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Comments on Proposed Health Canada Study

General Background

I have been asked to contribute comments on the Proposed Health Canada study, in my capacity as CEO of the Waubra Foundation. We are a national Australian organization, with close links to international researchers who are leading the way in measuring the acoustic emissions at wind developments, and in understanding the human health pathology being reported by residents, workers and visitors in the vicinity of industrial wind developments (IWD).

Our raison d'être is to promote multidisciplinary truly independent research, which all parties can trust, to investigate the serious health problems being reported at IWD. It is our strong position that independent health and acoustic engineering professionals with direct experience of the suffering, and direct experience of how to gather the acoustic data **MUST** be involved in such research, at a minimum as technical advisers, and their knowledge and experience needs to be respected and utilized to its full advantage, in order to constructively investigate and address the serious problems.

For too long vested interests have got away with labeling these courageous professionals as “anti – wind” and ignored the message that there is a very real problem. Far too often the interests of the wind industry, and governments and bureaucracies promoting wind technology have had far too much influence in ignoring the evident problems. Some of the comments in the information provided about the Health Canada study, together with the lack of participation of those researchers with the most knowledge of the situation at existing IWD in Canada such as Dr Robert McMurtry and Ms Carmen Krogh, give me cause for grave concern about the true intentions and motivations of those conducting this research. This will inevitably result in an outcome which is not trusted, and which may be less than useful in truly understanding the depth and extent of the problems, which would seem to be a waste of precious research resources, time and effort. I would urge the committee to consider these comments and make appropriate changes, to improve the design of the study, broaden the range of personnel involved, and thereby improve the usefulness of the research.

I have attached a document as an appendix to these comments, which gives further detail about the work of the Waubra Foundation, my own background and links to some of our material. Our field research in the vicinity of wind developments and other facilities emitting infrasound and low

frequency noise over the last 2 years has given us a good appreciation of the severity of the human health problems experienced, and of their relentless progress, unless sick people can remove themselves from that exposure. Our close collaboration with the Australian and international acousticians who have been out in the field gathering acoustic evidence of actual acoustic emissions inside and outside homes concurrently has given us insight into the unique acoustic signatures of wind turbine acoustic emissions, and the differences between outside and inside measurements.

Recent important developments and relevant “old” research

There is increased understanding of the problems from research which has recently been conducted or presented at international fora even in the last few months. We are also aware of groundbreaking recent research in Australia, which we have been told is currently being finalized for public circulation, which has shown a close relationship between specific low frequency noise emissions from the wind turbines and specific episodes of the characteristic sleep disturbance.

The residents invariably describe this sleep disturbance as “waking up in a panicked anxious state” and often state that they are not able to hear the turbines inside their homes at the time. We are not surprised at the results of this research, as the sleep disturbance being described around the world is unique and is characteristic of exposure to operating wind turbines in quiet rural environments. Spouses who describe watching their partners being peacefully sound asleep one minute and then instantly awake in a sudden agitated state in the next give us the clues that the physiological response is a rapid one, and that their sympathetic nervous systems are being stimulated significantly and suddenly, by some external stimulus which is affecting brain and nervous system function.

Professor Alec Salt’s recent paper at the Inter-Noise conference in New York has outlined that the inner ear’s response to these acoustic impulses is quite different in areas of quiet background noise, and is greater than previously thought possible. However this clearly fits with the patterns of symptoms of vestibular activation being reported by the sick residents in particular what Professor Salt describes as activation of the “alerting mechanism” which in lay terms refers to the “fight flight response”, or sympathetic nervous system. Further details of his work are available both at his website <http://oto.wustl.edu/cochlea/wind.html> and the paper he presented in New York is also downloadable from <http://www.wind-watch.org/documents/perception-based-protection-from-low-frequency-sounds-may-not-be-enough/>

The research in Australia previously mentioned was conducted measuring the full sound spectrum inside the homes of residents reporting the characteristic symptoms. **Nothing other than actual measurement of the full spectrum of acoustic emissions, coupled with actual concurrent physiological measurements of blood pressure and “in the field” sleep studies is going to investigate the problems accurately.** Half measures such as actigraphy, spot blood pressure measurements, and “estimating” internal acoustic exposures which are being suggested in the Health Canada study will simply not give the information required to properly investigate the true effect of the exposure to the wind turbine acoustic emissions, and will be at best, irrelevant, or at worst, misleading and a consequent waste of public money.

An example of such direct physiological research which has clearly identified that there is a connection between blood pressure, heart rate, and short term exposure to infrasound. This work from 2004 by Chen, Qibai and Shi (see <http://www.wind-watch.org/documents/an-investigation-on-the-physiological-and-psychological-effects-of-infrasound-on-persons/>) was discussed by another researcher in this area who also presented at the Inter-noise 2012 conference. Dr Malcolm Swinbanks is an eminent British acoustician with a long professional background in the field of low frequency noise. Dr Swinbank's paper is downloadable from the following: <http://www.wind-watch.org/documents/numerical-simulation-of-infrasound-perception/> What this work clearly establishes is that there are physiological effects on humans occurring at levels of infrasound exposure which may not be audible, but are nevertheless perceptible, and stimulating the sympathetic nervous system. The young fit subjects in the Chen study reported feeling symptoms of nausea, dizziness and headaches after very short exposures of only an hour.

