THE STATE OF NEW HAMPSHIRE
BEFORE THE
SITE EVALUATION COMMITTEE

DOCKET NO. 2010-01

APPLICATION OF GROTON WIND, LLC
FOR A CERTIFICATE OF SITE AND FACILITY

PREFILED TESTIMONY OF JAMES BUTTOLPH ON BEHALF OF INTERVENOR GROUP OF BUTTOLPH/LEWIS/SPRING

Qualifications

Q. Please state your name and business address.

A. My name is James Buttolph. My business address is 170 Quincy Road, Rumney, NH 03266.

Q. Who is your current employer and what position do you hold?

A. I currently serve as President of Kingsley Medical Supply, LLC.

Q. What additional positions do you hold?

A. I am an election official for the Town of Rumney, holding both the Town Moderator and School Moderator positions. I also serve on a number of charitable boards and committees in various positions such as the Long Term Planning Committee and Finance Committee of the Church of the Holy Spirit in Plymouth, NH, and Troop Committee Chairman for Plymouth Boy Scout Troop 56.

Q. Please summarize your educational and professional background.

A. I earned a BS degree, Summa Cum Laude, from Clarkson University (formerly Clarkson College of Technology) in 1982. My major was Industrial Distribution

(engineering calculus and physics with an emphasis on management and finance). I worked for IBM's Federal Systems Division in Owego, NY holding various positions in the Cost and Industrial Engineering functions over the ensuing ten-year period. Responsibilities included specialized DOD avionics computer hardware cost estimating, statistical learning curve trend analysis, proposal development, customer negotiations, and presentation to senior executive management on F15 AP1R Fighter, Space Shuttle, F117 "Stealth" Fighter, Harpoon and Tomahawk Cruise Missile programs, BQQ5/6 Sonar processing and many other programs. In the late 80's I was promoted to Development Engineering Manager of IBM's Estimating Systems Development Organization, responsible for development and implementation of automated estimating systems in support of 70 Cost and Industrial Engineers at IBM's Owego facility (Currently Lockheed Martin). In 1991, I was asked by senior management to serve in IBM's Manassas, Virginia facility as one of 14 volume leaders for a competitive new business proposal task team pursuing a US Army prime contractor role on a program called SBIS. SBIS was an IBM FSD must-win proposal, representing the lynchpin in the division's long term business strategy. SBIS workscope included the replacement of antiquated hardware, software, and telecommunications infrastructure with state of the art systems for use in all of the United States Army's sustaining base – hundreds of camps, posts and stations worldwide. The initial phase included a proposal contract valued at over $900 million dollars, with new business follow on contracts estimated by industry analysts at over $3.2 billion dollars. The Army's decision criterion was most heavily weighted on the Competitive Cost Bidding Model volume, which was my responsibility. IBM's proposal as prime contractor, teamed with subcontractors AT&T, CACI and PRC, was ultimately judged superior to competing proposals from General Dynamics and E-Systems. This represented the largest systems integration contract ever awarded to IBM's Federal Systems Division by the United States Army.

Q. Please describe your current employment responsibilities

A. After serving as a volume leader on the SBIS proposal task team, I expressed an interest in taking advantage of IBM's corporate wide buy-out program during the DOD business downturn after the Cold War ended. After turning down several IBM offers for reassignment both within the Owego facility and at other locations, I resigned from IBM in order to start Kingsley Medical Supply LLC, which I own and operate today.

Q. How does your past experience assist the SEC in fairly evaluating the Groton Wind Farm proposal?

A. The Groton Wind Farm proposal is being advertised by the applicant as a cost effective, environmentally friendly, practical solution to the energy needs of the State of New Hampshire. It is also being advertised as a necessary component for providing needed electrical power to the region in support of state policy goals reflected in RSA 362-F, the so called "renewable portfolio standard" (RPS). It is clear that the degree to which this power can be used in support of RSA 362:F requires a thorough, comprehensive, and independent review. I have significant experience in performing complex cost estimating challenges. This experience is now being brought to bear in an effort to test the core assumptions upon which this proposal is based. With this analysis factored into the SEC's decision making process, the SEC will be better able to decide whether or not this project achieves an appropriate "balance" (as required by RSA 162) between the need for energy and the obvious detrimental impacts on the environment, human population, property values and the region's natural beauty.

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Purpose of Testimony

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide the Committee with relevant facts about the nature of wind power generation. First and foremost, before placing humans and the environment at risk, we need to closely analyze the extent to which these wind turbines, if constructed, can be expected to provide usable electricity in a manner that is most effective when compared to other renewable options that can also contribute to the goal of implementing RPS legislation.

Q. What are your initial conclusions regarding the applicant's proposed wind production figures?

A. It appears that there are numerous areas where the claims of the applicant deviate significantly from the likely performance realities. For example, the applicant claims of capacity factors of 33 - 36% seem optimistic when compared to the raw wind data. Turbine production history suggests that 15-25% is more typical. Also, the applicant claims that this project will be able to power "between 19,000 and 21,000 homes on average." These numbers are highly misleading. Even assuming that the applicant's capacity factors represent an accurate estimate, wind power delivery is erratic and unreliable. It cannot be relied upon for so much as a single watt of power on demand, and as such, cannot be counted on to power a single home. Spinning reserves, which in the case of NH are primarily natural gas fueled, are required to back up wind power at all times. In some utility generation scenarios it is necessary to have spinning reserves equaling as much as 80% or more of the power of the wind turbines in order to be ready for when the wind dies down. Therefore, to suggest that this wind farm can "power 19,000 to 21,000 homes on average" is a misrepresentation of the highest order.

Q. Have you reviewed actual production numbers from existing wind farms?

A. Yes. For example, let's examine the PJM grid, which is the regional transmission organization (RTO) that covers all or parts of 13 states from New Jersey, south to North Carolina and west to Illinois, including 90+% of Pennsylvania. PJM is also the largest wholesale free market grid in the world. Electrical grids are engineered (in terms of generating capacity & reliability) to meet periods of maximum (summer) demand. On the PJM grid, the record hourly demand so far has been 144,644 MW on August 26, 2006. Current generation resources available to PJM approach 165,000 MW. Wind generation is highly variable. When demand is high, wind generation tends to be absent (as in a July heat wave). Thus, its contribution as a dispatchable resource (one with the ability to supply electricity on-demand) is negligible. In fact, PJM allows wind facilities to bid in the 24hr day-ahead market at only 13% of their nameplate capacity. Thus, PJM views a 100 MW wind facility as no more than a 13 MW facility for "24hr ahead" bidding.

Let's examine a specific case of the 4,535 MW (nameplate capacity) of wind generation on PJM. On July 8, 2010, the northeastern United States is suffering beneath a Bermuda high pressure system that has produced near record heat and humidity. This day will see demand on the PJM grid approach 140,000 MW during the afternoon hours. Temperatures all over Pennsylvania will peak in the mid-to-upper 90's. At 12:15 pm, PJM customers are demanding nearly 121,000 MW of electrical power. However, the 4535 MW of industrial wind turbines across the 13 states are contributing a mere 15 MW of power. Not only are PJM-connected generation facilities generating the 120,974 MW needed to satisfy demand; they are generating an additional 2624 MW of what are called

synchronized reserves. These are generators that are spinning but not actually delivering power to the grid at that instant. These facilities are already synchronized to the 60Hz grid frequency so that they can be put on-line in less than 5 minutes to meet any additional demand. To put wind power into perspective, only 15 of the 123,588 MW being generated on the PJM grid at this moment are coming from wind turbines. That's about 12 one-thousandths of one percent (0.012%) of PJM electrical energy being generated from the wind. Those who might suggest that we just need to build more wind turbines would be missing the point. It's not a lack of turbines here; it's a lack of wind. That's summer in the northeastern USA.

