

**SUMMARY OF RECENT RESEARCH ON
ADVERSE HEALTH EFFECTS OF WIND TURBINES**

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CONTENTS

ADDENDUM OF NEW UPDATES	4
1.0 INTRODUCTION	14
1.1. Background	14
1.2. Public Cost	15
1.3. Corporate Profits.....	15
1.4. Political Influence.....	15
1.5. Feasibility.....	15
2.0 THE SCOPE AND NATURE OF DISSENT WORLDWIDE	16
2.1. Economic Feasibility	17
2.2. Quotes From Electricity Generation Experts.....	18
2.3. Grass Roots Public Activism And Online Document Sources.....	18
3.0 THE HEALTH ISSUE	20
3.1. Available Research On Adverse Health Effects.....	20
3.2. Serious Warnings Already Issued By Credible Institutions	22
3.3. The National Institutes Of Health (NIH)	22
3.4. French National Academy Of Medicine	22
3.5. The Maine Medical Association	22
3.6. Minnesota Department of Health	23
3.7. Government of The State Of Victoria, Australia.....	23
4.0 A BRIEF SURVEY OF EVIDENCE BASED LITERATURE	23
4.1. England	25
4.2. United States	25
4.3. Dr. Michael Nissenbaum (USA)	26
4.4. Japan.....	26
4.5. Ontario.....	27
5.0 EFFECTS OF WIND TURBINES ON WILDLIFE, LIVESTOCK AND DOMESTIC ANIMALS	29
5.1. Heightened Sensitivities Of The Animal Kingdom	29

5.2.	Habitat Loss: European Studies	30
5.3.	Livestock.....	31
5.4.	Goats	31
6.0	EVALUATING WIND TURBINE NOISE	31
6.1.	WHO Guidelines	34
7.0	LOW FREQUENCY NOISE AS A WEAPON	35
8.0	FLAWED PUBLIC CONSULTATION PROCESS IN ONTARIO	35
8.1.	In Review.....	36
9.0	MITIGATION	38
10.0	CONCLUSION.....	38

Addendum OF NEW UPDATES

As more information emerges internationally and knowledge is accumulating, it has been thought useful to update and clarify this report by adding the following files:

SCIENTIFIC CREDIBILITY OF WIND TURBINE INDUSTRY “EXPERT” PANEL REVIEW CHALLENGED BY SOCIETY FOR WIND VIGILANCE

The Society for Wind Vigilance has now released its considered analysis of the American and Canadian Wind Energy Association “Expert Panel Review 2009”, produced and sponsored by the industry-created and industry-supported American and Canadian Wind Industry Associations. The industry report concluded that “ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans” and that “there is no reason to believe, based on the levels and frequencies of the sounds and the panel’s experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences” and that no further research is needed.

But the Society for Wind Vigilance disagrees. Medical doctors from Canada, the United States and Great Britain associated with the society-- all with experience of patients suffering from the adverse health effects of wind turbines-- have concluded:

“It is apparent from this analysis that the A/CanWEA Panel Review is neither authoritative nor convincing. The work is characterized by commission of unsupportable statements and the confirmation bias in the use of references. Many important references have been omitted and not considered in the discussion. Furthermore the authors have taken the position that the World Health Organization standards regarding community noise are irrelevant to their deliberation - a remarkable presumption.

“There is no medical doubt that audible noise such as emitted by modern upwind industrial wind turbines sited close to human residences causes significant adverse health effects. These effects are mediated through sleep disturbance, physiological stress and psychological distress. This is settled medical science.

“There are many peer-reviewed studies showing that infra and low frequency sound can cause adverse health effects, especially when dynamically modulated.

“Perhaps the most egregious conclusion is that no more research is required. That statement implies that the science is settled which quite simply is false. It also demonstrates a disdain for the scientific method itself. There is but one conclusion: independent third party studies must be undertaken to establish the incidence and prevalence of adverse health effects relating to wind turbines. Beyond that a deeper understanding of the potential mechanisms for the impacts must be elucidated in order to define

the mechanisms by which the sleep disturbance, stress and psychological distress occur. In contrast to the statement of the A/CanWEA Panel Review, our view is that *a great deal of research is required for the protection of people's health.*"

The Society's press release points out that, in fact, the A/CanWEA Panel Review actually "acknowledges that people are experiencing adverse physiological and psychological symptoms from exposure to industrial wind turbines. It also acknowledges that wind turbine noise, including low frequency noise may cause annoyance, stress and sleep disturbance". The press release continues:

"One of the authors of the A/CanWEA Panel Review, W. David Colby M.D. reinforced this position by stating during a recent radio interview: 'We're not denying that there are people annoyed and that maybe some of them are getting stressed out enough about being annoyed that they're getting sick.' Another author of the Panel Review, Geoff Leventhall PhD (UK) has previously acknowledged the serious nature of low frequency noise-induced annoyance by asserting, 'The claim that their "lives have been ruined" by the noise is not an exaggeration...'. (Low frequency noise and annoyance, *Noise Health* 2004)".

"Dr. Arlene King, Chief Medical Officer of Health of Ontario and Dr. Ray Copes, Ontario Agency for Health Protection and Promotion concur that wind turbines may cause annoyance, stress and sleep disturbance.

"Globally an increasing number of victims are reporting adverse health effects from exposure to industrial wind projects. Many families have abandoned their homes to protect their health. This cannot be denied. Yet **no clinical research of victims was carried out for the A/CanWEA Panel Review.** To prevent these adverse health effects, authoritative science-based guidelines based on third party independent health studies must be developed".

Dr. Michael Nissenbaum of the Northern Maine Medical Center is one of the specialists now associated with The Society for Wind Vigilance. He states: "An objective, medical science based clearinghouse for the archiving, presentation, and analysis of health related investigations pertaining to Industrial Wind Turbines is both timely and sorely needed. These are enormous industrial machines that produce a noise qualitatively unlike anything else in our environment".

The complete analysis by The Society for Wind Vigilance is available at: www.windvigilance.com

U.K. NATIONAL HEALTH SERVICE QUESTIONS VALIDITY OF INDUSTRY REPORT

On its web site, "*NHS Choices*" **the U.K. National Health Service has contradicted the conclusion of the A/CanWEA Panel Review:** "This research is unlikely to resolve the controversy over the potential health effects from wind turbines. This is mainly because the research on which the review was based is not sufficient to prove or disprove that there are health effects. The review itself also had some

methodological shortcomings, and the reviewing group did not include an epidemiologist, usually a given for assessing potential environmental health hazards”.

“Further research on this issue is needed. Ideally this would involve comparing people exposed to wind turbine noise with well-matched control subjects who have not had that exposure. These studies should also carefully evaluate the psychological harms of noise exposure”.

<http://www.nhs.uk/news/2010/01January/Pages/Wind-turbine-sound-and-health.aspx>

AUSTRALIA:

NEW SOUTH WALES LEGISLATIVE COMMITTEE RECOMMENDS 2 KILOMETRE MINIMUM SETBACKS FOR WIND TURBINES

Exerpts from the Report of the General Purpose Standing Committee of the Legislative Council of New South Wales, Australia, 16 December 2009.

Committee comment:

5.104 The Committee notes the stress placed on residents as a result of having wind turbines planned for construction within 600-800 meters from their houses. The Committee believes that locating a wind turbine within such distances of houses in rural areas, with limited community consultation and compensation is unreasonable.

5.105 The Committee notes with concern that it is likely that the adverse impacts experienced by some local residents as a result of the stress and anxiety associated with the planning process and the prospect of living in such close proximity to wind turbines, will eventually be replaced by impacts related to the actual construction and operation of the wind farm.

5.106 The Committee believes that the decision to approve wind farms with turbines so close to houses does not demonstrate a well considered approach by the Department of Planning. The absence of NSW guidelines that address many of the issues identified through this Inquiry, including the issue of setback distances, means that such outcomes may continue to occur.

5.107 The Committee accepts that wind farms will impact upon local communities. However, NSW communities should have a clear understanding of what level of impact can be expected. The current lack of guidelines and consistency of wind farm development in NSW results in undue stress on local communities.

5.108 The Committee acknowledges that a prescriptive setback distance will not address all the issues faced by residents who live next door to a wind farm. However, communities that may host wind farms are entitled to clear guidance on how close turbines may be from neighbouring residences. The Committee recommends a two kilometre minimum setback between wind turbines and neighbouring houses as a precautionary approach, in addition to the development and implementation of the *NSW Planning and Assessment Guidelines for Wind Farms*, to ensure that wind farms are located

appropriately. The minimum setback of two kilometres should be able to be waived with the consent of the affected neighbouring property owner.

5.109 The Committee further notes that if it is essential for a wind turbine to be placed in a location that will adversely impact neighbouring residents, the issue of compensation should be considered. The issue of compensation is examined in the last section in this Chapter.

5.110 With the creation of NSW Guidelines for wind farm developments, the decision regarding where to place wind turbines may better balance the needs of all stakeholders. It seems that the current planning process does not balance the need to develop areas of good wind resources with the needs of the local residents. It is hoped that guidelines will improve the representation of stakeholders such as neighbouring residents.

Recommendation 7

That the Minister for Planning include a minimum setback distance of two kilometres between wind turbines and residences on neighbouring properties in the *NSW Planning and Assessment Guidelines for Wind Farms*. The guidelines should also identify that the minimum setback of two kilometres can be waived with the consent of the affected neighbouring property owner”.

Compensation:

The Committee also acknowledged the need for compensation. “The Committee notes the precedents that have been set and agrees that there are some circumstances in which it would be appropriate for some form of compensation to be provided to residents who are adversely impacted by wind farms. However, the Committee has not received enough evidence to be able to conclude exactly what type of compensation is appropriate and to whom it should be provided. Research should be conducted into compensation options that are appropriate for residents who are adversely impacted by wind turbines. The research should investigate options such as the purchasing of affected properties and the provision of monetary compensation. The report should include recommendations to be implemented by the NSW Government.”

