

CANADA
PROVINCE OF SASKATCHEWAN

Q.B. No. _____ of A.D. 2010

**IN THE COURT OF QUEEN'S BENCH
JUDICIAL CENTRE OF SASKATOON**

BETWEEN:

DAVID McKINNON

PLAINTIFF

AND:

**RED LILY WIND POWER LIMITED
PARTNERSHIP,
a limited partnership by its General Partner
RED LILY ENERGY CORP.,
THE RURAL MUNICIPALITY OF MARTIN NO. 122
and
THE RURAL MUNICIPALITY OF MOOSOMIN NO.
121**

DEFENDANTS

AFFIDAVIT OF DR. MICHAEL M. NISSENBAUM, M.D.

I, DR. MICHAEL M. NISSENBAUM, M.D., of the City of Fort Kent, Maine, United States of America, MAKE OATH AND SAY AS THAT:

1. I am a from the University of Toronto Medical School with post-graduate training at McGill University and the University of California.
2. I am a specialist in diagnostic imaging, whose training and work involves developing and utilizing an understanding of the effects of energy deposition, including sound on human tissues. I am a former Associate Director of MRI at a major Harvard Hospital, a former faculty member (junior) at Harvard University, and a published author.

3. I developed an interest in the health effects of wind turbine projects after becoming aware of complaints related to an industrial wind turbine installation in Mars Hill, Maine, and subsequently investigating the widespread and serious health effects suffered by most of the residents of Mars Hill, who live in proximity (within 1100 meters) to a linear arrangement of twenty-eight 1.5 MW wind turbines.

4. I have recently conducted a study of the health effects of persons living within 1100 meters of the Mars Hill Wind Turbine Project in Aroostook County, Maine, which consists of 28 wind turbines. Each turbine is 389 feet tall, from base to blade tip. This study is important because it represents the first controlled study of adverse health effects attributed to industrial wind turbines.

5. As part of the study, 22 of an estimated 30 adults living in the affected area were interviewed. Subjects interviewed included 10 females, ranging in age from 18 – 73, and 12 males, ranging in age from 43 – 79. The CONTROL group comprised of 27 individuals, 12 female and 13 male, age ranges and averages comparable to the subjects. The control group lived on average 5000 meters away from the turbine installation. A true copy of the map of the study area is attached to this, my Affidavit, and marked as Exhibit “B”.

6. Of the 22 subjects I interviewed, 18 of them (82%), reported a new onset or worsened sleep disturbance since the Mars Hill Wind Turbine Project went online in December 2006. 17 of those interviewed (77%) reported their sleep disturbance problems included waking up in the middle of the night, while 10 (45%) reported

difficulty falling asleep. There were 5 new prescription medications for chronic sleep disturbance in this group of 22 subjects. In the CONTROL group, only 1 individual (4%) reported a new or worsened sleep disturbance in the same time period since the turbines went online. There were no new prescriptions for sleep disturbance in the CONTROL group.

7. Of the 22 subjects I interviewed, 9 of them (41%) reported increased headaches since the Mars Hills Wind Turbine Project went online in December 2006, with 7 of them (32%) reporting a new onset of headaches and 2 of them (9%) reporting increased migraine frequency. There were three new prescriptions for headache medication in this group. The CONTROL group had 1 individual (4%) with a worsened headache problem in this same time period.

8. Of the 22 subjects I interviewed, 3 of them (14%) reported new or worsened problems with dizziness since the Mars Hills Wind Turbine Project went online in December 2006, 3 (14%) reported tinnitus, 3 (14%) reported a new problem with ear pulsation sensations, and 1 (5%) reported periodic ear pain. There were no auditory or vestibular complaints in the CONTROL group.

9. Of the 22 subjects I interviewed, 7 of them (32%) reported they have been troubled by shadow flicker since the Mars Hills Wind Turbine Project went online in December 2006, with 2 (9%) of those reporting nausea, and 4 (18%) reported dizziness. 1 (5%) reported triggering migraine headaches by shadow flicker, and 2 (9%) reported a

feeling of unease created by shadow flicker. There were no complaints related to shadow flicker in the CONTROL group.

10. Of the 22 subjects I interviewed, 8 of them (36%) reported they have experienced unintentional weight changes since the Mars Hills Wind Turbine Project went online in December 2006, with 6 of those reporting weight gain and 1 reporting weight loss. In the CONTROL group, there was 1 person (4%) who experienced unintentional weight change in that period.

11. Many of those affected by the Mars Hill Wind Turbine Project also reported new or worsened psychiatric symptomatology, including feelings of “stress” (13 people or 59%), “anger” (17 people or 77%), “anxiety” (7 people or 32%), “irritability” (6 people or 27%), “hopelessness” (12 people or 55%), and “depression” (10 people or 45%). Of those 8 persons who reported experiencing feelings of “depression,” all of those reported that such feelings are new since the Mars Hills Wind Turbine project went online in December 2006. There were 4 new or increased prescriptions for psychiatric medication in the subject group. The control group reported no new or increased psychiatric complaints.

12. In reporting feelings of “anger,” a 67 year old woman described it as, “Absolute rage – you feel you want to kill someone, and don’t know who to kill.” A 65 year old man described it as, “So angry I could kill.” And a 65 year old woman described it as, “Makes my blood boil.”

13. In reporting feelings of “hopelessness,” several of those affected by the Mars Hill Wind Turbine Project described those feelings, making the following comments:

- a) “Nobody will help us.”
- b) “No options – can’t leave, and can’t live here.”
- c) “This is an awful thing to have happen to you.”
- d) “People don’t believe us – (our complaints) fall on deaf ears.”
- e) “No one cares. No one listens.”
- f) “They just tread on us.”
- g) “It’s very hard watching my child suffer.”

14. Those I interviewed reported a total of 15 new and increased prescriptions for various health ailments since the Mars Hills Wind Turbine Project went online in December 2006. The CONTROL group reported 4 new or increased prescriptions in that time period.

15. 21 out of the 22 people in the subject group (95%) reported that their quality of life has been negatively affected by the Mars Hill Wind Turbine Project. Comments made by those persons when reporting that their lives have been affected include the following:

- a) “Loss of joy in living ... put a lot of life’s plans on hold.”
- b) “No desire to go outside.”
- c) “Feel trapped.”
- d) “Dreams have been dashed.”

- d) "Was our dream home ... it's all been stolen from us."
- f) "We have no peace and quiet."
- g) "My husband's (who has advanced MS) only pleasure in life was to see the wild animals. They are gone."
- h) "No sleep."
- i) "Sinking feeling every night when I (come home) and see them."
- j) "I used to be able to hear it snow, before. Now, I do not look forward to going home."

