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Case # 14-f-0490
Cassadadaga Wind Project

Dear DPS Siting Board,

I have previously submitted articles regarding health issues incurred from improper wind farm siting. I am sending several more articles, written by physicians, biologists, pathologists, scientists, acousticians, etc. demanding health studies and recommending moratoriums or at least many mile setbacks from homes/dwellings. I respectfully ask you to please read these with careful consideration and an unbiased attitude. The future health and well-being of wind farm residents, their children and babies depends on your decision not to place wind turbines in close proximity to homes 24/7 for 20+ years. You are truly gambling with innocent people's lives. It is inconceivable to me how you can ignore the growing world wide health complaints and calls for caution. Germany's Medical Association has called for a moratorium , [as has the Rumford Hospital Maine Staff] on wind farms until long overdue health studies are done, especially in regards to low frequency and infrasound noise health impacts.

I would ask that you also, would use the precautionary principle and call for a wind farm moratorium. Seismic vibrations and infrasound can travel over 10 kilometers from wind farms. Many physicians and officials in Australia, advise a minimum 10 kilometers setbacks or at least 2-3 miles from homes. I beg you please don't ignore the cries and evidence from around the world of wind farm damage to rural communities. This kind of collateral damage is not acceptable.What kind of a heartless, insane policy to inflict this misery on small rural towns. Political correctness at its most inhumane level? What is this world coming to? Stop this madness please!

Sincerely,
Joni Riggle R.N.

Public Service Commission of Wisconsin (PSC)

Submitted: 6/17/2010 10:52:36 AM

COMMENTS FILED ELECTRONICALLY IN

Wind Siting Rules 1-AC-231

Commentor Information:

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Please Read in entirety!

Comment:

I posted a previous comment on the PSC website about concerns of Infrasound generated by of the wind turbines. Since posting that comment, I have been contacted by a woman who lives in Byron. The wind turbines went up over a year ago there, and she has not had good sleep since. She experiences a constant hum and a vibration in the floors of her house that prevents her from sleeping at night. She said that between the lack of sleep, flicker and noise from the generators, she might as well be living in downtown Chicago. She is a breast cancer survivor and is worried that all of this will cause her cancer to recur. She also stated that Invenergy sold the wind farm to a utility, WE Energies, who denies responsibility because they did not build the wind farm. They will not even listen to her complaints unless she can put some numbers on the problem.

I was also contacted by Healthy Wind Wisconsin, a group that is trying to get resolution of complaints from people living in wind farms. They told me of a man near Fond du Lac who raises chickens. Since the turbines went up, his adult chickens are sick, and he has seen deformities in his chicks. The deformities seen by the farmer are similar to those reported in a study done by the U.S. Army Aeromedical Research Laboratory (Shannon et al, 1994). In this study, fertilized eggs were exposed to different levels and frequencies of whole-body low frequency vibration. The results revealed increased mortality and birth defects caused by the vibration.

As a biologist, I am concerned. Chick development is used as a model of human embryonic development. Are there implications for people living in the wind farm who want to have children? According to "Excerpts from the Final Report of the Township of Lincoln Wind Turbine Moratorium Committee" people in the Lincoln Township (Kewaunee) wind farm have reported an inability to conceive. There have also been serious birth defects in calves, and cows spontaneously aborting in that wind farm.

Are people in the wind farms experiencing problems with low frequency vibration? According to G.P. van den Berg (2004) "Although infrasound levels from large turbines at frequencies below 20 Hz are too low to be audible, they may cause structural elements of buildings to vibrate." This is borne out in the wind farms as some people complain of hums and vibrations in the floors and windows of their homes and in other structures. If the floor is vibrating, the residents are experiencing whole body vibration.

Infrasound waves are not readily absorbed by matter, so they pass through us. Some people in wind farms say they can feel the sound waves moving through them. As sound moves through any object, it moves the molecules around it. At appropriate frequencies, the sound waves can set up resonances and cause vibrations. If the infrasound or low-frequency sound waves can resonate and vibrate windows in a home as they pass through them, it is easy to visualize how they may vibrate membranes, tissues and organs in the human body as they pass into and through the human body.

From Environmental Impacts of Wind-Energy Projects (2007) Board on Environmental Studies and Toxicology (BEST):
"Low-frequency vibration and its effects on humans are not well understood. Sensitivity to such vibration resulting from wind-turbine noise is highly variable among humans. Although there are opposing views on the subject, it has recently been stated (Pierpont 2006) that "some people feel disturbing amounts of vibration or pulsation from wind turbines, and can count in their bodies, especially their chests, the beats of the blades passing the towers, even when they can`t hear or

see them." More needs to be understood regarding the effects of low-frequency noise on humans." I`ve heard that the vibrations can be felt in one`s body much in the same way as the "deep base" can be felt at a rock concert when standing close to a speaker.

In addition to the acoustic vibrations, the giant spinning wind turbines also produce low-frequency vibrations which travel through the earth, seismic vibrations, in the form of Rayleigh waves. A study done by P. Styles (2005) reported "We have clearly shown that both fixed speed and variable speed wind turbines generate low frequency vibrations which are multiples of blade passing frequencies and which can be detected on seismometers buried in the ground at significant distances away from the wind farms even in the presence of significant levels of background seismic noise (many kilometers)." These results were obtained for turbines much smaller than the 400-500 foot giants that will go up in southern Brown County, and for much smaller arrays. The amount of vibration increases by a factor of 10 for every 100 turbines.

From Frey et al., 2007:
"In coursework description of "Whole Body Vibration" Prof Alan Hedge of Cornell University writes: "Vibrations in the frequency range of 0.5 Hz to 80 Hz have significant effects on the human body. Individual body members and organs have their own resonant frequencies and do not vibrate as a single mass, with its own natural frequency. This causes amplification or attenuation of input vibrations by certain parts of the body due to their own resonant frequencies. The most effective resonant frequencies of vertical vibration lie between 4 HZ and 8 Hz. Vibrations between 2.5 and 5 Hz generate strong resonance in the vertebrae of the neck and lumbar region with amplification of up to 240%. Vibrations between 4 and 6 Hz set up resonances in the trunk with amplification of up to 200%. Vibrations between 20 and 30 Hz set up the strongest resonance between the head and shoulders with amplification of up to 350%. Whole body vibration may create chronic stresses and sometimes even permanent damage to the affected organs or body parts.""

The vibrations residents experience in the wind farms, whether acoustic or seismic in origin, can amplify in internal structures and organs in their bodies. Since some people complain of disturbing amounts of vibration in their bodies in wind farms, and structures vibrating in their homes, there can be no doubt that wind farms create vibration problems.

What might the health effects of this vibration be? In the study mentioned earlier, increased embryonic mortality was the main outcome of whole-body low frequency vibration of fertilized chicken eggs, but some of the experimental chicks showed deformities. In biology, agents that cause birth defects are called teratogens. Each teratogen produces a specific range of effects in a species. You can think of the drug thalidomide which had the specific effect of causing people to be born without limbs. The experimental observations of low-frequency vibration teratogenic effects in animals are:
· In chickens: crossed beaks, missing eyeballs and missing bony structures in the skull. Some disorientation and muscular weakness and malformed feet were also seen in experimental chicks (Shannon et al, 1994)

The problems with animal reproduction reported in the wind farms in Wisconsin are lack of egg production, problems calving, spontaneous abortion (embryonic mortality), stillbirth, miscarriage and teratogenic effects:
· In chickens: Crossed beaks, missing eyeballs, deformities of the skull (sunken eyes), joints of feet/legs bent at odd angles (Jim Vollmer, personal communication)
· In cattle: missing eyes and tails (updated Excerpts from the Final Report of the Township of Lincoln Wind Turbine Moratorium Committee)

It is disturbing to me that in chickens and cows in separate wind farms (separated by 50 miles) similar teratogenic effects are being observed, namely missing eyeballs. Based on the correlation of effects seen experimentally and those seen in the wind farm in chickens, these defects may be due to low frequency vibration. Jim Vollmer, the farmer who owns these chickens, reports that the tin structures on his farm buildings vibrate. If the infrasound/ low- frequency sound is strong enough to vibrate structures on his farm as it passes through, what is it doing to the delicate connections and circulation inside the developing chicken embryos, and inside people, as it passes through them?

Some of the other health effects that have been reported in the Kewaunee wind farm (and other wind farms) could also be explained by low frequency vibration. From updated "Excerpts from the Final Report of the Township of Lincoln Wind Turbine Moratorium Committee
" (betterplan.squarespace.com):
Animal health problems in the Srnkas' formerly award-winning herd include cancer deaths, ringworm, mange, lice, parasites, cows not calving properly, dehydration, mutations such as no eyeballs or tails, cows holding pregnancy only 1 to 2 weeks and then aborting, blood from nostrils, black and white hair coats turning brown, mastitis, kidney and liver failure. . . .

Mr. Srnka and neighbors report serious health effects on not just dairy cows. Health problems in

residents include
· sleep loss
· diarrhea
· headaches
· frequent urination
· 4 to 5 menstrual periods per month
· bloody noses: Mr. Srnka had cows bleed to death from uncontrollable bleeding from the nostrils
· inability to conceive

According to scientific literature, low frequency vibration could result in the urge to urinate (Frey et al, 2007) , menstrual irregularities, embryonic mortality (Penkov, 2007), which may be interpreted as inability to conceive or spontaneous abortion, birth defects in animals, and kidney problems in animals (Skilianov et al, 2005). All of these effects have been reported in the Kewaunee wind farm.

Many of the remaining health problems in this wind farm could be explained by infrasound/ low-frequency sound exposure or vibroacoustic disease, which is caused exposure to low frequency sound waves over long periods of time. According to Alves-Pereira and colleagues (2007), The clinical symptoms of vibroacoustic disease (in people) are: Stage 1- slight mood swings, indigestion and heartburn, mouth or throat infections and bronchitis. Stage 2- chest pain, definite mood swings, back pain, fatigue, fungal, viral and parasitic infections, inflammation of the stomach lining, pain and blood in urine, conjunctivitis and allergies. Stage 3- psychiatric disturbances, small nose bleeds, varicose veins and hemorrhoids, duodenal ulcers, spastic colitis, decrease in visual acuity, headaches, severe joint pain, intense muscular pain and neurological disturbances. In experiments done on rats, low frequency sound has been shown to cause severe trauma to the cells lining the respiratory tract (Oliveira et al., 2001) and the delicate brush cells lining the respiratory tract fuse together.

Infrasound has been shown to damage numerous systems, including the liver and testes, of laboratory animals under experimental conditions , and some effects on people have been noted at 100 decibels. From Infrasound Toxicology Summary, 2001:
"When male volunteers were exposed to simulated industrial infrasound of 5 and 10 Hz and levels of 100 and 135 dB for 15 minutes, feeling of fatigue, apathy, and depression, pressure in the ears, loss of concentration, drowsiness, and vibration of internal organs were reported. In addition, effects were found in the central nervous system, the cardiovascular system, and the respiratory system. Synchronization phenomena were enhanced in the left hemisphere. Visual motor responses to stimuli were prolonged, and the strength of effector response was reduced. Heart rate was increased during the initial minutes of exposure. Depression of the encephalic hemodynamics with decreased venous flow from the skull cavity and was observed. Heart muscle contraction strength was reduced. Respiration rate was significantly reduced after the first minute of exposure." Reference 29, Karpova et al.,1970.