Wind turbine residents are living with unknown levels of infrasound and low frequency noise and vibration inside their homes, for perhaps 25 years or maybe more. Many are not fit young adults, and are thus may be more susceptible to the effects of acute and chronic exposure to these sound frequencies. Dr Nina Pierpont's work indicated that young children and the elderly, as well as those with migraines, inner ear pathology and a history of motion sickness were particularly vulnerable to developing symptoms with exposure to operating wind turbines, and long known by some acousticians such as Professor Geoffrey Leventhall and Dr Malcolm Swinbanks to be consistent with exposure to ILFN, which Dr Pierpont suggested were due to dysfunction of the vestibular system.

My own field research has confirmed Dr Pierpont's findings of susceptibility in these population groups. In addition, I have found that if people are chronically exposed, some preexisting conditions worsen over time, such as hypertension, diabetes, angina, post traumatic stress disorder, to name a few. When these residents move from their homes or have substantial periods of time away, their conditions start to normalise back to their baseline pre turbine exposure. Dr Robert McMurtry has noted similar patterns in sick residents in Ontario with chronic exposure to IWD.

There is also old research, highlighted in Professor Leventhall's 2003 literature review for the UK government department DEFRA. This exceedingly useful paper can be downloaded from the following: <http://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/>

Some of the key features of the research described in the Leventhall 2003 DEFRA literature review include the following:

- Low frequency noise has long been known to cause a range of symptoms (which Professor Leventhall has since stated publicly on numerous occasions are "well known" to him and are identical to those of "wind turbine syndrome" as described by Dr Nina Pierpont in her study. I have attached a table extracted from the DEFRA literature review as appendix 1. It shows the findings from a case control study from 2000, which are extremely relevant.
- Exposure to low frequency noise was noted to cause an acute physiological stress response – for example in sleeping children exposed to truck LFN (see section 10)

- the phenomena of people developing “sensitivity” was also mentioned – over time it appears that some people who are not affected by the LFN develop some of the symptoms.
- Wind turbines were one source of LFN noted
- **the ONLY “cure” was to ensure that exposure to the LFN ceased** (see concluding remarks by Professor Leventhall in his literature review)

It appears that this vitally important existing knowledge about what happens to people who are exposed to LFN, has somehow been “forgotten”, or never “discovered” by almost all medical practitioners, public health experts, and seemingly most acousticians working for the wind industry.

It is worth highlighting that for those sensitized to wind turbine LFN, it would appear the only solution currently for these sick people in Canada, as in other parts of the world, is to abandon their homes. This is currently happening, with “wind turbine refugees” being reported in many countries. Until relatively recently, their plight and their suffering has been largely hidden from public view.

As wind turbines increase in size, the amount and proportion of LFN increases, (<http://www.wind-watch.org/documents/low-frequency-noise-from-large-wind-turbines-2/>) as does the distance over which the wind turbine emissions are perceived. See the results of the community survey carried out in the vicinity of a wind development with V90 VESTAS wind turbines rated at 3MW, at TRU energy’s Waterloo wind development in South Australia by Mary Morris <http://www.windturbinesyndrome.com/2012/wind-turbine-syndrome-documented-out-to-10-km-australia/?var=cna> and details of how the survey was conducted together with the questionnaire are at <http://www.windturbinesyndrome.com/2012/gutsy-woman-takes-aim-at-the-big-wind-goliath-australia/?var=cna> .

Recent Acoustic Field research

Knowledge of the deleterious effects of low frequency noise, and the uselessness of dBA as a measure, and the need to measure inside homes for environmental noise is not new to acousticians, however, as is clear from the report from the QLD EPA Environmental Noise consultant Cedric Roberts, (see <http://www.wind-watch.org/documents/ecoaccess-guideline-for-the-assessment-of-low-frequency-noise/>).

Knowledge of the deleterious effects of noise, and environmental noise in particular, is also not new to some health professionals in Environmental Health and Public Health, as is evidenced by the material in the report from 2004, put out by ENHealth, Australia, a group made of State and Federal environmental health personnel (see <http://www.wind-watch.org/documents/health-effects-of-environmental-noise/>)

Until December 2011, there was virtually no information in the public domain with measurements of actual acoustic emissions from wind turbines inside people’s homes. This is somewhat extraordinary, given that complaints about the wind turbine noise problems and associated health problems had

been in the public domain since 2003 (Dr Amanda Harry <http://www.wind-watch.org/documents/wind-turbines-noise-and-health/>)

Within days of each other last December (2012), three acousticians released reports which contained data from measurements inside the homes of affected residents in the USA and in Australia.

