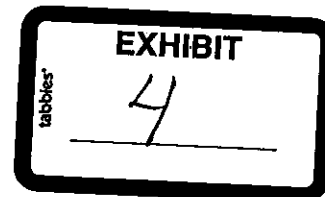


1

eton, Mary B

From: Littell, David P  
 Sent: Tuesday, February 10, 2009 7:31 AM  
 To: Fisk, Andrew C; Mullen, Mike; Cassida, James  
 Subject: Fw: Health hazards Generated by wind turbines



Fyi only. We will look at and do a response when it comes in

David Littell, Commissioner  
 Maine DEP  
 Via Blackberry

----- Original Message -----

From: Mills, Dora A.  
 To: Littell, David P; Brooks, James P; Kerry, John  
 Sent: Tue Feb 10 05:03:26 2009  
 Subject: FW: Health hazards Generated by wind turbines

I received a voicemail last week from a Dr. Albert Aniel from Rumford, who appears to be a practicing internist there. I talked with him at length yesterday, and he sent me a follow up email (way below). Included in his email was an attachment that says it is from the Rumford Hospital's medical staff and is an open letter asking for a moratorium on all wind turbine projects because of the need for more research on possible health effects. He says this letter has been sent to area newspapers and to Commissioner Littell and Director Kerry. Dr. Aniel's resources are from non-peer reviewed sources. I have tried to point him in the direction of peer reviewed sources in my email below.

I wanted you to know about my correspondence with him, which is below. Feel free to let me know if I can be of further help.

Thank you. Dora

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From: Mills, Dora A.  
 Sent: Tuesday, February 10, 2009 4:49 AM  
 To: 'athos'  
 Subject: RE: Health hazards Generated by wind turbines

Dr. Aniel: Thank you for your phone call and follow up email. I did some scanning overnight of some of the research on health effects due to wind turbines as well as existing Maine law. The British Medical Journal article from Sweden below I found helpful. Comparing their findings to existing Maine law, it appears our own law (under "Maine DEP Statute") is quite comprehensive and inclusive of the acoustical issues related to wind turbine development. Anyway, I hope some of the links below may be helpful to your own research. Dora

Dora Anne Mills, MD, MPH

State Health Officer

Director, Maine CDC/DHHS

Maine DEP Statute

38 M.R.S.A., Section 343

DEP Rules on Title 38 Section 343

<http://www.maine.gov/sos/cec/rules/06/096/096c375.doc>

Maine SPO Noise Technical Assistance Bulletin

<http://www.maine.gov/spo/landuse/docs/techassist/techassistbulletins/noisetabulletin.pdf>

US Dept of Energy's New England Wind Power Website on Wind Turbine Sound - this has a good summary and links to references

[http://www.windpoweringamerica.gov/ne\\_issues\\_sound.asp](http://www.windpoweringamerica.gov/ne_issues_sound.asp)

British Medical Journal (2007) Swedish Study (Eja Pedersen)

<http://oem.bmj.com/cgi/content/full/64/7/480?ijkey=blalae4a98c9453315a90941395e0a05262aca53>

Survey in Sweden of residents near wind turbines found annoyance increased with increased sound pressure levels (SPLs), and increased annoyance was associated with lower sleep quality and negative emotions. Annoyance levels were found at relatively low SPLs. References listed in this article include helpful resources.

*A Swedish Area at risk of persistent sound annoyance*

Noise Annoyance from Wind Turbines - A Review 2003 Sweden Environmental Protection Agency

<http://www.barrhill.org.uk/windfarm/noise/10%20pederson.pdf> *→ sleep disturbance*

Found no evidence of health problems, reviews the variety of noise regulation laws in place in Europe

US Dept of Energy Wind Turbine Aeroacoustic Research:

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[http://www1.eere.energy.gov/windandhydro/wind\\_research\\_enable.html#research](http://www1.eere.energy.gov/windandhydro/wind_research_enable.html#research)

"Turbine noise can be caused by rotor speed, blade shape, tower shadow, and other factors. The program is sponsoring both wind tunnel and field tests to develop a noise prediction code that turbine manufacturers can use to ensure that new rotor designs and full systems aren't too noisy. This is especially true for high-growth U.S. markets for small wind turbines that will demand quieter rotors, especially when turbines are sited in residential neighborhoods. Small turbines operate at high rotational speeds and tend to spin even if they are furled (pointed out of the wind). Aeroacoustics research activities will be conducted to explore how to reduce noise produced by distributed wind turbines in a variety of wind regimes and to develop a noise standard with industry participants that can be used for the growing domestic distributed wind turbine market. This research will support the program's public-private partnerships, both directly in working with industry and indirectly in providing necessary underlying research.