Given this, it does not surprise me that people in the wind farm complain of malaise, lack of concentration, vibration, and cardiovascular effects, among others. Infrasound at very low frequencies has measured nearly 100 decibels in a 17 turbine wind farm (van den Berg, 2004). What levels of infrasound have been recorded in the middle of a 100 unit wind farm comprised of GE 1.5 MW turbines? At what threshold are effects of infrasound seen with continuous exposure? We need answers.

Is the level of low- frequency sound in a wind farm sufficient to result in vibroacoustic disease? An investigation of a home in a wind farm revealed that the home had levels of Infrasound and low-frequency vibration conducive to the formation of vibroacoustic disease (Alvez-Pereira et al 2007, In-Home Wind Turbine Noise is Conducive to Vibroacoustic Disease posted on www.wind-watch.org). More investigations like this need to be done, as not all homes in a wind farm will be affected equally by these agents. In people with occupational exposure to low frequency sound, it can take 10 years to reach stage 3 vibroacoustic disease. Therefore, to know the full health effects of wind turbines, we need to look at older wind farms as well.

In a complex generating 150 megawatts of electricity, there will be some electrical pollution. Wind turbines create "dirty electricity" which has been implicated in a variety of symptoms (Havas, M. 2006). David Colling of Ontario, who has studied the dirty electricity created by wind farms, describes the effects on people as being "like living inside a microwave." The effects are reduced with buried cables, but there are still effects, especially around substations. (See David Colling`s You Tube videos on electrical pollution and wind turbines)

If not carefully constructed, electricity from the turbines can overload rural power grids, back up into people`s homes and barns, and into the ground, creating ground currents. All electricity generated has to complete a circuit and flow back to the site of production through the neutral return wire. There are grounding rods on the neutral return wires, so that some current can constantly flow down the grounding rods and through the earth back to the substation, more when the wire is overloaded or corroded. A Minnesota study found that up to 70% of the neutral current

returns to the substation via the earth, in some areas, in the form of ground current.

Dr. Duane Dahlberg has stated "Dairy operators are frequently required by state codes to construct equipotential planes in their barns as a means of avoiding electric shocks for the cows. Unfortunately the equipotential plane is a good conductor which attracts a greater percentage of the ground currents, causes the cows to be exposed to greater continuous currents, and frequently increases stray voltage effects . . . On dairy farms, current in the ground is associated with behavioral, health and production effects in cows." These effects have occurred in Mr. Srnkas cattle in the Lincoln Township wind farm. 100 turbines (with dangerous levels of rotor shaft voltages, up to 1200 volts) and 80 miles of cable carrying up to 150 megawatts of electricity will need to be grounded also, resulting in more current in our ground to get into homes. The electricity generated has to find its way back to the wind farm, a portion of which will travel through the ground in currents and become concentrated in the wind farm as it makes its way back. Ground currents enter our homes through plumbing and other conduits creating magnetic fields. Wertheimer, Savitz, and Leeper published a paper in 1995 that showed an association between cancer and conductive plumbing in residences, suggesting an increased cancer risk for persons with elevated magnetic fields from ground currents.

The utility can contribute to electrical pollution in another way when they connect the neutral on the primary side of the transformer serving a farm to the neutral on the secondary of the transformer. The National Electrical Code (NEC), which covers farm wiring, requires that the secondary neutral be hard wired to a building`s water system, structure and electrical ground rod. So, if the transmission line neutral is overloaded, more current from the electrical transmission neutral flows into the plumbing and structures on the farm. Here in Wisconsin currents can be measured flowing through the grounds of the transmission lines, as opposed to California where much larger neutral cables are used and current cannot be measured at the ground.

Electricity from the neutral or from ground currents flowing through plumbing can result in EMF and contact currents. According to a study done by Douglas (1993), the electric current flowing through water pipes and other grounding paths may be the largest magnetic field source in the home other than appliances.

Exposure to electromagnetic fields (EMF) has been linked to the formation of amyotrophic lateral sclerosis (Lou Gehrigs disease) and is considered "possibly carcinogenic" by the International Agency for Research on Cancer. A study in Turkey demonstrated that men who worked around low frequency EMF had higher levels of genotoxic effects in their lymphocytes. Genotoxic events are mutations which may result in cancers or other adverse outcomes. Children are especially susceptible to the effects of EMF (Kheifets, 2005); exposure above 0.4 μT has been linked to the formation of childhood leukemia (Ahlbom et al, 2001, Angelillo and Villari, 1999). Rates of childhood cancer have been found to be increased for children living within 600 meters of electrical transmission lines at time of birth (Draper et al, 2005). Experts have argued that we should do all we can to reduce exposure to EMF in children and fetuses (Carpenter and Sage, 2008). Building 150 megawatt electricity generating complex around families seems unwise to me. It would make more sense to put wind farms in unpopulated areas.

Exposure to more than one of these agents at a time, as occurs in wind farms, may result in especially detrimental health effects. From the research literature it appears that the combination of both whole body vibration and low frequency noise is particularly dangerous. Low frequency sound alone is not genotoxic, but when combined with vibration, chronic occupational exposure has genotoxic effects (Silva et al., 1999, 2002). This result has been replicated in laboratory animal experiments, demonstrating the mutations are definitely due to the combination of whole body vibration and low frequency noise. Again, genotoxic effects can result in cancer, and cancers have occurred in cattle in the Lincoln Township wind farm. Yet, to my knowledge, no one has studied genotoxic events in wind farms, or even the mortality rates in herds or people in the wind farms.

When I first looked at the list of symptoms being reported from the wind farm in Lincoln Township, I doubted such seemingly disparate symptoms could all be caused by wind turbines. A survey of scientific literature revealed plausible explanations for them based on exposures to infrasound/low frequency sound, vibration and electrical pollution.

We may all be exposed to some of these agents each day, but we know wind farms create these forms of pollution, increasing the dosage (and duration) of exposure for people living inside the wind energy complex. The scientific literature tells us of detrimental health effects from prolonged occupational exposure to these agents including vibroacoustic disease, genotoxic effects and embryonic mortality. People and animals in the wind farms seem to be suffering the very effects the science would predict for overexposure to these agents.

Many research studies demonstrate that the detrimental effects of exposure to these agents increase in severity with increasing time of exposure. It concerns me that there are no scientifically-established safe levels for continuous exposure to this combination of agents. In

occupational exposures people can go home after 8 hours of work and have 16 hours for their bodies to actively recover from the exposures, 64 hours on the weekend. People in a wind energy complex don`t get that break from exposure. Safe levels are likely to be considerably lower for the elderly, those with underlying health problems, pregnant women, children and fetuses. The standards we have also do not take into consideration the compounding of effects which can result from exposure to multiple agents at one time. Based on the chicken embryo studies, any level of exposure to low frequency vibration may pose some risk to developing embryos, as no threshold effect was observed (Shannon et al., 1994).

We have reports of animals in the wind farms here in Wisconsin with reproductive problems. Scott Srnkas cows suffer spontaneous abortion, problems calving, birth defects such as missing eyeballs and tails - all since the wind turbines. Jim Vollmer has seen changes in his chicken`s reproduction - lower hatch rates and birth defects such as missing eyeballs and crossed beaks. Ann Wirtz has reported reproductive problems in her alpacas. Since the wind farm became operational, they have not been able to accomplish a live birth - pregnancy always results in miscarriage or stillbirth. There are other reports of chickens no longer laying eggs, and there may be more reports of reproductive effects of which I am not aware.

People living in the Lincoln Township wind complex have reported an inability to conceive. It appears, from the scientific literature, that vibration is a reproductive hazard which can result in miscarriage, stillbirth and other changes in the reproductive system of women (Balichiyeva, 1993, Marinova, 1976, Penkov, 2007, Seidel, 1993). In rats it can reduce the blood flow to the reproductive organs (Nakamura 1996). What happens to little girls growing up in the wind farms, experiencing the continual "deep base" type vibration that people feel in their bodies and the microseismic vibrations? Are their reproductive organs affected? What about their egg cells experiencing the low frequency sound and vibration, a combination which could be genotoxic? Girls are born with all the egg cells they will ever have.

To my knowledge, no one has even studied the fertility rates or rates of birth defects in people and animals in wind farms, or in people exposed to wind farms. We need concrete scientific proof that the vibration, acoustic and electrical pollution created by wind farms will not cause disease, birth defects or infertility in anyone, before continuing to build them.

I`ve heard arguments for wind energy stating that it reduces coal emissions and therefore also reduces birth defects caused by those emissions. Based on the reports out of the wind farms, there could be far worse reproductive consequences in people or animals (infertility, spontaneous abortion or miscarriage, stillbirth, and birth defects) as a result of wind energy than there ever was from coal emissions or nuclear power in this country. This needs to be studied. In Europe vibration exposure is recognized as a potential reproductive hazard (EU Directive 92/85/EEC), and vibration or EMF exposures can result in reproductive problems in people, or animals under experimental conditions (Al-Akhras, 2008, Brown et al., 1992, Hardell and Sage, 2008, Kim et al, 1999, Lahijani et al, 2007, Penkov , 2007, Seidel, 1993, Uysal et al, 2004).

On many levels wind farming raises concerns, but none more than the health complaints of residents of wind farms. One cannot read the updated report from Lincoln Township without being concerned. The problems being reported are not just nuisances. When complaints arise in the wind farms, people, homes and farms should be monitored for low frequency sound/infrasound, vibration and electrical pollution. If this were done on a regular basis, we would know what levels and combinations of these agents may cause health effects, but since health complaints have been ignored, and studies have not been done, those levels are not defined.

People living in the wind farms need rights and protection. As it stands, complaints are often ignored. There should be requirements for health care practitioners to report all health problems in wind farms, for investigations into complaints and for resolution of problems -not at the resident`s expense. If neighbors suffer ill effects, turbines should be shut down until the problems are resolved. It is beyond my comprehension that an individual farmer is allowed to make a decision to put up a power plant with a giant industrial turbine, atop a skyscraping tower, without community approval. The community suffers burdens and hazards because of that decision. It should be a decision of the entire community whom it affects.
If wind turbines are coming to the area, organizations such as Healthy Wind Wisconsin recommend documenting everything - property value, the views from one`s property, the wildlife that frequents one`s home, well water quality, noise levels on a clear calm night, health records, electrical pollution, and more. They recommend this because more problems and more lawsuits are anticipated as this virtually unregulated industry continues to grow.

The residents of a wind farm are not just being "stressed out" by the wind farm, there are physical forces acting on their bodies as a result of the wind farm, physical forces that may do permanent damage. If we were putting up nuclear power plants, and we had reports of animals around them not able to successfully reproduce or being born without eyeballs, and also had some people reporting an inability to conceive, we would halt any new construction until it had been studied. In

wind farms, this is exactly what we are seeing.