The first report was an acoustic survey conducted over three days in Falmouth by Robert Rand and Stephen Ambrose, at the request of a private philanthropist who wanted to find out why people were becoming so unwell in their homes while wind turbines were operating. Rand and Ambrose conducted measurements concurrently inside and outside homes, and found, to their surprise, that they became unwell too, with identical symptoms to those described by the residents. They had many years experience as noise engineers and had never had this problem assessing wind turbine noise before. As with the residents their symptoms resolved when well away from the building or when the wind turbines were off. Rand and Ambrose presented recently at the inter-noise conference in New York, have published a paper in a peer reviewed journal, and written a comprehensive report, available from <http://www.wind-watch.org/documents/bruce-mcpherson-infrasound-and-low-frequency-noise-study/> .

Because of their own experiences becoming so unwell whilst doing this work at Falmouth, where it took one of them 6 weeks to recover, Rand and Ambrose have also raised concerns about the Occupational Health and Safety concerns of exposure to this sound energy. This is of relevance to anyone working in the vicinity of wind developments, including acousticians, teachers in schools located nearby, nursing and aged care staff if nursing homes are located nearby, and anyone doing work on other people's properties including tradesmen, contractors, farm employees etc.

The second report, was a peer review of a wind developer's acoustician's noise impact assessment, which contained data collected by Steven Cooper, an Australian acoustician with many years experience in acoustic fields other than wind turbines, highly regarded for his work in a number of areas including military aviation acoustics. Steven's initial report for Flyers Creek was followed by other reports, which include acoustic field data collected from wind developments in three Australian states, New South Wales, Victoria, and South Australia. His report on the Stony Gap wind development for the Goyder Council is the most recent of these reports, and can be downloaded from <http://www.wind-watch.org/documents/reviews-of-noise-impact-assessments-stony-gap/> .

Steven has identified the characteristic sound signature of a wind turbine, and clearly demonstrated that wind turbines do emit sound energy down in the infrasound and low frequency part of the sound spectrum, despite the claims of noise regulatory authorities and wind developers to the contrary. His work in this area is ongoing, as is work by other acousticians such as researchers at Adelaide University, Emeritus Professor Colin Hansen, and Dr Con Doolan, and Mr Les Huson who works as an independent acoustician in the community.

They join Dr Bob Thorne, and colleagues from Massey University, who have a wealth of experience in assessing wind turbine noise and its impacts on humans both in New Zealand and in Australia over many years, with multiple peer reviewed and published works, together with expert evidence provided to planning tribunals including the ERT in Ontario. Dr Thorne was one of a panel of speakers

at the Australian National Health and Medical Research Council's workshop on the Adverse health effects of wind turbines in June 2001 (download presentation and view video at <http://www.nhmrc.gov.au/media/events/2011/wind-farms-and-human-health-scientific-forum-7-june-2011>) One of Dr Bob Thorne's peer reviewed published papers can be located at the following: <http://www.wind-watch.org/documents/wind-turbine-noise-and-health-special-issue-of-bulletin-of-science-technology-society/>

Whilst the complete list of references was not made available for the Health Canada study for public scrutiny, and whilst some of the material above has been made available since the Health Canada study outline was issued, there would appear to be some published research and field work not yet included which would assist Health Canada improve the design of its study.

Comments on Health Canada Study

My comments on the specifics of the Health Canada study follow, with extracts taken directly from the Health Canada Study information in blue, below. Other highlights of mine in those quotes are in red for additional emphasis.

“The continued success and viability of wind turbine energy in Canada, and around the world, will rely upon a thorough understanding of the potential health impacts and community concerns that underscore public resistance.”

I would agree that the continued success and viability of wind projects will rely on a thorough understanding, but it needs to be of the ACTUAL health impacts at the existing developments, and the distance out to which they are occurring. In Australia, impacts are being reported out to at least 10km from existing wind developments (3MW VESTAS at Waterloo in South Australia), so I am concerned that the stated 5km distance may not be far enough. Public resistance to wind projects has emerged globally, because those legitimate health concerns (and others) have been consistently ignored, ridiculed and dismissed by those in positions of responsible authority, particularly in noise regulation and public health, in addition to the wind industry and its ideological and financial supporters. Significant damage has been done to public trust of those officers responsible and the organizations they work for, which makes it all the more important that this study is done properly, involving the “right” people with the field knowledge, and not those with preexisting ideological or other “bias”.

“Health Canada, in collaboration with Statistics Canada, will undertake a cross-sectional field study to evaluate these self-reported health impacts and symptoms of illness against objective biomarkers of stress and the sound levels generated by wind turbines, including low frequency noise. This data will be correlated with calculated wind turbine noise so that any potential relationship to reported health symptoms can be reliably determined”

I am concerned that this process is too far removed from the actual measurement of acoustic emissions inside homes and the direct human physiological responses to be of any use whatsoever. It ignores both the individual variability of response (some people being more susceptible than others)

and it is ignoring that over time people's responses will change. So the responses when people are relatively wind turbine "naïve" which may be normal initially, will be likely to be substantially different if remeasured some time later (months – years).

