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15th March, 2015

Mr George Hessler
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Sent via email: George@HesslerAssociates.com

Dear George,

Re: Your comments about the Pacific Hydro funded Cape Bridgewater Research by Steven Cooper

Thank you for your public comments about the Pacific Hydro funded Cooper research and its significance^{1 2} and your additional recent comments about future research directions.³ I understand your knowledge and experience from the December 2012 Shirley Wind Farm acoustic study⁴ allows you to comprehend the significance of what the Cape Bridgewater study achieved,⁵ and the implications for further research.

The gravity and urgency of the situation is exemplified by the subsequent declaration by the Brown County Town Health Board that the Shirley Wind Development is a Hazard to Human Health. The precise wording of the Health Board was

"To declare the Industrial Wind Turbines in the Town of Glenmore, Brown County. WI. a Human Health Hazard for all people (residents, workers, visitors, and sensitive passersby) who are exposed to Infrasound/Low Frequency Noise and other emissions potentially harmful to human health."

My following comments and suggestions about future research priorities may help you understand more about what has been found, when placed in an Australian context with the other field research, so that the research direction is focused and prioritized to prevent further harm to human health as quickly as possible.

The reports of the participating Cape Bridgewater residents, and their perceptions of sensations at times when they could neither hear nor see the wind turbines, are consistent with reports of identical sensations and symptoms followed by characteristic health problems I have heard directly from residents living near other industrial noise emitting machinery, including field compressors used for gas transportation,⁶ extractor fans used for underground coal mines,⁷ coal fired power stations,⁸ diesel machinery used at open cut coal

¹ <http://waubrafoundation.org.au/resources/schomer-p-hessler-g-review-steven-coopers-cape-bridgewater-report/>

² <http://waubrafoundation.org.au/resources/schomer-p-hessler-g-further-comments-cooper-review-muddying-waters/>

³ <http://docs.wind-watch.org/Comments-on-Cooper-3-9-15.pdf>

⁴ <https://www.wind-watch.org/documents/cooperative-measurement-survey-and-analysis-of-low-frequency-and-infrasound-at-the-shirley-wind-farm/>

⁵ <http://waubrafoundation.org.au/resources/acoustic-engineering-investigation-at-cape-bridgewater-wind-facility/>

⁶ <http://waubrafoundation.org.au/2013/report-tara-gas-field-health-survey-released/>

⁷ personal reports from residents in the Lithgow region in New South Wales

⁸ personal reports from residents in the Lithgow region

mines,⁹ and gas fired power stations, in addition to industrial wind turbines at many other locations in South Eastern Australia. I note UK Acoustician Professor Leventhall has also emphasised that what he calls “noise annoyance” symptoms are the same, **regardless of the source of sound energy.**¹⁰

Professor Leventhall also said in a workshop he presented to the Australian National Health and Medical Research Council in June 2011 that the symptoms he has called “noise annoyance” are the same as those described and investigated by US Paediatrician and population biology scientist, Dr Nina Pierpont, MD, PhD which she named Wind Turbine Syndrome.¹¹ Dr Pierpont has subsequently suggested that perhaps the syndrome should be referred to as Infrasound and Low Frequency Noise Syndrome,¹² which other noise and health researchers in this field of the impacts of infrasound and low frequency noise such as Dr Bruce Rapley PhD also agree with.¹³ Professor Leventhall has also accepted Dr Pierpont’s identification of some of the epidemiological risk factors for susceptibility to developing symptoms; being the extremes of age, migraines, motion sickness and inner ear pathology.¹⁴

So it would seem that there is a convergence in acceptance by acousticians and medical practitioners with direct knowledge of the adverse health impacts of sound energy below 200 Hz, that these reported adverse health impacts are real, are caused by exposure to sound energy, and that some people are inherently more at risk of developing the symptoms and sensations compared to others. The difference in opinion between Professor Leventhall and Dr Pierpont relates to the role which inaudible infrasound may play in directly causing the reported symptoms, sensations, sleep disturbance, and health problems.