I realize there may be technical difficulty in ascertaining the amount of vibration set up inside one`s body, but I am asking you to invoke the precautionary principle and suspend wind farm development until the reproductive effects of wind farms, here in Wisconsin, have been studied. If you move forward before studies have been done, people`s reproductive rights may be violated.

In March, when Governor Doyle signed a bill banning BPA in baby bottles and cups for children, he stated "It seems to me that if there is a question of (safety), the balance we should strike is on protecting our children." I agree with Governor Doyle. I want my children protected. And people in the wind farm want to have children. Elderly people, stay-at-home moms, children, and babies are in these wind farms 24/7 being bathed in low frequency sound/infrasound, vibration and electrical pollution. If we are going to err in the siting of wind turbines, it should be on the side of safety for the people.

Thank you for your consideration,

Lynne Knuth, Ph.D.

P.S. I attended the recent meeting with the Brown County Board of Health and Board of Human Services. I wish everyone in this state had been able to hear the testimonials of the people who are suffering in industrial wind projects here in Wisconsin. We live in the best country in the world, a country that cares about people, founded on the principle that all men are created equal and have equal rights under the law. Each life is equally valuable. To hear that the wind siting council referred to people suffering in wind farms as "collateral damage" is disturbing. Collateral damage may be unavoidable in military operations, but it is not acceptable in day to day life. The life of each person suffering in a wind farm is as valuable as the life of each legislator living in Madison. I`d like to see them switch places; then we`d get some wind farm legislation that makes sense. If people are going to suffer because of a new technology, we do not move forward with it, but instead we come up with a better solution. There are better solutions to our country`s problems.
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Balichiyeva DV. Vibration in parental occupation as a risk factor in the health and development of offspring. Reprod Toxicol 1993 Sep-Oct;7(5):492-3
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The results of this research are based on a complex evaluation of labor conditions of workers in a number of vibration-exposed occupations (machinists, excavators, operators of drilling wells, bulldozer operators, embryoiderers in tambour shops, weavers, and others) based on sociologic studies of 923 persons (including 532 men and 371 women), clinical and experimental data (1,119 white rats), and mathematical modeling methods. Special features of the effect of vibration on the reproductive system are apparent: in men, suppression of sex function is noted, and there is an increase in the frequency of spontaneous abortion in women who are not in contact with vibration as a result of genome changes in the male reproductive cells; in the women there was an increase in the frequency of menstrual disorders, swelling of the walls of the vagina and uterus, spontaneous abortion, toxicosis of both halves of pregnancy, and stillbirths. The adverse effects of vibration on the offspring are transmitted through both the female and the male parents. A high frequency of deviations in anthropometric indices is noted, as well as infant death and sickness in children at an early age. It was established that vibration-exposed occupations in one or both parents significantly increases the risk for the offspring according to the indices indicated above and even more, to a large degree, in combination with harmful habits (smoking, drinking alcohol). In the experiments on animals, a decreased probability of birth and viability of the offspring were shown in association with vibration exposure of the parents. A system was developed for the prevention of reproductive and developmental injury in which the following measures were important: a decrease in vibration

load for men and women; family planning, taking into consideration the vibration danger in the occupation of the parents; a healthy way of life; effective use of labor and social vacations for increasing reproductive health, reinforcement of the public health service for pregnant women, newborns, and weak children taking into consideration the professions with vibration danger for parents as a risk group.

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Brown KM, Doynov PG, Barber MK, Litovitz TL, Litovitz TA. Effects of extremely low frequency electromagnetic fields on chicken embryogenesis. Toxicologist 1992 Feb;12(1):100
Abstract:
Only a few epidemiological studies have examined the effects of extremely low frequency electromagnetic fields (ELF) on embryogenesis. Taken together, these studies are inconclusive and suffer from an inability to control for a variety of potential maternal influences on the embryo. In the present study we have examined the direct effects of ELF on chicken embryogenesis. Fertile, unincubated chicken eggs were placed in a Helmholtz coil inside each of two incubators. An electromagnetic field was created in the coil in one incubator by currents produced by a generator. These eggs were exposed to different frequencies, magnetic field strengths, and pulse shapes which were monitored along with temperature, vibrations and relative humidity. Eggs in the other incubator were not exposed to generated ELF. On average, twice as many abnormal embryos developed from eggs continuously exposed for 48 h to 60 Hz/L uT sinusoidal fields than from unexposed eggs. Most of these abnormalities were neural tube defects. This study suggests that embryonic processes, particularly the formation of the brain and spinal cord, are directly sensitive to ELF.

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Abstract:
During recent years there has been increasing public concern on potential health risks from power-frequency fields (extremely low frequency electromagnetic fields; ELF) and from radiofrequency/microwave radiation emissions (RF) from wireless communications. Non-thermal (low-intensity) biological effects have not been considered for regulation of microwave exposure, although numerous scientific reports indicate such effects. The BioInitiative Report is based on an international research and public policy initiative to give an overview of what is known of biological effects that occur at low-intensity electromagnetic fields (EMFs) exposure. Health endpoints reported to be associated with ELF and/or RF include childhood leukaemia, brain tumours, genotoxic effects, neurological effects and neurodegenerative diseases, immune system deregulation, allergic and inflammatory responses, breast cancer, miscarriage and some cardiovascular effects. The BioInitiative Report concluded that a reasonable suspicion of risk exists based on clear evidence of bioeffects at environmentally relevant levels, which, with prolonged exposures may reasonably be presumed to result in health impacts. Regarding ELF a new lower public safety limit for habitable space adjacent to all new or upgraded power lines and for all other

new constructions should be applied. A new lower limit should also be used for existing habitable space for children and/or women who are pregnant. A precautionary limit should be adopted for outdoor, cumulative RF exposure and for cumulative indoor RF fields with considerably lower limits than existing guidelines, see the BioInitiative Report. The current guidelines for the US and European microwave exposure from mobile phones, for the brain are 1.6 W/Kg and 2 W/Kg, respectively. Since use of mobile phones is associated with an increased risk for brain tumour after 10 years, a new biologically based guideline is warranted. Other health impacts associated with exposure to electromagnetic fields not summarized here may be found in the BioInitiative Report at www.bioinitiative.org.

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Electric Transmission Lines Individual Rights vs Utility Rights of Public Domain
By Donald Hillman, Ph.D., Professor Emeritus, Michigan State University.2005.

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In today's world, technologic developments bring social and economic benefits to large sections of society; however, the health consequences of these developments can be difficult to predict and manage. With rapid advances in electromagnetic field (EMF) technologies and communications, children are increasingly exposed to EMFs at earlier and earlier ages. Consistent epidemiologic evidence of an association between childhood leukemia and exposure to extremely low frequency (ELF) magnetic fields has led to their classification by the International Agency for Research on Cancer as a "possible human carcinogen." Concerns about the potential vulnerability of children to radio frequency (RF) fields have been raised because of the potentially greater susceptibility of their developing nervous systems; in addition, their brain tissue is more conductive, RF penetration is greater relative to head size, and they will have a longer lifetime of exposure than adults. To evaluate information relevant to children's sensitivity to both ELF and RF EMFs and to identify research needs, the World Health Organization held an expert workshop in Istanbul, Turkey, in June 2004. This article is based on discussions from the workshop and provides background information on the development of the embryo, fetus, and child, with particular attention to the developing brain; an outline of childhood susceptibility to environmental toxicants and childhood diseases implicated in EMF studies; and a review of childhood exposure to EMFs. It also includes an assessment of the potential susceptibility of children to EMFs and concludes with a recommendation for additional research and the development of precautionary policies in the face of scientific uncertainty.

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Abstract:
To evaluate the possible effects of electric and magnetic fields to fetal abnormalities, 60 female BALB/c mice (initial age 6 weeks) were divided into 5 groups and an equal number of male mice were also divided into 5 groups. Twelve mice of each group were exposed continuously at 60 Hz field of 5 kV/m, 30 kV/m, 0.5 mT (5 G) or 1.5 mT (15 G) for 20-22 weeks, and then mice under the same condition were mated and were exposed continuously. Pregnant mice were sacrificed on day 17-18 postconception. The rate of fetal abnormalities was 10% in 5 kV/m, 15.2% in 30 kV/m, 20.3% in 5 G and 14.3% in 15 G, but 5.3% in the control group. The pregnancy rate was not different significantly. Exposure of electromagnetic fields induced early fetal death, late fetal death and abnormalities such as cleft palate, exencephaly as well as minor anomalies. Especially 5 G induced early fetal death but 15 G and 30 kV/m caused late fetal death and abnormalities (P less than 0.05). In some dead embryos of early periods, a single ventricle was noted. Hypertrophy, degeneration and disarray of cardiac muscle were found in the same heart. Congestion and hemorrhage were noted in lungs. Nodular formation of endocardial cushion was found in the area of aortic and pulmonary valves. Diffuse congestion was found in atrium and ventricle. It appears that 5 G influences early fetal period but 15 G and 30 kV/m influence late fetal periods. It can be insisted that electric and magnetic fields are environmental factors in fetal abnormalities at the permissible safety limits of them by the guidelines of several international associations.

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Abstract:
We investigated the effects of an electromagnetic field (EMF) of 50 Hz, 1.33-7.32 mT on sections of preincubated white leghorn chicken embryos using light, SEM and TEM microscopes. Five hundred

healthy, fresh, and fertilized eggs (55-65 g) were divided into three groups of experimental (n = 18-20), control (n = 60), and sham (n = 50). Experimental eggs (inside the coil) were exposed to 15 different intensities (1.33-7.32 mT) for morphological surveys and to the known most effective intensities for light, scanning electron microscopy (SEM), and transmission electron microscopy (TEM) studies. Sham groups were located inside the same coil with no exposure for 24 h before incubation. Control, sham, and experimental groups were then incubated in an incubator (38 +/- 0.5 degrees C, 60% humidity) for 4 days. At the end of this period, embryos were removed from their shells, prepared for morphometric, light, and SEM/TEM studies. Results of light microscopic studies (serial sections, 6mu) and morphometric data showed significant differences between different groups (P < 0.005). Larger and abnormal brain cavities, spina bifida, monophthalmia, microphthalmia, anophthalmia, and growth retardation were shown on SEM. TEM sections demonstrated that the nucleus was condensed, the nuclear envelope disappeared, and mitochondria degenerated. Golgi apparatus and endoplasmic reticulum were the least affected organelles. The Telencephlon was the most affected region, and the retina was altered more than the lens. We conclude that EMFs affect the brain, especially the Telencephalon and eye of preincubated-exposed chick embryo at the morphological and cellular level, nuclei are the most affected part, and our data agrees with "Ubeda's windows effects" of EMFs on preincubated chick embryos.

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Luo Q, Yang J, Zeng QL, Zhu XM, Qian YL, Huang HF. 50-Hertz electromagnetic fields induce gammaH2AX foci formation in mouse preimplantation embryos in vitro. Biol Reprod. 2006, Nov; 75 (5):673-80.