There were no perceptions of reduced quality of life in the CONTROL group.

16. One hundred percent of the persons I interviewed reported they had considered moving away. None of the CONTROL group admitted to considering moving away during that time period.

17. It is my professional opinion that there is a high probability of significant adverse health effects for those whose residence is located within 1100 meters of a 1.5 MW turbine installation based upon the experiences of the subject group of individuals living in Mars Hill, Maine. It is my professional opinion, based on the basic medical principle of having the exposure to a substance proven noxious at a given dose before risking an additional exposure, that significant risk of adverse health effects are likely to occur in a significant subset of people out to at least 2000 meters away from an industrial wind turbine installation. These health concerns include:

- a) Sleep disturbances/sleep deprivation and the multiple illnesses that cascade from chronic sleep disturbance. These include cardiovascular diseases mediated by chronically increased levels of stress hormones, weight changed, and metabolic disturbances including the continuum of impaired glucose tolerance up to diabetes.

- b) Psychological stresses which can result in additional effects including cardiovascular disease, chronic depression, anger, and other psychiatric symptomatology.
- c) Increased headaches.
- d) Unintentional adverse changes in weight.
- e) Auditory and vestibular system disturbances.
- i) Increased requirement for and use of prescription medication.

18. I have been provided with a copy of the Red Lily Wind Energy Project Environmental Assessment prepared by Tetres Consultants Inc. dated November 2008 (“Environmental Assessment”), a copy of which I believe has been filed with the Court. My review of the Environmental Assessment indicates that the proposed wind turbines to be constructed will be 1.5 to 2.5 megawatts. The wind turbines constructed in Mars Hill, Main were 1.5 megawatts.

19. In reviewing the Environmental Assessment, there is no definitive setback established with respect to the minimum distance from each resident’s home a turbine could be built. The only reference I found in the Environmental Assessment, with respect to the minimum setback distance, is for the wind turbines from each resident’s home is approximately “400m (varying from 300m to 600m, depending on site - specific characteristics)”. This reference can be found at Page 79 of the Environmental Assessment.

20. Moreover, I have been advised by the Plaintiff and verily believe the same to be true that neither the Rural Municipality of Moosomin nor the Rural Municipality of

Martin have imposed any minimum setbacks with respect to how close a turbine can be constructed to a resident's home.

21. Attached and marked as Exhibit "C" to this, my Affidavit is a map titled Red Lily Wind Energy Partnership, Distance from Turbines to Residences. This map indicates the distance of the proposed initial 16 turbines to 21 residences in the proposed project boundary. As can be seen on this map, all of the residences with the exception of number 5 fall within 2000 meters of where at least one turbine will be located. Moreover, 12 of the 21 residences will have a wind turbine constructed less than 1200 meters from their residence. With respect to the issue of the proposed setbacks, it is important to note that while the initial proposal is for the construction of 16 turbines, the literature attached to the Environmental Assessment, Attachment B, Page 5A, shows that up to an additional 14 wind turbines, for a total of 30 wind turbines will be constructed in this area.

22. In addition to my controlled research with respect to the Mars Hill linear wind turbine project, there has been research in Ontario conducted by Dr. Robert McMurtry and Carmen Krogh with respect to the health risks associated with industrial wind turbine installations. The research conducted by Dr. Robert McMurtry and Carmen Krogh consists of a questionnaire completed by 109 people in Ontario and 9 people from other jurisdictions. It is my understanding that the questionnaire was distributed by word of mouth under a protocol and is uncontrolled, which means that there is no control group against in which to measure these results. Attached and marked as Exhibit "C", to this, my Affidavit, is a true copy of the results of Dr. McMurtry and Carmen Krogh's survey.

The results of the survey provide additional confirmation of the types of symptoms that occur among effected people.

23. The Environmental Assessment at Page 79 states, “setback distances to residences and other receptors of about 400m (varying from 300m to 600m, depending on site - specific characteristics) have demonstrated to be generally adequate to reduce the nature and frequency of audible noise emissions to levels within acceptable nuisance thresholds”. I strongly disagree with this statement. The authors of the Environmental Assessment, not being medical doctors, did not describe the health significance or severity of the “nuisance” in medical terms. A review of the controlled Mars Hill, Maine findings and the uncontrolled findings of Dr. McMurtry and Carmen Krogh, however, indicates that this “nuisance”, is one of the root causes of sleep disturbance and secondary negative health effects suffered by the residents of Mars Hill, Maine.

24. The first slide in Exhibit “F”, are additional graphs created by Richard James, which indicate why the measurements taken demonstrates the fact that there is a statistical standard deviation for each point on a standard ‘equal loudness contour graph’. That is to say, the point on the graph represents only an average, with half of the human population being more sensitive, and half less sensitive, to a noise at any given frequency and decibel level combination. An equal loudness contour is a line that maps out a person’s perception of a certain degree of loudness by frequency. The standardized equal loudness contour graphs, such as seen in subsequent graphs of appendix 5, represent the cumulative results for a population of test subjects, averaged out. The first graph reminds us that each point on the lines that make up the graphs are in fact average values, with a

normal statistical distribution, whose standard deviation is 6 decibels. This means that one person in 6 or 7 is 4 times as sensitive to a sound as the average person. Moreover, at Page 79 of the Environmental Assessment it is stated that, “there will be inaudible noise and infrasound effects”. However, it would appear that the Environmental Assessment attempts to minimize the seriousness of this issue. It is again important to point out that the authors of the Environmental Assessment are not physicians. To my knowledge, there has been no medical refutation of the potential negative health effects of infrasound emitted by wind turbines and the subject is at least an open medical issue of concern, warranting immediate investigation prior to the construction of this project. New investigations performed with state of the art equipment, which has temporal, sound level, and frequency resolution of a much higher degree compared to equipment that is currently and conventionally used to monitor wind turbine sound (and provide the basis for preconstruction sound modeling), indicated that sound levels at low frequencies occur at sufficient decibel levels to be heard by a significant proportion of normal individuals.

25. The second slide of Exhibit “F” is a standard equal loudness contour graph (ISO 2003) which has been taken from the recent American and Canadian Wind Energy Association White paper published in late 2009. The source is not important. It is a standard, accepted graph used by industry, engineers, acousticians and the like. The important point this slide makes is that the sounds that the tests subjects (who were recruited to create this graph) heard were ‘pure tones’, that is to say, sinusoidal wave forms that were uniform, neither frequency nor amplitude modulated, and free of randomness. These types of tones are less intrusive than more complex tones, and hence are perceived as less loud at any given decibel level compared to complex tones. In the case of a pure

tone at 20 HZ, the blue arrow shows us that the average person will begin to hear it at 79 decibels sound pressure level.