Typically, wind energy on the PJM grid on a summer day with moderate wind is the rough equivalent of one or two small natural gas plants that could be sited on plots of less than 20 acres. However, during that July day at 9:02 am, when demand was about to ramp up on the PJM grid, another stark disadvantage of wind generation was in evidence. At that time, wind generation on the grid was actually negative 5MW. Not only were the wind turbines not contributing, they were actually drawing power from the grid. Industrial scale wind turbines are not self starting. Their internal mass is so great that it takes power to start them spinning. Turbines must also be spun periodically to help circulate lubricants and spread out static loads on the bearings.

Let's examine the ERCOT (Electric Reliability Council of Texas) grid, with the greatest wind generation capability in the USA. They allow wind facilities to bid in at just 8.7% of nameplate capacity. After careful study of the realities of wind power generation, the unfortunate inferiorities become painfully clear. 1 MWh of electricity generated between 4-5 PM on a hot July afternoon is very valuable. However, 1 MWh of wind-generated electricity produced between 3-4AM on a

May morning is virtually worthless to the grid because it simply is not needed. Base load resources like nuclear also have minimum levels of operation. Their output cannot be reduced below a certain point. The economic result of this thermodynamic reality is called negative pricing – the situation where supply of power exceeds demand. Unfortunately, RPS standards fail to distinguish the "time-generated" value of electricity. The grid is forced to buy wind power whether it is needed or not, and taxpayers shell out $2.1 cents per kWh in federal Production Tax Credits (PTC's) for useless electricity generated in the early hours of the morning. Recent statistics from ERCOT indicate that as high as 14% of their hours of generation are now negative, due almost exclusively to wind power proliferation in West Texas.

Q. The PJM data in July of 2010 may show that wind power was significantly out of phase with demand in that grid during the heat wave, but perhaps there are different conditions in effect in New Hampshire. The Lempster Wind farm was operational during this same heat wave. What do the production numbers for that wind farm show during a sample period of time that includes very high electricity demand due to a heat wave?

A. As far as I know, there is no reason to believe that the Lempster Wind Farm actual production numbers will be comparatively robust during a similar heat wave. Nevertheless, I asked the applicant for a chart of actual historical power output from the Lempster Wind farm during the data request discovery process for this docket. The applicant's initial response was that the data is irrelevant and refused to share it with me. I can only conclude that the data is not flattering to their case.

Q. What is the lesson that we should be carrying forward from this analysis?

A. While we recognize that the RPS standard is the law of the land, the SEC has the flexibility to decide which renewable resources are approved and which are not. Renewable energy advocates have admonished New Hampshire for having only one approved industrial wind farm in production, but this reaction, after careful analysis of the facts, is precisely backwards. The good news is that an enormous amount of data has recently become available that can be analyzed such that we do not repeat the mistakes of other regions. Approval of a wind farm like Groton Wind will necessarily consume the availability of limited transmission equipment – transmission assets that could be utilized later to transport electricity generated by more cost effective, reliable, and RPS compliant renewable options that may be proposed later. For example, a biomass thermal plant may be expected to have an 80% capacity factor according to the Renewable Energy Research Laboratory, University of Massachusetts, Amhearst. Biomass will also require a small fraction of space to establish this generation capability when compared to the enormous acreage necessary for a wind farm. As an added benefit, this electricity generation is regular and predictable. Also, biomass facilities need not be placed in sensitive, pristine natural settings such as what is found along the tops of ridgelines in the Baker River Valley. What is most important is that when the SEC evaluates the negative impacts due to the construction and operation of this wind farm, we must keep in mind that these costs are sacrifices that should only be made for a worthwhile purpose. That purpose is to generate necessary power for the State of New Hampshire in an environmentally friendly way. Clearly, if the wind turbines do not work as effectively as advertised, this draws into serious question the rationale for placing at risk our wildlife, human health, property values, and pristine areas of the historic Baker River Valley. The story becomes all pain for no gain.

Q, The application indicated that there is minimal risk to wildlife in the area. Do local organizations agree with this assessment?

A. Some local organizations have only just recently become aware of the details of the Groton Wind project. These organizations are now carefully reviewing the application. Although these reviews are just underway, early analysis indicates grave concerns for wildlife, particularly avian impacts and concerns with the turbine locations. One organization, HMANA, is in the process of compiling a letter indicating strong concern on a number of fronts with this project's analysis. They are likely to soon express the opinion that HMANA protocols for raptor migration studies were not followed during the analysis conducted by the applicant. Temporal and spatial variation in yearly passage rates and the passage of weather/frontal systems necessitate conducting raptor migration surveys throughout entire migration seasons over several years, during both fall and spring, to accurately assess site use and yearly abundance of migrating birds. Furthermore, it appears that monitoring date ranges miss a significant portion of migration periods for certain raptor species like golden eagle. The restrictive time frame provides only a snapshot of the migration thus a greater portion of the overall migration is totally missed. Also, since raptor migration and patterns of migration vary site to site due to topography, wind patterns, and geographic locations, it is totally inappropriate to use raptor migration data from other sites when assessing potential local impacts to birds. The only valid data in this case is that which is collected from the specific project site. Regarding migrating songbirds, radar studies did not indicate duration or times of nightly surveys. Since altitude of flight varies predictably with time of day or night and weather conditions, the results given are highly suspect in that their radar studies were only conducted in the hours around midnight when birds are known to be migrating at higher elevations. Also, the project site is primarily oriented in north-south direction, which naturally aligns

with the general flight direction of thousands of migrating birds. This, combined with the forested habitats with readily available resources for migrating birds, makes this physiographic feature conducive to migration stopover in spring and fall for a multitude of species. Like humans, a bird's visual acuity is hampered under certain light and weather conditions. Many birds migrate at night and descend to rest and forage in the forested habitats in the hours around dawn and ascend during the hours around dusk to continue their journey. At these times perception is reduced and the likelihood of a bird detecting spinning turbine blades due to motion smear is very low. The placement of industrial scale wind turbines on this area that is part of a key migration corridor is a bad idea that will only continue to increase the cumulative risks of significant harm to migratory birds and bats, despite reports to the contrary.

Q. **Do you have concerns about possible health impacts related to the wind turbines should they be erected?**

A. Yes. I've included testimony of Michael Nissenbaum in exhibit A of my testimony. Dr. Nissenbaum raises serious concerns about the impact of turbine sound emissions on human health. The intervenor group of Buttolph/Lewis/Spring hereby announces the enlistment of Dr. Michael Nessenbaum as an expert witness, and he has indicated that the same concerns articulated in exhibit A for the Red Lily Wind Power Partnership would be applicable to the Groton Wind Farm.