I strongly agree with you that further objective research is required to confirm the thresholds of perception of inaudible infrasound, which both Dr Neil Kelley and his team,¹⁵ and Steven Cooper and his team have established with remarkable consistency between acoustic surveys separated by thirty years. I also note that there was internal consistency between Dr Kelley’s results and those of Harvey Hubbard’s preceding work with noise from military aircraft and noise perception inside homes.¹⁶

The “threshold of perception” levels according to Steven Cooper’s fieldwork at Waterloo and then subsequently at Cape Bridgewater appear to be around 50 dB at 4 – 5 Hz **for residents who have been chronically exposed to impulsive infrasound and low frequency noise (ILFN) and are sensitized** – ie for residents who report the characteristic “noise annoyance” impacts.

I note that both Dr Neil Kelley in his 1985 acoustic field survey noted the problem of **sensitization** to impulsive ILFN,¹⁷ as did Professor Leventhall from the UK in his 2003 Report and literature review for the UK Government (DEFRA).¹⁸ In the nearly five years I have been working in this area, my observations about progressive sensitization and worsening symptoms with ongoing exposure to excessive ILFN are identical to those of Dr Kelley and Professor Leventhall. Without exception, I have observed that if people are unable to

⁹ for example mentioned by Bulga residents quoted in the Climate and Health Alliance’s recent report on noise pollution near coal mines in the Upper Hunter region in NSW <http://waubrafoundation.org.au/2015/waubra-foundation-calls-for-research-and-full-spectrum-full-time-acoustic-monitoring-coal-and-gas-noise/>

¹⁰ For example in Professor Leventhall’s 2003 Literature review for the UK Government

<http://waubrafoundation.org.au/resources/review-published-research-low-frequency-noise-leventhall/>

¹¹ <http://waubrafoundation.org.au/resources/leventhall-g-comments-nhmrc-june-2011-wind-turbine-syndrome-symptoms-same-as-noise-annoyance/>

¹² <http://waubrafoundation.org.au/resources/dr-nina-pierpont-md-phd-writes-acnc-regarding-waubra-foundations-status/>

¹³ <http://waubrafoundation.org.au/resources/rapley-b-letter-ama-audibility-and-effects-infrasound/>

¹⁴ <http://waubrafoundation.org.au/resources/leventhall-g-comments-nhmrc-june-2011-wind-turbine-syndrome-symptoms-same-as-noise-annoyance/>

¹⁵ <http://waubrafoundation.org.au/2013/explicit-warning-notice/>

¹⁶ <http://waubrafoundation.org.au/resources/hubbard-h-1982-noise-induced-house-vibrations-human-perception/>

¹⁷ p 199 of the 1985 Acoustic survey report by Kelley et al <http://waubrafoundation.org.au/resources/kelley-et-al-1985-acoustic-noise-associated-with-mod-1-wind-turbine/>

¹⁸ <http://waubrafoundation.org.au/resources/review-published-research-low-frequency-noise-leventhall/>

reduce their exposure to ILFN if they are impacted adversely by it, they will report worsening symptoms and decreasing tolerance to the sound and vibration, and worsening of mental and physical health. This consistently reverses if they are able to reduce their exposure, which is generally only possible if they move away, either for regular breaks, or more permanently. The sound source does not matter. However people who are sensitised and who have moved away, can be immediately impacted when they return, even after an absence of prolonged periods, for example in one situation 16 weeks.

Moreover, if they become sensitized to one source of ILFN, they then report perceiving ILFN when exposed, often unexpectedly, to other sources. This can be profoundly distressing for these people, because “moving away” from their home does not guarantee they will be free of adverse impacts in future, from other sources of ILFN.

We do not know how long it takes to fully recover from ILFN sensitization, or indeed if it is possible. Certainly individuals who were severely affected from ILFN emissions from wind turbines and coal mining even up to ten years ago report ongoing physical and mental health problems directly as a result of their exposure.