26. The third slide of Exhibit "F" shows us that more complex sounds, in this case random noise with sound pressure level increasing and falling (amplitude modulation) in a temporally random pattern, will be perceived at a lower sound level (even if the peak level has a sound pressure no higher than an otherwise comparable pure tone). In the case of random noise with an average frequency of 20 HZ, it will be perceived at a sound pressure 10 decibels less than a pure tone 20 HZ sound by the average person: it will be perceived at 69 decibels (red arrow).

27. The fourth slide in Exhibit "F" slide demonstrates how, when the 6-decibel standard deviation is added, the threshold of hearing for a 20 HZ average complex tone for one in 6 or 7 people falls to 62 decibels. Given that turbine noise is not a pure tone, and is not random, but actually has a pulsatile, or periodic structure with a repeat rate of around once per second, the threshold of perception likely falls even farther, as we are designed, as human beings, to automatically try and derive information from structured sounds as opposed to truly random sounds or pure tones).

28. If we understand the significance of the facts in Exhibit "F" and we revisit Exhibit "E", it becomes clear that the noise put out by a 1.5 MW turbine 1500 feet away contains components that will be readily audible, DIRECTLY, to a significant minority of people (greater than one in 6 or 7, or about 15% of the population).

29. Infrasound, if at a sufficient volume level, will cause windows, walls, and floors to vibrate, and so convert sound that would, on its own, be inaudible to the majority of people into sound that will be audible to most. Attached and marked as Exhibit “G” to this, my Affidavit, is a short segment removed from the spectral graph set out in Exhibit “E”. The information on this spectral graph segment was plotted onto standard building science graph of the response of windows, walls and floors of common residential construction as a function of frequency and sound pressure level. For the frequencies plotted here in red dots, we see that they would be expected to result in audible noise, and we find an explanation for why many more people who live in proximity to turbines experience noise than we might expect based purely on the 15% or so of people who would be expected to directly hear very low frequency turbine noise. The homes are ‘converting’ direct turbine noise that would be inaudible to most, into noise that is in fact audible to most. The sound would be experienced as noise, and because of known effects, would be most pronounced at night, and so result in sleep disturbance and deprivation. If chronic (and wind turbine installations are by definition ‘chronic’), this would result in consequent adverse health effects. There are additionally significant issues relating to audible low frequency noise of a persistent, pulsatile nature, such as created by wind turbines.

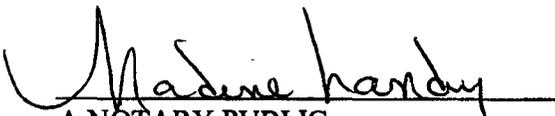
30. Attached and marked as Exhibit “H” to this, my Affidavit, is a standard ISO 2003 equal loudness contour graph that has the ‘blade swish’, or ‘blade thump’ typical of industrial wind turbines plotted on to it (red dot) at the frequency and decibel level measured at Ubly, Michigan, 1,500 ft (500 meters) from a 1.5MW GE industrial wind turbine by well known Acoustic Engineer Richard James, INCE, in December of

2009. This will be a noise audible to essentially everyone, at a loudness of about 45 phon, considered intrusive if unwanted, or containing disturbing noise characteristics, and enough to affect sleep levels, rousing some people from deeper levels of sleep into shallower, and fully waking others.

31. It is also important to consider the climate in Saskatchewan. In the winter, these wind turbines will be prone to icing which will increase the sound coming off the turbines by up to 6 dBA. As the icing occurs symmetrically on all blades, imbalance detectors do not kick on, and the blades keep turning, contrary to claims in the Environmental Assessment at Page 77.

32. I make this Affidavit on the basis of providing the Court with expert evidence with respect to the health risks associated with industrial wind turbine installations.

SWORN BEFORE ME at the City of Fort
Kent in the State of Maine, this 11th
day of August, A.D. 2010.

