED JURISDICTIONS ARE DOING TO MAKE WIND TURBINES SAFER

- A 2016 peer reviewed article in the Journal of Hearing Health and Technology Matters web site, **Wind Turbine Noise and Human Health: A Four-Decade History of Evidence that Wind Turbines Pose Risks 2** provides a meticulous analysis and rebuttal to the ten most common claims of the wind industry and certain government publications. The paper calls for a pro-health approach and endorses a

2km setback. "Copyright (c) Hearing Health & Technology Matters. All rights reserved." Punch, Jerry L. and James, Richard R. http://hearinghealthmatters.org/journalresearchposters/

- On September 1, 2016, the Zoning Commission of Clinton County, Missouri, voted 8-0 to prohibit commercial scale wind turbines in the county. Three days later the Clinton County Commission ratified this decision 3-0, This was in response to a review of the county's wind regulations ongoing for the previous nine months. Small wind turbines for personal use are allowed.

- On July 19, 2016, it was announced that The World Health Organization-Europe (WHO) is currently modernizing its noise guidelines for wind turbines. This is expected to prompt a serious worldwide examination of all aspects of this problem.

- In May, 2016, the Bavarian government passed a law requiring industrial turbines to be set back from residences a minimum distance of ten times the height of the turbine. This "10-H" law, with turbines towering 200m, means a minimum distance of 2km from homes (6561 feet).

- On June 10, 2016, Poland also adopted wind turbine setbacks 10 times the turbine height.

- On June 30, 2014, Donnegal, Ireland: 10 x height setback

- **Since 2010 many jurisdictions in the U.S. have established safer setbacks:**
  - Umatilia County, Oregon, June 28, 2011: change of setback to 2 miles from "urban grown boundary", 1 mile from "unincorporated community" zones from 3520 feet.
  - Catarunk, Maine and Moscow, Maine –8,000 feet.
  - Montville, Maine and Buckfield, Maine –13 times the turbine height.
  - Fayette County, PA – 6,000 feet.
  - Trempealeau County, Wisconsin, Sumner, Maine and Hillsdale County, Michigan –5280 feet.
  - Freedom, Maine, November 17, 2015: 13 x height setback from property line, 4 x height from public roads, 2,500 feet from special

resources; sound limits 5 dBA above preconstruction ambient level, 40 dBA during day, and 35 DBA at night at property line and 20 DBC above preconstruction ambient dBA level at property line and inside dwellings.

- Lancaster County, Nebraska, November 10, 2015: sound limits at exterior wall of dwellings 40 dBA and 3 dBA above background from 7 am to 10pm, 37 dBA from 10pm to 7am.
- Buckland, Massachusetts, September 25, 2014:limits of 250W capacity and 120 Ft. height, setbacks 360 ft to property line and half-mile to off-site residence.
- Centerville Township, Michigan, Aug. 18, 2010: height limit 199 ft: setback 10 x rotor diameter to property line or road; noise limits at property line 35 dBA of 5 dBA above background during the day, 3 dBA above background at night, with low frequency limits and tonality penalty.
- Frankfort, Maine, Dec. 1,2011: 1 mile setback from property line, noise limits within 2 miles 35 dB day, 25 dB night.

A BRIEF REVIEW OF SCIENTIFIC STUDIES
LIVING IN PROXIMITY TO WIND TURBINES DOES CAUSE DISEASE:

- In 2011. Noise & Health, an Inter-Disciplinary Journal, published a study finding that residents living within 6500 feet of a turbine feel an overall diminished quality of life. Those exposed to turbine noise at 5000 feet also experienced significantly lower sleep quality and rated their environment as less restful. The study concluded: "night time wind turbine noise limits should be set conservatively to minimize harm, and, on the basis of our data, we suggest that setback distances need to be greater than 2 km in hilly terrain. Shepherd D, McBride D, Welch D, Dirks KN, Hill EM. **Evaluating the impact of wind turbine noise on health-related quality of life**. Noise Health 2011; 13:333-9

Fourteen studies in the academic literature have come to similar conclusions and are included in the bibliography of this brief.