The full report is available at:

<http://www.parliament.nsw.gov.au/Prod/parlament/committee.nsf/0/EA247659081D31FDCA25768E001A2E2A>

JAPAN:

HEALTH COMPLAINTS INCREASE AS MORE WIND TURBINES ARE INSTALLED

According to the findings of a survey carried out by the Tokyo newspaper, *Asahi Shimbun* (19 January, 2010), the number of people complaining about health problems has risen as more wind turbines have been installed.

“An Asahi Shimbun survey, meanwhile, has found that residents have filed complaints to the state, local governments or operators over turbines at 30 locations (31 municipalities) in 18 prefectures.

When opposition to proposed construction is included, the number of locations comes to 72 (73 municipalities) in 24 prefectures.

At the 30 locations where complaints have been filed, 90 percent concerned health problems. Residents say they suffer from insomnia, headaches, dizziness or buzzing in the ear.

At the 42 sites where turbine construction faces opposition, health and environmental concerns are most often cited. At 12 of those sites, plans have been dropped or frozen due to a lack of cooperation from residents.

In Nagano Prefecture, plans were afoot to build 49 wind turbines at Mount Nekodake, in Suzaka city, and in a Southern Alps area in Ina city. But opposition from nature conservation groups and others, along with Nagano Governor Jin Murai's call for "caution" last February, has sent the plans back to the drawing board. In Kawauchi village in Fukushima Prefecture, Minamata city in Kumamoto Prefecture and Ojika town in Nagasaki Prefecture, the mayors, along with assembly members, have expressed their opposition to the plans". <http://www.asahi.com/english/TKY201001180410.html>

JAPANESE MINISTRY OF THE ENVIRONMENT UNDERTAKES HEALTH SURVEY

"In response to growing health complaints from the public, the Japanese Ministry of the Environment has launched a four year study of the health effects of wind turbines on nearby residents.

"The Environment Ministry will conduct its first field survey of possible health hazards of wind turbines, covering all of more than 1,500 units in operation across the country.

"The four-year study, to start in April, was planned following complaints from neighborhood residents about noise and environmental problems as well as health issues. The ministry's field survey will measure low-frequency sounds from turbine operations and interview residents face to face, according to officials. If residents complain of health problems, their symptoms will be examined. Measuring equipment will be placed in their homes to find out the relationship between the turbines and health problems. The distance between the turbines and homes as well as geographical features of the area will also be examined. The ministry's Office of Odor, Noise and Vibration says finding out the effects of low-frequency noise on the human body is "a pressing issue".

("Sickness claims prompt study of wind turbines" by Aya Ito and Tsuyoshi Takeda, *The Asahi Shimbun*, www.asahi.com 19 January 2010). <http://www.asahi.com/english/TKY201001180410.html>

UNITED KINGDOM:

U.K. CIVIL SERVANTS SUPPRESSED CONSULTANTS' WARNINGS THAT WIND TURBINES CAN GENERATE NOISE DAMAGING PEOPLE'S HEALTH FOR SEVERAL SQUARE MILES AROUND

An article in the *Sunday Times* of London indicates that “it has now emerged that officials removed the warnings from the draft report in 2006 by Hayes McKenzie Partnership (HMP), the consultants. The final version made no mention of them”.

“The guidance from consultants indicated that the sound level permitted from spinning blades and gearboxes had been set so high — 43 decibels — that local people could be disturbed whenever the wind blew hard. The noise was also thought likely to disrupt sleep.

“The report said the best way to protect locals was to cut the maximum permitted noise to 38 decibels, or 33 decibels if the machines created discernible “beating” noises as they spun.

“It means that hundreds of turbines at wind farms in Britain have been allowed to generate much higher levels of noise, sparking protests from people living near them. --“Officials cover up wind farm noise report” by Jonathan Leake and Harry Byford. *The Sunday Times*, 13 December, 2009.

<http://www.timesonline.co.uk/tol/news/environment/article6954565.ece>

GERMANY:

Economic impacts from the promotion of renewable energies:

The German experience.

Final report published by the Rheinisch-Westfälisches Institut für Wirtschaft sforschung (Rhine-Westphalia Institute for Economic Research) October 2009.

Project team: Dr. Manuel Frondel, Nolan Ritter, Prof. Colin Vance, Ph.D., Fabian Scheffer and Prof. Christoph Schmidt.

http://www.instituteforenergyresearch.org/germany/Germany_Study_-_FINAL.pdf

A newly published German report from one of the leading economic research institutions in Germany, the Rhine-Westphalia Institute for Economic Research has analyzed the German experience with renewable energy technology promotion. (It is a non-profit, independent and non-commercial organization based in Essen). The report concludes that “although Germany’s promotion of renewable energy is commonly portrayed in the media as setting ‘a shining example’, we would instead regard the country’s experience as a cautionary tale of massively expensive environmental and energy policy that is devoid of economic and environmental benefits”.

The Institute combines the expertise of researchers from all four participating institutions: Ruhr University Bochum, University of Dortmund and University of Duisburg-Essen as well as the newly established Ruhr Graduate School of Economics.

Moreover the committee of respected university professors and economists who wrote the report warns that policy makers in other governments in Europe and the U.S. “should scrutinize the logic of supporting energy sources that cannot compete on the market in the absence of government assistance. History clearly shows that governments have an abysmal record of selecting economically productive projects through such programs”.

It points out that photovoltaics (solar panels) and wind turbines are “among the most expensive greenhouse gas reduction measures” and that there are “much cheaper ways to reduce carbon dioxide emissions than subsidizing renewable energy”.

Using current data and a wide range of recently published studies, the report also demonstrates that “while employment projections in the renewable sector convey seemingly impressive prospects for gross job growth, they typically obscure the broader implications for economic welfare by omitting any accounting of off-setting impacts. These impacts include, but are not limited to, job losses from crowding out of cheaper forms of conventional energy generation, indirect impacts on upstream industries, additional job losses from the drain on economic activity precipitated by higher electricity prices, private consumers’ overall loss of purchasing power due to higher electricity prices, and diverting funds from other, possibly more beneficial investment”.

Analysis of the German operational data between 2000 and 2010 shows that “on-shore wind, requires feed-in tariffs that exceed the per-kWh cost of conventional electricity by up to 300% to remain competitive”. The report estimates that subsidies for wind converters installed between 2000 and 2010 may total \$28.1 billion (U.S.). The report emphasizes that, “consumers ultimately bear the cost of renewable energy promotion”. In Germany this has meant hefty increases in electricity bills. The “price mark-up due to the subsidization of green electricity was about 2.2 (U.S.) per kWh, meaning the subsidy accounts for about 7.5% of average household electricity prices”. It also finds that renewable energy is among the most expensive green house gas reduction measures.

The hope of increased energy security by reliance on wind and solar energy has not materialized. “Due to their backup energy requirements, it turns out that any increased energy security possibly afforded by installing large PV [solar] and wind capacity is undermined by reliance on fuel sources – principally gas – that must be imported to meet domestic demand”. (The cost of gas back-up is usually omitted from estimates of the cost of wind energy).

However, the report is highly skeptical of the ability of “green” energy to create jobs and revive the economy. It points out that “it is most likely that whatever jobs are created by renewable energy promotion would vanish as soon as government support is terminated”. The report cites evidence to show that “while . . . projections convey seemingly impressive prospects for gross employment growth, they obscure the broader implications for economic welfare by omitting any accounting of off-setting impacts. The most immediate of these impacts are job losses that result from the crowding out of cheaper forms of conventional energy generation, along with indirect impacts on upstream industries. Additional job losses will arise from the drain on economic activity precipitated by higher electricity

prices.” Two important aspects must be taken into account: “First, the private consumers’ overall loss of purchasing power due to higher electricity prices adds up to billions of Euros. Second, with the exception of the preferentially treated energy-intensive firms, the total investments of industrial energy consumers may be substantially lower. Hence, by constraining the budgets of private and industrial consumers, increased prices ultimately divert funds from alternative, possibly more beneficial, investments. The resulting loss in purchasing power and investment capital causes negative employment effects in other sectors (BMU 2006:3), casting doubt on whether the EEG’s (Renewable Energy Sources Act) employment effects are positive at all”.

Several recent investigations of the German experience support such skepticism. They “find an initially expansive effect on net employment from renewable energy promotion resulting from additional investments. By 2010, however, this gives way to a contractive effect as the production costs of power increase”.

Even more disturbing for governments such as Ontario which are now beginning to subsidize the manufacture of solar and wind components is the need for a robust foreign trade of renewable energy technologies.

“Whether favourable conditions on the international market prevail for PV [photovoltaic or solar], for example, is highly questionable, particularly given negligible or even negative net exports in recent years A recent article in the *German Financial Times* reports that the situation remains dire, with the German solar industry facing unprecedented competition from cheaper Asian imports (FTD 2009). Hence, any result other than a negative net employment balance of the German PV promotion would be surprising. In contrast, we would expect massive employment effects in export countries such as China, since these countries do not suffer from the EEG’s crowding-out effects, nor from negative income effects. In the end, Germany’s PV promotion has become a subsidization regime that, on a per-worker basis, has reached a level that by far exceeds average wages: Given our net cost estimate of about 8.4 Bn € (US \$ 11.5 Bn) for 2008 reported in Table 4, per-worker subsidies are as high as 175,000 € (US \$ 240,000), if indeed 48,000 people were employed in the PV sector (see BSW 2009).