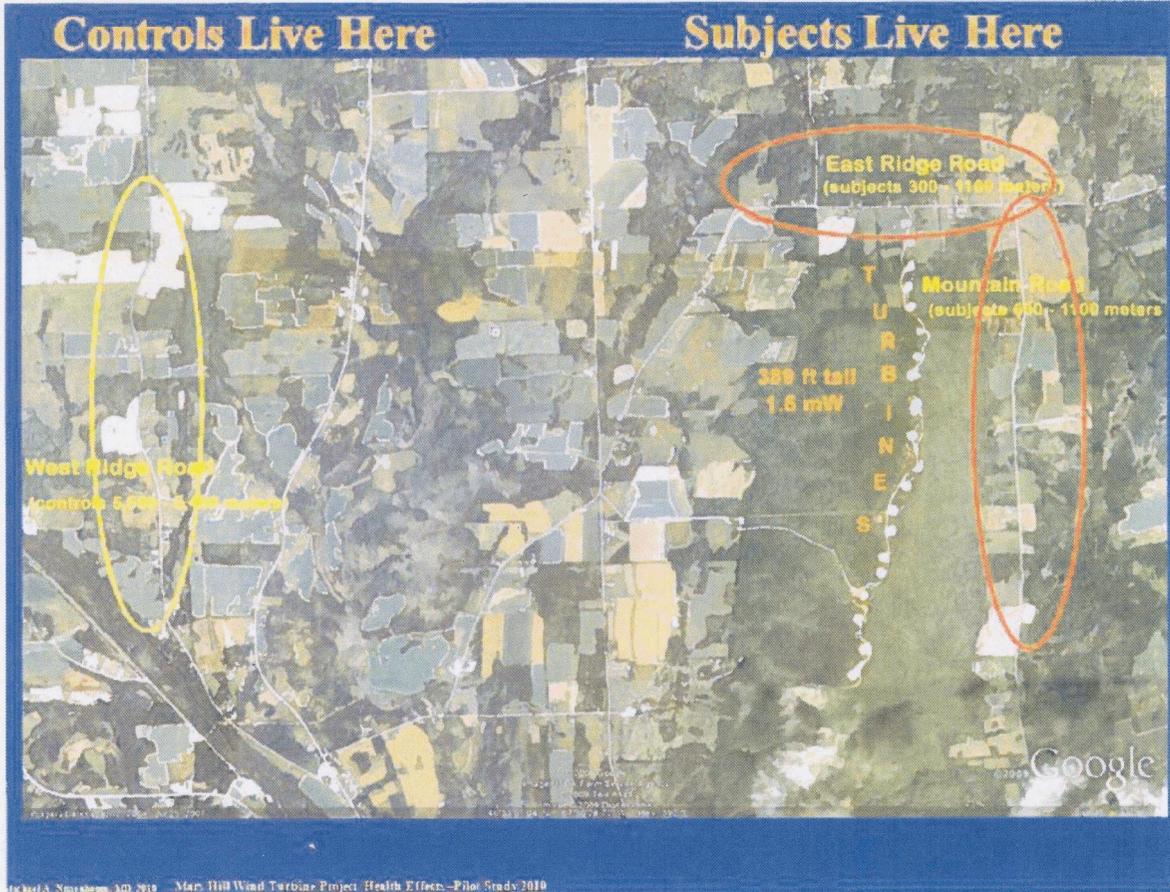

A NOTARY PUBLIC

in and for the State of Maine.


DR. MICHAEL A. NISSENBAUM,
M.D.

Appendix 1

Study Map, Mars Hill, Maine



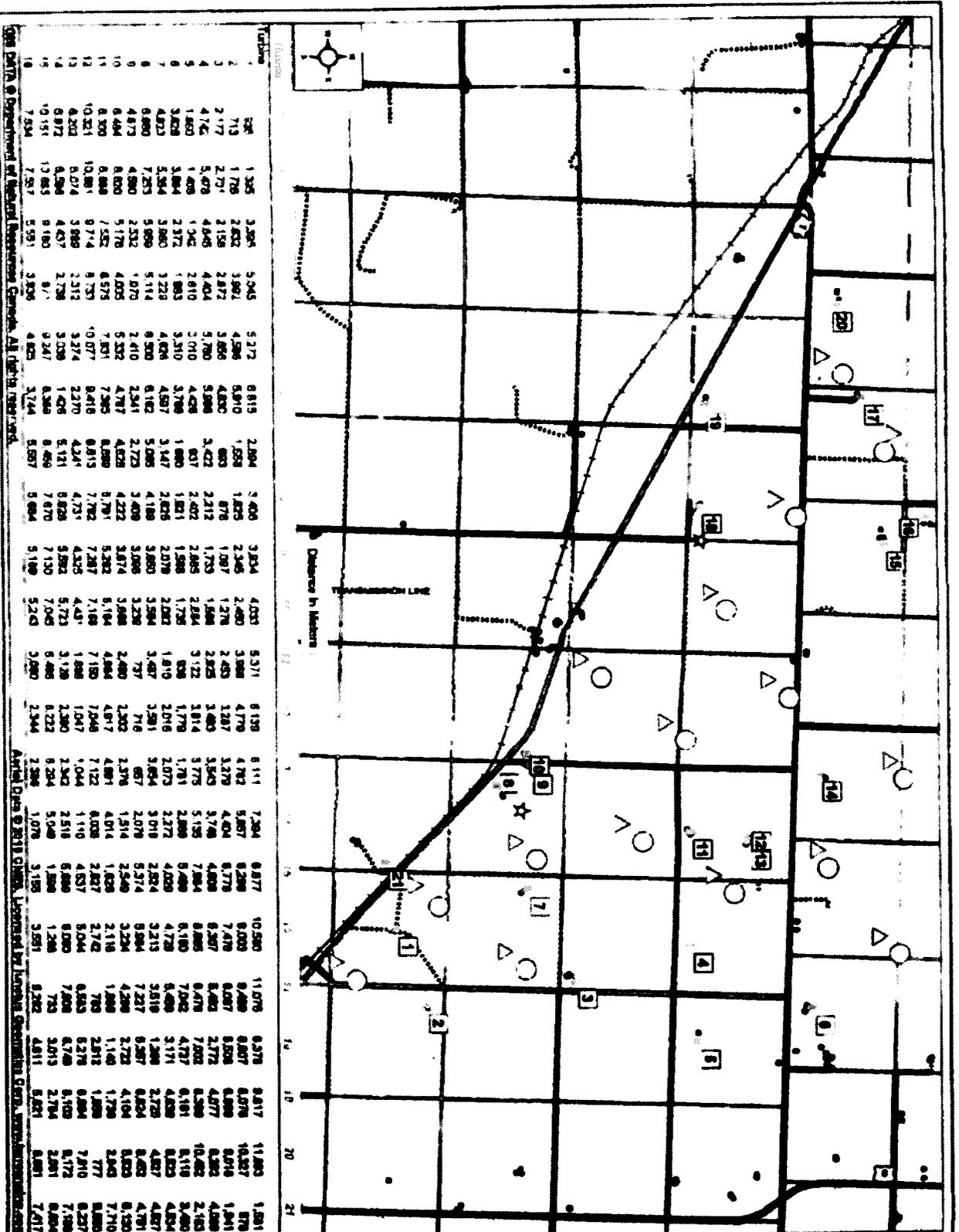
THIS IS EXHIBIT "B." REFERRED TO IN THE
AFFIDAVIT OF Dr. Michael Nissenbaum
SWORN BEFORE ME AT Eastport
IN THE PROVINCE OF Maine
THIS 11th DAY OF Aug A.D. 2010

Madeline Handley
A NOTARY PUBLIC IN AND FOR THE
State PROVINCE OF Maine
BEING A SOLICITOR - or -
MY APPOINTMENT EXPIRES 10-27-2011

THIS IS EXHIBIT "C" REFERRED TO IN THE
AFFIDAVIT OF Dr. Michael Nissenbaum
SWORN BEFORE ME AT Fort Kent
IN THE PROVINCE OF Maine
THIS 11th DAY OF Aug A.D. 2010

Madine Landry

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Legend

- △ Turbine Locations
- Residences
- Project Boundary
- ★ WRT Tower
- Star-shaped boundary indicates the third stage boundary (pre-validated) - boundary
- Investigation Line

Scale: 0 0.25 0.5 1.0 Kilometers / 0 0.25 0.7 1.4 Miles

Key Plan

ALGONQUIN POWER
 NED LBY WIND ENERGY PARTNERSHIP

Distance from Residences to Turbines

Scale: 1:50,000
 Date: FEB 22 2010

420 - 128 0

Table with 18 columns and 18 rows of numerical data. The columns are labeled 1 through 18. The rows contain numerical values representing distances from residences to turbines.

From Data @ Department of Natural Resources Canada. All rights reserved.