Q. Do you have concerns about the impact to property values in the Baker River Valley and surrounding neighborhoods?

A. Absolutely. The intervenor group of Buttolph/Lewis/Spring calls the attention of the SEC to the written testimony submitted by Michael McCann, of McCann Appraisal LLC. Mr McCann raises serious concerns about the likely devastating impact to property values in the area. As the SEC will note, Mr. McCann has

raised specific concerns with the study titled "The Impact of Wind power Projects on Residential Property Values" by Mr. Ben Hoen.

Q. What about the cost of power generated by wind power? Clearly the production of wind must be financially viable and competitive if Groton Wind LLC has expressed an interest in pursuing this project. Why would they pursue this project if it did not generate electricity competitively?

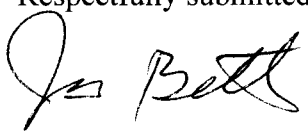
A. Unfortunately, wind power is among the most costly options for renewable power generation. If it were not for fabricated cost incentives mandated by government, costly and inefficient projects such as the Groton Wind Farm would never see the light of day in the real business world. First, approximately $2 billion dollars was allocated to Wind power development by federal stimulus legislation, creating a false perception of competitiveness. Second, as previously mentioned, the federal government issues Production Tax Credits at the rate of 2.1 cents/ kW hr. Even with these incentives, full implementation of RPS standard is estimated to raise electric rates by as much as 30-40%. According to the United States Government's Energy information administration, net generation in 2007 for wind power amounted to 31,000,000,000 billion KWh, which was subsidized and supported to the tune of $724,000,000. This represents a subsidy of a whopping $23.37/mW hour. Compare this to other available renewable options such as biomass (subsidized at $.89/ mW hour) and it is crystal clear that the competitiveness of wind power is being artificially propped up by your tax dollars.

Q. Do you have anything else to add?

A. I think it is appropriate to summarize my testimony as follows:
Given the realities associated with wind power generation in general and the Groton Wind LLC project in particular, one can't help but question the wisdom of

allowing this project to go forward. The SEC's declaration of purpose is to maintain a balance between the environment and the possible need for new energy facilities in the State of New Hampshire. From my point of view, it appears that the "need" , such as it is, does not justify the costs.

Respectfully submitted,



James Buttolph
170 Quincy Road
Rumney, NH 03266

I, James Buttolph, do hereby certify that I caused the foregoing to be sent by electronic mail or U.S. mail to the persons on the currently active service list for docket 2010-01 (Exclusive of Committee Members). Pursuant to SEC applicable orders, the original and nine copies are also being mailed to the SEC.

Attachment

CANADA
PROVINCE OF SASKTCHEWAN

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 mediation 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. McMurty 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 we 'pure tones', that is to say, sinusoidal wave forms that were uniform, neither frequency nor amplitude modulated, and free of randomness. These types of tines are less intrusive that 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 father, 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.

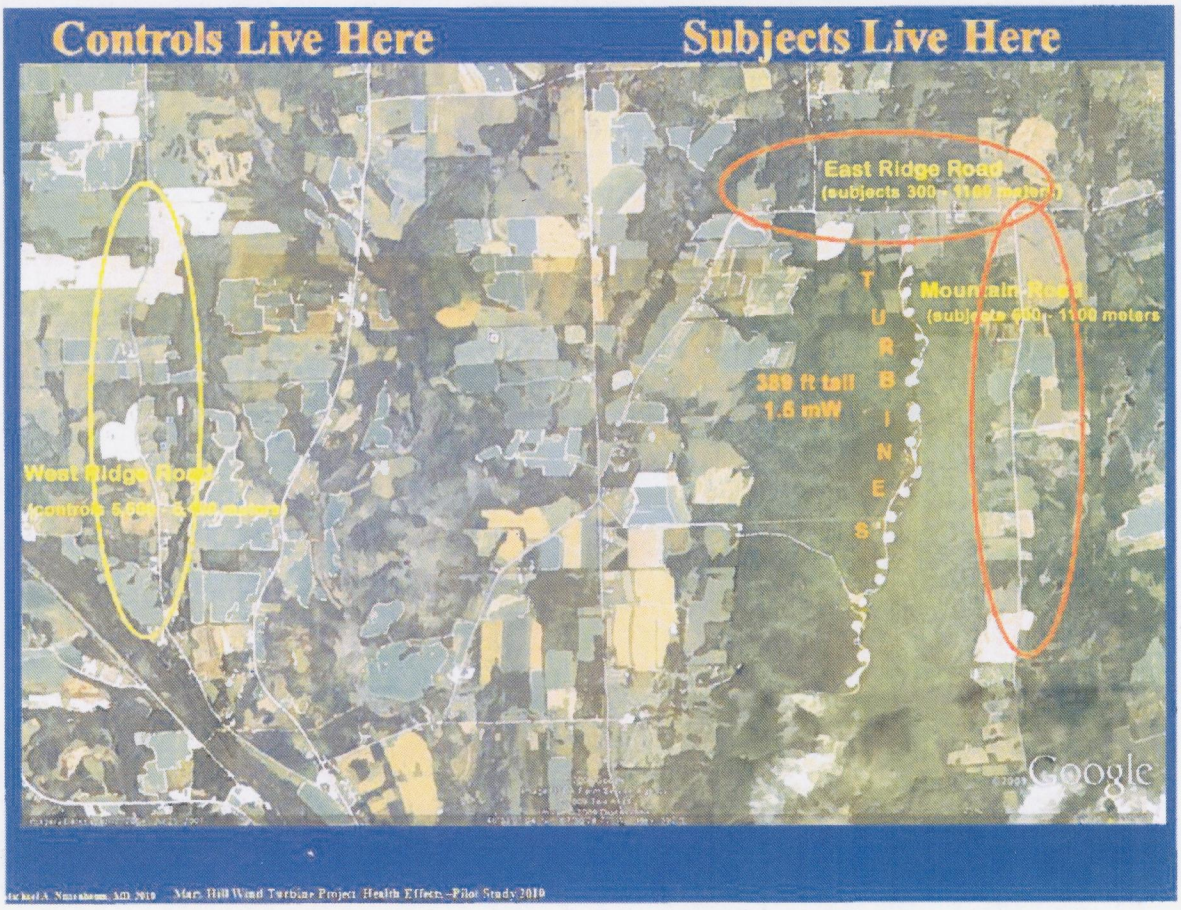
SWORN BEFORE ME at the City of Fort Kent in the State of Maine, this 11th day of August, A.D. 2010.

A NOTARY PUBLIC
in and for the State of Maine.

DR. MICHAEL A. NISSENBAUM, M.D.