“The research design includes a computer-assisted personal interview using a questionnaire consisting of modules that probe endpoints such as noise annoyance, quality of life, sleep quality, stress, chronic illnesses and perceived impacts on health”

This process and the materials used needs much more transparency. The questionnaire itself is unknown, and the clinical training of those administering the questionnaire is also not clear. For too long, trained skilled experienced general physicians have not been involved in collecting the front line clinical data – and the results of those who have done so on their own initiative (eg Dr Amanda Harry (UK), Dr David Iser, (Australia), Dr Nina Pierpont, (USA), Dr Robert McMurtry, (Canada) and myself (Australia) have been universally ignored by the health authorities, particularly those in public health departments. Good clinical skills are essential in order to properly detect these problems with appropriate questioning, and there is no evidence that this crucial ingredient has been taken into account.

All of us as trained clinicians have found that what engineers and medical sociologists have referred to as “annoyance” is actually hiding a myriad of clinical pathology, much of it increasingly serious as exposure continues. Hence “annoyance” is a useless term from a clinician's perspective in assessing the true clinical impact and accurately diagnosing clinical conditions. Assessing perceived impacts on health of residents is important, but there is no substitution for accurate clinical diagnoses by an experienced clinician, taking a thorough clinical history, with appropriate clinical examination and investigations. This is something which only trained health practitioners have the requisite training and clinical experience to do, and would appear to be undervalued.

“This will include an automated blood pressure measurement and the collection of a small hair sample that will provide a 90-day retroactive average cortisol level. An objective evaluation of sleep will be undertaken using actigraphy for a period of 7 consecutive days, which will be synchronised with wind turbine operational data.”

The reported problems of changes in blood pressure are complex and need a careful study design of their own, and much more intensive investigation than a “once off” blood pressure measurement. I have discussed the complexities of this particular clinical problem and how best to investigate it with experienced blood pressure researchers and cardiologists for some time, and they concur. Such results at the very least need to be repeatedly replicated, as blood pressure can be affected by so many different variables.

Two relevant variables in these circumstances are those of chronic stress and chronic sleep deprivation. Both chronic stress and chronic sleep deprivation are well known to clinical medicine to be associated with hypertension, and both are being commonly reported with chronic exposure to operating wind turbines. When residents are away from the turbines for any length of time, both those problems invariably start to ameliorate, and as residents start to recover their pre turbine exposure health status some report that their blood pressure normalizes back towards their pre

turbine baseline. The longer they have been exposed, the longer the recovery period required, much like the pattern of recovery of soldiers who have returned back from combat stress to return to normal cognitive functioning, as reported in a very recent Dutch study using functional MRI to measure brain changes with cognitive function (Van Wingen et al, "Persistent and reversible consequences of combat stress on the mesofrontal circuit and cognition" www.pnas.org/cgi/doi/10.1073/pnas.1206330109). This Dutch study on a seemingly unrelated group of people may be a method by which PTSD precursors could be measured, using cognitive neuropsychological tests while undergoing functional MRI. Dr McMurtry and myself are both of the opinion that PTSD symptomatology is overrepresented in this population who have been chronically exposed to operating IWD.

The proposed method in this study for determining whether or not there is a change in blood pressure resulting from exposure to operating wind turbines is useless.

Any primary care physician knows that a single blood pressure measurement needs replication a number of times, in order to confirm the result. "White coat hypertension" is but one of the variables which can affect the reading in the space of a 15 minute consultation, which may give a false representation. The gold standard method of blood pressure measurement is 24 hour ambulatory blood pressure, and that is what is required here, preferably in conjunction with concurrent acoustic measurements inside the home to which the resident is blinded, and done under case crossover conditions so that differences between when turbines are "on" vs when they are "off" can be observed, measured and subsequently analysed to see if there is any relationship to acoustic emissions and frequencies in that particular person, over that time period.

I am unable to comment on the proposed method for measuring cortisol, as I am not familiar with the use of hair for this purpose and the validity of the normative values which it will be compared to. I agree that cortisol is one measure of stress which is required, however other clinical researchers and endocrinologists I have spoken to advise that replication of sequential salivary or serum cortisol, used in other studies with noise exposure, could be of great benefit if correlated with specific acoustic emissions & cumulative exposures.

The hair cortisol measure could well be very useful as an indicator of chronic stress if reliable normative values have been established, and if it is possible to get a reasonably reliable estimate of likely individual exposure to the full spectrum of acoustic frequencies by gathering representative sample data of **actual** measurements inside homes, NOT estimates or calculations. It is not clear if this is contemplated with this study from the limited information provided.