April Data @ 2010 ONER. Approved by LUTHER GREENBERG LTD. WIND ENERGY PARTNERSHIP

THIS IS EXHIBIT "E" REFERRED TO IN THE
AFFIDAVIT OF Dr. Michael Nissen-Daypo
SWORN BEFORE ME AT Fort Kent
IN THE ~~STATE~~ PROVINCE OF Maine
THIS 11th DAY OF Aug A.D. 2010

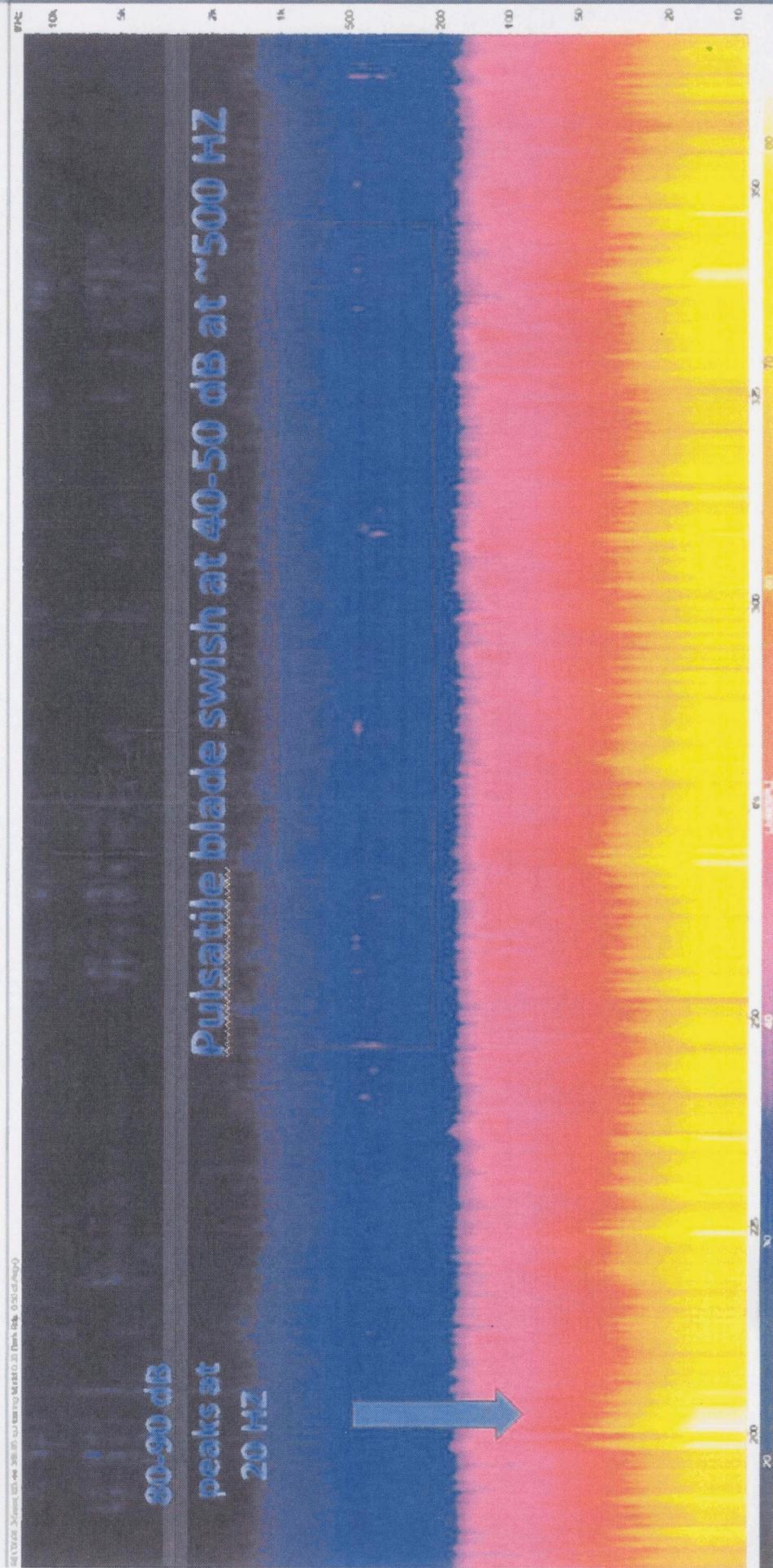
Madine Landry

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Outdoors 3 A.M.

Modern 1.5 MW GE turbine at 1500 feet, Ubly, MI,

Dec. 2009



Courtesy Richard James, E-coustics Solutions

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Madeleine Landry

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There is a standard deviation of 6 dB around the 'average' point on the equal loudness contours. This means that one person in 7 is at least 4 times as sensitive to noise as the average person.