Appendix 1

Study Map, Mars Hill, Maine



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IN THE ~~PROVINCE~~ State OF Maine
THIS 11th DAY OF Aug A.D. 2010

Nadine Landry

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

THIS IS EXHIBIT "C" REFERRED TO IN THE
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IN THE ~~PROVINCE~~ State OF Maine
THIS 11th DAY OF Aug. A.D. 2016

Nadine Landry

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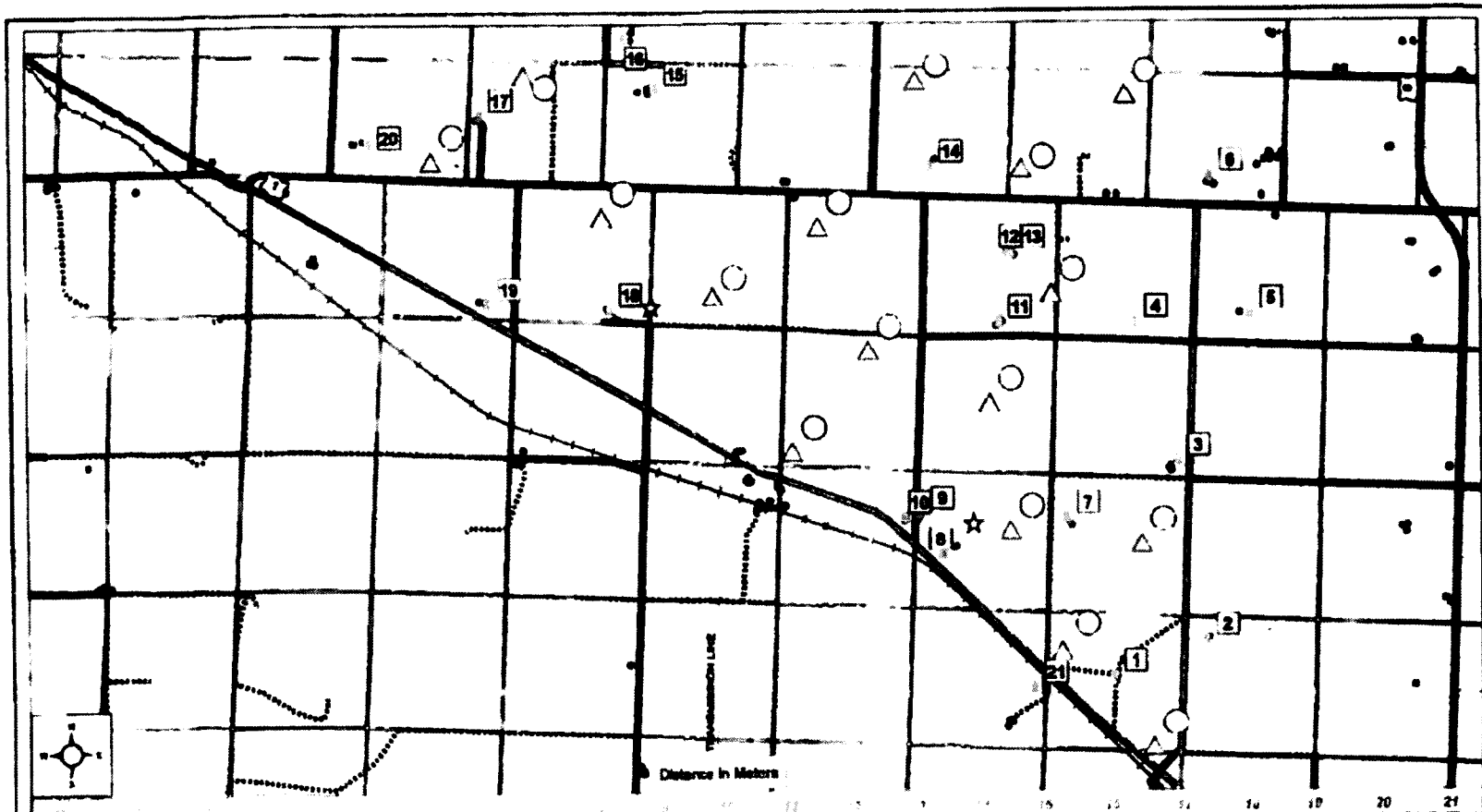
~~PROVINCE~~ State OF Maine
BEING A SOLICITOR - or -
MY APPOINTMENT EXPIRES 10-27-2011



Turbine																			
1	935	1,305	3,395	5,045	5,272	6,815	2,884	3,406	3,834	4,033	5,371	6,139	6,111	7,384	9,877	10,580	11,076	9,378	9,617	11,883	1,581
2	713	1,726	2,632	3,992	4,586	5,910	1,558	1,825	2,345	2,460	3,988	4,779	4,762	5,857	8,298	9,003	9,489	8,007	8,076	10,327	576
3	2,177	2,751	2,158	2,872	3,656	4,830	693	876	1,097	1,276	2,453	3,287	3,279	4,404	6,778	7,478	8,087	6,508	6,899	8,018	1,941
4	4,742	5,478	4,845	4,404	5,780	5,998	3,422	2,212	1,733	1,586	2,825	3,483	3,545	3,748	4,808	5,367	5,492	2,772	4,077	6,392	4,089
5	1,860	1,408	1,342	2,610	3,010	4,426	937	2,402	2,885	2,884	3,122	3,814	3,775	5,135	7,984	8,885	9,478	7,802	8,399	10,482	2,163
6	3,828	3,894	2,372	1,983	3,310	3,788	1,980	1,921	1,588	1,736	936	1,779	1,781	2,899	5,499	6,180	7,042	4,727	6,181	8,118	3,480
7	4,823	5,354	3,860	3,229	4,626	4,597	3,147	2,826	2,079	2,082	1,610	2,016	2,073	2,272	4,029	4,728	5,489	3,171	4,639	6,823	4,834
8	5,660	7,253	5,959	5,114	6,500	6,162	5,085	4,189	3,850	3,584	3,487	3,591	3,654	3,019	2,824	3,213	3,519	1,298	2,725	4,827	4,827
9	4,673	4,590	2,532	1,070	2,410	2,341	2,723	3,409	3,096	3,239	737	716	657	2,079	5,374	5,984	7,227	5,387	6,824	8,453	4,781
10	6,484	6,820	5,178	4,005	5,332	4,787	4,828	4,222	3,674	3,688	2,480	2,302	2,376	1,514	2,549	3,234	4,289	2,723	4,104	5,923	6,130
11	8,300	8,888	7,552	6,575	7,831	7,365	6,889	5,791	5,282	5,184	4,984	4,917	4,991	4,014	1,828	2,118	1,888	1,140	1,739	2,943	7,710
12	10,321	10,881	9,714	8,733	10,077	9,418	8,813	7,782	7,287	7,169	7,150	7,048	7,122	6,038	2,827	2,742	783	2,912	1,888	777	9,880
13	8,202	8,074	6,989	6,312	8,274	7,270	4,241	4,731	4,325	4,431	1,888	1,047	1,044	1,110	4,537	5,044	6,583	5,276	6,884	7,910	8,237
14	6,972	6,596	4,437	2,736	3,036	1,426	5,121	5,826	5,592	5,723	3,128	2,380	2,342	2,516	6,089	6,080	7,808	6,749	8,103	8,172	7,188
15	10,151	10,083	8,180	6,7	9,247	8,368	8,459	7,670	7,130	7,045	6,486	6,222	6,294	5,049	1,599	1,268	733	3,013	2,784	2,981	9,804
16	7,534	7,557	5,551	3,936	4,825	3,744	5,567	5,884	5,189	5,243	3,080	2,344	2,396	1,078	3,155	3,581	5,282	4,611	5,821	6,881	7,417