Experienced sleep physician colleagues advise that actigraphy is a very crude measure of sleep disturbance, because it measures body movement, which can misrepresent the true sleep experience, and true arousals. They have suggested that much more useful information would come from using in home sleep studies "in the field" combined with concurrent full spectrum acoustic monitoring, and usage of a pulse transit time (PTT) device as an estimate of blood pressure which is non invasive and will not cause disturbance of its own. A smaller number of intensive investigations would yield much more useful information than much more data which is of questionable benefit in its representation and measurement of the problems. The other instrument which has proven useful in research in this

field is the use of standardized validated questionnaires such as the Pittsburgh Sleep Quality Index (PQSI) used for example by Shepherd et al (<http://www.wind-watch.org/documents/evaluating-the-impact-of-wind-turbine-noise-on-health-related-quality-of-life/>) Thorne (personal communication) and Nissenbaum & Hanning (prepublication).

“Environmental sound level measurements, including low frequency noise, will be conducted inside and outside a sub-sample of homes in order to validate parameters ensuring accurate sound level modeling”

This actual measurement of noise, inside AND outside a sub sample of homes is a vitally important component of this study, but my concern would be that it is not apparent that the full range of acoustic emissions is being measured, namely sound and vibration including infrasound (0-20Hz) as well as low frequency noise and audible noise. This needs to be clarified. It is even more use, if these measurements are conducted concurrently with sleep studies and blood pressure measurements, whether via Pulse Transit time devices or 24 hour ambulatory blood pressures, rather than in isolation from the physiological investigations.

“The sample will consist of 2000 dwellings at setback distances ranging from less than 500 metres to greater than 5 kilometres from 8-12 wind turbine power plants.”

I have already commented on the need to measure out well beyond 5km, in order to reach the limits of impact. It is not clear how those reporting health impacts will be “selected”, and given that it would be expected that numerous people out to bigger distances would not report an affect, there is the risk of encountering the problem of “the dilution effect” explained so clearly by Professor Salt (see <http://www.wind-watch.org/documents/why-pro-wind-studies-often-use-a-10-km-radius/>) In my opinion it would be more useful to measure a smaller number of dwellings, but perform those measurements with the best possible method of measurement of the clinical physiological variables of sleep and blood pressure, rather than a greater number of dwellings but using a less than adequate method. However there is no reason why the greater number of dwellings and individuals should not be investigated with a wide range of standardized questions designed to elicit information about their mental and physical health and wellbeing in addition to specifics of expected symptomatology given what is already known about exposure to low frequency noise (per Leventhall’s DEFRA report, Dr Amanda Harry’s survey, Dr Nina Pierpont’s study, and Dr Robert McMurtry’s proposed Case Definition downloadable at <http://www.wind-watch.org/documents/wind-turbine-noise-and-health-special-issue-of-bulletin-of-science-technology-society/>).

“Considering the scientific evidence on the lowest observed adverse effect level for sleep disturbance, the WHO identified an average annual outdoor nighttime sound level of 40 dBA as a recommended limit to protect public health from night noise, including that of the most vulnerable groups such as children, the chronically ill, and the elderly. Although the limits in the WHO’s *Night Noise Guidelines* are based on transportation noise sources, current science shows that the same levels are applicable to noise emitted from WTs. There has also been criticism directed at the use of an A-weighted base limit for a source that contains low frequencies such as the large scale WTs.”

Usage of the WHO criteria in this instance is not useful or even relevant, as 40 dBA outside in urban areas is not a good measure of sleep disturbance INSIDE quiet country homes. It is already known that low frequency noise is associated with sleep disturbance, dBA is not an appropriate measure for LFN, and LFN is penetrating through well insulated buildings, resulting in a markedly different sound frequency spectrum inside the homes compared to outside. Rand and Ambrose's Falmouth study illustrated this very clearly.

In quiet rural areas the inner ear behaves very differently when exposed to high infrasound and low frequency noise emissions without the higher frequencies, as Professor Alec Salt has just demonstrated in his presentation to Inter-noise 2012. All these reasons make it imperative that the actual full spectrum of acoustic emissions is measured both inside and outside the home concurrently. (see <http://www.wind-watch.org/documents/wind-turbine-acoustic-pollution-assessment-requirements/>)

Current science DOES NOT support the usage of the same levels of noise from transportation in urban areas being applicable to noise from industrial wind turbines in quiet rural areas. Firstly, the seminal Pedersen and Wayne 2004 paper (*Pedersen, E., and Persson Wayne, K. Perception and annoyance due to wind turbine noise—a dose-response relationship. Journal of the Acoustical Society of America, 2004, 116, 3460–3470*) makes it clear that percentages of people who are “highly annoyed” (code for seriously stressed and possibly very ill when clinicians evaluate them) starts climbing at a lower sound pressure level in dBA than for other sources of transportation noise, and climbs much more steeply. One of the reasons suggested for that difference now by acousticians leading investigation into this area of wind turbine noise is thought to be the low frequency component of that wind turbine noise, which is not captured by dBA measures.

“In both cases, it is difficult to make causal statements about the relationship between exposure to WTN and community annoyance and, therefore, to set science-based sound level limits”

There has been an assumption, based on very limited research data, that “annoyance” does not change over time. Leaving aside the appropriateness of using “annoyance” in a clinical context, my own experience has very clearly shown that many people welcomed the turbines into their region, and were completely unprepared for what happened next to themselves and their families if they became unwell. Some have clearly become “sensitized” over time, which has resulted in what engineers would certainly call increased “annoyance”, but what clinicians diagnose as serious clinical conditions.