Marinova G, Svetoslavova E, Mateeva E. Industrial vibrations and their repercussions on the basic functions of the genital system in women Akush Ginekol (Sofiia). 1976; 15(1):74-8. [Akusherstvo i ginekologiia]

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Abstract
Effects of whole-body vibration on normal pregnancy were studied in the rat. Uterine blood flow and five endocrine functions corticosterone (CS), estradiol (E2), progesterone (P), prostaglandin E2 (PGE2) and prostaglandin F2 alpha (PGF2 alpha) concentration were measured in rats exposed to whole-body vibration with an acceleration of 10 m.s-2 at a frequency of 8 Hz. While no change in uterine blood flow was observed in control rats, uterine blood flow was significantly decreased 75 and 90 min after exposure to vibration. The uterine blood flow at 15 and 30 min was increased by pretreatment with intraperitoneal injections of angiotensin II (AII). In contrast, in AII pretreated rats exposed to the vibration, uterine blood flow was significantly reduced 90 min after exposure. The CS concentration was increased by vibration independently of the pretreatment with AII. Neither E2 nor PGF2 alpha concentration were changed by the vibration with or without AII administration. The P and PGE2 concentrations were both decreased by vibration in the absence of AII, while the decrease in PGE2 induced by the vibration was also found in AII-treated rats. The present results indicated that the pregnant rats subjected to whole-body vibration responded with changes in uterine and ovarian function. The observed decrease in uterine blood flow may have been the result of reduced PGE2 concentration resulting from an indirect effect of vibration.

Oliveira MJ, Pereira AS, Castelo Branco NA, Grande NR, Aguas AP. In utero and postnatal exposure of Wistar rats to low frequency/high intensity noise depletes the tracheal epithelium of ciliated cells. Lung. 2001; 179(4):225-32.
Abstract:
Chronic exposure of men or rodents to low frequency/high intensity (LFHI) noise causes a number of systemic changes that make up the so-called vibroacoustic disease (VAD), a disorder that includes alterations of the respiratory system, namely, of its epithelial layer. We have investigated here the susceptibility of the tracheal epithelium of Wistar rats to in utero and postnatal exposure to LFHI noise by comparing its ultrastructure with that of the tracheal epithelium of control rats and of animals exposed to LFHI noise only after reaching adulthood (8 weeks of age). Scanning electron microscopy (SEM) of the inner surface of rat trachea was used to determine the relative areas covered by ciliated and non-ciliated cells. In rats that were exposed in utero and postnatally to LFHI noise, we observed that out of 100 microm(2) of tracheal epithelium only 31 +/- 14 microm(2) were covered by cilia, whereas in control rats; ciliated cells occupied an average of 60 +/- 18 microm(2) out of 100 microm(2) of the epithelium; this difference between the two groups was statistically significant (p <0.05). In rats that were exposed to LFHI noise only after reaching adulthood, cilia covered 55 +/- 22 microm(2) out of 100 microm(2) of the luminal surface of the trachea, a value that, although lower than that of controls, was not found to be statistically

different. We conclude that (1) the tracheal ciliated cells are damaged by exposure of rats to LFHI noise if the animals are kept under this environmental aggression during in utero and postnatal periods; (2) tracheal ciliated cells from adult rats are more resistant to the deleterious effects of LFHI noise than pleura or lung alveolar cells that were shown before to undergo marked changes upon chronic exposure of rats to LFHI noise. These findings suggest a note of caution regarding pregnant women and young children: they should be prevented from areas where LFHI noise occurs, namely, in aircraft and textile industries where this type of environmental hazard is often present.

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Akush Ginekol (Sofiia). 2007; 46(3):44-8. [Akusherstvo i ginekologiia]
Abstract:
The relevant literature on the effects of occupational vibration was analyzed in order to obtain information concerning a possibly health risk on the female reproductive organs Vibration exposure can probably contribute to the pathogenesis of disorders of female reproductive organs (decrease in uterine blood flow, menstrual disturbances, and anomalies of position) and disturbances of pregnancy (abortions, stillbirths). Experimental animal studies on the reproduction function suggest harmful effects on the fetus, and dystrophic and morphological changes in the uterus and ovaries in animals.

Seidel, H. Selected health risks caused by long-term, whole-body vibration. AM J Ind Med. 1993, Apr:23(4):589-604

Shannon SG, Moran AW, Shackelford LC, Mason KT. Effect of vibration frequency and amplitude on developing chicken embryos. NTIS Technical Report (NTIS/AD-A288517) (USAARL-95-1) 1994 Oct;:34
Abstract:
Fertilized chicken eggs were incubated and exposed repeatedly to whole-body vibration forces with frequencies ranging from 5 to 50 Hz, and amplitudes ranging from 0.09 to 4.93 Gz(rms). The timing and duration of exposure were selected to model pregnant women flying Army helicopters 3 hours per day, 5 days per week. Factors associated with chicken embryo mortality were: frequency, amplitude, amplitude transmission, and timing of the exposure. As the magnitude of the exposure increased, mortality increased. No clear HRA threshold values were identified due to the retrospective discovery of protocol problems. The use of an entire tray of eggs as the unit of amplitude measure was invalid due to the differences in vibration amplitude transmission at each egg station. However, mortality thresholds were proposed using a logistic model that controlled for the differences in vibration amplitude noted at various egg stations. No extraneous factors such as month of incubation, flock, and incubator were significant in analysis of variance modeling. Controlling for the amplitude transmission, we found very strong effects of vibration on embryonic development and mortality. Exposure of chicken embryos to vibration above 2.0 Gz should be avoided. Exposures as low as 1.0 Gz are harmful at certain frequencies. Congenital malformations occurred in chicks exposed to vibration, but in none of the control chicks. The malformation syndrome was characterized by crossed beaks and missing eyes. We observed several experimental chicks with malformed feet, sensory disorientation, and muscular weakness. Further studies are required to define and validate these findings. Whole-body vibration exposures are harmful to the developing chicken embryo. Until further laboratory and epidemiological studies of this potential health hazard on animal and human pregnancy outcomes are completed, pregnant Army aviators should not fly in rotary-wing aircraft. We believe the vibratory aspect of the rotary-wing aircraft environment is a fetal health hazard.

Silva MJ; Carothers A; Castelo Branco NA; Dias A; Boavida MG. Sister chromatid exchange analysis in workers exposed to noise and vibration. Aviat Space Environ Med. 1999, Mar; 70(3 Pt 2):A40-5.

Silva MJ; Dias A; Barreta A; Nogueira PJ; Castelo-Branco NA; Boavida MG. Low frequency noise and whole-body vibration cause increased levels of sister chromatid exchange in splenocytes of exposed mice. Teratog Carcinog Mutagen. 2002; 22(3):195-203.Abstract:

Chronic exposure to low frequency (LF) noise and whole-body vibration (WBV) induces both physiological and psychological alterations in man. Recently, we have shown that long-term occupational exposure to LF noise and WBV produces genotoxic effects in man expressed as an increase in sister chromatid exchange (SCE) levels in lymphocytes. The objectives of the present study were to investigate whether the observed effect could be reproduced in a murine model and, if so, which of the agents, LF noise alone or in combination with WBV, would be instrumental in the SCE induction. SCEs were analyzed in spleen lymphocytes of mice exposed to LF noise alone and in combination with WBV for 300 and 600 hr. An effect at the cell cycle kinetics level was also investigated. The results revealed significant increases in the mean SCE number per cell and in the proportion of cells with high frequency of SCEs (HFCs) in lymphocytes of mice submitted to combined noise and WBV over controls. No significant differences were found between single noise-exposed and control mice. A cell cycle delay was observed exclusively in the noise and WBV exposure groups. In conclusion, we demonstrated that, as in exposed workers, prolonged exposure to the combination of LF noise and WBV determines an increase in SCE level in mice while LF noise alone is not effective in SCE induction.

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On Low Frequency Noise and Vibration and its Control. Maastricht The Netherlands 30 August to 1 September 2004

Wertheimer, Nancy, David Savitz, Ed Leeper. 1995. "Childhood Cancer in Relation to Indicators of Magnetic Fields from Ground Current Sources. Bioelectromagnetics. 16:86-96 (1995).
Abstract:
This study examines childhood cancer risk in relation to certain factors likely to indicate magnetic field exposure from ground currents in the home. Substantial ground currents are most often found in homes having conductive plumbing, in which an uninterrupted metallic path in the water pipes and water main connects the grounding systems of neighboring houses. Information on plumbing conductivity was obtained from water suppliers for the homes of 347 cases and 277 controls identified in an earlier study of magnetic field exposure and childhood cancer in the Denver area. An increased cancer risk was observed for children in homes with conductive plumbing: The matched odds ratio was 1.72 (1.03-2.88) and increased to 3.00 (1.33-6.76) when analysis was limited to cases and controls who were residentially stable from the reference date to the study date. A measurement metric likely to indicate active ground currents (measurements having above-median intensity and a nonvertical orientation of < 55 degrees from the horizontal) was identified. In contrast to measured field intensity alone, for which only modest associations with cancer have been reported, this metric shows a high and significant cancer risk [matched O.R. = 4.0 (1.6-10.0)] consistent over a range of intensity and angle cutpoints. Such elevated nonvertical fields were also associated with cancer in an independent data set, which was gathered to study adult nonlymphocytic leukemia in the Seattle area. The associations of cancer with conductive plumbing and with this exposure metric both suggest that cancer risk is increased among persons with elevated magnetic field exposure from residential ground currents.

I affirm that these comments are true and correct to the best of my knowledge and belief.
Lynne Knuth, PhD

windAction

The WindAction Group (www.windAction.org)

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Maine hospital staff calls for moratorium on wind turbines citing health risks

Medical Staff, Rumford Community Hospital - February 11, 2009

Impact on People *Maine*

Following is the statement issued by the staff of the Rumford Community Hospital, and sent to Gov. Baldacci, Dr. Mills of Maine Center for Disease Control, as well as the Rumford Falls Times and the Lewiston Sun Journal.

HEALTH CONCERNS GENERATED BY WIND TURBINES

As members of the Rumford Community Hospital medical staff we endorse the concept of alternative energy including but not limited to wind turbines.

As wind turbine generated power has been introduced on an industrial level in more areas around the country as in the world, there is a literature emerging worldwide expressing a multitude of side effects affecting those who live, work or attend school in the vicinity of wind farms.

The health hazards include problems arising not only from audible noise frequencies but also from inaudible low frequency noise waves. There are growing scientific observations and studies suggesting that some people living within 2-6 miles of these industrial wind farms are affected at a variety of levels from a variety of symptoms.

In light of those growing serious medical concerns we propose a moratorium of at least one year and possibly more on the building of any such "wind farms" until more research is being done on the public health impact that such facilities can and will have on a segment of the communities surrounding such technology.