ALGONQUIN POWER

RED LILY WIND ENERGY PARTNERSHIP

Distance from Turbines to Residences

HORIZONTAL: NAD83/UTM ZONE 14N	SCALE: 1:50,000
DRAWN: R HARROP	DATE: FEB 22 2010
PROJECT: 420 - 128	REVISION No: 0

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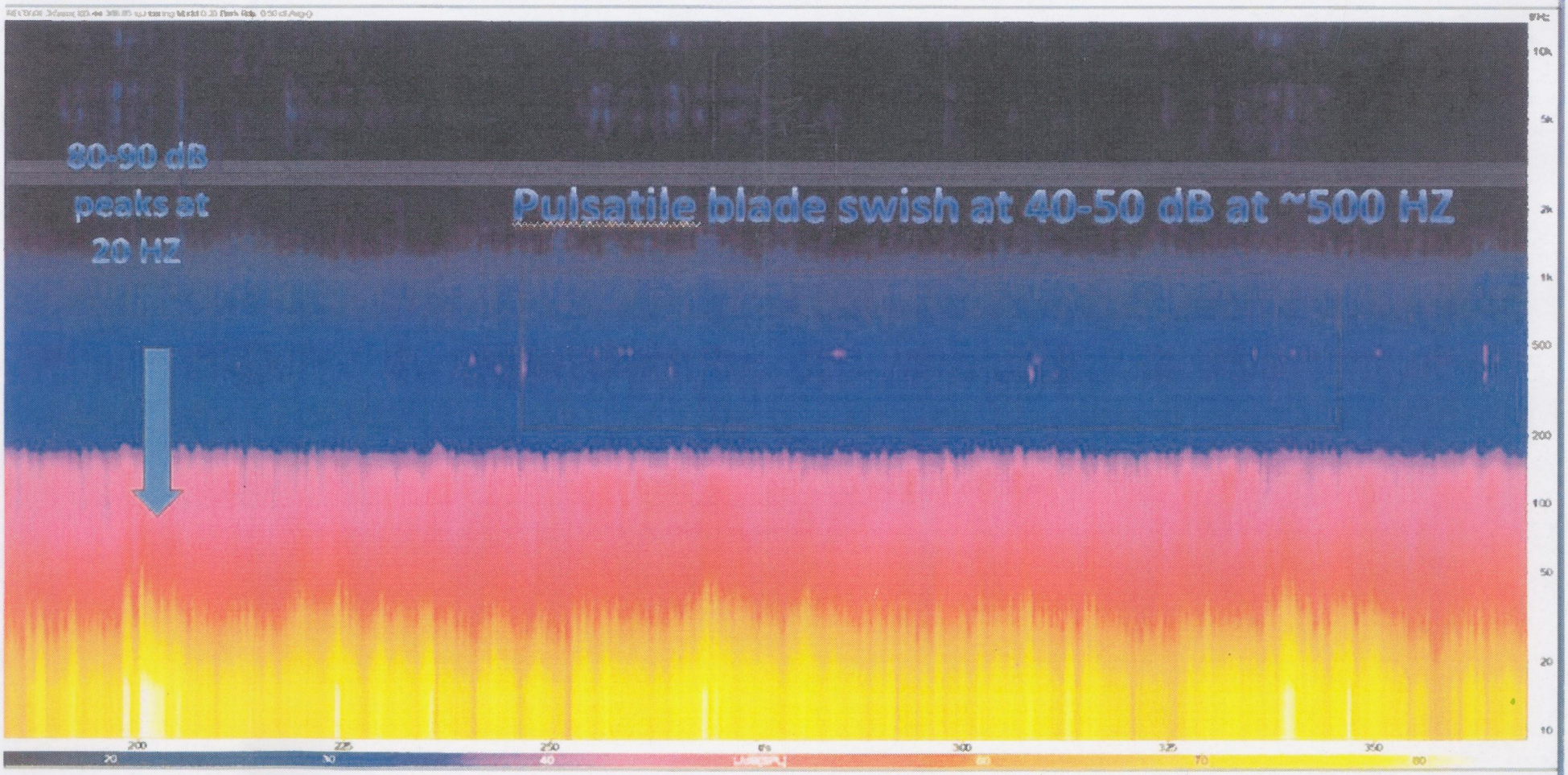
Outdoors 3 A.M.

Modern 1.5 MW GE turbine at 1500 feet, Ubly, MI, Dec. 2009



Courtesy Richard James, E-coustics Solutions

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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.