In my experience, the growing strength of the rural backlash globally is occurring precisely because these sick people have been ignored, vilified and ridiculed by those who would seek to deny the genuineness of their symptoms. In my view it will be possible to set accurate science based sound level limits, which adequately protect human health, if the correct scientific research is conducted, free from ideological or political bias, and with the best possible advice from people with relevant experience in the field, rather than dismissing them as “anti-wind”.

“Although modern WTs have overcome many of the noise problems associated with their predecessors (modern turbines have blades placed upwind of the tower to minimize the generation

of low-frequency noise and infrasound), today's turbines are much larger and continue to generate noise complaints from nearby residents”

This assertion is commonly made by the wind industry, but where is the full spectrum acoustic data which backs up this assertion that upwind blades really do minimize the generation of low frequency noise and infrasound? Where are the extensive inside / outside home measurements, which can show that these assertions are correct, with respect to the measured acoustic emissions inside the homes of those living nearby who are developing symptoms. They do not exist, apart from the limited field evidence collected in the USA and Australia. Infrasound IS being measured at existing wind developments where wind developers and noise regulatory authorities have either denied its very existence, or said it is occurring at levels which are insufficient to be perceived or do harm. Chen et al's work would suggest otherwise, as would Salt's. In fact, we do not yet have those dose-response curves, because even that basic data has not yet been collected. It urgently needs to be, and this study could help contribute to that knowledge if done properly with the full acoustic spectrum measured concurrently inside and outside homes.

“Sampling will be conducted on volunteers that are at least 18 years of age”

This excludes children, who are one of the most vulnerable groups in our society with respect to their exposure to operating wind turbines. This was identified in the previous section and highlighted in red by me – “**the most vulnerable groups such as children, the chronically ill, and the elderly**”. Indeed they are the most vulnerable to the effects of chronic exposure to operating wind turbines, and therefore I suggest they need to be a priority in the study design, and it is not clear to me that the chronically ill and the elderly have been identified as a priority.

Young children and teenagers are already reported to be suffering from sleep deprivation, cognitive problems, behavioural problems, and inner ear problems, and this is being reported by their parents, their teachers, and in some instances their treating doctors. Dr Pierpont's case data contains multiple examples, and affidavits and witness statements lodged for court actions in Ontario alone contain others.

Any health study purporting to investigate adverse health effects of operating wind turbines must not exclude the most vulnerable members of our society.

We have a duty of care to investigate and protect these most vulnerable citizens. The effects of acute and chronic exposure to all the potentially noxious effects of operating wind turbines are unknown (eg noise, vibration, air pressure fluctuations, and EMF). We do know that chronic exposure to infrasound has resulted in damage to organs including testes in rats (Dadali et al, study number 58 in the NIEHS literature review of the Toxicology of infrasound <http://www.wind-watch.org/documents/infrasound-brief-review-of-toxicological-literature/>) and we do know that acute exposure to truck LFN resulted in measureable increased levels of cortisol in sleeping children (Ising & Ising, cited in Leventhall et al, 2003 DEFRA op cit). We also know from a body of work by Professor Arline Bronzaft over many decades that noise can be a noxious agent with respect to adversely impacting on children's learning (see Professor Bronzaft's peer reviewed published article accessible at <http://www.wind-watch.org/documents/wind-turbine-noise-and-health-special-issue->

[of-bulletin-of-science-technology-society/](#)). I am therefore very concerned about the omission of children from this study.

Another group who would appear to have been excluded from this study design are those who have been forced to abandon their homes, because of serious ill health. In Australia, people in this situation have moved well away from the nearest wind turbine, further than the 5km radius indicated by the study design. **So by its design, this study is automatically excluding two of the most vulnerable groups who are already known to have problems.**

These two population subgroups are a PRIORITY to learn more about, not to ignore and exclude.

“The questionnaire will be read to the subject and it includes modules that assess demographics and validated scales that provide information on well-being, sleep quality and noise annoyance”

If this questionnaire is utilizing standardized and previously validated questionnaires which can properly assess health indicators of physical and mental health, such as those used by Dr Shepherd et al op cit (egHRQOL or SF36) that will be very useful, but this is not clear from the study)

“Indoor levels will be estimated assuming a generic transmission loss for rural Canadian homes when windows are partially open”

I am not an acoustician, however acousticians have made it clear to me that transmission losses need to be measured and they can vary significantly from house to house, depending on house construction. If the home is well insulated, and the noise from the turbines is unbearable, residents resort to trying to shut the noise out, but this can make the ILFN problem inside worse, because the proportions of sound energy inside the home become even more skewed down into the low frequency range.

“Due to the large number of individuals wearing actimeters at any given time, simultaneous indoor sound level measurement is not a feasible option.”