Signed,
Medical Staff of the Rumford Community Hospital

Rumford Hospital Staff Resolution

The WindAction Group (www.windAction.org)

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Signed,
Medical Staff of the Rumford Community Hospital

Rumford Hospital Staff Resolution

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Effects of ultrasound and infrasound relevant to human health

Review

Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling

Mariana Alves-Pereira[a], Nuno A.A. Castelo Branco[b]

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Windfarm = LFN & infrasound 24/7 for 20 yrs

Abstract

At present, infrasound (0–20 Hz) and low-frequency noise (20–500 Hz) (ILFN, 0–500 Hz) are agents of disease that go unchecked. Vibroacoustic disease (VAD) is a whole-body pathology that develops in individuals excessively exposed to ILFN. VAD has been diagnosed within several professional groups employed within the aeronautical industry, and in other heavy industries. However, given the ubiquitous nature of ILFN and the absence of legislation concerning ILFN, VAD is increasingly being diagnosed among members of the general population, including children. VAD is associated with the abnormal growth of extra-cellular matrices (collagen and elastin), in the absence of an inflammatory process. In VAD, the end-product of collagen and elastin growth is reinforcement of structural integrity. This is seen in blood vessels, cardiac structures, trachea, lung, and kidney of both VAD patients and ILFN-exposed animals. VAD is, essentially, a mechanotransduction disease. Inter- and intra-cellular communication is achieved through both biochemical and mechanotranduction signalling. When the structural components of tissue are altered, as is seen in ILFN-exposed specimens, the mechanically mediated signalling is, at best, impaired. Common medical diagnostic tests, such as EKG, EEG, as well as many blood chemistry analyses, are based on the mal-function of biochemical signalling processes. VAD patients typically present normal values for these tests. However, when echocardiography, brain MRI or histological studies are performed, where structural changes can be identified, all consistently show significant changes in VAD patients and ILFN-exposed animals. Frequency-specific effects are not yet known, valid dose-responses have been difficult to identify, and large-scale epidemiological studies are still lacking.

Keywords

Extra-cellular matrix; Actin; Tubulin; Collagen; Tensegrity

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Vibroacoustic Disease – The Response of Biological Tissue to Low-Frequency Noise

Alves-Pereira, Mariana; Joanaz de Melo, João; and Castelo Branco, Nuno

Summary

BACKGROUND: Vibroacoustic disease (VAD) is a systemic pathology caused by excessive exposure to low frequency noise (LFN). Until 1987, it was thought that the pathological effects of excessive LFN exposure were limited to the realm of cognitive and neurological disturbances. After the autopsy findings in a deceased VAD patient, it became clear that LFN impinges on the entire body, particularly the cardio-respiratory systems. In 1992, rodents were exposed to LFN, and the respiratory tract was studied through scanning and transmission electron microscopy. Pericardial, tracheal and lung fragments, removed with informed consent from VAD patients, have also been studied with light and electron microscopy. This report summarizes what is known to date on the tissue and cellular response to LFN exposure.
TUBULIN-BASED STRUCTURES: Cilia are tubulin-based and exist in normal pericardia as well as in the respiratory tract. In VAD patients, pericardial cilia cease to exist, while tracheal and bronchial cilia are distributed in abnormal arrangements. In LFN-exposed rodents, respiratory tract cilia appear sheared, clipped or shaggy.
ACTIN-BASED STRUCTURES: Cochlear cilia are actin-based structures, as are brush-cell microvilli that protrude into the respiratory tract airway. In LFN-exposed rodents, both structures appear fused. Actin filaments are also a fundamental element of the cellular cytoskeleton. In VAD patients' pericardia, cytoskeletal deformations may be a consequence of LFN-induced changes of the actin filaments.
BIOTENSEGRITY HYPOTHESIS: One of the most consistent findings in almost all human and rodent tissue fragments is the abnormal proliferation of collagen and elastin. It is hypothesized that the principles of biotensegrity structures may contribute to the explanation of tissue and cellular responses to LFN exposure.

Introduction

For the past 24 years, the effects of low frequency noise (LFN) (<500 Hz, including infrasound) exposure have been the object of intense scientific inquiry. Vibroacoustic disease (VAD) is a whole-body pathology caused by excessive exposure to LFN, either due to occupational sources or environmental sources. The response of biological tissue to LFN has drawn great interest, particularly given the significant structural, or morphological, changes of the exposed organs, tissues and cells.

In 1987, an autopsy was performed on a deceased VAD patient, as specifically bequeathed by the patient in his will. Until then, it was thought that LFN-induced pathology was restricted to the realm of neuropathophysiology. Autopsy findings disclosed, among several other extraordinary features, widespread thickening of blood vessel walls, and abnormally

The ruptured cellular membranes seen in the pericardial mesothelial layer are very unusual. Cellular debris is seen in all layers of the pericardium. This sort of cellular death is not related to the normal, programmed, or apoptotic, cellular death. In VAD patients' pericardia, cellular death seems to be associated with mechanical processes and stresses. The fact that the cellular debris is being spewed into the pericardial sac may be a contributing factor to the development of auto-immune diseases in VAD patients.

It would seem that in the presence of LFN, living tissue responds by reinforcing its structural integrity. This is strongly suggested by the thickening observed in blood vessel walls, as well as in alveoli walls.

In conclusion, while biochemical and molecular signalling play fundamental roles in tissue re-organization, given the nature of the mechanical insult perpetrated by LFN, mechanically-induced signalling must also be greatly implicated.

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Presented at the 11th International Meeting on Low Frequency Noise and Vibration and Its Control, Maastricht, The Netherlands, 30 August to 1 September 2004

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thickened cardiac structures, namely valves and pericardium. Fibrosis (collagen proliferation) was also identified in the lungs.

In 1992, Wistar rats began to be used as animal models for VAD. Rodents were exposed to LFN, and fragments of different sections of the respiratory tract were studied with electron microscopy. In 1996, the first pericardial fragments were taken from fully informed VAD patients who were undergoing cardiac surgery (for other reasons). Since then, 12 VAD patients have provided pericardial fragments for our study. Similarly, several other VAD patients have provided fragments of respiratory tract tissue (epithelia) through biopsy (conducted for other reasons). All these tissue samples were examined with electron microscopy.

The goal of this report is to contribute to the characterisation of the biomechanical response of tissue to the presence of excessive LFN, drawing upon the data collected from the microscopy studies. ...

Discussion

LFN induces tissue reorganization and neo-formation. One of the underlying purposes may be the need to maintain structural integrity in a viscoelastic environment undergoing LFN-induced vibratory propagation.

Actin-based structures seem to have a tendency to fuse. Indeed, microvilli fusion (as seen in the brush cell) will alter the kinetic properties of the structure. Cochlear cilia, for example, are supposed to vibrate freely against the upper tectorial membrane, when an acoustical pressure wave is transduced along the basal membrane. This movement is what relays the acoustical signal to the brain. However, in LFN-exposed rats, cilia are fused together, as well as with the upper tectorial membrane. Hence, when the basal membrane attempts to transduce the acoustical signal, instead of freely vibrating, cochlear cilia, now a non-vibrating structure, will be pulled. If something similar occurs in the cochlear cilia of LFN-exposed humans, then perhaps discomfort might be felt. Discomfort that may be closely associated with the concept of annoyance.

The destruction of ciliary fields is dramatic, and might be related to its structural specificities. The cilium is anchored to the cellular cortex through an actin-based network located within the cytoskeleton directly under the plasma membrane. Given the response of other actin-based structures, namely brush cell microvilli as well as cochlear stereocilia, it is not unreasonable to hypothesize that perhaps the actin filaments that compose the cytoskeleton might also be reacting to LFN exposure. Corroborating this notion are transmission electron microscopy images showing intact internal ciliary structures. Yet, strands of apparently sheared cilia appear lying horizontally on the epithelial surface, and ciliary fields are depleted.

The response of the pericardium to LFN certainly appears to be an adaptation response. This does not exclude the loss of functional capabilities, for example, not a single cilium was found in mesothelial cells. Despite the dramatic alterations of the pericardia, heart function is normal and no diastolic dysfunction exists in VAD patients. It would seem that this newly formed loose tissue layer, rich in vessels and adipose tissue, with numerous elastic components, plays a very important role, possibly of a pneumatic and logistic nature, in maintaining normal function of the heart in these patients.

4/23/12 How long will the Wind Industry deny the problem? For as long as the money keeps coming.

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WIND SPIN: BLOWING HOLES IN WIND INDUSTRY'S DENIAL OF HEALTH IMPACTS

By Miriam Raftery,

Source East County Magazine, **eastcountymagazine.org**

April 22, 2012

For years, the tobacco industry claimed that cigarettes don't cause cancer—long after compelling medical evidence proved otherwise. A similar scenario is now happening with the wind industry, which has put forth various "experts" funded by the wind industry to claim that no evidence exists of negative health impacts caused by wind turbines.

Those are dubious claims that ignore mounting medical evidence around the world indicating that living near wind turbines can harm human health.

In numerous countries, neighbors living near turbines have been forced to abandon their homes after developing serious health problems. Low-frequency infrasound, audible noise, dirty energy, and ground currents are among the measurable outputs at some wind energy facilities—despite industry denials–and all have been linked to serious health impacts in people as well as animals.

Besides extensive anecdotal evidence, a growing number of medical journals, including peer-reviewed studies, have documented health issues related to wind energy. A growing number of medical experts and public health departments have called for new wind facilities to have significantly greater setbacks than the industry wants in order to protect public health—if such projects are built at all.

The **American Wind Energy Association** steadfastly denies that wind turbines cause health problems. According to the AWEA website, "An Expert Panel Review (full report **here**, executive summary **here**), was released in December 2009. Following review of current literature, the advisory panel concluded that there is no evidence the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects on humans."

AWEA further claims that "Wind power is a clean energy source that can provide communities with decreased greenhouse gas emissions, along with air quality improvements and corresponding human health benefits. For more information, please see AWEA's **Wind Turbines and Health** and **Utility Scale Wind Energy and Sound** fact sheets."

On a large scale, replacing coal-burning plants with wind means cleaner air. But clean air is just one measurement of health—and the industry conveniently omits the fact that for people living or working near wind turbines, health concerns appear both real and plentiful.

Let's start with a real world example. On January 10, 2012, the Brown County Board of Health in Wisconsin adopted a resolution **http://www.windturbinesyndrome.com/wp-content/uploads/2012/03/BCResolutions.pdf** also supported by County Supervisors calling for emergency state funds to aid "families suffering around industrial wind turbines" including relocation of entire families. The resolution includes an extensive bibliography of sources documenting serious health impacts from turbines, including many that are peer-reviewed. The resolution declares an "emergency relating to public heatlh, safety or welfare" including effects from noise and shadow flicker.

Judy Frieerichs, director/health officer at Brown County Health Dept., told ECM that the residents who are ill live at distances ranging from 1,150 feet to 3,200 feet from the turbines.

Jay Tibbetts, M.D., with Brown County Dept. of Health said the board recommends a minimum half to three-quarters of a mile setback, with no audible noise or shadow flicker. "There is some consensus of a setback of 2 kilometers, 1.24 miles," he said."A huge problem is that none of these setbacks take infrasound (inaudible sound) into consideration. Infrasound can travel much greater distances than audible sound," he said, adding, "Infrasound may be more of a threat to human health than other factors."

Dr. Tibbetts also voiced concern over stray voltage (dirty electricity) linked to wind turbines in his community. "There is an association of pediatric leukemia and lymphoma with prolonged exposure and one family has a very high stray voltage measurement."

Symptoms experienced by Brown County residents include a "sense of flight or flight, marked uneasiness, headache, nausea, dizziness, ear pressure…A few family members living in the vicinity of wind turbines can sense when the turbines are on and off without seeing them. Two families have abandoned their homes and another four would if they could financially."