In the longer term, program researchers will work to develop physics-based aeroacoustics codes for both design and problem solving applications. These will enable more slender blades and higher tip speeds, enhancing both cost and performance of future designs."

US Dept of Energy's Wind Energy Guide for County Commissioners:  
<http://www.nrel.gov/wind/pdfs/40403.pdf>

Page 6: An operating modern wind farm at a distance of 750'-1,000' is no louder than a kitchen refrigerator or moderately quiet room.

Dept of Energy's Consumer Guide on Small Wind Turbines  
[http://apps1.eere.energy.gov/consumer/your\\_home/electricity/index.cfm/mytopic=10930](http://apps1.eere.energy.gov/consumer/your_home/electricity/index.cfm/mytopic=10930)  
 <[http://apps1.eere.energy.gov/consumer/your\\_home/electricity/index.cfm/mytopic=10930](http://apps1.eere.energy.gov/consumer/your_home/electricity/index.cfm/mytopic=10930)>

"Noise Issues: The sound level of most modern residential wind turbines is slightly above the ambient wind noise. This means that while the sound of the wind turbine may be picked out of surrounding noise if a conscious effort is made to hear it, a residential-sized wind turbine is not a significant source of noise under most wind conditions."

Wind Turbine Noise Issues: A white paper prepared by Renewable Energy Research Laboratory, U of Massachusetts, 2004:  
<http://www.town.manchester.vt.us/windforum/aesthetics/WindTurbineNoiseIssues.pdf>

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From: athos [mailto:[athos@wildblue.net](mailto:athos@wildblue.net)]  
 Sent: Monday, February 09, 2009 5:19 PM  
 To: Mills, Dora A.  
 Subject: Health hazards Generated by wind turbines

Dear Dr mills

(4)  
It certainly was a refreshing pleasure to talk to you today.

Here are some references along with the above statement:

[www.windturbinenoisehealthhumanrights.com](http://www.windturbinenoisehealthhumanrights.com) (the best as overview 137 pages long)

[www.ninapierpont.com](http://www.ninapierpont.com) (who testified to the NY legislature)

[www.vibroacousticsyndrome.com](http://www.vibroacousticsyndrome.com) (the importance of inaudible sound generated pathology)

George W Kamperman study

Our medical staff would really appreciate being kept abreast of your conclusions and recommendations.

Most sincerely

The medical staff of Rumford Community Hospital

Albert Aniel Md

Click the OneNote attachment if you want to view or edit the notes in OneNote.

If you don't have OneNote 2007, you can click the second attachment to view the notes as a Web page.

You can download a free OneNote trial version from:

<http://r.office.microsoft.com/r/rlidOneNoteTrial?clid=1033&ver=12&app=onenote.exe&p1=12>

**From:** Mills, Dora A.  
**Sent:** Wednesday, February 11, 2009 6:23 PM  
**To:** Littell, David P  
**Cc:** Fisk, Andrew C; Mullen, Mike; Cassida, James  
**Subject:** RE: Noise Regulations

FOAA 5

(b)

Thank you very much, David. I would be very interested in learning more from you all at DEP – this is a new topic to me, but a very interested one, and if we have a group of physicians making claims, I would like to be as well prepared as possible.

Also, if DEP has easily accessible data on the amounts of pollution coming into Maine from fossil fuels, that would be helpful. In the Q&A I quickly developed this am, I included some data from a NRCM source, which I suspect originates from DEP. If I can use DEP's original data that would seem to be best. And, if there are other DEP data that would be helpful for me to include to refute the claims made by the Rumford medical staff, that would be most appreciated.

Thank you! (Dora)

GNST

**From:** Littell, David P  
**Sent:** Wednesday, February 11, 2009 4:35 PM  
**To:** Mills, Dora A.  
**Cc:** Fisk, Andrew C; Mullen, Mike; Cassida, James  
**Subject:** RE: Noise Regulations

Dora, thank you for these sources and your previous email alerting us to your contact on this.

Noise has been an issue we looked at last year to determine whether our existing rules are adequate as part of the wind power task force. The Wind Power Task Force asked us for an analysis and we provided it, asking for the authority to modify operational requirements if we later find a noise issue that the application noise analysis did not indicate would be present at a protected location (meaning a residence).