I have commented previously on the usefulness of using actimeters vs in home sleep studies for properly assessing sleep disturbance. Increased quantities of information of less accurate quality is not going to assist with properly understanding what the factors are leading to the reported repetitive sleep disturbance. Furthermore, not concurrently measuring the indoor full spectrum acoustic emissions will therefore not yield the information required to determine precisely what “dose” of acoustic energy at certain frequencies is waking individual people up.

Concluding remarks

The study design proposed by Health Canada has numerous serious flaws.

The selection of personnel would appear to specifically exclude those with direct independent clinical and acoustic field research experience in this area, and include those who have vested interests to

protect or ideologies to promote. It does not appear that experienced clinicians have been extensively consulted with respect to the study design. The choice of less than gold standard techniques for collecting the clinical / physiological data will not yield the most useful results, if indeed the aim is to investigate why these reported effects are occurring and what is directly causing them.

Significant changes, as suggested, would need to be made to make the most of this important opportunity to objectively investigate the serious health problems being reported. If these changes are not adopted, the information obtained could well be less than useful, and at worst could be misleading.

This outcome is in no one's interests, least of all the wind industry itself.

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Attachments

Appendix 1 – table extracted from Leventhall et al 2003, report for DEFRA

Appendix 2 – Professional qualifications, and list documents and submissions

Also submitted, attached separately to email to Health Canada Study

Van Wingen et al, "Persistent and reversible consequences of combat stress on the mesofrontal circuit and cognition" www.pnas.org/cgi/doi/10.1073/pnas.1206330109

APPENDIX 1

Extracts from Leventhall et al 2003 report for the UK Dept of Food and Rural Affairs on the effects of Low Frequency Noise on Human Health,

12.2 Effects on health. In an epidemiological survey of low frequency noise from plant and appliances in or near domestic buildings, the focus was on health effects (Mirowska and Mroz, 2000). ...

A control group of dwellings had comparable conditions to the test group, with similar A-weighted levels, except that there was no low frequency noise. There were 27 individuals in the test group and 22 in the control group.

The test group suffered more from their noise than the control group did, particularly in terms of annoyance and sleep disturbance. They were also less happy, less confident and more inclined to depression.

The comparison of the symptoms between the tested group and the control group show clear differences, as in Table 5.

Table 5. Health comparison of exposed and control group.

Symptom	Test group %	Control group %
Chronic fatigue	59	38
Heart ailments anxiety, stitch, beating palpitation	81	54
Chronic insomnia	41	9
Repeated headaches	89	59
Repeated ear pulsation, pains in neck, backache	70	40
Frequent ear vibration, eye ball and other pressure	55	5
Shortness of breath, shallow breathing, chest trembling	58	10
Frequent irritation, nervousness, anxiety	93	59
Frustration, depression, indecision	85	19
Depression	30	5

These results are extremely interesting as an epidemiological survey of an affected and a control group. Table 5 shows very adverse effects from low frequency noise levels which are close to the threshold and which do not exceed A-weighted limits.

Download from <http://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/>

DR SARAH LAURIE, CHIEF EXECUTIVE OFFICER, WAUBRA FOUNDATION

RELEVANT PROFESSIONAL QUALIFICATIONS AND EXPERIENCE

Qualifications

Bachelor of Medicine, Bachelor of Surgery awarded 1995, Flinders University, South Australia

Fellowship of Royal Australian College of General Practitioners, (RACGP) awarded July 1999

Fellowship of Australian College of Remote and Rural Medicine, (ACRRM) awarded March 2000

Clinical examiner, RACGP 2001

Member of State Council, Australian Medical Association of South Australia, 2001.

Personal

In April 2002, a sudden illness requiring immediate surgery and follow up necessitated Dr. Laurie withdrawing from practice as a rural general practitioner. It was not until 2010 that her own health and other responsibilities made it possible for Dr Laurie to consider returning to practice. During this extended period Dr Laurie did not continue to renew her registration, nor was she able to formally participate in the continuing medical education required to maintain her fellowships in RACGP and ACRRM. Regardless, Dr Laurie remains a qualified medical doctor.

In April 2010, when Dr. Laurie was preparing to re-enter the medical workforce, a wind energy project was announced for the hills near her home. A concerned neighbour drew Dr. Laurie's attention to Dr Amanda Harry's survey from 2003 (see <http://www.wind-watch.org/documents/wind-turbines-noise-and-health/>). This local development proposal has since been withdrawn, however Dr. Laurie's professional concern about the reported adverse health effects from exposure to operating wind turbines, and the lack of proper research continues.

In late July 2010, after voicing her growing professional concerns at a public meeting, Dr. Laurie was approached by Peter Mitchell to join the Waubra Foundation as its inaugural Medical Director, later to become its Chief Executive Officer, both roles being performed on a voluntary basis.

Experience with Wind Derived Health Problems

In the second half of 2010 Dr. Laurie commenced intensive fieldwork, visiting and listening to over 100 sick neighbours of wind projects and other industrial developments with noise pollution issues in South Eastern Australia, liaising with acousticians and concerned medical practitioners in Australia, Western Europe, United Kingdom, and North America.