It is therefore all the more important, in my opinion, to ensure that we carefully study the thresholds of perception in those who are chronically sensitized and reporting adverse health impacts, as a priority. If those people can be protected from experiencing symptoms and sensations related to ILFN emissions, then it follows that individuals who are less susceptible and less sensitized should also be protected. **A failure to do this will result in further serious harm to vulnerable populations, which is an undesirable public health and social outcome.**

Population or laboratory studies on unexposed people with no underlying susceptibility factors will not protect those who have become sensitized from further damage to their health, because the thresholds established by studying these unexposed people for short periods of time will not be sufficiently low enough. I note that this issue of shifts in thresholds of perception was raised by Berglund and Lindvall in 1995,¹⁹ so it is not a new concept.

I also note your comment about the “*small percentage of subjects that are extremely or acutely sensitive to wind-turbine infrasound*”. There is no doubt that there is a small sub group in the population of people reporting adverse impacts who are acutely sensitive *immediately* to the impacts of excessive infrasound and low frequency noise. Their symptoms are usually manifested by a severe motion sickness or vestibular dysfunction pattern of symptoms, with extreme distress. These are the individuals whom Dr Schomer and his colleagues discussed in their 2013 paper presented at Denver.²⁰

However the adverse health impacts of wind turbine noise, and I suspect other sources of ILFN, are much larger than just this small sub group, especially because of the widely reported characteristic “new” sleep disturbance correlating with exposure to operating wind turbines out to distances like ten km. Population noise impact surveys carried out at three wind developments in Australia suggest that a far greater proportion of the population living out to distances of 10km from the nearest 2 – 3 MW wind turbines have disturbed sleep which they attribute to the new source of sound and vibration in their community.²¹ In the case of Waterloo, their attribution of these impacts has been borne out by subsequent acoustic field data collected by Emeritus Professor Colin Hansen and his team,²² who found excessive levels of wind turbine noise inside

¹⁹ <http://waubrafoundation.org.au/resources/berglund-b-lindvall-t-community-noise/>

²⁰ <http://waubrafoundation.org.au/resources/schomer-et-al-wind-turbine-noise-conference-denver-august-2013/>

²¹ the three locations of these population noise impact surveys were at Cullerin in NSW (Schneider 2012 <http://waubrafoundation.org.au/resources/cullerin-range-wind-farm-survey-august-2012/> and Schneider 2013 <http://waubrafoundation.org.au/resources/schneider-p-cullerin-range-wind-farm-survey-follow-up-july-august-2013/>), Macarthur in Victoria (Schafer, 2013 <http://waubrafoundation.org.au/resources/macarthur-wind-energy-facility-preliminary-survey/>) and Waterloo in South Australia (Morris, 2012 <http://waubrafoundation.org.au/resources/morris-m-waterloo-case-series-preliminary-report/>)

²² see particularly the detailed report of the acoustic data collected concurrently with the SA EPA acoustic survey in mid 2013 <http://waubrafoundation.org.au/resources/hansen-zajamsek-hansen-noise-monitoring-waterloo-wind-farm/>

homes out to 8.7km, which would be expected to result in sleep disturbance in a very quiet background noise environment, and which indeed correlated with noise complaints noted in diaries.

The correlation of sleep disturbance to wind turbine noise exposure is further corroborated by data sets such as that recorded by Mrs Mary Morris from Waterloo, documenting what happened when the turbines were “off” for a week immediately after the South Australian EPA survey, because of a cabling fault.²³ These reports from Waterloo residents who had a week of no turbine’s operating were consistent with what Steven Cooper’s study participants reported when the Cape Bridgewater turbines were off during the Pacific Hydro acoustic survey.

There is also evidence that the proportion of people impacted in the community by sleep disturbance (as a result of wind farm acoustic emissions) increases over time, and that the impacts worsen. This is consistent with the many individual reports the Waubra Foundation is given, volunteered to us by those who are directly and seriously adversely impacted, often to the extent of needing to leave their homes in order to obtain relief.