- A 2015 meta-analysis from Oxford University, UK, Bond University, Australia, and the University of Washington, Seattle, USA, confirmed that proximity to wind turbines is associated with the high probability of loss of sleep and reduced quality of life. This carefully done study involved over 2,000 subjects. Igho J. Onakpoya, Jack O'Sullivan, Matthew

J. Thompson, Carl J Heneghan, **The effect of wind turbine noise on sleep and quality of life: A systematic review and meta-analysis of observational studies.** Environment International www.elsevier.com/locate/envint

- In 2006, The National Academy of Sciences Institute of Medicine declared that: "Sleep disorders and sleep deprivation are an unmet public health problem." Institute of Medicine (IOM) Committee on Sleep Medicine and Research, Colten HR and Altevogt BM (ed.), **Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem**, Washington, DC: National Academy of Sciences, 2006.

- Harvard University has published a pamphlet that says, "In the short term, a lack of adequate sleep can affect judgment, mood, ability to learn and retain information, and may increase the risk of serious accidents and injury. In the long term, chronic sleep deprivation may lead to a host of health problems including obesity, diabetes, cardiovascular disease, and even early mortality." Research has overturned the dogma that sleep loss has no health effects, apart from daytimesleepiness.**http://healthysleep.med.harvard.edu/healthy/matters/consequences**

- Children and teens are particularly susceptible to sleep deprivation. A study published in the Journal of The American Academy of Child and Adolescent Psychiatry in 2000, found a strong link between insufficient sleep and aggression, delinquent behavior, and attention problems among 7- to 12-year-old children. **Sleep and Psychiatric Symptoms in School-Age Children**. Journal of American Academy of Child and Adolescent Psychiatry. 2000;39:502-508.

- The WHO has cited numerous studies showing that sleep deprived children can be less reflective, more impulsive and hyperactive and show poorer attention span. WHO also accepts the research that some children and teens show reduced academic performance and learning when exposed to fractured sleep. One such study is referenced. It concludes: "Observational and experimental studies have shown that

noise exposure leads to annoyance, disturbs sleep and causes daytime sleepiness, affects patient outcomes and staff performance in hospitals, increases the occurrence of hypertension and cardiovascular disease, and impairs cognitive performance in schoolchildren." Dr Mathias Basner, MD, Wolfgang Babisch, PhD, Prof Adrian Davis, PhD, Mark Brink PhD, Charlotte Clark, Phd, Sabrine Janssen, PhD, Prof Stephen Stansfeld, PhD: Auditory and non-auditory effects of noise on health, The Lancet, Volume 383, Issue 9925, 12-18, Page 1270.

- The WHO notes that outside noise of 30 to 40 decibels (dB) may cause some harm to children and the elderly; but above 55 dB the situation is considered increasingly dangerous for public health. WHO night noise guideline for safe sleeping indoors is 30 dB. WHO –**Night Time Noise Guidelines for Europe**. Roko, Kim; Van den Berg, Martin: Noise and Health, Volume 12, Issue 47, Page 61-63. 14 May 2013.

- A 2014 article in the Canadian Journal of Rural Medicine came to this conclusion: "If placed too close to residents, IWTs (industrial wind turbines) can negatively affect the physical, mental and social well-being of people. There is sufficient evidence to support the conclusion that noise from audible IWTs is a potential cause of health effects. Inaudible low-frequency noise and infrasound from IWTs cannot be ruled out as plausible causes of health effects. "Jeffery, Roy D. MD, Krogh, Carmen M.E., Horner, Brett BA, CMA: **Industrial wind turbines and adverse health effects**. Canadian Journal of Rural Medicine, 2014;19