Finally, the report claims, wind turbines and solar panels have produced no environmental benefit in Germany in terms of lowering of CO₂ emissions that would not have been produced by other plans already in effect.

It also questions the rationale of legislation that subsidizes production of technology that is only “theoretically promising”. “In the early stages of development of non-competitive technologies, for example, it appears to be more cost-effective to invest in R&D (research and development) to achieve competitiveness, rather than to promote their large-scale production”.

In its country’s report on Germany’s energy policy, the International Energy Agency (IEA) specifically recommends considering “policies other than the very high feed-in tariffs to promote solar photovoltaics” (IEA, 2007:77). This recommendation is based on the grounds that “the government should always keep

cost-effectiveness as a critical component when deciding between policies and measures” (IEA, 2007:76). Consequently, the IEA proposes policy instruments favouring research and development.

“Lesser and Su (2008:986) concur with this viewpoint: ‘Technologies that are theoretically promising, but unlikely to be competitive for many years, may be best addressed under other policies, such as publicly funded R&D’. This reasoning is particularly relevant for solar cells, whose technological efficiency is widely known to be modest and, hence, should be first increased substantially via R&D”.

“Instead of a policy instrument that aims at pushing technological improvements, however, Germany’s support scheme of renewable energy technologies resembles traditional active labour market programs, which have been demonstrated in the literature to be counterproductive (Kluge, 2006:13). It bears particular noting that the long shadows of this economic support will last for another two decades even if the EEG were to be abolished immediately”.

The Government of Ontario would ignore the advice of experience at its peril.¹

¹ **About the Rhine-Westphalia Institute for Economic Research:**

The **RWI Essen**, full German name *Rheinisch-Westfälisches Institut für Wirtschaftsforschung e.V.*, is one of the leading economic research institutions in Germany. It is a non-profit, independent and non-commercial establishment based in Essen. RWI is a member of the *Leibniz Association*, an association of 83 scientifically, legally and economically independent research institutes and service establishments for research in Germany. Twice a year (in spring and autumn), it submits a joint report on the state of the German economy, the so-called *Gemeinschaftsdiagnose* (joint diagnosis).

It explicitly combines the expertise of researchers from all four participating institutions: Ruhr University Bochum, University of Dortmund and University of Duisburg-Essen, and the newly founded Ruhr Graduate School of Economics. Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Hohenzollernstraße 1/3, 45128 Essen, Germany. Phone +49 201/81 49-0, Fax +49 201/81 49-200, e-mail: rwi@rwi-essen.de

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FRENCH COURT OF APPEAL ORDERS WIND TURBINES TO BE SHUT DOWN OVERNIGHT

In France a decision issued by the Court of Appeal of Rennes on 1 December 2010 ordered eight wind turbines installed in Cast and Châteaulin to be halted from 10:00 p.m. to 7:00 a.m.

This represents a victory for the members of the Association for the Protection of Ménez, Quelec'h and Saint-Gildas, who had filed a legal action in January 2008 against the disturbance caused by these wind turbines.

The builder, Nordex, had appealed this decision, and carried out considerable operations in the meantime. However, Nordex did not provide any justification or acoustic measurement to prove that these disturbances have been significantly reduced.

1.0 INTRODUCTION

Authorities and politicians in Ontario have been repeatedly warned that industrial wind turbines are having an adverse effect on the health of those living nearby.

Health complaints are not peculiar to this province but are consistent throughout the world wherever large industrial wind turbines have been installed.

Contrary to the claims of the industry, there is a growing body of peer-reviewed research substantiating these health claims. This report attempts to catalogue the most recent.

A generally acknowledged major concern about wind turbine disturbance centres around the noise, including that of low frequency noise (infrasound) projected from this heavy industrial machinery.

There is already ample scientific evidence that noise, including low frequency noise, is a cause of sleep disturbance in humans. The evidence also suggests that long term exposure normally leads to serious health problems.

Reinforcing this body of knowledge is the research that has been conducted on animals. Long term studies by European biologists indicate that habitat disturbance and abandonment takes place around wind turbine developments. Further research on animals indicates that basic survival functions such as hunting, self protection and reproduction are interrupted by low frequency noise exposure.

The only effective mitigation is to adequately separate wind turbine developments from sensitive wildlife habitats and human dwellings.

It should be no great surprise to policy makers that failure to do so exposes the rural population to a serious health threat. The only mystery is why public health authorities, Members of Provincial Parliament and the wind industry have not yet accepted their responsibility to exercise due diligence in protecting human health and already done this.

This report is intended to bring together the most recently published literature so that decision makers can now go forward and act *preventatively* before any further human suffering needlessly occurs.

1.1. Background

It is often claimed that there are health benefits in developing industrial wind energy contained in its ability to curtail excessive CO2 emissions, eliminate unacceptable pollution from coal fired

electricity generating plants,² provide inexpensive, renewable electricity and avert the crisis of global warming.

Indeed, such arguments have been used by the Ontario Ministries of Energy and Infrastructure, Environment, and Natural Resources as well as the commercial wind industry in an attempt to counter public health concerns. However, even a superficial investigation of the reality of commercial wind power soon challenges the acceptability of such assertions.

1.2. Public Cost

International experience to date has demonstrated that industrial wind power is unviable without heavy government subsidies and inflated feed-in tariffs. In addition it relies on massive taxpayer funding for the necessary back-up support which has to be added to existing infrastructure. \$5 billion is estimated as the cost of new transmission lines needed to facilitate wind power in Ontario and \$1.2 billion for each additional back-up gas plant.

1.3. Corporate Profits

The beneficiaries of this public largess are the wind developers which, in Ontario, include large multinational oil and gas producers (Suncor, Trans-Alta and Enbridge). Developments are also being proposed by foreign energy corporations including Florida Power and Light. Equipment suppliers are also foreign multinationals: (Siemens, General Electric and Vesta).

1.4. Political Influence

Wind turbine developers have long exerted considerable influence over government decision making through well funded lobbying of politicians. The wind energy industry enjoys close ties with the Liberal Party.

1.5. Feasibility

In every country where wind turbines have been installed, they have failed to demonstrate economic feasibility, viability as a solution to global warming, significant CO2 reduction, efficient electricity production or protection of the environment.

In countries where industrial wind power has been added to the grid in any volume, consumer electricity costs have skyrocketed. The two countries with the highest number of installed commercial wind turbines, Germany and Denmark, now have the highest electricity rates in Europe. In Ontario, one MPP has estimated the needed additional transmission lines will add 30% to every electricity bill. Ontarians, however, are already paying more than double the market price

² The Ontario Medical Association *Level Ozone Position Paper* states: 'More than 96% of the coal fired stations are located in the United States.' It raises the question whether Ontario coal fire plants are the issue.

for electricity produced by wind turbines even when it is not required and electricity rates will be even higher still once additional gas plants are built.

But most alarmingly, health issues have already arisen for many rural Ontario residents living near wind power installations.

2.0 THE SCOPE AND NATURE OF DISSENT WORLDWIDE

An increasingly well-informed public has questioned their governments' policies in promoting the rapid installation of wind turbines in the United States, Great Britain, Europe, Australia, New Zealand, and most recently Japan.

A number of professional reports, based on actual operating experience, have challenged the *raison d'être* of the wind turbine enterprise.

- As early as 2005, the German electricity supplier *E-ON Netz Report* warned: "Wind energy is only able to replace traditional power stations to a limited extent. Their dependence on the prevailing wind conditions means that wind power has a limited load factor even when technically available. It is not possible to guarantee its use for the continual cover of electricity consumption. *Consequently, traditional power stations with capacities equal to 90% of the installed wind power capacity must be permanently online in order to guarantee power supply at all times*".
- The *Tallinn Report* from the Tallinn Technical University of Estonia challenged the CO2 reductions that were claimed by the industry:

"Participation of thermal power plants in the compensation of fluctuating production of windmills eliminates the major part of the expected positive effect of wind energy. . . . In some cases the environmental gain from the wind energy use was lost almost totally. . . . *It seems reasonable to ask why wind-power is the beneficiary of such extensive support if it not only fails to achieve the CO2 reductions required, but also causes cost increases in backup, maintenance and transmission, while at the same time discouraging investment in clean, firm generation capacity.*"³
- *Der Spiegel* reported in 2008 that despite all the wind turbines in Germany (more than 20,000) "German CO2 emissions haven't been reduced by even a single gram" and even

³ A technical paper presented by the Tallinn Technical University of Estonia at the International Energy Workshop at Laxenburg, Austria in 2003. *Estimation of real emissions reduction caused by wind generators*. O. Liik, R. Oidram, M. Keel Tallinn Technical University, 5 Ehitajate tee, Tallinn 19086, Estonia.

the Green Party has recognized the problem.⁴ Additional coal burning facilities have been built in Germany to support wind power.

- In the United Kingdom the introduction of destabilizing wind energy to the grid has meant extensive resort to gas burning facilities and greatly increased consumption of gas so that its price in the UK has risen dramatically over the last few years.⁵
- Energy Minister Smitherman has indicated that the construction of new gas plants in Ontario will be necessary to back up renewable energy.⁶ But particulate waste from new gas plants will make a new and substantial contribution to smog pollution in Ontario. Running these plants on stand-by mode will decrease their efficiency and increase CO₂ emissions.⁷

2.1. Economic Feasibility

The economic feasibility of industrial wind power has been questioned on a wide scale.

In Denmark electricity costs are now the highest in Europe. The Danish experience suggests wind energy is expensive, inefficient and most importantly not even particularly green. Jytte Kaad Jensen, chief economist for ELTRA, Denmark's biggest electricity distributor laments: "In just a few years we've gone from some of the cheapest electricity in Europe to some of the most costly." And *the Danish Member of Parliament, Aase Madsen who chaired energy policy admits: "For our industry it has been a terribly expensive disaster"*.