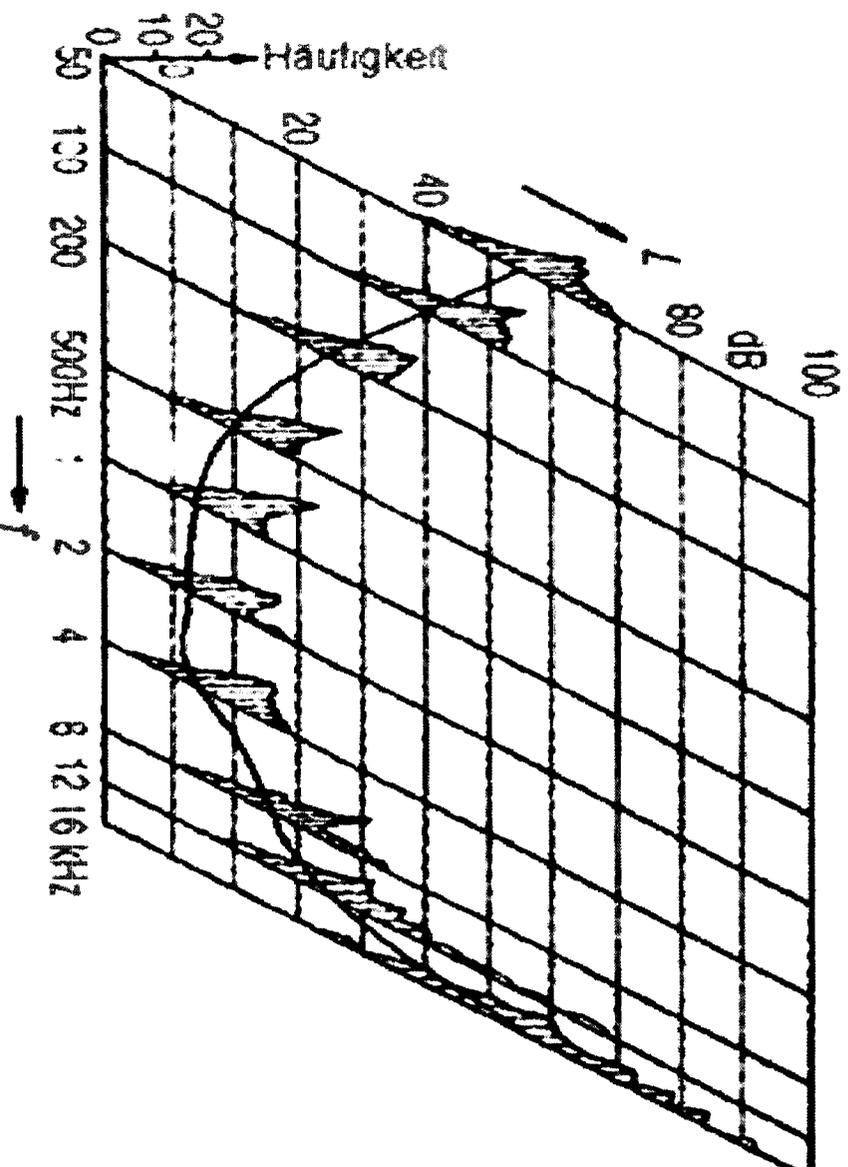
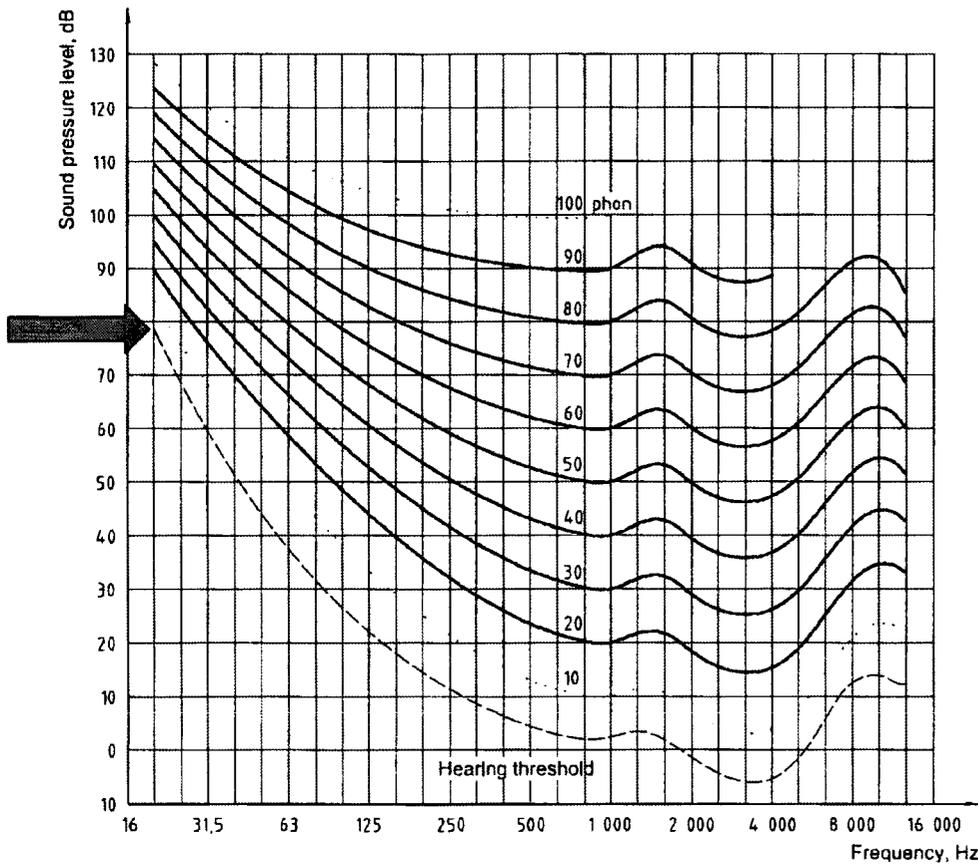


Fig. 9 Threshold in quiet. Also shown, distribution of thresholds (14)

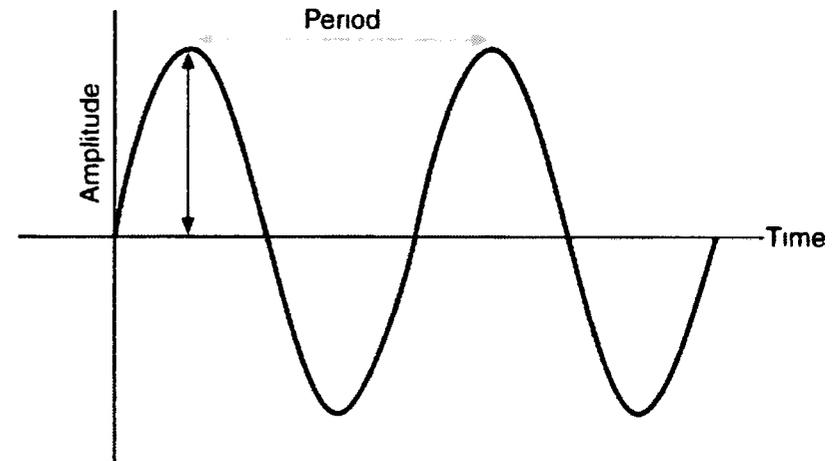
J. Spille, "Messung der Vor- und Nachverdeckung bei Impulsen unter kritischen Bedingungen," In tern.Rep., Thomson Consumer Electronics, Hanover, Germany (1992)

What Can We Actually Hear?