MANY SYMPTOMS EXPERIENCED BY WIND TURBINE VICTIMS EQUATE WITH POST TRAUMATIC STRESS SYNDROME:

- Through my interviews, communications with people living nearby wind turbines and viewing videos of wind turbine victims, I have learned that the imposition of wind turbine facilities on rural communities is often a traumatic and stressful experience**.** In addition to the obvious noise related loss of sleep and the health consequences from that, the presence of tall

industrial structures, dominate the previously pristine locality and can result in symptoms of the post-traumatic stress disorder (PTSD), according to the criteria of the American Psychiatric Association. Modern turbines are now some 600 feet tall, higher than the 554 foot Washington Monument

- In 2013, the American Psychiatric Association revised the PTSD diagnostic criteria, removing it from the class of anxiety disorders to a new class of "Trauma and Stressor-related disorders."

    - Affected people experience symptoms that go beyond those of noise induced sleep deprivation but do fit the PTSD diagnostic criteria. American Psychiatric Association. (2013) *Diagnostic and statistical manual of mental disorders*, (5th ed.). Washington, DC: AuthorPTSD National Center for PTSD: DSM-5 Diagnostic Criteria for PTSD Released - <http://www.ptsd.va.gov/professional/PTSD-overview/diagnostic_criteria_dsm-5.asp>

    - Symptoms include: negative alterations in cognition and mood, externalization of anger, expression of anxiety or fear-based symptoms, avoidance attempts and a persistent negative emotional state.

    - So, when people describe to me how family conflicts have been exacerbated, that they feel trapped and have a persistent fear that they cannot be happy in their new environment, that they no longer can enjoy life because of an inability to concentrate and describe how their life plan has been altered by the presence of wind turbines giving them an underlying fear for the future, I realize I'm talking to people with PTSD symptoms.

    - Fear for the future is particularly strong in the few children I've talked to and I consider this to be a very serious

health outcome. When a child's parents are not OK the child is not OK and that imprint will follow them for the rest of their lives.

WHY DOES PUBLIC POLICY OFTEN ALLOW WIND TURBINES TO BE CLOSE ENOUGH TO HOMES TO CAUSE HARM?

- Until recently, most information about grid scale wind has come from industry sources. Like the tobacco industry of a few decades ago, this industry has been quite disingenuous and successful in contending that there is no scientific evidence that exposure to wind turbine noise causes disease.

- In many jurisdictions, industrial wind energy has become a politically favored energy alternative – primarily because its marketers have persistently represented it as being green (although there is no scientific proof that it is.) As such, government funded reports on wind energy tend to support the political narrative, and almost never objectively and comprehensively address health effects on people living in the vicinity of turbines.

  - Reports on wind development written for the government tend not to address health effects on people living in the vicinity of turbines.

- **THE PUBLIC HEALTH PROFESSION IS TRYING TO CORRECT THIS SITUATION.**
  - For the last 15 years or so, the public health profession has reported how wind turbines harm human health (see above) and has endorsed the **Precautionary Principle** to respond to the many technological events that are becoming part of the experience of society. **WHO-Europe: The Precautionary Principle: protecting public health, the environment and the future of our children.** Edited by Marco Martuzzi and Joel A. Tickner. Document # ISBN 92 890 1098 3, Published by World Health Organization 2004.

- According to the precautionary principle, the burden of proof is placed on the industry associated with the problem, not the people who are being aggrieved. Public policy is not deferred until absolute scientific proof is settled. The WHO puts it this way: "The Principle states that in the case of serious or irreversible threats to the health of humans or the ecosystem, acknowledged scientific uncertainty should not be used as a reason to postpone preventative measures". How to Apply the Precautionary Principle to Wind Energy Projects. Waubra Foundation. June 19, 2012. <docs.wind-watch.org/How-to-Apply-the-Precautionary-Principle-to-Wind-Energy-Projects.pdf

- Precaution is at the heart of public health protection. For example, current regulations pertaining to tobacco, environmental lead and pharmaceuticals are based on precaution and prevention. Initially, especially with tobacco and lead related diseases, the tendency was to wait on scientific proof, with disastrous results.