Contrary to North American wind industry spin, the Danish people have not accepted wind energy enthusiastically. Danish wind developers are now obligated under law to compensate nearby property owners for loss of real estate value. And now the Danish people have been so adamant in their objections to any further onshore wind developments that the government is going to restrict it to off-shore projects.

In Spain, a recently published economic study from Juan Carlos University has laid the blame for Spain's worsening economic crisis (reported to be in serious depression) at the doorstep of the government for its policy of subsidizing the wind industry. It points out that as a result of the

⁴ Anselm Waldermann. "Wind Turbines in Europe Do Nothing for Emissions-Reduction Goals". *Der Spiegel*. Feb 11 2009. <http://www.spiegel.de/international/business/0,1518,606763,00.html> ca

⁵ *The Wall Street Journal* explained in September 2008 that in order to cover the inconsistencies of the wind power now on the German grid, "Germany's gas consumption for power generation more than doubled between 1990 and 2007." Edgar Gartner. "Wind Fuels Gas". *Wall Street Journal*, 11 September 2008. In the U.K., the newly installed wind technology is also backed up by gas. Figures released in November by the OECD indicate that "in the past year alone, prices for electricity and natural gas in the U.K. have risen twice as fast as the European Union average".

⁶ Minister Smitherman's remark was made on the Focus Ontario television show.

⁷ "Thermal power stations constantly have to keep additional spinning [standby] reserve capacity equal to the maximum total power of windmills (e.g. for the case when too high wind speed stops full power operating windmills). This makes the thermal plants run inefficiently and increases fuel consumption (emissions)". (Tallinn Report. *Op. cit.*)

unparalleled rise in electricity prices that resulted from the introduction of wind energy onto the grid, most intensive energy consuming manufacturers have left the country.

2.2. Quotes From Electricity Generation Experts

“Electricity differs from other forms of energy, and cannot be stored directly on an industrial scale. Any calculation of the CO2 emissions reduction from wind must take into account the quantity of conventional generating capacity that has to be in the grid. . . In fact, analysis of data from the UK, Denmark, Ireland, Germany and the USA shows that a substantial part of the theoretical CO2 saving does not accrue in practice. In some circumstances there may be only minimal benefit. The evidence shows that as the level of wind capacity increases, the CO2 emissions actually increase as a direct result of having to cope with the variation of wind-power output.”

-- U.K. energy expert, David White: *Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution from Wind Power, published in December 2004 by the Renewable Energy Foundation in the U.K.*

“It has been estimated that the entire benefit of reduced emissions from the renewables programme has been negated by the increased emissions from part loaded plant.”

-- From a paper given at the British Institution of Mechanical Engineers, by David Tolley.

“The tax breaks and subsidies for the wind industry are at the expense of ordinary taxpayers and electricity customers whose interests are not well represented in government circles. The practical effects of the tax breaks and subsidies are to:

- “Misdirect hundreds of millions of investment dollars into energy projects that produce only small amounts of low value, low quality electricity.
- “Transfer substantial wealth from ordinary taxpayers and electricity customers to “wind farm” owners by shifting tax burden from “wind farm” owners to ordinary tax payers, and passing along the high priced electricity from “wind farms” to electricity customers.”

--From: *“Big Money” Discovers the Huge Tax Breaks and Subsidies for “Wind Energy” While Taxpayers and Electric Customers Pick up the Tab.* 2004, by Glenn R Schleede (a graduate of Harvard Business School’s Advanced Management Program. and former Vice President of New England Electric System (NEES) former Associate Director (Energy and Science) of the White House Domestic Council).

2.3. Grass Roots Public Activism And Online Document Sources

The last two years has seen phenomenal growth in public dissent on the basis of all these objections as well as adverse health effects. Wherever industrial wind turbines have been introduced, citizens' groups have been formed to fight them.

"I have not seen anything like this before," says Chris Forrest, vice president of communications and marketing at the Canadian Wind Energy Association (CanWEA). "Groups are coordinating fully orchestrated media campaigns with a ferocity and an intensity that has really taken us by surprise," he says.

Local groups all over the world have formed coalitions with others to create national and international organizations.

2.3.1 **The European Platform Against Windfarms (EPAW)** <http://www.epaw.org/> now has 364 signatory organizations in 19 different European countries. Recently the second annual march on the Elysée Palace took place in Paris, and public protests are on the increase throughout Europe. Health issues and economic concerns are among the most important objections raised by these groups. They insist:

- that hundreds of associations, local initiatives and other groups are totally dissatisfied with wind farms;
- that intermittent, uncontrollable energy does not solve any of humanity's problems, even in part;
- that the only thing wind turbines do is cause considerable harm to people, the economy, national budgets and the environment.

2.3.2 **Country Guardian** is a UK-wide conservation group which has warned about wind turbines for nearly 20 years, since the first UK wind developments appeared in the Lake District. Initially it campaigned mainly about landscape damage, but it soon became clear that a) the technology of wind turbines was seriously flawed and b) the environmental damage extended far beyond the landscape. The group provides one of the most useful web sites for research and documentation: www.countryguardian.net

2.3.3 In the United States, there are three major coalitions, each maintaining highly respected sources of information through their web sites:

- **Industrial Wind Action Group** <http://www.windaction.org/>;
- **National Wind Watch** <http://www.wind-watch.org/>
- **Industrial Wind Energy Opposition** <http://www.aweo.org/>

2.3.4 In Ontario, **Wind Concerns Ontario** has grown at an impressive rate over the last year, largely out of a feeling of injustice and loss of local democratic input on planning decisions legislated by the Green Energy Act and outrage at government indifference to those suffering adverse health effects from the turbines. It is now comprised of **41 citizens' groups and extends to 27 counties and districts throughout Ontario.** The web site is an invaluable source of information on the Ontario situation. <http://windconcernsontario.wordpress.com/>

Familiarity with these sites is essential to understanding the depth and extent of opposition to industrial wind development and the degree of concern over health issues.

It should however, be added that while North Americans seem to consider the aesthetic appearance in the landscape of wind turbine developments as a matter of individual judgment, older European societies still value the importance of beauty, architecture, and unspoiled nature as their cultural heritage—part of the value of a viable tourism resource.⁸ The World Health Organization 2004 Fourth Ministerial Conference on Environment and Health, Sustainable Development states: “Wind energy can, however, have some potential burdens on amenity through **visual intrusion or/and noise.**”⁹

3.0 THE HEALTH ISSUE

3.1. Available Research On Adverse Health Effects

The Minister of Energy was first warned of the emerging health problem as early as August 2, 2008 and legislators in Ontario were further informed on April 22, 2009 by one of the province's most prominent physicians. Dr Robert McMurtry, M.D., F.R.C.S (C), F.A.C.S, is a former Dean of Medicine at the University of Western Ontario and in 1999, he became the first Cameron Visiting Chair at Health Canada - a post carrying the responsibility for providing policy advice to the Deputy Minister and Minister of Health for Canada. In December 2003, he was appointed to the Health Council of Canada and is Chair of the Wait Times and Accessibility Work Group. Dr. McMurtry is the founding Assistant Deputy Minister of the Population and Public Health Branch of Health Canada. He was appointed to Roy Romanow's Commission on the Future of Health Care in Canada in 2002 as a Special Advisor to Commissioner Romanow.

In his Deputation to the Standing Committee on General Government Regarding Bill C-150 presented at the Ontario Legislature, Dr. McMurtry stated:

⁸ One of the public protests currently underway in France is to save Mont Ste. Michel from an adjacent wind turbine development. There, artists are looked to for aesthetic judgments based on their training and experience. Artists from around the world opposed to defacing the rural landscape with wind turbines have contributed to a web site based in England: <http://www.artistsagainstwindfarms.blogspot.com/>; <http://www.artistsagainstwindfarms.com/pinboard.html>.

⁹ **World Health Organization 2004 Fourth Ministerial Conference on Environment and Health, Sustainable Development**, p. 12.

“There have been many reports of adverse health events. At the outset it must be made clear that there has not been any systematic epidemiological field study that could yield authoritative guidelines for the siting of wind turbines. Secondly no epidemiological study has been conducted that establishes either the safety or harmfulness of Industrial Wind Turbines. In short there is an absence of evidence. Accordingly until more authoritative information is available it is important to consider the growing number of reports of cases and case series of adverse health effects that are emerging.”

The McMurtry report has disclosed that the number of people in Ontario reporting adverse health affects due to industrial wind turbines continues to rise. The new total as of September 13, 2009 is now 98 which is a disturbing 85% increase from 53 as reported earlier this year. Some families have been driven from their homes. See www.windconcernsontario.org

It has to be emphasized that as with all public health issues, precautionary regulation are preferable to allowing an avoidable health risk to spread. In the words of Dr. McMurtry, “*When uncertainty exists and the health and well-being of people are potentially at risk, assuredly it is appropriate to invoke the precautionary principle.*”

It also has to be underlined that there is no credible research to back up industry claims that wind turbines *do not* threaten human health.

The wind industry often states that “there is no peer-reviewed scientific evidence indicating wind turbines have an adverse impact on human health”. (This statement is taken directly from actual applications for approval to build industrial wind turbines).

Health Canada disagrees. In a letter dated August 6, 2009 from Health Canada Safe Environments Program (Halifax), Allison Denning, Regional Environmental Assessment Coordinator Health Canada, Atlantic Region pointed out:

“Health Canada advises that this statement be revised to indicate that there are peer reviewed scientific articles indicating that wind turbines may have an adverse impact on human health. In fact, there are peer reviewed scientific articles indicating that wind turbines may have an adverse impact on human health.”