Because these issues can get very detailed and technical (different types of noise, different atmospheric conditions, different ground conditions such as leaves and hard ice covered snow) we have retained the services of an outside noise expert to review noise study submissions as part of applications and compliance evaluations (such as Mars Hill).

I am copying Andy Fisk who you know and our acting division director Mike Mullen and director of licensing Jim Cassida on the sources you provide as well as more information is often useful. Let us know if you want to get together to discuss this as we would value the expert input of CDC.

David

**From:** Mills, Dora A.  
**Sent:** Wednesday, February 11, 2009 2:06 PM  
**To:** Littell, David P  
**Subject:** Noise Regulations  
**Importance:** High

I don't know who at Maine DEP oversees noise regulations. In my reading the last couple of days on wind turbine issues, I did come across Mass DEP regulations as well as two very recent articles from Canada proposing some ways to address unique features of wind turbines in measuring or setting standards for noise levels. These three sources are listed in below. As I mentioned in the previous email, it appears that Maine's rules have not been updated since 1989, though that may not be true if they've been recently updated. University of Massachusetts also has a research lab on

0/7/2009

...this subject, but thought I'd just share the information I came across when looking into the health effects issue.

6

Please let me know if I can be of further help.

FOAA 6

Thank you! Dora

**Massachusetts DEP Regulations**

<http://www.nonoise.org/lawlib/states/mass/mass.htm>

*A source of sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) if the source: Increases the broadband sound level by more than 10 dB(A) above ambient, or Produces a "pure tone" condition - when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more.*

*These criteria are measured both at the property line and at the nearest inhabited residence. Ambient is defined as the background A-weighted sound level that is exceeded 90% of the time measured during equipment operating hours. The ambient may also be established by other means with the consent of the Department.*

**A Proposal for Evaluating the Potential Health Effects of Wind Turbine Noise for Projects Under the Canadian Environmental Assessment Act**

[http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&index)

[title=Noise+annoyance+in+Canada&title\\_type=tka&year\\_from=1998&year\\_to=2009&database=1&pageSize=20&index](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&index)

Keith, Stephen E.; Michaud, David S.; Bly, Stephen H.P. Source: Journal of Low Frequency Noise, Vibration and Active Control, Volume 27, Number 4, December 2008 , pp. 253-265(13) The advice that Health Canada provides on the health effects of noise is generally based only on well-accepted scientific evidence for a link between noise exposure and health. For quiet rural areas, in which annoyance reactions towards intruding noise may be augmented, this paper proposes noise mitigation if predicted wind turbine noise levels exceed 45 dBA at noise sensitive receptors. In this proposal, a cautious approach is adopted by using predicted noise levels that are evaluated at the wind speed that produces the highest wind turbine noise, and background noise is evaluated in calm winds. This accounts for sheltering by obstructions. Wind speed gradient effects related to stable atmospheric conditions are also accounted for with this approach. The proposal is based on predicted project-noise related changes in long-term high annoyance, rattle and sleep disturbance. Noise mitigation for wind turbine construction noise is proposed based on potential for expectation of complaints.

**Incorporating Low Frequency Noise Legislation for the Energy Industry in Alberta, Canada**

[http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&index)

[title=Noise+annoyance+in+Canada&title\\_type=tka&year\\_from=1998&year\\_to=2009&database=1&pageSize=20&index](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&index)

Authors: DeGagne, David C.; Lapka, Stephanie D. Source: Journal of Low Frequency Noise, Vibration and Active Control, Volume 27, Number 2, September 2008 , pp. 105-120(16) Environmental noise from energy industry facilities in Alberta, Canada, is regulated by the province's Energy Resources Conservation Board (ERCB) (until 2008 known as the Alberta Energy and Utilities Board [EUB]) as set out in Directive 038: Noise Control. The 2007 edition of the directive, which comprises a comprehensive policy and guide, adopts A-weighted energy equivalent sound levels (LAeq), with sound pressure level criteria, as the primary measurement system for a receptor location. With the receptor being some distance from the energy industry noise source, the high and medium frequency components can dissipate or be absorbed by air and ground conditions, leaving mostly low frequency noise (LFN). Consequently, A-weighted measurements do not reflect the full annoyance potential of the remaining industrial noise. Complaints related to LFN