It is the Waubra Foundation’s view, based on our work in this area with residents and Australian Acousticians over the last five years, that **as a priority multidisciplinary field research measuring the full acoustic exposures inside homes is urgently required, together with physiological monitoring in those individuals reporting the most severe impacts, in order to understand what maximum tolerable exposure levels at specific frequencies are required, inside homes**, so people can live in their homes and sleep in their beds without experiencing adverse health effects from “noise annoyance”, regardless of the noise source.

The important issue of sensitization to ILFN and reports of permanent damage to physical and mental health as a result of chronic exposure to excessive levels of IFLN makes this even more of a public health priority, in order to protect people against sensitization in the first place.

I note your suggestion for both field and laboratory investigations and agree with you such work is needed.

I understand from various acousticians in Australia that there are real problems with reproducing the sound field of infrasound in a laboratory environment that is exactly the same as that which is present in dwellings.

It is therefore important that if the thresholds of perception are to be established for chronically sensitized persons that the testing be carried out in their homes, being the exact environment in which they experience such disturbances and adverse health impacts. Similarly testing of person not chronically sensitized but experiencing disturbance from ILFN should first be established in their natural environment, where they are experiencing the sensations and symptoms, before moving to laboratory testing.

Then those same people can be tested in a laboratory – after the researchers have been able to verify the reproduced sound field agrees with the acoustic environment and exposures in their dwelling. I understand this validation is a very involved and complex process whereas measurements in the field are in some respects simpler because they are occurring in the actual real world environment, where these people are trying to live, work, and sleep.

In relation to proposed research a number of other issues should also be considered. The threshold issue is relative to the ambient conditions, and the variation in ILFN from wind farms is relevant, as well as the measurement indices identified in the Shirley wind farm report. Both Professor Hansen and Steven Cooper note the extremely low background noise levels in the rural environment, and the observations of the residents of noise related sleep disturbance indicate the “nominal” 30 dB(A) sleep disturbance criterion is inappropriate for rural residences. Furthermore both Hansen and Cooper have expressed concerns about the use of background (L90) or even Leq levels for assessment purposes that do not identify the significant range in pressure levels generated by turbines, pointing out that Kelley used peak levels. As Emeritus Professor John Harrison (Queens University, Ontario) has pointed out, the ear hears the peaks of sound levels.²⁴ Salt’s team’s

²³ Morris, 2013 <http://waubrafoundation.org.au/resources/morris-m-waterloo-case-series-preliminary-report/>

²⁴ Harrison, John 2011 <http://waubrafoundation.org.au/resources/harrison-jp-wind-turbine-noise/>

work suggests that this applies for inaudible sound peaks as well.²⁵

Finally, with respect to the conduct of Pacific Hydro, I agree with you that Pacific Hydro are to be commended for initiating the investigation into the noise nuisance being reported by local residents, and for funding Steven Cooper's acoustic investigation and the Foundation has previously congratulated Pacific Hydro for taking this step which no other wind developer or government authority has done. There is no doubt there has been a quantum leap forward in knowledge of the acoustic exposures and sound and vibration imissions of wind turbines, especially with the crucially important "on off" comparative data.

What has angered many people, including particularly the severely impacted residents unable to live in their homes at Cape Bridgewater,^{26 27} is the subsequent conduct of Pacific Hydro in walking away from addressing the serious noise nuisance their wind turbines have clearly created. The local situation is further complicated by the recent completion of the construction of Portland Stage 4, which is right on the edge of the township of Portland, where local residents including some of Pacific Hydro's own employees are already reporting adverse impacts.²⁸

With best wishes



Sarah

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²⁵ <http://waubrafoundation.org.au/resources/salt-n-lichtenhan-j-t-how-does-wind-turbine-noise-affect-people/>

²⁶ <http://de.friends-against-wind.org/health/it-has-never-been-about-money-it-is-about-being-able-to-live-in-our-home>

²⁷ <http://en.friends-against-wind.org/health/pacific-hydro-refuses-to-deal-with-health-damaging-levels-of-wind-turbine-emissions>

²⁸ personal communication, local residents from Portland