For example, Keith *et. al.* (2008), identified annoyance as an adverse impact on human health that can be related to high levels of wind turbine noise. In addition, there are several articles by Pedersen (and others) related to wind turbine annoyance (as referenced below). The relationship between noise annoyance and adverse effects on human health is also further investigated in the manuscript by Michaud *et. al* (2008)¹⁰.

¹⁰ References listed by Health Canada include:

Keith, S. E., D. S. Michaud, and S. H. P. Bly. 2008. A proposal for evaluating the potential health effects of wind turbine noise for projects under the Canadian Environmental Assessment Act. *Journal of Low Frequency Noise, Vibration and Active Control*, 27 (4):253-265.

Like the wind industry today, the tobacco industry denied for many years that there were any adverse health effects from their products. Corporate denial of a health problem is generally a delaying tactic not in the best interest of the public.

3.2. Serious Warnings Already Issued By Credible Institutions

A number of cautions have already been provided by some of the most eminent medical authorities around the world. *These should alert decision makers at once to their responsibility:*

3.3. The National Institutes Of Health (NIH)

In 2008 the NIH (part of the US Department of Health and Human Services) warned:

'Wind energy will undoubtedly create noise, which increases stress, which in turn increases the risk of cardiovascular disease and cancer.' (*Environmental Health Perspectives*, volume 116, pg A237 – 238, 2008).

3.4. French National Academy Of Medicine

In 2006, the French National Academy of Medicine issued a report that concludes:

"The harmful effects of sound related to wind turbines are insufficiently assessed. . . The sounds emitted by the blades being low frequency, which therefore travel easily and vary according to the wind, constitute a permanent risk for the people exposed to them.. The Academy recommends halting wind turbine construction closer than 1.5 km from residences".¹¹

3.5. The Maine Medical Association

On September 12, 2009, the Maine Medical Association passed a Resolution to 'work with health organizations and regulatory agencies to provide scientific information of known medical consequences of wind development in order to help safeguard human health and the environment; and to 'work with other stakeholders to encourage performance of studies on health effects of wind

Michaud, D.; S.H.P. Bly, and S.E. Keith. 2008. Using a change in percentage highly annoyed with noise as a potential health effect measure for projects under the Canadian Environmental Assessment Act. *Canadian Acoustics*, 36(2): 13-28.

Pedersen E. and Halmstad, H.I. 2003. Noise annoyance from wind turbines – a review. Swedish Environmental Protection Agency, Report 5308.

[Health Canada's response to the Digby Wind Power Project Addendum, Digby, Nova Scotia. Author: Safe Environments Program, Regions and Programs Branch, Health Canada](#)

¹¹ Chouard, C-H. Le retentissement du fonctionnement des éoliennes sur la sante de l'homme. (Repercussions of wind turbine operations on human health). *Panorama du Medecin*, 20 March 2006.

turbine generation by independent qualified researchers at qualified research institutions'; and to 'ensure that physicians and patients alike are informed of evidence-based research results.'

3.6. Minnesota Department of Health

On May 22, 2009, the Minnesota Department of Health released a report evaluating the health impacts from wind turbine noise and low frequency vibrations. The conclusions noted that wind turbines generate a broad spectrum of low-intensity noise. The low frequency may affect some people in their homes, especially at night:

"The most common complaint in various studies of wind turbine effects on people is the impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints. Complaints are more likely when turbines are visible or when shadow flicker occurs. Most available evidence suggests that reported health effects are related to audible low frequency and with increasing outside noise levels above 35 dB(A)."

"Low frequency noise from a wind turbine is generally not easily perceived beyond ½ mile. However, if a turbine is subject to aerodynamic modulation because of shear caused by terrain (mountains, trees, buildings) or different wind conditions through the rotor plane, turbine noise may be heard at greater distances".

"Unlike low frequency noise, shadow flicker can affect individuals outdoors as well as indoors, and may be noticeable inside any building".

3.7. Government of The State Of Victoria, Australia

In Australia, the Government of the State of Victoria has now committed to investigating the health concerns of Victorians who live near wind farms. Some landholders near the Waubra wind farm, west of Ballarat, say a low frequency hum from the turbines is making them sick. An investigation will now be conducted by WorkSafe, the Department of Human Services and the Environment Protection Authority.

4.0 A BRIEF SURVEY OF EVIDENCE BASED LITERATURE

The June 2009 report on Sleep disturbance and wind turbine noise by the British physician Christopher Hanning, BSc, MB, BS, MRCS, LRCP, FRCA, MD provides a useful survey of up-to-date evidence-based literature by a physician who is more qualified than most to carry out this peer review. The report can be seen in pdf form at <http://www.windaction.org/documents/22602>

Dr. Hanning's credentials and experience are beyond dispute. He is an expert in sleep medicine and sleep physiology. Dr. Hanning founded and ran the Leicester Sleep Disorders Service, one of the longest standing and largest services in the United Kingdom. The University Hospitals of Leicester NHS Trust named the Sleep Laboratory after him as a mark of its esteem.¹²

His report concludes:

"In weighing the evidence, I find that, on the one hand, there is a large number of reported cases of sleep disturbance and, in some cases, ill health as a result of exposure to noise from wind turbines, supported by a number of research reports that tend to confirm the validity of the anecdotal reports and provide a reasonable basis for the complaints. On the other, we have badly designed industry and government reports which seek to show that there is no problem. I find the latter unconvincing."

"In my expert opinion, from my knowledge of sleep physiology and a review of the available research, I have no doubt that wind turbine noise emissions cause sleep disturbance and ill health."

Dr. Hanning has also stated: *"There can be no doubt that groups of industrial wind turbines ("wind farms") generate sufficient noise to disturb the sleep and impair the health of those living nearby."*

He noted that *"families whose homes were around 900m from wind turbines found the noise, sleep disturbance and ill health eventually drove them from their homes."*

Hanning emphasizes that *"inadequate sleep has been associated not just with fatigue, sleepiness and cognitive impairment but also with an increased risk of obesity, impaired glucose tolerance (risk of diabetes), high blood pressure, heart disease, cancer and depression. Sleepy people have an increased risk of road traffic accidents."*

His report is examined in detail below because it represents one of the most professional reviews of the available literature. Hanning also analyzes and disputes the acceptability of several industry sponsored studies because of flawed methodologies and researchers working outside their area of competence.

CLINICAL EVIDENCE

¹² Trained at St. Bartholomew's Hospital Medical School in London England and a Fellow of the Royal College of Anaesthetists, he is honorary Consultant in Sleep Disorders Medicine to the University Hospitals of Leicester NHS Trust, (England) based at Leicester General Hospital having retired in September 2007 as Consultant in Sleep Disorders Medicine. In 1996, he was appointed Consultant Anaesthetist with a special interest in Sleep Medicine to Leicester General Hospital and Honorary Senior Lecturer to the University of Leicester.

4.1. England

Throughout the history of public health, our initial awareness of health threats has always come from *clinicians* working with patients in the field. One of the first MDs to report on wind turbine difficulties was Dr. Amanda Harry in England. Those who would dismiss the work of Dr Harry as “anecdotal” and of no significance do not understand the role played by the clinician in our understanding of pathology. (Harry, Amanda. February 2007. Wind turbines, noise, and health. 32 pp. <http://www.windturbinehealthhumanrights.com>)

Dr. Hanning points out: “Dr Amanda Harry (2007), a UK GP, conducted surveys of a number of residents living near several different turbine sites and reported a similar constellation of symptoms from all sites. A study of 42 respondents showed that 81% felt their health had been affected, in 76% it was sufficiently severe to consult a doctor and 73% felt their life quality had been adversely impacted. This study is open to criticism for its design which invited symptom reporting and was not controlled. While the proportion of those affected may be questioned *it nevertheless indicates strongly that some subjects are severely affected by wind turbine noise at distances thought by the industry to be safe.*”

4.2. United States

Another physician with actual clinical experience dealing with patients affected by wind turbines is Nina Pierpont in the United States. (Nina Pierpont, MD, PhD, *Wind Turbine Syndrome: A Report on a Natural Experiment*. 2009. www.windturbinesyndrome.com)

According to Dr. Hanning, her work is “a very detailed, peer-reviewed case-control study of 10 families around the world who have been so affected by wind turbine noise that they have had to leave their homes, nine of them permanently. The turbines ranged from 1.5 to 3MW capacity at distances between 305 to 1500m. The group comprised 21 adults, 7 teenagers and 10 children of whom 23 were interviewed. While this is a highly selected group, the ability to examine symptoms before, during and after exposure to turbine noise gives it a strength rarely found in similar case-control studies. 14 of the 21 adults described the symptoms of wind turbine syndrome outlined above and confirmed that they were not present before the turbines started operation and resolved once exposure ceased.”

“There was a clear relationship between the symptoms, even in children, and the noise exposure. She reports also that all adult subjects reported ‘feeling jittery inside’ or ‘internal quivering’; often accompanied by anxiety, fearfulness, sleep disturbance and irritability. Pierpont offers compelling evidence that these symptoms are related to low frequency sound and suggests very plausible physiological mechanisms to explain the link between turbine exposure and the symptoms.”

“Of particular concern were the observed effects on children, including toddlers and school and college aged children. Changes in sleep pattern, behaviour and academic performance were noted. 7 of 10 children had a decline in their school performance while exposed to wind turbine noise which recovered after exposure ceased. In total, 20 of 34 study subjects reported problems with concentration or memory.”

“Pierpont’s study mostly addresses the mechanism for the health problems associated with exposure to wind turbine noise rather than the likelihood of an individual developing symptoms. Nevertheless, it convincingly shows that wind turbine noise does cause the symptoms of wind turbine syndrome, including sleep disturbance. She concludes by calling for further research, particularly in children, and a 2km setback distance.”