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FOAA 7

are often described by the affected party as a deep, heavy sound, like "humming", sometimes with an accompanying vibration. In some cases, the direction of the source of the LFN will be unknown to the receptor. However, it is the complainant that is most able to detect the presence of the LFN, signifying a particular sensitivity of the individual to the sound while others in the same family may not be able to detect the sound at all. To make a proper determination for the presence of LFN, the data must be collected during a time when environmental conditions are representative of when the sound is annoying. Residents who are impacted by LFN may suffer from sleep disturbances, headaches, and in some cases chronic fatigue. This paper examines the work undertaken by the ERCB to understand the issue, the various metrics tested to easily identify LFN, and finally the approach that would be incorporated into the new 2007 edition of Directive 038: Noise Control to address the problem.

**Breton, Mary B**

FOAA 8

**From:** Littell, David P  
**Sent:** Wednesday, February 11, 2009 6:35 PM  
**To:** Mills, Dora A.  
**Cc:** Fisk, Andrew C; Mullen, Mike; Cassida, James; Brooks, James P  
**Subject:** RE: Noise Regulations

Data on the air pollution - we wish more people would ask!

What do you want:

- (1) climate change pollutants (carbon dioxide and carbon dioxide equivalents)
  - (a) all sources from fossil fuels (point sources, transportation, agricultural/forestry?)
  - (b) power plants from fossil fuels?
  - (c) all air emitting sources (point sources)
- (2) Ozone precursors (NOx/vocs)?
  - (a) all sources from fossil fuels (point sources, transportation, agricultural/forestry?)
  - (b) power plants from fossil fuels?
  - (c) all air emitting sources (point sources)

- (3) Particulates (fine and course PM?)

I am not sure we can break this down like the other two sources but can check.

- (4) All the above?
- (5) Other

We can make some practical observations if that helps as well, there is no question clean renewables reduce air pollution.

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**From:** Mills, Dora A.  
**Sent:** Wednesday, February 11, 2009 6:23 PM  
**To:** Littell, David P  
**Cc:** Fisk, Andrew C; Mullen, Mike; Cassida, James  
**Subject:** RE: Noise Regulations

Thank you very much, David. I would be very interested in learning more from you all at DEP – this is a new topic to me, but a very interested one, and if we have a group of physicians making claims, I would like to be as well prepared as possible.

Also, if DEP has easily accessible data on the amounts of pollution coming into Maine from fossil fuels, that would be helpful. In the Q&A I quickly developed this am, I included some data from a NRCM source, which I suspect originates from DEP. If I can use DEP's original data that would seem to be best. And, if there are other DEP data that would be helpful for me to include to refute the claims made by the Rumford medical staff, that would be most appreciated.

Thank you! Dora

---

**From:** Littell, David P  
**Sent:** Wednesday, February 11, 2009 4:35 PM  
**To:** Mills, Dora A.  
**Cc:** Fisk, Andrew C; Mullen, Mike; Cassida, James  
**Subject:** RE: Noise Regulations

Dora, thank you for these sources and your previous email altering us to your contact on this.

Noise has been an issue we looked at last year to determine whether our existing rules are adequate as part of the wind power task force. The Wind Power Task Force asked us for an analysis and we provided it, asking for the authority to modify operational requirements if we later find a noise issue that the application noise analysis did not indicate would be present at a protected location (meaning a residence).

Because these issues can get very detailed and technical (different types of noise, different atmospheric conditions, different



ground conditions such as leaves and hard ice covered snow) we have retained the services of an outside noise expert to review noise study submissions as part of applications and compliance evaluations (such as Mars Hill).

I am copying Andy Fisk who you know and our acting division director Mike Mullen and director of licensing Jim Cassida on the sources you provide as well as more information is often useful. Let us know if you want to get together to discuss this as we would value the expert input of CDC.

David

9

FOAA 9

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**From:** Mills, Dora A.  
**Sent:** Wednesday, February 11, 2009 2:06 PM  
**To:** Littell, David P  
**Subject:** Noise Regulations  
**Importance:** High

I don't know who at Maine DEP oversees noise regulations. In my reading the last couple of days on wind turbine issues, I did come across Mass DEP regulations as well as two very recent articles from Canada proposing some ways to address unique features of wind turbines in measuring or setting standards for noise levels. These three sources are pasted in below. As I mentioned in the previous email, it appears that Maine's rules have not been updated since 1989, though that may not be true if they've been recently updated. University of Massachusetts also has a research lab on wind turbines that you're probably quite familiar with, but they also appear to be a source for information on setting standards for noise issues. I'm sure DEP has experts, including yourself, who know a great deal more than I do about this subject, but thought I'd just share the information I came across when looking into the health effects issue.