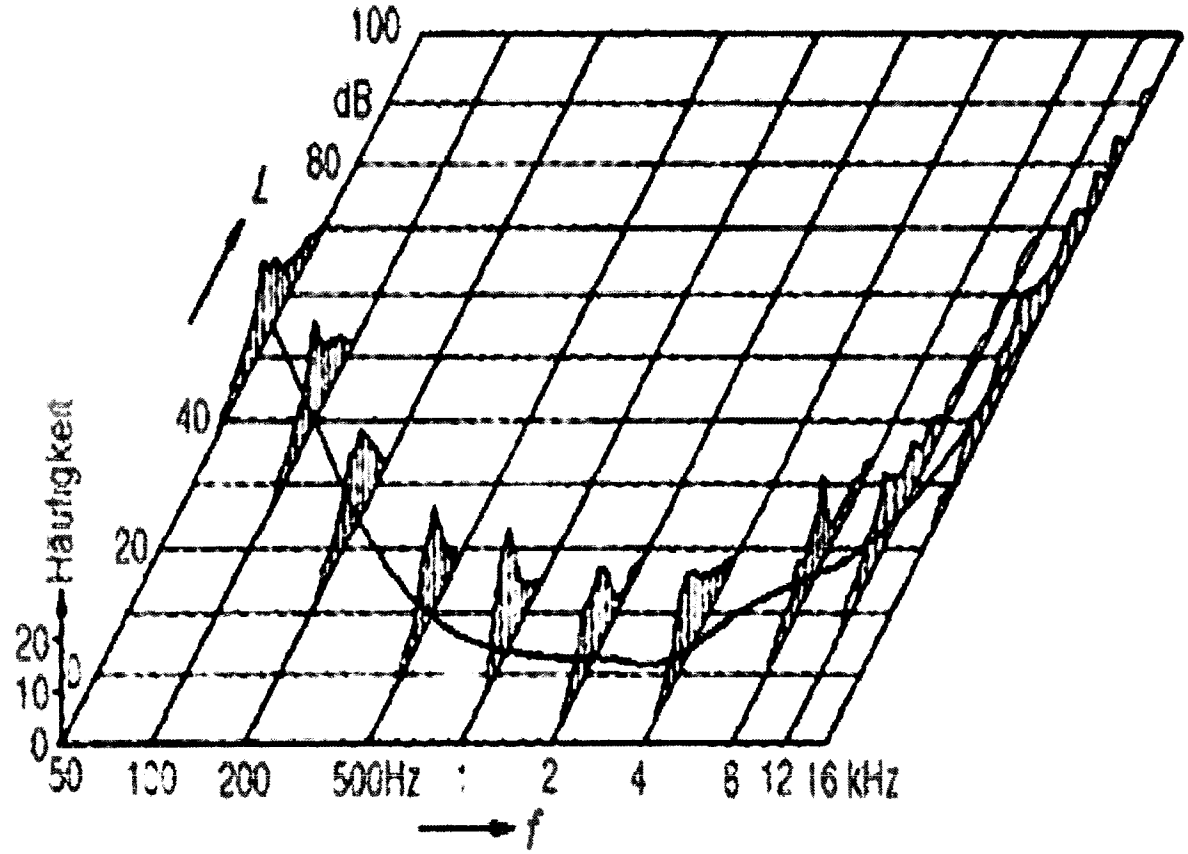
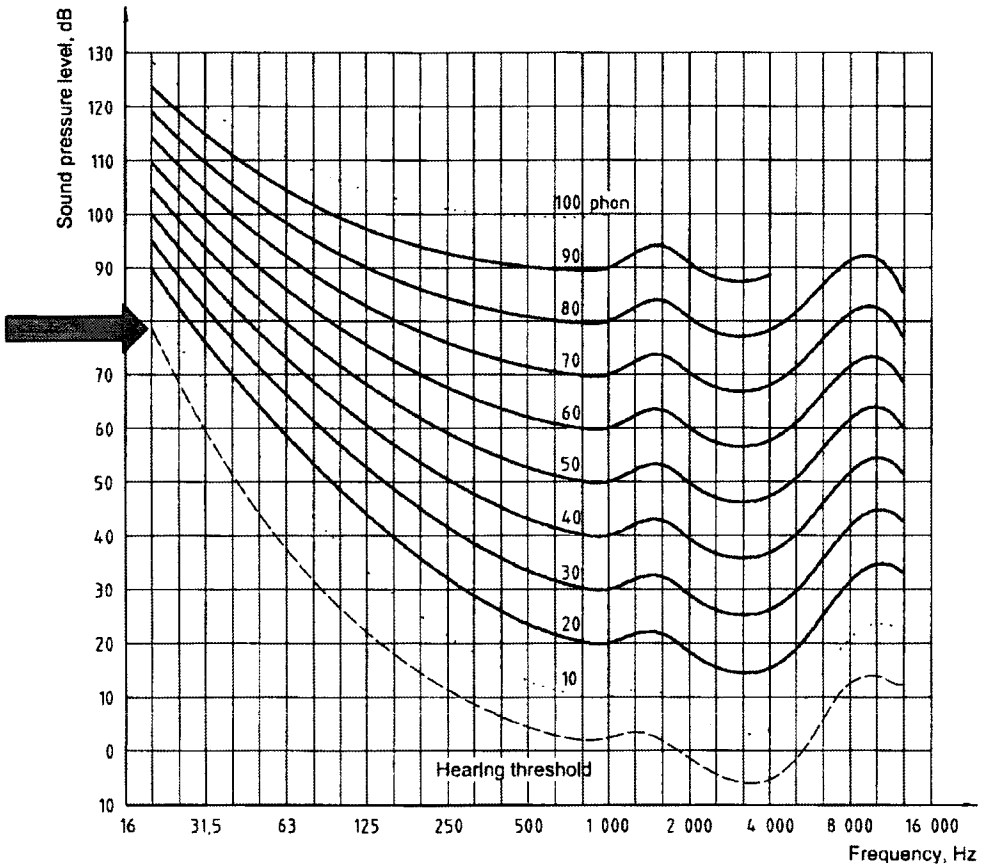


Fig. 9 Threshold in quiet. Also shown, distribution of thresholds [14]

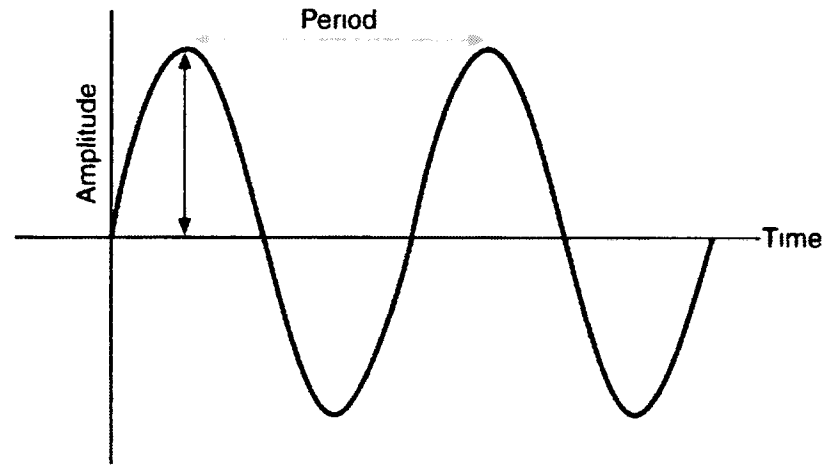
J. Spille, "Messung der Vor- und Nachverdecknung bei Impulsen unter kritischen Bedingungen," In tern.Rep., Thomson Consumer Electronics, Hanover, Germany (1992)

What Can We Actually Hear?

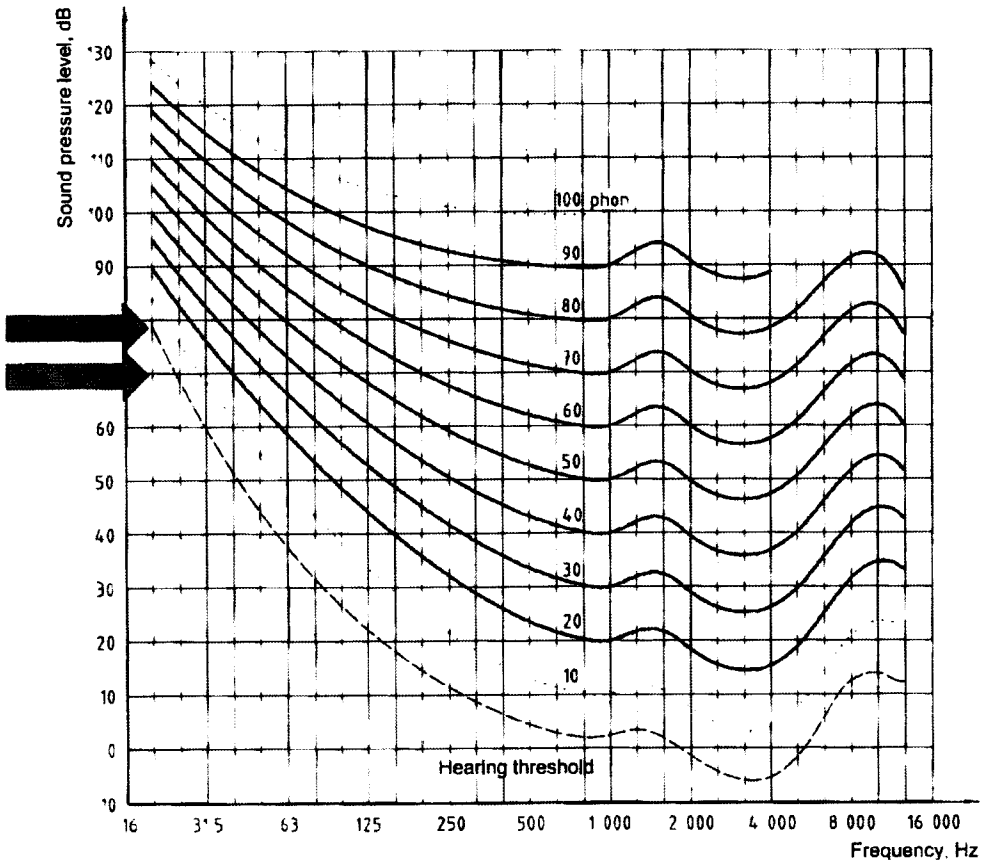


Hearing Contours for Equal Loudness Level (ISO 2003) from A/CanWEA 12/2009 'White Paper'