A recently published paper on low-frequency vibration further elucidates Pierpont’s work: Research from Neuroscience Letters 444 (2008) 36–41 by medical researchers McAngus Todd, Sally M. Rosengren, James G. Colebatch, demonstrates Dr. Pierpont’s contention that low frequency vibration (low frequency bone-conducted sound) can stimulate the vestibular system at energy levels far lower than those needed to stimulate the cochlea, at certain frequencies.

4.3. Dr. Michael Nissenbaum (USA)

Another group of clinicians in the USA who have studied symptoms experienced by their patients living near wind turbines have called for a moratorium on wind turbine installation until proper studies are completed. In March 2009, Dr. Michael Nissenbaum of the Northern Maine Medical Center presented his findings to the Maine Medical Association. His study, which he characterized as “alarming”, suggests that his patients are experiencing serious health problems related to shadow flicker and noise emissions from the turbines near their homes.¹³ The onset of symptoms (including sleep disturbance, headaches, dizziness, weight changes, possible increases in blood pressure, as well as increased prescription medication use), all appear to coincide with the time when the turbines were first turned on in December 2006.

Dr. Nissenbaum has written: “There are many issues that need to be worked out. A moratorium is logical, unless we quickly move to adopt more stringent European . . . standards. *Otherwise, the state’s failure to act responsibly on this issue is the equivalent of abandoning its responsibility to protect public health, which would leave the people with few options other than seeking remedy and redress through the courts*”.

4.4. Japan

¹³ Shadow flicker is starting to be considered more problematic than many have thought. Hilly terrain - shadow flicker is more pronounced. I.e. R.H. Bolton: *Evaluation of Environmental Shadow Flicker Analysis for Dutch Hill Wind Power Project*. January 30, 2007

In Japan, in February, 2009, 70 cases of adverse health effects from wind turbines were reported. The Japanese call this "Wind Turbine Disease". Their Minister of Environment fears a public health issue and is investigating low frequency sound as being of concern.

The ministry is concerned that reports of ill health could spread as more wind turbines are built near residential areas. Bouts of dizziness and inability to sleep properly were reported. When victims spent time away from the house, the symptoms quickly dissipated. But as soon as they returned, they would flare up again.¹⁴

So far, more than 70 people living near wind turbines have reported ill health. They include residents in Ikata, Ehime Prefecture; Higashi-Izu, Shizuoka Prefecture; Toyohashi, Aichi Prefecture; and Minami-Awaji, Hyogo Prefecture.

4.5. Ontario

Researchers and victims in Ontario have reported altered living conditions and ill health. Sleep disturbance is the most common complaint. Other symptoms include inner ear problems, cardiac concerns such as arrhythmias and palpitations, headaches and cognitive and mood disturbances. Several suffered acute hypertensive episodes which are most concerning. Some have had to leave their homes in order to protect their health¹⁵. These reports are consistent internationally.

There are unanswered questions about infants, children, and the unborn whose mothers are exposed, family members and workers such as farmers and technicians who live and work in close proximity to the wind turbines.

The reports of symptoms are consistent with the work of Dr. Amanda Harry, U.K., Dr. Nina Pierpont, U.S.A. and are remarkably similar to other work quoted above and to the just released study by Dr. Michael Nissenbaum in Maine who reports on 15 further cases.

Virtually always the commonest complaint is sleep disturbance. The number of sleep disturbances with the September survey results is 67 of 98 victims. Already thirty-nine individuals indicate that their health has been affected as a consequence of what they are experiencing. The number is 81 of 98 with affected health. One person has had to be admitted to hospital with an acute hypertensive episode, another experienced a cardiac arrhythmia (atrial fibrillation), 30 of 98 experienced heart palpitations. Reports of health problems are still coming in. The survey will be ongoing and results will be updated periodically.

¹⁴ Something in the wind as mystery illnesses rise BY TSUYOSHI TAKEDA ASAHI SHIMBUN SENIOR STAFF WRITER 2009/2/6 <http://www.asahi.com/english/Herald-asahi/TKY200902060054.html>

¹⁵ Canadian Hydro Developers who operated the wind turbine facility in Melancthon Township near Shelburne appear to have tacitly recognized the seriousness of these symptoms and their legal implications by purchasing six homes from those unable to remain in them. However, in order to sell and get away, the beleaguered owners had to sign agreements not to speak publicly of the transactions.

In his literature search, *Low Frequency Noise and Infrasound (Some possible causes and effects upon land-based animals and freshwater creatures): A literary comment*; 2006, Ivan Buxton notes:

- “There are a great number of articles that include reference to the effects of infrasound and vibration upon humans. It is evident from these papers that the **effect of low frequency noise on humans goes much deeper than subjective “annoyance” as has been asserted by wind proponents. On the contrary, it has already been demonstrated that cardiovascular risks and chronic endocrine effects including increased cortisol production.** (As indicated by Harlow et al. (1987), chronically elevated blood cortisol may adversely impact the efficiency of animal production by reducing weight gain and otherwise affecting animals in captivity (Van Mourik and Stelmasiak 1984, Van Mourik et al. 1985) and **decreasing antibody production, thereby inhibiting or suppressing the body’s ability to resist disease** (Roth 1984, Jensen and Rasmussen 1970, Huber and Douglas 1971, Revillard 1971, Paape et al.1973, Hartman et al. 1976, Stein et al. 1976)”.
- “These impacts, particularly if chronic, can result in: increased sickness, disease, and death; a decrease in animal productivity (Knight and Cole 1991, Anderson and Keith 1980); and ultimately result in population declines [in wild animal populations] (Anderson and Keith 1980)”.

*These investigations offer an explanation of the reason for the symptoms that have been observed among those suffering from wind turbine effects.*¹⁶

It should also be emphasized that there is widespread agreement on the fact that wind turbines create intrusive noise and there are many existing peer reviewed studies on the adverse health effects of noise. For example, World Health Organization, Noise and Sound, Bergland et al, 2000; Health Council of the Netherlands (HCN). 2004 The Influence of Night-time Noise on Sleep and Health. The Hague: Health Council of the Netherlands, 2004; publication no. 2004/14E; Human Rights section 9 EU June 2007 www.windturbinenoisehealthhumanrights.com

¹⁶ i) “Selected Health risks caused by long term, whole body vibration”_by Seidel H. Federal Inst. Of Occupational Health, Berlin. (Am J. Med. 1993 Apr. 23(4) ; 589 – 604.)

ii) “Characterising the effects of airborne vibration on human body vibration response” by Smith S.D. Air Force Research Lab., Wright – Patterson AFB, USA. (Aviation. Space Environment. Med. 2002 Jan; 73 (1); 36 – 45

iii) “Low frequency noise enhances cortisol among noise sensitive subjects during work performance”_by Kerstin person-Waye. J Bengtsson, R. Rylander, F. Hucklebridge. P. Evans, A. Clow. (Dept. Environ. Medicine, Univ. of Gothenburg. (Life Science 2002 Jan 4; 70(7) 745 – 58. . [See also by same team “Effects of night time LFN on the cortisol response to awakening and subjective sleep quality)

iv) “Noise induced Endocrine Effects & Cardiovascular Risks” by H. Ising, W Babisch, B. Kruppa, Federal Environ. Agency, Inst. Of Water, Soil & Air Hygiene, Berlin.(Noise Health 1999; 1 (4); 37 – 48.

v) “Coping with stress; Neuroendocrine Reactions & Implications for Health” by U. Lundberg, Dept. of Psychology, Stockholm. (Noise Health 1999; 1 (4); 67 – 74

vi) “Possible health effects of noise induced cortisol increase” by M. Spreng. Dept. Physiology, Univ. Erlangen, Germany (Noise Health 2000; 2(7); 59 – 64

vii) “Acute and chronic endocrine effects of noise”: Review of the research conducted at the Inst. For Water, Soil & Air Hygiene, Berlin. H. Ising, C. Braun (Noise Health 2000;2(7) 7 – 24.

According to Buxton, “the frequency ranges are recorded in many of these studies and the overall result always appears to depend upon the exposure time when coupled with the dB and Hz levels. A few seconds is all it takes at very low Hz and high dB levels before severe problems arise”.

“Very low frequency sound can travel long distances, penetrate buildings and vehicles and does not significantly diminish its properties when it changes mediums such as from air to tissue. This is because unlike ultrasound it travels ‘in band’ more effectively due to the propensity of low frequency sound waves to travel in a straight line”.

5.0 EFFECTS OF WIND TURBINES ON WILDLIFE, LIVESTOCK AND DOMESTIC ANIMALS

Animal studies are an important tool used in modern medicine to determine harm to human health. Reports of adverse effects on animals are considered to be cautionary.

There is growing evidence that animals are affected even more severely than humans by the low frequency noise and vibrations from industrial wind turbines. This has serious implications for our treaty obligations to protect endangered and threatened species which depend on ever shrinking sensitive natural habitats. It also reinforces and provides further caution on the human health issues already listed above.

5.1. Heightened Sensitivities Of The Animal Kingdom

It appears that animals are even more susceptible to low frequency noise than humans. The animal kingdom relies upon a wide range of sound frequencies inaudible to humans. It has to be remembered that within these sensitive habitats where almost no background noise is experienced, the low frequency noise and vibration projected (and transmitted through the earth) by industrial wind turbine operation is most certainly threatening or confusing to wildlife. The hearing and vibration sensitivity of most creatures in the wild is far more acute than human sound perception.

Confusion by sound emanations can lead to the failure of hunting success, self defense and ultimately survival. Snakes, for example, which rely extensively upon their perception of vibration, are particularly sensitive to habitat disturbance from industrial developments. The noise pollution at higher frequencies may explain the catastrophic effect wind turbines are having on bats, a significant keystone species within the balance of nature. Permeating a large area of natural habitat with extraneous noise pollution will have obvious repercussions for the survival of species dependent on the special characteristics of these unique refuges and, as has been observed by biologists, lead to permanent abandonment.