Shadow flicker, which can cause migraines and potentially seizures in epileptics similar to the effect of strobe lights are simply annoying to many people. "One local wind farm supplied a household with a room darkening shade," said Tibbett, who finds the solution woefully inadequate. "The best way to prevent health issues is safe siting."

(Editor's note: In San Diego County, this author took a neighbor to arbitration over a security light shining through a bedroom window. The owner proposed a black out blind for her neighbor, but the mediator ruled that this would not be adequate mediation since a homeowner has a right to have their windows open for fresh air. He found the light to be a private nuisance and ordered the owner to cover half of it and prevent light from disturbing the household next door.)

Brown County officials also called for **science-based setback guidelines**, noting that wind siting rules "were created without oversight of a medical professional." Their proposed guidelines also include provisions to hold wind energy companies responsible for resolving problems if health issues occur despite reasonable efforts to establish safe setbacks.

Carmen Krogh, a retired pharmacist from Ontario, Canada, **spoke in Boulevard,** California recently on the impacts wind turbines could have on people, particularly children. Research has

found that intrusive noises adversely affect children's cardiovascular systems, memory, language development and ability to learn, though studies specifically on impacts of wind turbine noise on youngsters has not been done. She titled her presentation "Children: The Canaries in the Coal Mine." At the same meeting, appraisal consultant Mike McCann of Chicago **said the impact zone of a wind farm** is two to five miles, with dramatic negative impacts on property values as well.

Audiology Today, a publication of the American Academy of Audiology, published an article in June/July 2010 titled "**Wind Noise: What Audiologists Should Know**." The report cites "evidence that exposure to high levels of low-frequency energy can have adverse health effects" and notes that wind turbines produce low-frequency acoustic energy below the level that humans can here. Turbines also generate vibrations that can be highly disturbing and harmful. These inaudible sounds can vibrate in houses and building spaces, rattling doors and rumbling through the ground, even vibrating in "bodily tissues and cavities", causing chronic sleep disturbances and other illnesses, the report states.

Sleep disturbances are "common in people who live up to about 1.25 miles away" from turbines. "This is the setback distance at which a group of turbines would need to be in order not to be a nighttime noise disturbance," the *Journal of Audiology* concludes, noting that this is the setback required in several countries with substantial experience with wind energy facilities.

The French National Academy of Medicine recommends turbines be placed at least 1.5 km away from residential areas Buffers to disrupt sound waves and filters to prevent stray electricity are among other measures that can also be taken—but the core protection is making sure that homes are not located too close to industrial wind facilities.

But sleep isn't the only problem.

Wind Turbine Syndrome has been documented by Dr. Nina Pierpont of the esteemed Johns Hopkin Medical School in a peer-reviewed report. **http://www.windturbinesyndrome.com/wind-turbine-syndrome/what-is-wind-turbine-syndrome/** These include headache, dizziness/vertigo, tinnitus (ringing in ears), ear pressure, ear pain, memory and concentration problems, fatigue, irritability, sleep disturbance and Visceral Vibratory Vestibular Distrubance (VWD). The latter includes rapid heartbeat, nausea, internal quivering or pulsation, and more.

A report in *Aviation, Space, Environmental Medicine* details **Vibracoustic Disease (VAD)**, an ailment associated with long-term exposure to infrasound for ten years or more. It can cause permanent tissue and organ damage as well as cardiac arrhythmias, hypertension and more. It can also cause chest pain, severe join pain, stroke, epilepsy, and neurological disturbances in the late stages, the ***Bulletin of Science, Technology & Society*** reports, citing multiple scientific studies.

Audible sounds from turbines have been described as airplanes or helicopters overhead that never leave, whooshing and thumping sounds.

The World Health Organization concludes that what you can't hear CAN hurt you, just as x-rays and UV radiation that you can't see causes harm. According to WHO, populations vulnerable to infrasound include "elderly persons, children, especially those younger than age six; and people with pre-existing medical conditions, especially if sleep is affected."

To date, the wind industry has fought to keep sound measured only in decibels (dba) using an A-weighted scale. But the Journal of Audiology report concludes that "For wind turbine noise, the A-weighting scale is especially ill-suited because of its devaluation of the effects of low-frequency noise. This is why it is important to make C-weighted measurements, as well as A-weighted measurements, when considering the impact of sound form wind turbines."

The *Bulletin of Science, Technology & Society* issued a proof article September 20, 2011 titled ***Wind Turbines Make Waves: Why Some Residents Near Wind Turbines Become Ill."*** Researchers describe how turbines generate pressure waves and electromagnetic waves. High frequencies can also flow along wires (dirty electricity) and along the ground generating ground current.

"These four types of waves—noise, infrasound, dirty electricity, and ground current—and shadow flicker are each likely to contribute to ill health among those who live near wind turbines," the article states.

Not all individuals experience symptoms. Just as some people are more sensitive to chemicals, allergies, and electromagnetic radiation, so, too, are some people more sensitive to the effects of waves from wind turbines. Some studies suggest that people who experience motion sickness, experience dizziness or nausea on carnival rides, or have migraines, eye or ear problems are more apt to suffer serious effects.

A report by the U.S. Air Force Institute for National Security Studies in 1997 indicated that low frequency sound can travel long distances and penetrate buildings with potentially lethal effects. "Transmission of long wave-length sound creates biophysical effects, nausea, loss of bowels, disorientation, vomiting, potential organ damage or death may occur," the report found.

Indeed, infrasound has been used by the U.S. military as a weapon capable of deterring enemy forces with potential for serious and permanent harm to health at high or prolonged levels.

Dirty electricity, or electricity escaping power lines, can interfere with electronic equipment as well as harming humans, livestock, pets and wildlife. Symptoms include sleeplessness, higher blood pressure, heart palpitrations, itching, ringing and pain in the ears, watery eyes, chest pressure, difficulty breathing and more – symptoms that disappear when patients leave home and reappear when they return. Impacts on health have been documented at schools in Canada and Wisconsi, as well as among teachers in a California school, as Milham & Morgan reported in 2008.

Dr. Milham **submitted evidence** at a San Diego County Planning Commission in April 2012 demonstrating that he took measurements and found skyrocketing levels of ground current inside the Manzanita Indian reservation's tribal hall and church—measurements he attributes to the nearby Kumeyaay wind farm on the Campo Indian reservation. High ground current levels have also been found in Palm Springs due to a wind farm nearby. Ground current can even enter homes through plumbing.

The Ontario Federation of Agriculture in 2007 warned that ground current, also called stray voltage or tingle voltage, can harm farm animals, pets and people. Symptoms that the Ontario report cites include high rates of spontaneous abortions in cattle, higher piglet mortality rates, horses exhibiting behavior and handling issues, dairy cows shocked through milking machines, an cats producing small, unhealthy litters or dying.

If wind farms can cause miscarriages in animals, can they have similar impacts on pregnant women? Nobody knows, since no studies have been done.

Unexplained mass die-offs of livestock have occurred near some wind farms. In New Zealand, 400 goats dropped dead. In Wisconsin, a farmer lost most of his cattle herd after turbines went in.

Problems are getting worse as turbines become bigger and more powerful.

On June 29, 2011, the Waubra Foundation in Australia issued an "**explicit cautionary notice**" to officials worldwide responsible for wind turbine siting decisions. The Foundation's field research identified symptoms of people not only living, but working or visiting within 10 kilometers or turbines. In addition to symptoms listed above, the list includes depression and post traumatic stress disorder, suicidal ideation, heart attacks and more at the Toora and Waubra wind projects in Australia, where over 20 familiies have abandoned their homes due to ill health since turbines began operations.

"Some of these people have walked away from their only financial asset, to live in a shed or a caravan on someone else's land," Waubra Foundation notes.

The organization urges prohibiting turbines within 10 km of homes, adding, "To ignore existing evidence by continuing the current practice of siting turbines closet o homes is to run the dangerous risk of breaching a fundamental duty of care, thus attracting grave liability."

Around the world, opposition to wind energy is growing.

The North American Platform Against Windpower (NA-PAW) at **http://www.na-paw.org/** is mobilizing people seeking a moratorium on siting projects near homes until science determines safe distances. Similar groups have formed in many communities around the wolrd, such as the Ontario Wind Resistance Website (**http://ontario-wind-resistance.org/**) and Wind Wise Radio in Vermont (**http://www.windwiseradio.org**).

In Wisconsin, residents near the Shirley wind farm have videotaped their stories and put them on Youtube.

One family moved away after the entire family developed ear pain and headaches, but can't sell their home due to the property devaluation.

A farmer whose land is a mile to a mile and a half away from turbines reports that "cows are dying…going down, pretty much lifeless…19 died or had to be put down, I lost 30 calves so far." One cow taken to a friend's recovered after leaving the farm.

Yet another family says they escape into their basement, where symptoms including severe headaches temporarily subside.

Eerily, several residents reported they no longer hear crickets or see birds. "Wildlife in our area has drastically dropped…it's pretty much lifeless," one resident said.

An elderly neighbor living near a wind facility said hearing aids pick up turbine noise that can't be tuned out. "Once they're up, there's no way out," she complained. "You're stuck for 30 years, which is a long time."

One problem facing researchers is that the wind industry has often persuaded residents to sign nondisclosure releases regarding medical and noise complaints in exchange for money, such as renting a farmer's field to site turbines, or giving money to organizations.

Government officials have often failed to give adequate weight to health issues, ignoring voluminous evidence. The final environmental impact statement/final environmental impact review for the Ocotillo Express wind project proposal, for instance, is dismissive of the issues despite the fact that some homes in Ocotillo would be within a half mile of turbines on not one, but up to three sides – clearly well within the impact where significant health problems can be anticipated.

Some agencies ARE taking notice, however.

San Diego County's Planning Commission recently heard testimony regarding a proposed wind ordinance that industry sources said would impose the toughest infrasound requirements in California—so stringent that some wind energy representatives present testified that if enacted, it could spell the death knell for the wind industry in San Diego County. Harley McDonald of Iberdrola, which hopes to build the Tule Wind facility in McCain Valley, said the ordinance would amount to a "de facto ban" on wind facilities in San Diego County, where numerous projects are proposed, most on public lands including Cleveland National Forest sites.

The proposed San Diego ordinance would include C-measurements for infrasound—a proposal the industry representatives vigorously opposed, claiming it would force setbacks from homes that would be impossible to meet. **http://eastcountymagazine.org/node/9354** . San Diego planners also heard from concerned residents, then postponed a decision in order to conduct site visits and a workshop to explore issues further—including the impacts of noise, infrasound, dirty energy and ground current.

Commissioner Bryan Woods drew applause from beleaguered residents when he stated that he will not support "wind energy at the expense of folks who have lived there for generations. It's not right to displace them."

[video available: "The Unvarnished Truth: Shirley Wind Project Victims Speak Out" {Wisconsin}]

Article originally appeared on Better Plan: The Trouble With Industrial Wind Farms in Wisconsin (http://betterplan.squarespace.com/).
See website for complete article licensing information.