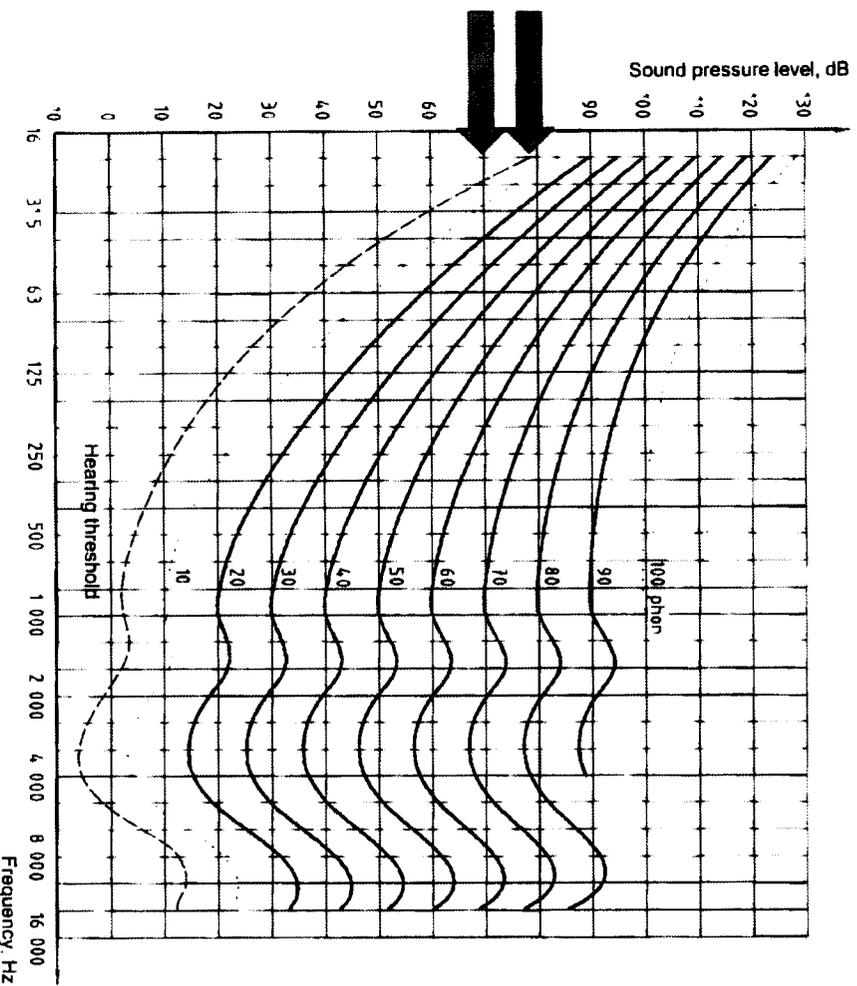


Hearing Contours for Equal Loudness Level (ISO 2003) from A/ConWEA 12/2009 'White Paper'

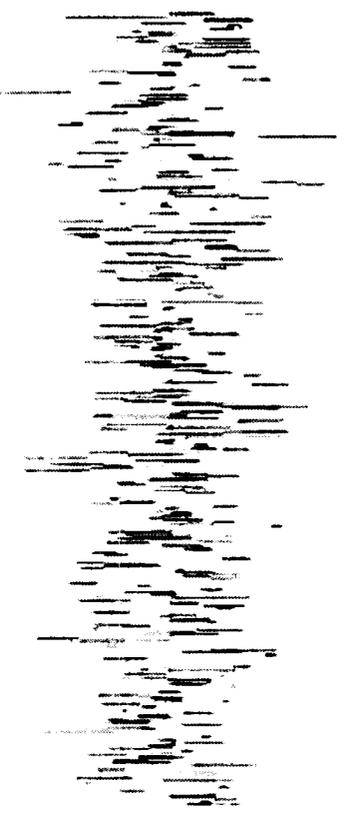
Traditional *equal loudness contours* were obtained by playing pure tone, sinusoidal wave forms.
20HZ discernable at 79dB



What Can We Actually Hear?

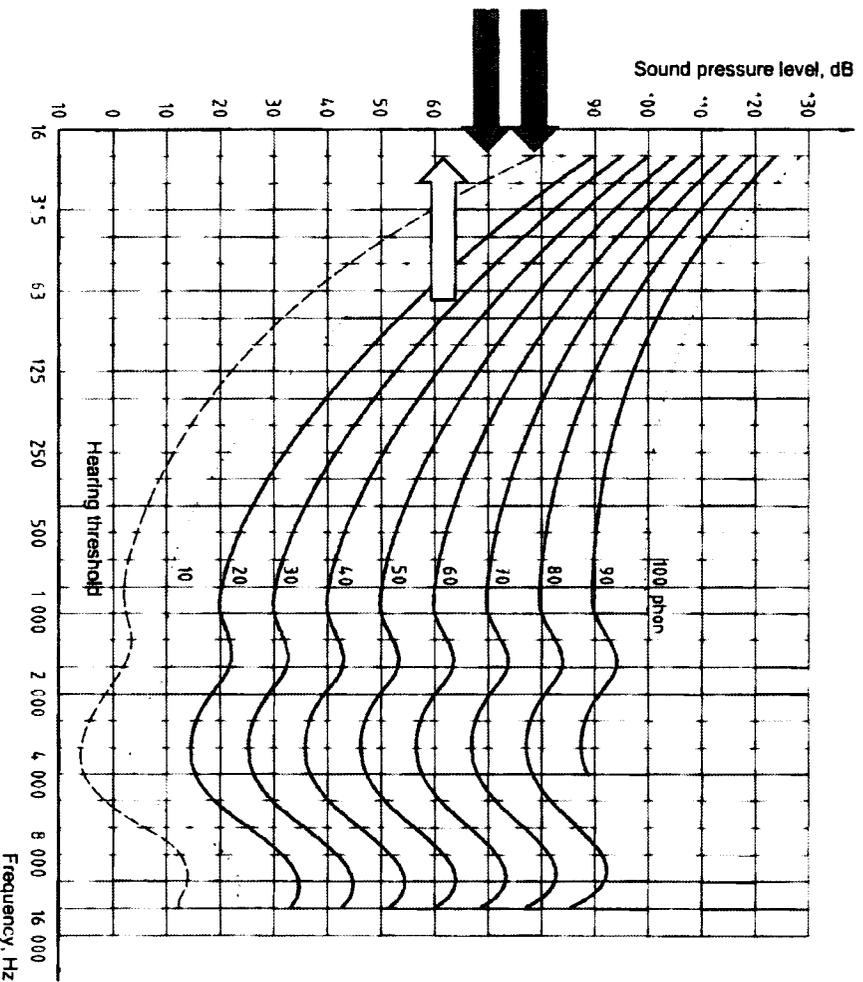


Random Noise is mixture of frequencies and amplitudes. It has a 'crest factor' which refers to the above average peaks. The hearing threshold drops by up to 10dB at 20HZ*



*Moller H & Pedersen C.S. Hearing at Low & Infrasonic Frequencies, Noise & Health, Volume 6, Issue 23, April-June 2004

What Can We Actually Hear?



Hearing Contours for Equal Loudness Level (ISO 2003) from A/CANWEA 12/2009 'White Paper'

The organized, pulsatile broadband turbine noise results in even greater reduction in the hearing threshold.