Similarly the shadow flicker with its widespread emanations is another phenomenon that alerts the wild creature to danger. Confusion and avoidance are caused by both these disturbances and they may contribute to abandonment of the habitat thus affected. When such disturbance affects an already threatened species forcing it to abandon one of the last remaining suitable specialized habitats, the consequences can be catastrophic. But it has to be remembered that the ecology within any Natural Heritage System is completely inter-related and seemingly insignificant effects have major repercussions because of the interdependency of all the species within the system.

Buxton concluded: "there is a case to answer when land based animals and freshwater creatures are exposed to noise at low Hz levels. Because of the limitations of our hearing it would be easy to suppose that noises beyond our receiving range do not exist and should therefore be of no concern to us. Yet both very high and extremely low inaudible sounds may be harmful to us and other animals with similar but not identical ranges of hearing".

"Other creatures have lower acceptance levels, as their survival is more reliant upon instinct and interpretation of unusual sounds as a source of danger.

A few seconds is all it takes at very low Hz and high dB levels before severe problems arise. There is reason to suppose that similar effects would also occur with wild animals if exposed to the sounds for long enough periods. The presumption must be that as soon as they felt uncomfortable they would move away from the zone of discomfort-- term more properly described as, disturbance and displacement, which in the case of protected species would be contrary to appropriate legislation".

"Laboratory studies upon animals have been reviewed with quite chilling results, as it clear that deformities, damage and impairment occur to the subjects with regularity. Admittedly the animals were contained and subjected to exposure times of several hours per day at moderate to high intensity levels of LFN and infrasound. Yet fish and aquatic creatures contained in ponds and lakes would certainly be unable to escape whatever the level of sound intensity or duration of exposure".

Buxton cites as examples of the effect of noise on animals: the reduction of egg laying by domestic poultry; injury and loss involving livestock; goats with reduced milk production; pigs with excessive hormonal secretion as well as water and sodium retention; sheep and lambs with increased heart rates, respiratory changes and reduction in feeding.

"There is clearly a cause for concern because of the likely effects upon wildlife and current protective measures seem inadequate".

5.2. Habitat Loss: European Studies

There is a growing body of evidence from European biologists who have now completed decade-long studies of the effect of wind turbines on wildlife.

Scientists have concluded that wind turbine developments placed near important wildlife areas have a long term, irreversible destructive effect upon these habitats. The effect is cumulative, and increases the longer the wind turbines remain in place.

Many European studies have documented habitat degradation and avian collision mortality. The U.S. Fish and Wildlife Service guidelines were based on peer-reviewed scientific avian studies written by biologists. Important studies include Orloff and Flannery 1992, Leddy et al. 1999, Woodward et al. 2001, Braun et al. 2002, Hunt 2002 as well as studies of bats: Keeley et al. 2001, Johnson et al. 2002, Johnson et al. 2003, Manes et al. 2002, and Manville 2003.

Biologists are concerned not only with collision mortality which seems to be critical when turbines are sited on migratory flyways (and takes a greater toll on raptors, waterfowl and songbirds), but even more with long-term habitat disturbance, degradation and abandonment.

5.3. Livestock

Farmers in Ontario have observed health problems with their livestock which began shortly after the wind turbines were installed. Awareness of the research cited by Buxton (above) indicating endocrine and cardiovascular effects from noise would certainly support the symptoms observed by Ontario farmer Ross Brindley who lives near the Kingsbridge wind turbine development near Goderich. According to a report in the December 2008 *Better Farming Magazine*, his cattle exhibited aggressive and erratic behaviour, "including the kicking of newborn calves, prolapsed birthing, weight loss, decline in fertility, a high incidence of mastitis, calves being deformed at birth and a high incidence of stillbirths." After being driven out of business as a result of problems suffered by his beef cattle herd, Brindley is suing Hydro One Networks Inc. and Edmonton Power Corporation (EPCOR).

5.4. Goats

In the same context, the BBC recently reported that 400 goats in Taiwan had died after eight wind turbines were installed close to their grazing land. "The goats looked skinny and they weren't eating. One night I went out and the goats were all standing up; they weren't sleeping", the farmer reported. The Council of Agriculture suspects that noise may have caused the goats' demise through lack of sleep. The power company, Taipower has offered to pay part of the cost of building a new farmhouse elsewhere.

6.0 EVALUATING WIND TURBINE NOISE

Hanning disputes the claim that continual exposure to noise results in habituation.

“It is often claimed that continual exposure to a noise results in habituation, i.e. one gets used to the noise. There is little research to confirm this assertion and a recent small study (Pirrera et al. 2009) looking at the effects of traffic noise on sleep deficiency suggests that it is not so.”¹⁷

He points out the flaws of using averaged noise levels, or measuring wind speed at a single low height.

Hanning notes that “sleep disturbance has been experienced by people living within 1km to 1.6 km of wind turbines. . . . The experiences of the Davis (2008) and Rashleigh (2008) families from Lincolnshire whose homes were around 900m from wind turbines make salutary reading. The noise, sleep disturbance and ill health eventually drove them from their homes”.

“Surveys of residents living in the vicinity of industrial wind turbines show high levels of disturbance to sleep and annoyance. A 2005 survey of 200 residents living within 1km of a 6 turbine, 9MW installation in France showed that 27% found the noise disturbing at night (Butre 2005)”.

The Ontario WindVOiCe health survey found that 81 of 98 report their health affected’. The distances for survey results range up to 5k (2 respondents) with most under 1000m. This emphasizes the need for more 3rd party, multi-disciplinary, health studies including that of epidemiology’.

Buxton advises: the measurement methods should be reviewed to embrace ‘C’ Weighting and ‘G’ Weighting as well as the usual ‘A’ Weighting so that a proper appreciation of the extent of LFN and infrasound is achieved before, during and after the noise source is installed.

Dr. McMurtry points out that: “Quite simply national regulations do not exist in Canada. According to a November 2008 letter from Morel Oprisan, (Deputy Director S&T, Renewable Energy Technologies, Government of Canada) in an electronic mail to Professor John Harrison (Queens University) he stated:

“As you correctly noted in your letter, the issue of the wind turbine set-back from a residence, is regulated locally (municipally or provincially).”

“As part of the work done by the federal government in this area, we have worked together with CSA and, internationally with IEC, to bring international standards to Canada. However, these standards, at this time, are not mandatory and their use is voluntary.”

“To add to my concern regarding this regulatory uncertainty is the fact that this Provincial Ministry of the Environment has regulations with many flaws. One of these is the failure to measure for low frequency noise (LFN). Instead regulations . . . measure in A Weighted decibels or dBA only. To measure for LFN it is necessary to screen with C Weighted

¹⁷ Hanning 2.2.8.

decibels or dBC. It is not possible to develop authoritative guidelines for set-backs and monitoring of industrial wind turbines specifically if LFN is not taken into account”.

For example, “the wind developer IPC Energy contracted Avalon Consulting to do Environmental Screening. I contacted Avalon who indicated to me on 2 occasions that it is ‘not necessary’ to monitor for LFN. The wind industry at large agrees as they also deny the need to monitor for LFN. The Ministry of the Environment of Ontario concurs as all its regulations are based on dBA (Decibels with A weighting) which is relatively insensitive to LFN. dBA however is adequate for higher frequency noises such as the characteristic ‘swoosh, swoosh, swoosh’ of turbine blades which are in the mid-frequency range”.

“How important is LFN? The World Health Organization in a 2000 publication (“*Community Noise*” by Berglund *et al*) made the following observations:

- "Since A-weighting underestimates the sound pressure level of noise with low frequency components, a better assessment of health effects would be to use C-weighting”.
- "It should be noted that a large proportion of low frequency components in a noise may increase considerably the adverse effects on health”.
- "The evidence on low frequency noise is sufficiently strong to warrant immediate concern”.
- “Styles *et al* observed that there is ‘. . . clear evidence that wind turbines generate low frequency sound (infrasound) and acoustic signals which can be detected at considerable distances (many kilometres) from wind farms on infrasound detectors and low-frequency microphones.”

In July, 2008, U.S. acousticians Kamperman and James introduced a set of proposed sound limits to prevent health risks from wind turbines. They emphasized that “the simple fact that so many residents complain of low frequency noise from wind turbines is clear evidence that the single A-weighted (dBA) noise descriptor used in most jurisdictions for siting turbines is not adequate. The only other simple audio frequency weighting that is standardized and available on all sound level meters is the C-weighting or dBC.” They proposed the following limits:

“Proposed Wind Turbine Siting Sound Limits”

1. Audible Sound Limit

- a. No Wind Turbine or group of turbines shall be located so as to cause an exceedance of the pre-construction/operation background sound levels by more than 5 dBA.
- b. The background sound levels shall be the L90A sound descriptor measured during a pre-construction noise study during the quietest time of evening or night. All data recording

shall be a series of contiguous ten (10) minute measurements. L90A results are valid when L10A results are no more than 15 dBA above L90A for the same time period. Noise sensitive sites are to be selected based on wind development's predicted worst-case sound emissions (in LeqA and LeqC) which are to be provided by the developer.

- c. Test sites are to be located along the property line(s) of the receiving nonparticipating property(s).
- d. A 5 dB penalty is applied for tones as defined in IEC 61400-11.