In October 2010, Dr. Laurie attended the first International Symposium on Adverse Health Effects of Wind Turbines in Ontario, organized by the Society for Wind Vigilance (www.windvigilance.com), and ever since has liaised closely with other professionals and researchers who gave presentations at that symposium.

Dr Laurie's work has included: recommendations about setback distances for new wind projects based upon her gathering of evidence of health impacts at multiple projects; encouraging acoustic measurements by independent acousticians, assisting researchers to connect with sick residents; making submissions to relevant authorities and politicians; educating other medical practitioners; and where invited, educating concerned community groups and affected individuals.

This work has unfortunately and inappropriately attracted unpleasant comments and misleading public statements concerning Dr Laurie's professional qualifications from sections of the wind industry and its vocal, well intentioned but generally ignorant supporters, who are unwilling to accept that there is a very real problem which must be addressed, and who prefer instead to "shoot the clinical messenger".

Legal & Committee Involvement

Shortly after commencing her fieldwork, Dr. Laurie was approached to help give expert evidence in a court case in Adelaide. The academic who ultimately gave evidence for the wind developer agreed that witnesses were "sick" and they were "stressed", but then blamed that on what he called "scaremongering". Unfortunately, the court did not have the benefit of a survey conducted by Dr. David Iser from Toora, Victoria who had gathered clinical evidence of identical serious ill health from his patients living near the Toora wind project as far back as 2004, well before there was any public knowledge of these problems. In this particular case, the judges preferred the "expert" advice of the academic to field evidence from Dr Laurie.

Shortly after this, in July 2011, judges in a similar court in Ontario found that there **are** adverse health effects from wind turbines, and that further research is required. A range of international experts in acoustics and health gave evidence for both developers and the appellants. In that case, Professor Geoffrey Leventhall, one of the acousticians for the Wind Developer, admitted that he knew of the symptoms of "wind turbine syndrome" as they were identical to those occurring from exposure to low frequency noise, known to be emitted by wind turbines as well as other sources. The quote from the Canadian judgment is below:

"This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. *The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree.*" (p. 207) (*Emphasis added*)

Environmental Review Tribunal, Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment, Dated this 18th day of July, 2011 by Jerry V. DeMarco, Panel Chair and Paul Muldoon, Vice-Chair,

In June 2011, Dr. Laurie was asked to Chair a Panel at the National Health and Medical Research Council's Workshop, which was re-examining the issue of adverse health effects of wind turbines. (See <http://www.nhmrc.gov.au/your-health/wind-farms-and-human-health>)

In July 2012 Dr. Laurie was asked by a Canadian lawyer for an upcoming case to provide independent expert witness testimony for that case. She has agreed to do so. The name of that case is Haldimand Wind Concerns V Ministry of Environment, ERT case No 12 – 073. The hearings will commence in September 2012.

Dr Laurie's own field work, and extensive knowledge of the field work of others including acoustic and psycho acoustic measurements and physiological research, is widely appreciated. Her help, knowledge and advice is sought by doctors, acousticians and researchers working in this field in Australia and overseas. Her ability to understand the acoustic and human health evidence has contributed considerably to the general community understanding of the existing known pathophysiological pathways which make this condition so devastating to a significant proportion of wind project neighbours.

Important Submissions, Letters and Documents by Dr Laurie

- Federal Senate Inquiry into the Social & Economic Impact of Rural Wind Farms, February 2011 submission number 390 at the following weblink:
http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=clac_c tte/impact_rural_wind_farms/index.htm
also accessible at the following: <http://www.windwatch.org/documents/submission-to-the-australian-federal-senate-inquiry-on-rural-wind-farms/>
- Oral evidence given to Federal Senate Inquiry, given on 29th March 2011 <http://www.wind-watch.org/documents/sarah-laurie-address-to-australian-senate-inquiry/>
- Explicit Cautionary Notice 29th June, 2011
<http://waubrafoundation.com.au/~waubra/Y2NpZD0xJmNhaWQ9MTMmYWlkPSZjcmM9MTQ0OTg1MjMyOA%3D%3D>
- Letter to Prime Minister Gillard 3rd March, 2012
<http://www.wind-watch.org/news/2012/03/09/letter-to-australian-prime-minister-from-dr-sarah-laurie/>
- NSW Planning Department Draft Guidelines March, 2012
<http://www.wind-watch.org/documents/response-to-nsw-planning-department-draft-guidelines-for-wind-developments/>
- Wind Turbine Acoustic Pollution Assessment Requirements 11th May, 2012
<http://www.wind-watch.org/documents/wind-turbine-acoustic-pollution-assessment-requirements/>
- Opinion piece " Silent epidemic" 28th May 2012-08-28
<http://www.wind-watch.org/news/2012/05/31/acoustic-pollution-a-silent-epidemic/>
- Submission to NSW Director General of Planning re Mt Bodangora, 8th August 2012
<http://www.wind-watch.org/documents/comments-on-wind-turbine-noise-and-its-health-effects/>