Please let me know if I can be of further help.

Thank you! Dora

#### Massachusetts DEP Regulations

<http://www.nonoise.org/lawlib/states/mass/mass.htm>

*A source of sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) if the source:*  
*Increases the broadband sound level by more than 10 dB(A) above ambient, or*  
*Produces a "pure tone" condition - when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more.*  
*These criteria are measured both at the property line and at the nearest inhabited residence. Ambient is defined as the background A-weighted sound level that is exceeded 90% of the time measured during equipment operating hours. The ambient may also be established by other means with the consent of the Department.*

#### A Proposal for Evaluating the Potential Health Effects of Wind Turbine Noise for Projects Under the Canadian Environmental Assessment Act

[http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqec6gbu.alice?title=Noise+annoyance+in+Canada&title\\_type=tka&year\\_from=1998&year\\_to=2009&database=1&pageSize=20&in](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqec6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&in)

Keith, Stephen E.; Michaud, David S.; Bly, Stephen H.P. Source: Journal of Low Frequency Noise, Vibration and Active Control, Volume 27, Number 4, December 2008, pp. 253-265(13) The advice that Health Canada provides on the health effects of noise is generally based only on well-accepted scientific evidence for a link between noise exposure and health. For quiet rural areas, in which annoyance reactions towards intruding noise may be augmented, this paper proposes noise mitigation if predicted wind turbine noise levels exceed 45 dBA at noise sensitive receptors. In this proposal, a cautious approach is adopted by using predicted noise levels that are evaluated at the wind speed that produces the highest wind turbine noise, and background noise is evaluated in calm winds. This accounts for sheltering by obstructions. Wind speed gradient effects related to stable atmospheric conditions are also accounted for with this approach. The proposal is based on predicted project-noise related changes in long-term high annoyance,

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rattle and sleep disturbance. Noise mitigation for wind turbine construction noise is proposed based on potential for expectation of complaints.

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FOAA 10

Incorporating Low Frequency Noise Legislation for the Energy Industry in Alberta, Canada

[http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&inc)

[title=Noise+annoyance+in+Canada&title\\_type=tka&year\\_from=1998&year\\_to=2009&database=1&pageSize=20&inc](http://www.ingentaconnect.com/search/article;jsessionid=kqu0ghqe6gbu.alice?title=Noise+annoyance+in+Canada&title_type=tka&year_from=1998&year_to=2009&database=1&pageSize=20&inc)

Authors: DeGagne, David C.; Lapka, Stephanie D. Source: Journal of Low Frequency Noise, Vibration and Active Control, Volume 27, Number 2, September 2008 , pp. 105-120(16) Environmental noise from energy industry facilities in Alberta, Canada, is regulated by the province's Energy Resources Conservation Board (ERCB) (until 2008 known as the Alberta Energy and Utilities Board [EUB]) as set out in Directive 038: Noise Control. The 2007 edition of the directive, which comprises a comprehensive policy and guide, adopts A-weighted energy equivalent sound levels (LAeq), with sound pressure level criteria, as the primary measurement system for a receptor location. With the receptor being some distance from the energy industry noise source, the high and medium frequency components can dissipate or be absorbed by air and ground conditions, leaving mostly low frequency noise (LFN). Consequently, A-weighted measurements do not reflect the full annoyance potential of the remaining industrial noise. Complaints related to LFN are often described by the affected party as a deep, heavy sound, like "humming", sometimes with an accompanying vibration. In some cases, the direction of the source of the LFN will be unknown to the receptor. However, it is the complainant that is most able to detect the presence of the LFN, signifying a particular sensitivity of the individual to the sound while others in the same family may not be able to detect the sound at all. To make a proper determination for the presence of LFN, the data must be collected during a time when environmental conditions are representative of when the sound is annoying. Residents who are impacted by LFN may suffer from sleep disturbances, headaches, and in some cases chronic fatigue. This paper examines the work undertaken by the ERCB to understand the issue, the various metrics tested to easily identify LFN, and finally the approach that would be incorporated into the new 2007 edition of Directive 038: Noise Control to address the problem.