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

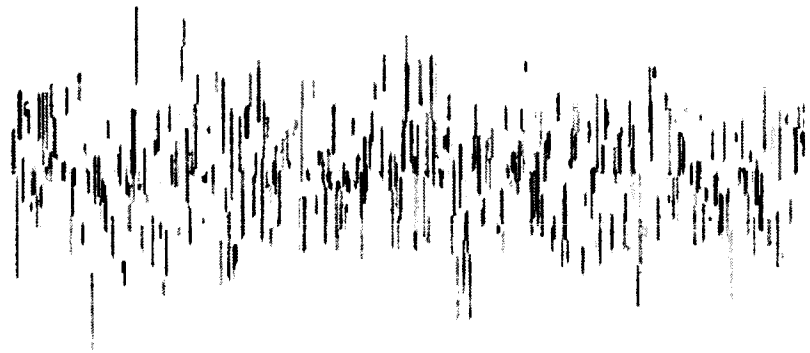


What Can We Actually Hear?



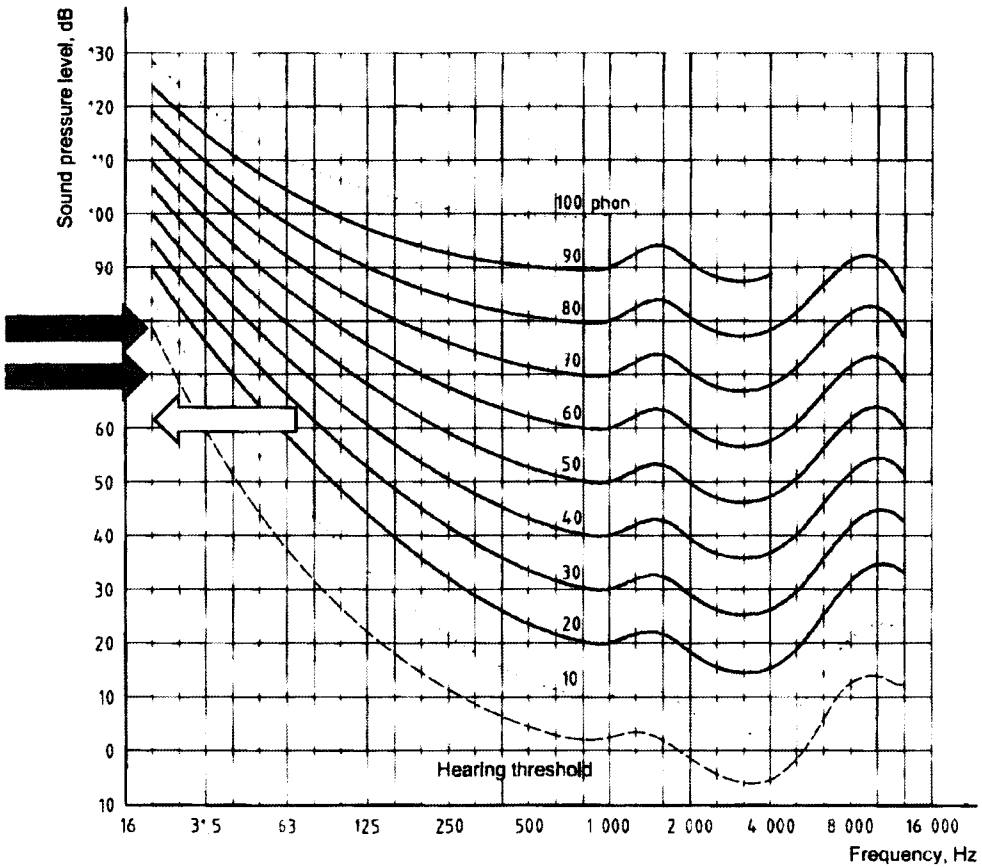
Hearing Contours for Equal Loudness Level (ISO 2003) from A/CanWEA 12/2009 'White Paper'

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.