November 4, 2011
Environment, Health, Impacts, Noise, Wildlife

Wind power and ecology

Whisson, Max

The survival of the world ecosystem, including of course ourselves, requires that we harness renewable energy in an environmentally tolerable way. One source of power is wind and it is vital that we assess the impact of current developments. We are destroying our only home, the Earth, on a scale that no other species has even remotely approached. Wind power has a long history. It has been an important local source of energy, for pumping water, grinding corn etc., for almost two millennia and during the last century millions of improved small wind turbines have been usefully installed on farms. In the last three decades a dramatic change has occurred with the development of enormous horizontal axis three-bladed wind turbines, all having vast blades with tip speeds of 100 kph [actually 240-320 kph —Ed.] whirling on top of massive towers, many more than 100 m high, built on huge concrete bases set into excavated ground. These huge machines have been built in large groups on dedicated land called wind farms.

An alternative approach has been the development of small machines often fitted to rooftops, even in cities. Quiet vertical axis machines have been widely set up in a number of countries, notably in Finland. One advantage of this "distributed energy production" is that the overall wind power is more constant than it is in large concentrated installations of the wind farm type, but the huge three bladed machines now dominate the landscape in many areas around the world and form the basis of several multi-billion dollar companies with immense lobbying power. Increasingly, people living near these vast machines have suggested they are detrimental to their health and there are some reports of abnormalities appearing in farm animals.

Most of the discussions have centred on the effects of the noise made by the wind farms, and many thousands of people have reported sleep disturbances and serious health effects forcing them to leave the area they have called home. The wind turbine companies refuted, even ridiculed these complaints, and pointed out that many common sources generate noise of greater intensity. The thousands of reports from doctors dealing with people suffering stress, sudden bursts of tachycardia, and hypertension would seem to be harder to discount, but these reports have not yet been prepared as a coordinated scientifically controlled study. The turbine companies and organizations buying clusters of the turbines often have considerable power over affected communities, through agreements with local administrators and contracts with residents for use of the land. In many cases the residents of wind farms have had to sign agreements forbidding public complaints.

The advocates of the new large machines respond to complaints by residents and their doctors by stating that people would not complain if they received adequate payment for the use of their land as a wind farm. There have been many statements belittling distressed or even seriously ill people, often along the lines that they are just awkward and resistant to progress. Objections are increasing however, and in a recent decision the Victorian government has decreed that wind turbines must be at least 2 km away from inhabited areas.

With audible noise, the loudness of the sound is often emphasised whereas it is only one factor. Consider the effect of music. It can have profound effects on behaviour even when very quiet. This can be shown experimentally. If you play Mozart to mice for a few hours they find their way out of a maze much faster than mice that have had to listen to noise. Similarly music can alleviate pain and is now used clinically for this purpose. The loudness of the music is almost irrelevant. It is the sequence of harmonic tones that is important in producing the effects. It is surely similar with noise. If you are nodding off to sleep and the wind picks up, starting a group of wind turbines and your brain picks up a quiet crunch-crunch-crunch, in an irregular and unpredictable sequence because the various turbines are not synchronous, you may not imagine a monster approaching but primitive circuits in your amygdala, prefrontal cortex and other areas of your brain will automatically fire off a stress response, triggering an increase in adrenaline and cortisol secretion. This fundamental mechanism has been an important factor in our survival as a species but we have not adapted to these previously unknown disturbances. Not good for a restful sleep.

After looking at evidence from several seemingly disparate areas of research it seems to me that the effect of the current wind farms is not confined to the noise they make. I am convinced that the evidence suggesting tissue damage both to people and to a wide range of other species is strong enough to sound a warning of environmental damage far beyond 2 km both on land and on water.

That the disturbance caused by the new large turbines is not trivial is highlighted by a recent decision by the UK Ministry of Defence (MOD) objecting to plans to build wind turbines on the north-west coast of England and the south-west coast of Scotland. Why? Because the vibrations, the "seismic noise" from such wind farms would interfere with the MOD instruments that detect terrorist bombs.

So, what do we know about the seismic noise of wind turbines? Quite a lot actually, but it has not yet received as much attention as it warrants. Like the UK MOD, scientists seeking to find evidence of gravitational waves have extremely sophisticated equipment designed to detect vibrations in rock, soil and water. Any device producing such vibrations can interfere with their research, so several centres, notably the Laser Interferometric Gravitational Wave Observatory (LIGO), University of Oregon, near the Stateline Wind Project, and the VIRGO European Gravitational Observatory in Pisa, near a small wind farm, have done detailed measurements of the generation and transmission of seismic vibrations from large wind turbines. Both of these centres were able to detect seismic vibrations travelling through soil, rock and water. The vibrations were correlated unambiguously with the operation of the wind turbines. The distance travelled by these vibrations may surprise those who talk about siting homes no closer than 2 kilometres from the turbines. The seismic vibrations remained strong beyond 10 kilometres and were still detectable at 18 kilometres.

It is important then to ask the question whether vibrations can affect health. Here we can refer to a quite extensive literature on communication between creatures. These range from the simplest multicellular organisms such as *Physarum polycephalum*, a yeast that can at times join with its neighbours and coordinate joint behaviour by transmitting vibrations from cell to cell, to a wide range of insects that transmit information to others of their species using a range of different mechanisms. In most species the frequencies used are below 20 Hz and transmission is through solids, usually the fine stems of flowers and leaves. The vibrations produced in a plant stem by a small insect are so tiny they are undetectable without very sensitive equipment. For a small insect however they are immensely significant, sending information about potential threats, about food, and of course courtship.

Most marine creatures, some of them very small, transmit information through water, also usually by low frequency vibration. All fish are very sensitive to low frequency vibrations and any angler will tell you that merely walking on the side of a lake will send most fish scurrying out of range of their net.

The sensitivity of earthworms to vibration is well-known not only to anglers but to predators that have learned to bring the worms to the surface by a carefully calculated series of taps on the ground. Here it is important to note that there are many reports from farmers that seagulls no longer follow the plough in areas near wind turbines. It has been suggested that the seagulls have learned that the worms have all been driven away and that in that area the farmer's plough will not bring breakfast to the surface. They must go elsewhere for their food.

How many of the species found in the soil and waterways have been affected by wind farm vibrations? We do not know because the necessary environmental and ecological studies have simply not been done. There are many anecdotal reports but it is surely urgent that we learn a great deal more. Of particular concern is that many farmers have reported that bees are no longer seen in the vicinity of wind farms.

What is known of the effect of vibrations on people working in industry? Here there is a great deal of information, but it is not widely known. Much of what has been discovered over the last three decades is reported by Mariana Alves-Pereira and Nuño Castelo Branco of Portugal. These extensive studies report numerous serious illnesses and, yes, many deaths, mainly from unusual cancers. A particularly characteristic finding is a thickening of the fibrous sheath surrounding the heart, the pericardium. Diseases such as type I diabetes and epilepsy developing late in life were also found and unusual malignant tumours were seen in the lungs, colon and brain. Rage attacks occurred in some individuals and sudden attacks of nonconvulsive mental defects were seen. These illnesses were caused by low frequency vibrations and developed slowly over many years, with deaths usually occurring after five years of exposure. The low frequency induced disease complex is called Vibro Acoustic Disease, or VAD and is thought to be the result of disruption of the fine fibres that connect the cells of the body. This disease complex is not yet widely recognised clinically or legally and this has seriously delayed diagnosis. Detailed experimental studies of VAD pathology have been reported. A characteristic finding is the production of excess collagen in the absence of an inflammatory response. This results in the thickening of blood vessel walls and abnormal gas flow in the lungs. Other findings in the experimental studies were unusual cell death without the usual "cell suicide" mechanism of apoptosis.

So, what can we expect from the noise and vibrations caused by wind farms? Many of the illnesses caused by industrial vibrations would not be associated with wind farms by doctors seeing such patients. Someone develops a heart disease, a brain tumour or gets a stroke five years after a wind farm starts up a few kilometres from their home. Or they have their first epileptic fit very late in life, or they get a cancer in the lung or bowel. Few doctors today would make the connection with the wind farm. A diagnosis of VAD could be made by detecting a thickening of the pericardium, but this would not be done unless the clinician suspected VAD. The association of this disease with wind farm operation is not widely known.

Putting all this together, it seems obvious to me that there is a very urgent need to study disease rates and death rates in the areas near wind farms and in "control" areas more than 10 km away. There is also an urgent need to organise clinical and epidemiological studies to

seek further evidence of the diseases and pathology described in the studies of industrial Vibro Acoustic Disease. There is similarly a very urgent need for veterinarians and ecologists to follow up the reports from farmers all around the world of abnormalities in farm animals near current large wind turbines, as with chickens that are hatching with crossed beaks and other abnormalities, and stock of many types being born with unusual abnormalities. Above all I feel that there is an urgent need to study the epidemiology of organisms that live in the soil and water around wind farms. These organisms are known to communicate by low frequency vibration. All of this must be correlated with precise measurements of noise and vibration associated with wind turbine operation. Such measurements must be made on the turbine towers, on surrounding soils and on surrounding buildings out to at least 10 km.

And what of the prospects for wind power today? A potentially extremely valuable source of auxiliary power I would say, but definitely not if it continues to be developed for massive commercial gain as at present. Instead of covering the planet with small quiet wind turbines feeding continuously into an international power grid we have "wind farms" springing up as concentrated power producing enterprises that are as much like a farm as an open cut coal mine.

Nature and Society [1], October-November 2011, pp. 7-9

Max Whisson, MB, BS FRCPath, is a retired pathologist with a strong interest in ecological issues. He invented the Whisson Windmill, a device for extracting water from the atmosphere.

Download original document: *Nature and Society*, October-November 2011 [2]

URL to article: **https://www.wind-watch.org/documents/wind-power-and-ecology/**

URLs in this post:
[1] Nature and Society: **http://www.natsoc.org.au/**
[2] Download original document: *Nature and Society*, October-November 2011:
https://docs.wind-watch.org/Nature-Society-Nov-2011.pdf

The WindAction Group (www.windAction.org)

Facts, analysis, exposure to industrial wind energy's real impacts

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2010

Document

Wind Turbines, Health, Ridgelines, and Valleys

Michael A. Nissenbaum, MD - May 7, 2010

Impact on People *Noise* *Maine* *Vermont*

These remarks were presented by Dr. Michael Nissenbaum at a press conference held at the Vermont legislature. Dr. Nissenbaum has been documenting the adverse health effects of industrial turbines on residents living near the Mars Hill Maine towers.

It is a medical fact that sleep disturbance and perceived stress result in ill effects, including and especially cardiovascular disease, but also chronic feelings of depression, anger, helplessness, and, in the aggregate, the banishment of happiness and reduced quality of life.

Cardiovascular disease, as we all now, leads to reduced life expectancy. Try and get reasonably priced life insurance if you are hypertensive or have suffered a heart attack.

If industrial wind turbines installed in close proximity to human habitation result in sleep disturbance and stress, then it follows as surely as day follows night that wind turbines will, over the long term, result in these serious health effects and reduced quality of life.

The question is, then, do they?