2. Low Frequency Sound Limit

- a. The LeqC and L90C sound levels from the wind turbine at the receiving property shall not exceed the lower of either:
 - 1) LeqC-L90A greater than 20 dB outside any occupied structure, or
 - 2) A maximum not-to-exceed sound level of 50 dBC (L90C) from the wind turbines without other ambient sounds for properties located at one mile or more from State Highways or other major roads or 55 dBC (L90C) for properties closer than one mile.
- b. These limits shall be assessed using the same night time and wind/weather conditions required in 1.a. Turbine operating sound emissions (LeqA and
- c. LeqC) shall represent worst case sound emissions for stable nighttime conditions with low winds at ground level and winds sufficient for full operating capacity at the hub.

3. General Clause

- a. Not to exceed 35 dBA within 30 m. (approx. 100 feet) of any occupied structure.

4. Requirements

- a. All instruments must meet ANSI or IEC Precision integrating sound level meter performance specifications.
- b. Procedures must meet ANSI S12.9 and other applicable ANSI standards.
- c. Measurements must be made when ground level winds are 2m/s (4.5 mph) or less. Wind shear in the evening and night often results in low ground level wind speed and nominal operating wind speeds at wind turbine hub heights.
- d. IEC 61400-11 procedures are not suitable for enforcement of these requirements except for the presence of tones”.

6.1. WHO Guidelines

The World Health Organization (WHO) *Guidelines for Community Noise*, WHO (1999) states: 'In all cases, noise should be reduced to the lowest level achievable in a particular situation. Where there is a

reasonable possibility that public health will be damaged, action should be taken to protect public health without awaiting full scientific proof.'

Night Noise Guidelines for Europe, World Health Organization (October 2009) states:

'40 dB . necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise.'

The full report can downloaded at

http://ec.europa.eu/health/ph_projects/2003/action3/docs/2003_08_frep_en.pdf

7.0 LOW FREQUENCY NOISE AS A WEAPON

Those engaged in political torture have long been aware that low frequency noise is a powerful "weapon" with devastating effects upon human beings.

The Israeli army used the sound weapon to disperse a crowd by causing dizziness and nausea.

"Professor Hillel Pratt, a neurobiologist specializing in human auditory response at Israel's 'Technion Institute', says 'It doesn't necessarily have to be a loud sound. The combination of low frequencies at high intensities, for example, can create discrepancies in the input to the brain.' Later he explained, 'that by stimulating the inner ear, which houses the auditory and vestibular (equilibrium) sensory organs with high intensity acoustic signals that are below the audible frequencies (<20Hz), the vestibular organ can be stimulated and create a discrepancy between inputs from the visual system and somatosensory system (that report stability of the body relative to the surroundings) and the vestibular organ that will erroneously report acceleration (because of the low-frequency inaudible sound). This will create a sensation similar to sea or motion sickness. Such cases have been reported and a famous example is workers in a basement with a new air-conditioning system that all got sick because of low frequency noise from the new system.'¹⁸

8.0 FLAWED PUBLIC CONSULTATION PROCESS IN ONTARIO

The government of Ontario has been advised of health problems being experienced in Ontario and has not responded to widespread requests to stop building more wind turbines until the 3rd party evidence based health studies are conducted in order to determine authoritative noise levels. Many requests have also been made for realistic cost/benefit accounting but the Government has not disclosed the real cost or actual benefit of wind power.

There have been substantial sums invested in extensive social marketing and lobbying in order to:

- enable rapid policy action in favour of the industry

¹⁸ *Toronto Star*, 6 June, 2005.

- convince the public of the benefits of industrial wind turbines while ignoring the health risks and cost/benefits
- stereotype as NIMBYs those concerned about the serious consequences of industrial-scale wind turbines so that people who have fallen victim to the technology are invalidated at the outset.

Public input critical of Bill 150, the Green Energy Act has been almost entirely disregarded. Hundreds of submissions to the EBR and MOE have never been made public nor have those on the proposed regulations.

Of the 300 applications to present information to the Standing Committee on Government Affairs reviewing the legislation, less than half were allowed to speak. Selection of speakers was carefully manipulated by the Government to allow mostly those in support of the bill. Some of those opposed were invited to present their concerns at Sault Ste. Marie, a journey of 8-10 hours for people living in Southern Ontario.

Facilitation notes on MOE workshops have never been produced. Requested corrections of policy have not been implemented.

Elevation requests for full environmental screening for all 19 existing wind turbine projects currently installed in Ontario have been categorically denied. A host of project approvals has been passed during the interim between the passing of the GEA and the establishment of new regulations. Detailed public requests for review of these proposals have similarly been denied.

An application to install a wind turbine at the Canadian Autoworkers Centre in Port Elgin has recently been allowed even though it is well within the new regulation 550 metre setback—by a “special amendment” of the regulations.

In short, Bill 150, the Green Energy Act, designed to facilitate rapid installation of industrial wind turbines across Ontario was railroaded through the legislature in so short a period of time that no meaningful public discussion was allowed to take place—an unprecedented situation for a bill that amended so many other acts and removed democratic rights from local communities.

8.1. In Review

1. Evidence-based health studies were not conducted prior to the implementation of the provincial policy to determine authoritative setbacks and noise levels for installation of industrial wind turbines.
2. Provision for vigilance monitoring was not provided.

3. Provision for long term post-market surveillance was not provided to monitor adverse health effects and post-traumatic stress consequences.

4. The Green Energy Act, Bill 150 removes rights of Ontarians including the ability to protect their health.

5. There are many flaws and inadequacies regarding the approval process.

6. The government of Ontario has been advised of these issues and has continued development at a rapid pace.

7. Indications are there is no authoritative oversight or detailed review of the health information cited in the community response.

On November 24, 2004, the Ontario Government announced the results of its Request for Proposals for 300 megawatts of renewable energy. *Noise guidelines were developed from the suggestions of the wind energy industry*; however, there were no authoritative guidelines determined for setbacks.

In a May 2004 letter to the Ontario Government, the Canadian Wind Energy Association (CanWEA) lobbied for higher noise limits “as noise regulations can have a significant impact on wind turbine spacing, and therefore the cost of wind generated electricity.”

Prior to June 2004 wind turbine noise may have been limited to 40 dBA. In June 2004 the limit was increased to 53 dBA. In October 2008 the limit was reduced to 51 dBA for new projects possibly in response to ongoing problems. Less than 9 months later, on Tuesday June 9, 2009 the Ministry of the Environment (MOE) released new draft setback regulations which according to the Minister Mr Gerretsen “... best protect the health and safety of Ontarians”. The MOE’s draft setback regulations propose a wind turbine noise limit of 40 dBA. This reduction is very significant as a 10 dBA increase is subjectively heard by the human ear as an approximate doubling in loudness.

The new draft setback regulations had provisions to monitor and address low frequency noise, which has been known for many decades in the medical and health care community as causing adverse health effects.

The proposed regulations contained a matrix for setbacks with respect to multiple IWTs (Industrial Wind Turbines). If these proposed setbacks were applied to existing Ontario wind turbine projects some IWTs may have been set back up to three times further than they currently are. Under the proposed setback matrix one of the victims in Ontario would likely have the closest wind turbine at about 1.5 km as opposed to slightly more than 450 m.

Researchers are stating it is important to ensure sufficient set-backs. Some set-backs of up to 1.5 miles (about 2.5 km) are being proposed in the references dealing with health risks. In New Zealand, suggestions are that set-backs should be 1.9 miles (3.1 km) in order to reduce the impact on people. Dr. Pierpont says it could be 2 to 3.5 km based on recent studies. It is important that the set-backs do not overlap property lines so that property owners who do not have turbines can still enjoy their property to the full area that they own.

Time is needed for the researchers and clinicians to study the effects of wind generation on people. Time is needed for the decision-makers and the public to understand the consequences of introducing these industrial complexes into areas where people live.

Once these giant turbines are built, they will be here for a long time so great care needs to be exercised in order to protect the health and quality of life of our population.

It is clear that the final regulations are not adequate to protect human health. These regulations are not founded on evidence-based medical research and are lacking studies on humans. They are based on conservative computer-modeling which in other parts of the world is used only in worse case scenarios.

A growing number of health care professionals and many organizations and rural Ontario families are urging that *independent* evidence-based studies (epidemiology) be conducted to determine authoritative set backs and noise levels, including that of low frequency/infrasound.

The final Regulations which state they are 'unofficial'¹⁹ were released September 24, 2009. References to the promised 40 dBA noise limits for wind turbines and low frequency / infrasound monitoring are lacking. Solar energy will limit noise to 40 dBA.

While it is obviously unproductive even to speculate on a setback that would satisfy 100% of those who are complaining of adverse health effects from wind turbines, it is certainly not impossible to determine ways to protect a significant number of those affected.

9.0 MITIGATION

"The only mitigation for wind turbine noise is to place a sufficient distance between the turbines and places of human habitation." – Dr Christopher Hanning

10.0 CONCLUSION

¹⁹ They are not Gazetted yet and until they are, they are unofficial.

10.1 There is widespread consensus that wind turbines cause noise pollution which frequently leads to sleep disturbance for those living nearby.

10.2 There is growing documentation from medical professionals about the related adverse health effects on humans and animals living within affected areas.

10.3 The Ontario Agency for Health Protection and Promotion has an obligation under its mandate for Health promotion, chronic disease prevention, and injury prevention to thoroughly investigate the growing number of complaints being received from people in Ontario living near wind turbines. Elected members of the legislature have a responsibility to exercise due diligence to protect the health of rural Ontarians.

10.4 Researchers are stating it is important to ensure sufficient set-backs. Some set-backs of up to 1.5 miles (about 2.5 km) are being proposed in the references dealing with health risks.

To repeat Dr. Nissenbaum's warning:

"There are many issues that need to be worked out. A moratorium is logical, unless we quickly move to adopt more stringent European ... standards. Otherwise, the state's failure to act responsibly on this issue is the equivalent of abandoning its responsibility to protect public health, which would leave the people with few options other than seeking remedy and redress through the courts".