Also, 6 dB SD means 16% of us will have at least a further 6 dB increase in sensitivity at 20 Hz.

This brings us to 62 dB or lower threshold for one in 6 people.

THIS IS EXHIBIT "G" REFERRED TO IN THE
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Madeira Landry

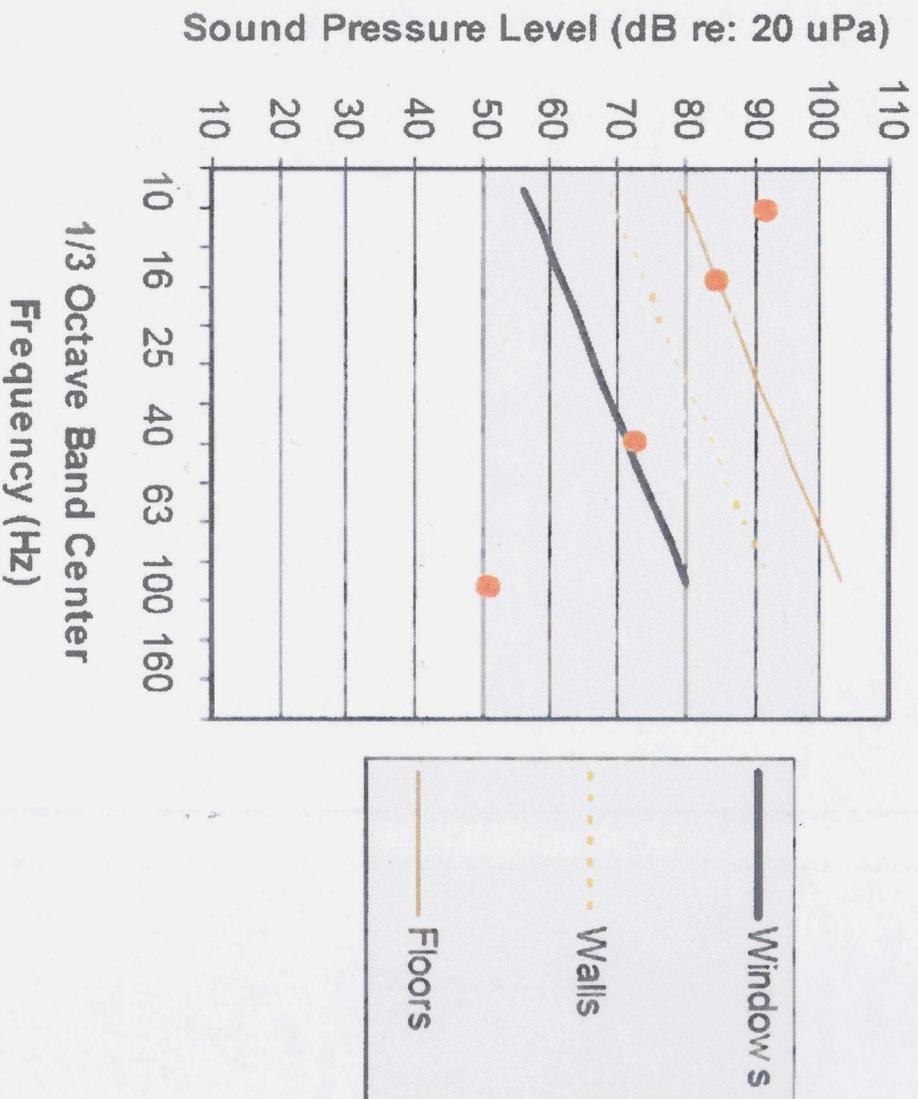
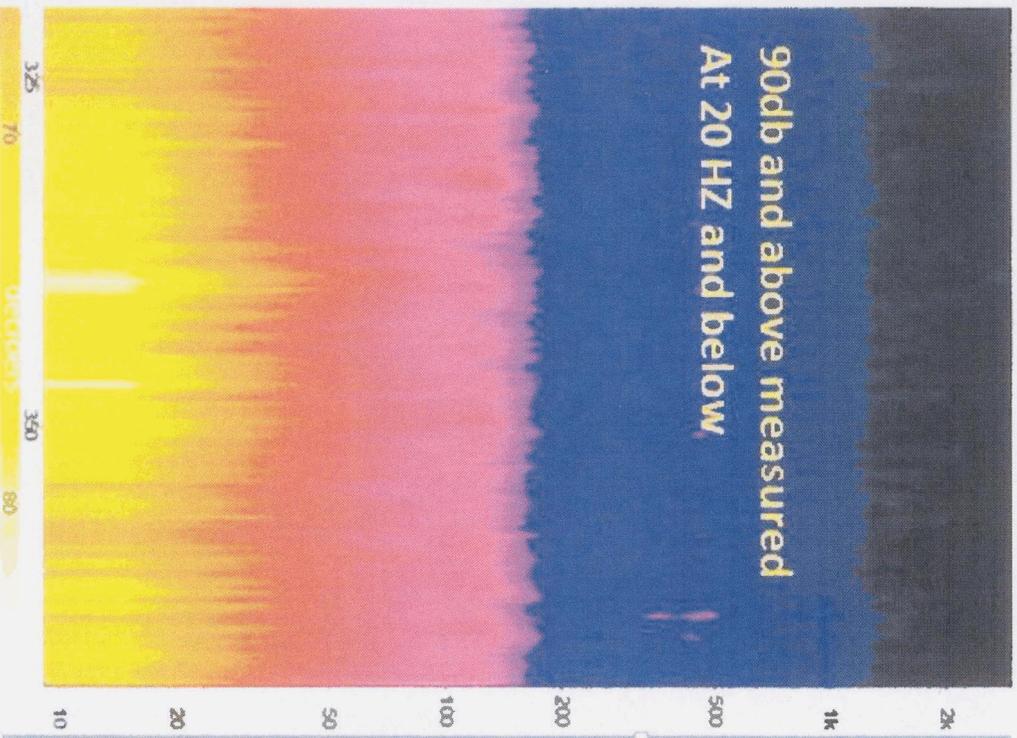
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Dwelling Vibration and Rattle

Perceptible vibration in residential structures by low frequency noise

Outdoors 1500ft 1.5MW, Ubly Michigan, Dec 2009



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Melanie Landry

A NOTARY PUBLIC IN AND FOR THE
~~state~~ PROVINCE OF Maine

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MY APPOINTMENT EXPIRES 10 27 2011

'Blade Swish'