In my investigation of Mars Hill, Maine, 22 out of about 30 adults ('exposed') who live within 3500 feet of a ridgeline arrangement of 28 1.5 MW wind turbines were evaluated to date, and compared with 27 people of otherwise similar age and occupation living about 3 miles away (Not Exposed).

Here is what was found:

82% (18/22) of exposed subjects reported new or worsened chronic sleep deprivation, versus 4% (1 person) in the non-exposed group. 41% of exposed people reported new chronic headaches vs 4% in the control group. 59% (13/22) of the exposed reported 'stress' versus none in the control group, and 77% (17/22) persistent anger versus none in the people living 3 miles away. More than a third of the study subjects had new or worsened depression, with none in the control group. 95% (21/22) of the exposed subjects perceived reduced quality of life, versus 0% in the control group. Underlining these findings, there were 26 new prescription medications offered to the exposed subjects, of which 15 were accepted, compared to 4 new or increased prescriptions in the control group. The prescriptions ranged from anti-hypertensives and antidepressants to anti migraine medications among the exposed. The new medications for the non exposed group were anti-hypertensives and anti-arthritics.

The Mars Hill study will soon be completed and is being prepared for publication. Preliminary findings have been presented to the Chief Medical Officer for Ontario, and have been presented to Health Canada, by invitation. Earlier partial results were presented to the Maine Medical Association, which passed a Resolution calling for caution, further study, and appropriate modification of siting regulations, at its annual meeting in 2009.

There is absolutely no doubt that people living within 3500 feet of a ridgeline arrangement of turbines 1.5 MW or larger turbines in a rural environment will suffer negative effects.

The study was undertaken as a pilot project to evaluate for a cluster of symptoms after numerous media reports, in order to present data to the Maine Medical Association, after the Maine CDC failed to more fully investigate.

While the study is not perfect, it does suggest a real problem that warrants not only further more detailed investigation, but the tenderest caution, in the
meantime, when decisions on how to site industrial wind turbines are made. What is it about northeast USA ridgelines that contribute to these ill effects, and how can they be avoided?

Consider, the Northeast is prone to icing conditions. Icing will increase the sound coming off of turbines by up to 6 dBA. As the icing occurs symmetrically on all blades, imbalance detectors do not kick on, and the blades keep turning, contrary to wind industry claims.

Sound is amplified coming off of ridgelines into valleys. This is because the background noise in rural valleys is low to begin with, increasing the sensitivity to changes, particularly the beating, pulsatile nature of wind turbine noise, and sound sources at elevation do not undergo the same attenuation that occurs from groundcover when noise sources are at ground level. The noise travels farther and hits homes and people at greater amplitude that it would from a lower elevation. Even though this is not rocket science, it was conclusively proven in a NASA funded study in 1990. Snow pack and ice contribute to increased noise transmission. Vermont valleys have both, I believe.

Preconstruction sound modeling fails to take the tendency of the homes that people live in to respond and vibrate perceptibly to sound at frequencies that the occupants of the dwellings cannot necessarily hear. They hear, and feel, the walls and windows rattle, and the floors vibrate, in a pulsing manner at a frequency or the turbine rpm.

When pre construction modeling fails to take the pulsatile nature, propensity for icing, and ridgeline elevation into account, as well as a linear as opposed to point source of noise, problems can be expected. What distance is safe? It
depends on the terrain, the climate, the size of the project and the turbines themselves. Accurate preconstruction modeling with safe targets in mind is critical. The WHO says that 30dbA is ideal, and noise levels of above 40dbA have definite health consequences. At Mars Hill, where affected homes are present at 3500 feet, sound levels have been measured at over 52.5dbA. The fiasco there has been acknowledged by the local wind energy company, and by a former Maine governor.

Vermont would do well to learn from the affected people in Mars Hill. I have seen the preliminary plans for the planned Deerfield Wind Facility, and have particular concerns regarding the dwellings to the north and northeast of the northernmost extension of the turbine layout. These homes are well within a mile, generally downwind, and downhill from what I am told may well be 2 MW turbines (or larger?), in a snowy and icy part of the Northeast.

The parallels to Mars Hill are striking.

We know that preconstruction sound modeling failed at Mars Hill. No matter what the preconstruction modeling at Deerfield shows, the real world experiment at Mars Hill suggests that there will be problems for homes at the setbacks that seem to be planned for Deerfield on the attached image. The people who live within 3500 feet at Mars Hill are truly suffering. Learn from Mars Hill. It is not a matter of not having wind turbines. It is a matter of putting them where they will not affect people's health.

Newer technology to accurately measure sound at a quantum level improvement in temporal, frequency and amplitude resolution over commonly used acoustician's equipment now exists, though it is costly and not readily available. But it will be widespread, soon, well within the tenure of the individuals responsible for making siting decisions today.

Avail yourselves of these findings and familiarize yourselves with the new technologies. You will not only be future proofing your current decisions, you will also be helping people who would otherwise end up too close to industrial wind turbines escape the fate of the exposed residents of Mars Hill, and many other sites in North America (Mars Hill, Maine, merely represents the first small 'controlled' study).

I have seen the results of this cutting edge equipment, and how it has revealed drastic short duration excesses over allowed sound levels, levels that set homes vibrating and rendering them unlivable, but also levels of lower frequency transient noise at the audible level, that demonstrates not only failure of preconstruction sound modeling as currently practiced, but also the inadequacy of the measuring tools in the toolkit of the everyday practicing acoustician-consultant who generates reports for industry and local government.

10 05 07 Nissenbaum Montpelier Document
Download file (http://s3.amazonaws.com/windaction/attachments/1447/10-05-07_Nissenbaum_MONTPELIER_document.pdf) (179 KB) pdf

http://www.windaction.org/posts/26159-wind-turbines-health-ridgelines-and-valleys

National Wind Watch
February 2, 2008
Grid, U.K.

Windfarms cannot meet UK Government's renewable energy target

Courtney, Richard

Synopsis: This paper suggests the use of windfarms cannot make significant contribution to reducing the emissions and suggests the construction of tidal coffer dams instead. Windfarms for power generation provide intermittent power so they merely displace thermal power stations onto standby mode or to operate at reduced efficiency while the thermal power stations wait for the wind to change. They make no significant reduction to pollution because thermal power stations continue to use their fuel and to produce their emissions while operating in standby mode or with reduced efficiency that can increase their emissions at low output. And this need for continuously operating backup means that windfarms can only provide negligible useful electricity to electricity grid supply systems. But the large scale use of windfarms requires upgrading of an electricity grid, more complex grid management, and operation of additional thermal power stations to protect against power cuts in time of supply failure. These effects increase the cost of electricity supplied by the grid in addition to the capital, maintenance and operating costs of the windfarms themselves. And the windfarms cause significant environmental damage. Tidal coffer dams would not have these problems and could provide continuous and controllable power supply at similar cost to off-shore windfarms.

The 2006 Annual Prestigious Lecture to The North of England Institute of Mining and Mechanical Engineers and The Institute of Materials, Minerals and Mining (North East) held on Thursday 26th October 2006

"Suggestion for meeting the UK Government's renewable energy target because the adopted use of windfarms cannot meet it"

Download original document: "Windfarms cannot meet UK Government's renewable energy target" [1]

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Energy

Germany Runs Up Against the Limits of Renewables

Even as Germany adds lots of wind and solar power to the electric grid, the country's carbon emissions are rising. Will the rest of the world learn from its lesson?

by Richard Martin May 24, 2016

At one point this month renewable energy sources briefly supplied close to 90 percent of the power on Germany's electric grid. But that doesn't mean the world's fourth-largest economy is close to being run on zero-carbon electricity. In fact, Germany is giving the rest of the world a lesson in just how much can go wrong when you try to reduce carbon emissions solely by installing lots of wind and solar.

After years of declines, Germany's carbon emissions rose slightly in 2015, largely because the country produces much more electricity than it needs. That's happening because even if there are times when renewables can supply nearly all of the electricity on the grid, the variability of those sources forces Germany to keep other power plants running. And in Germany, which is phasing out its nuclear plants, those other plants primarily burn dirty coal.

Now the government is about to reboot its energy strategy, known as the *Energiewende*. It was launched in 2010 in hopes of dramatically

increasing the share of the country's electricity that comes from renewable energy and slashing the country's overall carbon emissions to 40 percent below 1990 levels by 2020 (see "The Great German Energy Experiment"). What happens next will be critical not only for Germany, but also for other countries trying to learn how to best bring more wind and solar online—especially if they want to do it without relying on nuclear power.

Germany has struggled to manage its surge in solar and wind capacity.

Some aspects of the *Energiewende* have been successful: renewable sources accounted for nearly one-third of the electricity consumed in Germany in 2015. The country is now the world's largest solar market. Germany's carbon emissions in 2014 were 27 percent lower than 1990 levels.

However, an expert commission appointed by the country's minister of economy and energy has said the 40 percent target probably won't be reached by 2020. And the energy revolution has caused problems of its own. Because fossil-fuel power plants cannot easily ramp down generation in response to excess supply on the grid, on sunny, windy days there is sometimes so much power in the system that the price goes negative—in other words, operators of large plants, most of which run on coal or natural gas, must pay commercial customers to consume electricity. That situation has also arisen recently in Texas and California (see "Texas and California Have Too Much Renewable Energy") when the generation of solar power has maxed out.

In hopes of addressing such issues, Germany's Parliament is expected to soon eliminate the government-set subsidy for renewable energy, known as a feed-in tariff, that has largely fueled the growth in wind and solar. Instead of subsidizing any electricity produced by solar or wind power, the government will set up an auction system. Power producers will bid to build renewable energy projects up to a capacity level set by the government, and the resulting prices paid for power from those plants will be set by the market, rather than government fiat.

The auction system is designed to reduce the rate of new renewable-energy additions and keep Germany from producing too much power. It might seem like an easy way to solve the oversupply issue would be to shut down excess power plants, especially ones that burn coal. But not only are the coal plants used to even out periods when wind and solar aren't available, they're also lucrative and thus politically hard to shut down. Because German law requires renewable energy to be used first on the German grid, when Germany exports excess electricity to its

European neighbors it primarily comes from coal plants. Last fall, the German subsidiary of the Swedish energy giant Vattenfall started up a 1,600-megwatt coal-fired plant that had been under construction for eight years, defying opposition from politicians, environmental organizations, and citizens who want to see coal plants eliminated.

Putting a steep price on carbon emissions would hasten the shutdown of German coal plants. But Europe's Emissions Trading Scheme, designed to establish a continentwide market for trading permits for carbon emissions, has been a bust. Prices for the permits are so low that there is little incentive for power producers to shut down dirty plants.

Also helpful would be a Europewide "supergrid" that would enable renewable power to be easily transported across borders, reducing the need for reliable, always-on fossil fuel plants to supplement intermittent electricity from solar and wind. "If you want to use fluctuating renewable power, you have to upgrade the grids across Europe," says Daniel Genz, a policy adviser with Vattenfall. Efforts to build that grid are under way, but they'll be expensive: between €100 billion and €400 billion ($112 billion to $448 billion), according to a November 2015 report from e-Highway2050, which was formed by the European Union to plan for a pan-European power grid.

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