(11)

**Breton, Mary B**

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**From:** Littell, David P  
**Sent:** Wednesday, February 11, 2009 6:39 PM  
**To:** Brooks, James P; Fisk, Andrew C  
**Cc:** Garrett, Deborah N; Cassida, James  
**Subject:** FW: Wind Turbine Points  
**Importance:** High  
**Attachments:** Wind Turbine Points 02 11 09.doc

Jim (Brooks), can you look at point 6 to see if valid, if we want CDC to quote a source of ours.

Andy, can you look at the noise treatment in the other points to see if consistent with our guidelines and information we provide. This piece will be good to have to address these issues I believe.

Thanks.

David

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**From:** Mills, Dora A.  
**Sent:** Wednesday, February 11, 2009 1:57 PM  
**To:** Harvey, Brenda; Green, Geoffrey; Martins, John A; Littell, David P; Kerry, John; Farmer, David W; Ende, Patrick  
**Subject:** Wind Turbine Points  
**Importance:** High

Attached is a rough draft of a Q&A I drafted to answer the questions that the Sun Journal is asking in response to the Rumford Hospital's medical staff letter calling for a moratorium on wind turbines until further research delineates and mitigates health effects. I've pasted the medical staff's letter below this email. I do not find evidence to support their conclusions, and I state that in the last question in the FAQ. There are no firm statements I could find from non-industry sources stating there are no adverse health effects from wind turbines, but that would be true of most products.

I did not state this in the Q&A, but unless DEP rules have been recently updated and are not online yet, there may be room for improving the noise rules for developments to take in account wind farms. The last time these rules were updated appear to be 1989. Massachusetts has rules that take in account the change over ambient noise levels rather than a level cap. And, there are some proposals from Canada that take into account low frequency noise emissions. However, that said, I am not a noise expert and Maine is fortunate to have statute and rules on noise levels in place, given that many states do not. I will send my findings under separate a cover to Commissioner Littell on this matter.

Please review the enclosed Q&A and provide any feedback. I started working on this very early (2 am) today, and have also been busy doing other things, so I'm sure it needs some refinement. The reporter wanted to talk with me today or tomorrow, so if I can get feedback on this by late today or early tomorrow am, that would be great, and at least I can use this as my speaking points.

Also, I did not spend much time in the Q&A writing about the medical staff's sources of information, but I did check them out, and can tell the reporter, as I did yesterday (I had checked a few out early yesterday morning after reading the email from Dr. Aniel) that they are not from peer-reviewed studies. Most of the information was not from legitimate sources, though some were and had misinterpreted.

Thank you! Dora

## Health hazards Generated by wind turbines

As members of the Rumford Community Hospital medical staff we endorse the concept of alternative energy including but not limited to wind turbines.

As wind turbine generated power has been introduced on an industrial level around the country as well as in the world , there is literature emerging worldwide expressing a multitude of side effects affecting those who live , work, attend school in the vicinity of wind farms.

These health hazards include problems arising not only from the audible noise frequencies but also from inaudible low frequency noise waves.

There are growing scientific observations and studies suggesting that some people living within 2 to 6 miles of these industrial "wind farms" area affected at a variety of levels from a variety of symptoms.

In light of these growing serious medical concerns we propose a moratorium on the building of any such "wind farms" for at least a year and possibly longer until more research is being done on the public health impact that such facilities can and will have on a segment of the communities surrounding such technology.