POLICY MAKERS ARE BEGINNING TO RESPOND TO PUBLIC HEALTH PROFESSIONALS ON THE WIND TURBINE ISSUE.

This issue was introduced at the beginning of this document but it is important enough to repeat here. The most important initiatives are to establish setbacks from turbines to residences that acknowledge what is known about the probability of sleep deprivation. This is particularly true in Europe where the experience with wind installations has been longer and the most pervasive:

- The Bavarian government has a "10-H-law" that calls for a setback distance to the nearest residential area of ten times a turbine's total height. This is based on data that show sleep-depriving noise from turbines is a function of their height. A turbine 150 meters high (492 feet) would be kept 1500 meters (4921 feet) away from homes. In May, 2016, the Bavarian Constitutional Court affirmed this law. <u>The precautionary principle: protecting public health, the environment and the future of our children.</u>

WHO-Europe, 2004. www.euro.sho.int/_data/assets/pdf_file/0003/91173/E83079.pdf

- A second German state, Rhineland-Palatinate, (southern Germany) plans to impose a minimum of 1,100 meters (3609 feet) between wind developments and nearest housing.

- Ireland has a bill that says the distance from a wind turbine to a house should be 10 times its height.

  - Jurisdictions in the United States are also realizing that large wind turbine installations are harmful and people are beginning to resist their placement:
    - On 10-14-14 the Brown County Board of Health declared the 2.5 MW wind turbines at Duke Energy's *Shirley Wind* project in Brown County, Wisconsin, to be a "human health hazard". That declaration was based on the Board of Health's five years of experience, research, and review of the evidence. On 6-3-16 it was reported that the Brown County Commissioners gave initial approval of the board of health findings. **Shirley Wind Farm opponents see ray of hope.** Doug Schneider: **USA TODAY NETWORK-Wisconsin; July 3, 2016**
  - Since 2010 many local jurisdictions have established safer setbacks:
    - Umatilia County, Oregon, and Riverside, California have ordinances stipulating a setback of 10,561 ft.
    - Catarunk, Maine and Moscow, Maine – 8,000 ft.
    - 13 times the turbine height – Montville, Maine and Buckfield, Maine.
    - 6,000 ft. – Fayette County PA.
    - 5,280 ft. – Trempealeau County, Wisconsin, Sumner, Maine & Hillsdale County, Michigan.

  - In a letter to constituents dated May 19, 2016, Tennessee Senator Lamar Alexander shared the following information:
    - "In October, the residents of Irasburg, Vermont, voted 274 to 9 against a plan to install a pair of 500 foot

turbines on a ridgeline visible from their neighborhoods."

- "In New York, three counties opposed 500 to 600 foot wind turbines next to Lake Ontario"
- In Kent County, Maryland, Apex Clean Energy, is trying to put down 25 to 35 500-foot turbines a quarter-to a half-mile apart across thousands of acres of farmland,"
- "According to the Baltimore Sun, Stephen S. Hershey Jr., a local state legislator, introduced a bill that would give county officials the right to veto any large-scale wind project in their jurisdiction. **Alexander urges Cumberland County Residents, All Tennesseans to Oppose Proposed Wind Farm –** e-mail Newsletter, May 19, 2016 : lamar@alexander.senate.gov
-

- There is now a proposal in the NC State Legislature that would provide a setback of at least 1 ½ miles from a neighboring property line. NC Senate Bill 843: Renewable Energy Property Protection: Sen. Bill Cook & Sen. Andrew Brock: <ncleg.net>

- In December 2015, the Board of Zoning Appeals, Allegany County, Maryland, supported Code 360-92 (requires turbines to be placed at least 2000 feet from resident's homes) by unanimously denying an application for 26 variances that would have placed the Dans Mountain Wind Project within 1000 feet from some residences. **Wind farm developer denied in Allegany County: Cumberland Times-News** 11/17 2015 http://www.your4state.com/news/news/wind-farm-denied-in-allegany-county

COMMENT

- Established science shows that wind turbines cause sleep deprivation that in turn causes ill health and diseases.