<u>This brings us to 62 dB or lower threshold for one in 6 people.</u>

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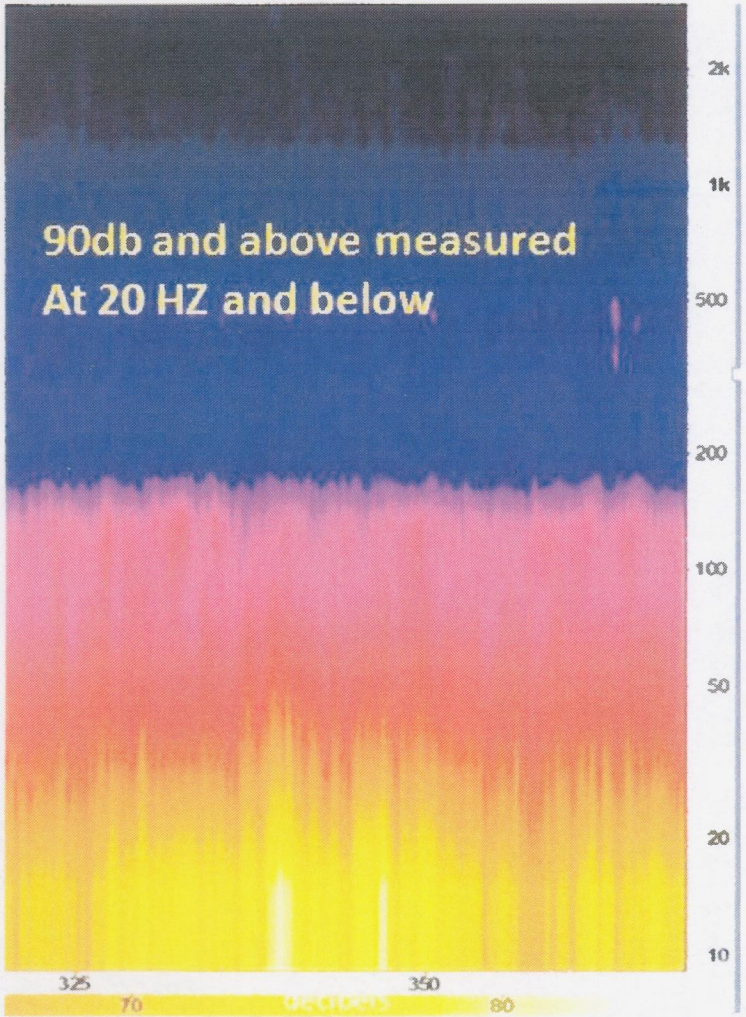
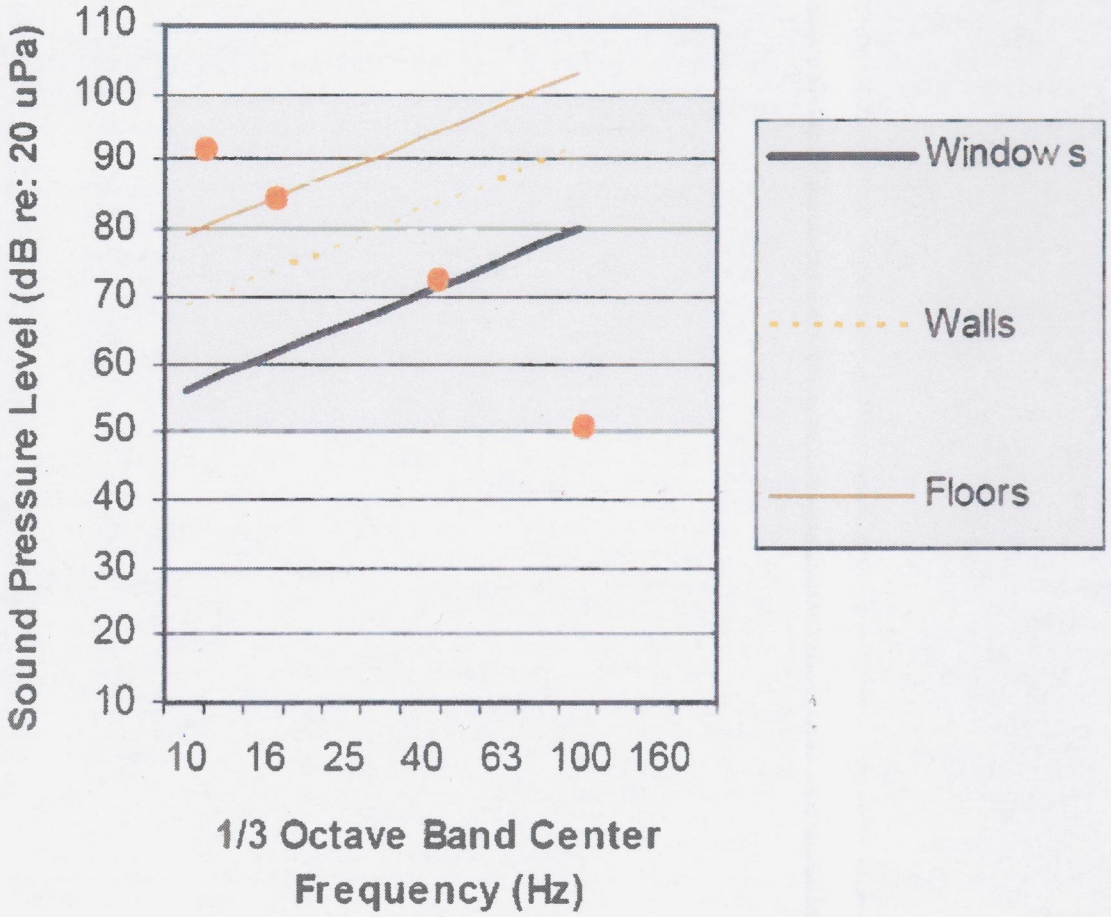
Dwelling Vibration and Rattle

Perceptible vibration in residential structures by low frequency noise

Outdoors 1500ft 1.5MW, Ubly Michigan, Dec 2009





Courtesy Richard James, INCE

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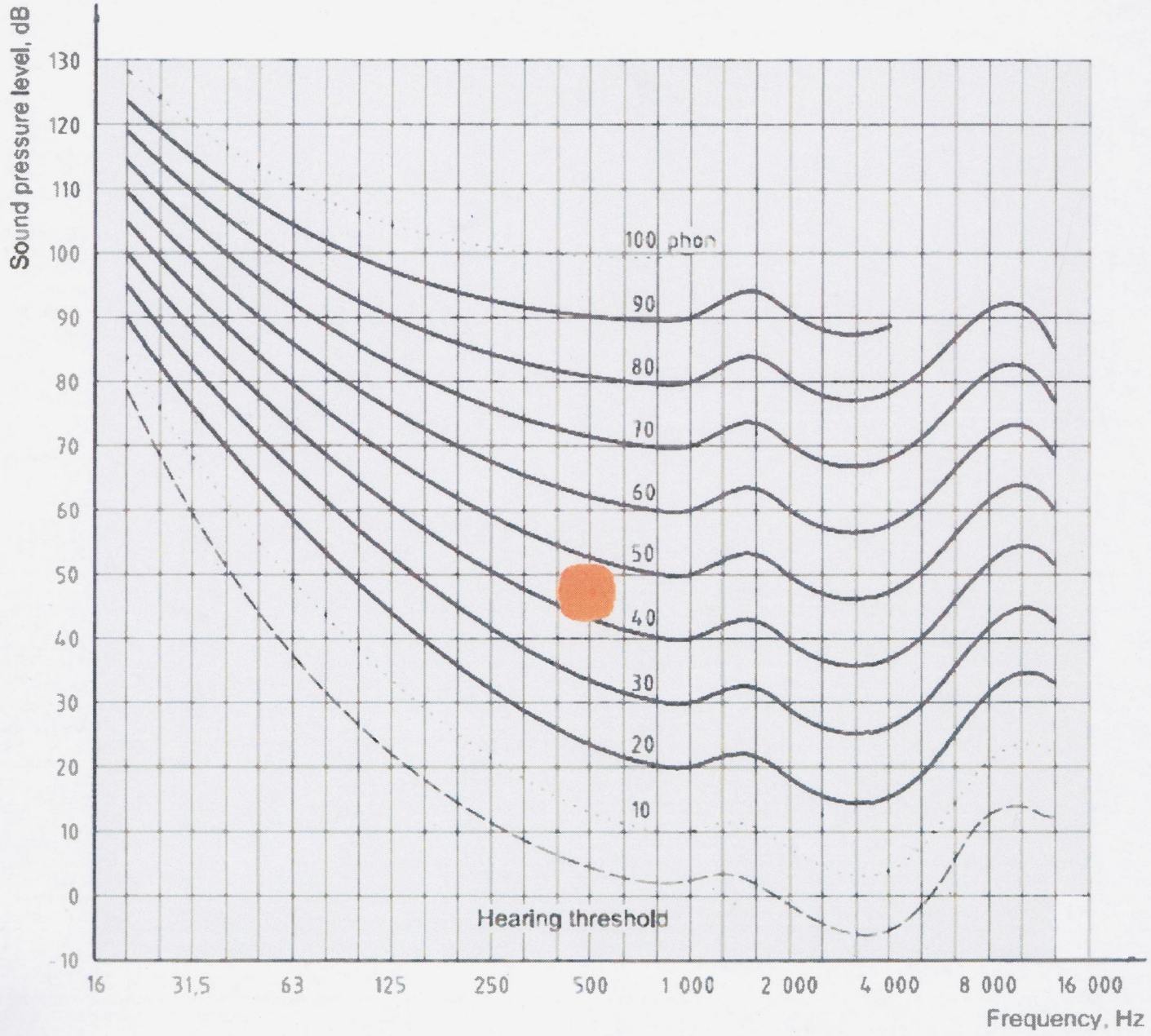
‘Blade Swish’


Sound pressure level, dB
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
100 phon
90
80
70
60
50
40
30
20
10
Hearing threshold
16
31,5
63
125
250
500
1 000
2 000
4 000
8 000
16 000
Frequency, Hz