- People living adjacent to wind turbines often exhibit symptoms of post-traumatic stress syndrome as described

by the 2013 criteria of the American Psychiatry Association.

- Increasingly, jurisdictions are developing setbacks for wind turbines that protect the public health. A distance of 10 times the height of the turbine to the nearest residence is emerging as a reasonable setback for sleep deprivation while distances to prevent PTSD require more than that.

- Setback distances less than 10 x turbine height or 2 km (approximately 6500 ft) do not protect the public.

- Regulatory authorities could find themselves in a position in the future where they are successfully prosecuted for breaches of their duty to protect the community from harm.

- **Industrial wind turbine regulations should factor the height of the turbine and the level of noise they produce. Setting noise levels without significant penalties for exceeding them does not protect the public.**

- Until such regulations become the norm, people who live adjacent to wind turbines will continue to suffer and public resistance to this industry can be expected to increase.

- Regulatory authorities could find themselves in a position in the future where they are successfully prosecuted for breaches of their duty to protect the community from harm.

- It is important to recognize infrasound as an important driver of adverse health consequences for people living near industrial wind turbines.

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"We conclude that IWT noise at these two sites disrupts their sleep and adversely affects the health of those living nearby."

Wind Turbines can be Hazardous to Human Health. Alec N. Salt, Ph.D., Cochlear Fluids Research Laboratory, Washington University in St. Louis. **http://archive.org/web/web.php**
"You cannot hear the infrasound at the levels generated by wind turbines, but your ears certainly detect and respond to it." ""*This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree.*"—Chatham-Kent tribunal,

Wind Turbines are Hazardous to Human Health: Alec N. Salt, PhD., ., Cochlear Fluids Research Laboratory, Washington University in St. Louis. **http://archive.org/web/web.php**

"Recent epidemiological studies suggest that significant disturbances of sleep and mental health occur in people living within 5 Km from wind turbines.

Conflict With Health"...Physicians Recommend 3-Kilometer Minimum Distance!"

German Wind Turbines "In Conflict With Health"…Physicians ...

notrickszone.com › 2016 › March › 26

Mar 26, 2016 - **Physicians Recommend 3-Kilometer Minimum Distance**! ... Reinhardt says that human **health** "is now in **conflict** with Germany's Energiewende" "Slowly, but surely, methodical Medicos are gathering the evidence that proves what victims have known all along: constant exposure to low frequency noise infrasound is a serious human health hazard."
"A Canadian review of 62 scientific publications appearing in the Canadian Journal of Rural Medicine concluded that industrial wind turbines have "negative Health impacts" on people who live in their vicinity."

DISCONNECT BETWEEN TURBINE NOISE GUIDELINES AND HEALTH AUTHORITY RECOMMENDATIONS

(Paper presented at World Wind Energy Conference 2008, Kingston, Canada) John P Harrison
Professor Emeritus, Physics Department, Queen's University Kingston, ON K7L 3N6 harrisjp@physics.queensu.ca "There is a disconnect between the setbacks of modern up-wind blade wind turbines from homes as recommended by health authorities and as determined from the noise guidelines of various jurisdictions. Typically, health authorities recommend 1.5 to 2 km while noise guidelines allow setbacks of 400 to 500 meters."

VERMONT HOME ABANDONED DUE TO NOISE FROM LOCAL WIND TURBINES

http://watchdog.org/273828/vt-center-for-turbine-impact-studies/

— Some worthwhile scientific studies on wind turbine noise —

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