The Medical Staff of Rumford Community Hospital

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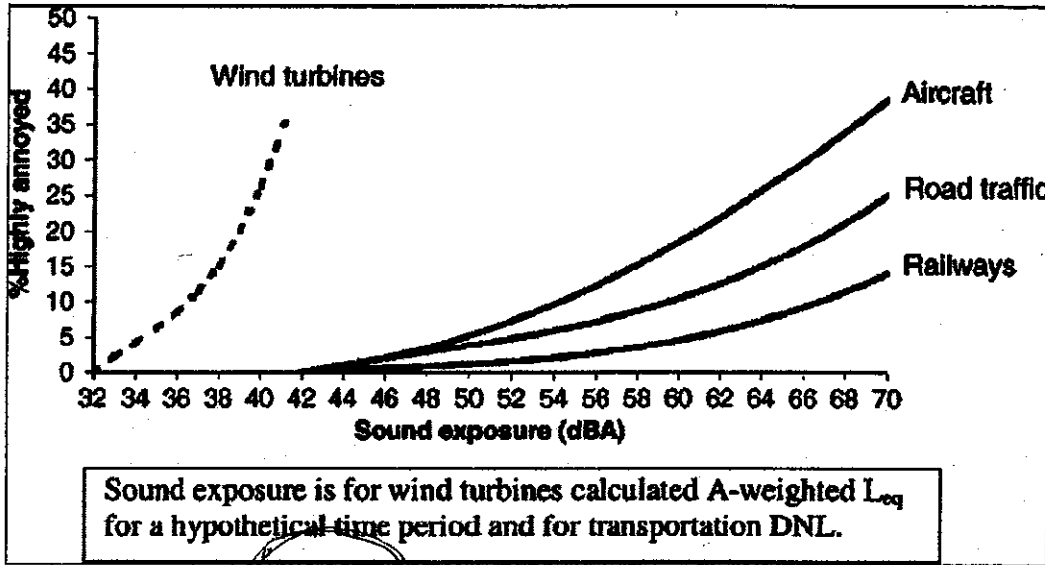
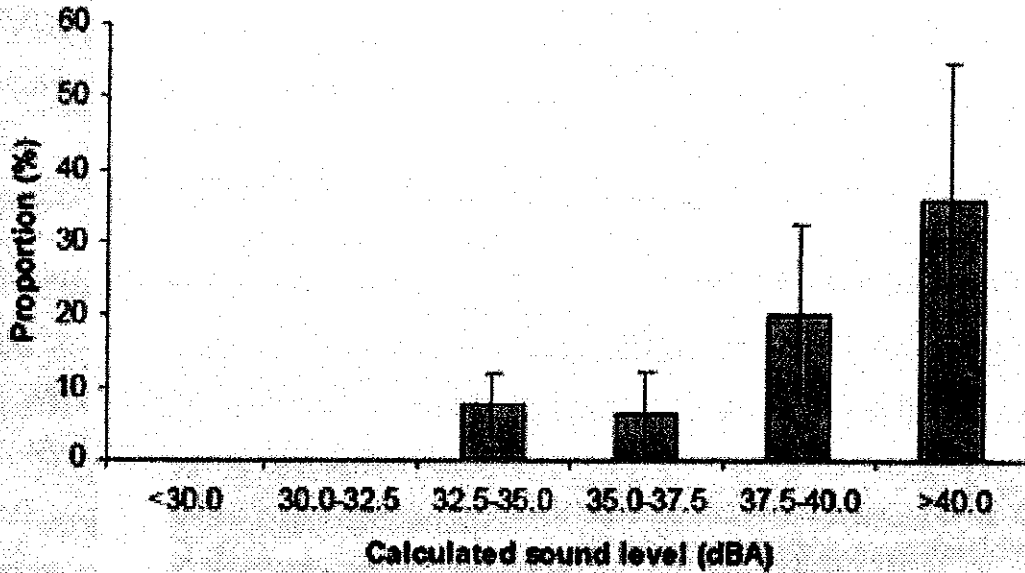


Fig. 13 : High Annoyance from Wind Turbines (Pederson 2004, Ref. 20)

Also:

SWEDISH ENVIRONMENTAL PROTECTION AGENCY Report 5308  
Noise annoyance from wind turbines – a review



The proportions very annoyed by noise outdoors from wind turbines (95%CI) at different A-weighted sound pressure levels [Pedersen and Persson Waye 2002]

**Cassida, James**

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**From:** Fisk, Andrew C  
**Sent:** Tuesday, March 03, 2009 4:18 PM  
**To:** Mills, Dora A.  
**Cc:** Boutilier, Lynn A; Littell, David P; Cassida, James  
**Subject:** FW: Wind Turbine Points revised 2-26-09.doc  
**Attachments:** Wind Turbine Points revised 2-26-09.doc

Dora,

Attached is a vetted and edited version of your talking points on wind noise. Please hold these for our conversation that we have scheduled between DEP, yourself (and others as you need), and our noise consultant on Thursday.

I would like the two of you to discuss your mutual observations on low frequency noise (<250 Hz). Warren Brown is evaluating these frequencies generated by wind turbines. He is not a medical doctor but is looking at some studies and evaluating the presence of these noises.

Thanks, sorry this took a bit but we've been having conversations over here.

A

**Andrew Fisk**  
Bureau Director, Land & Water Quality  
Maine Department of Environmental Protection

207-287-7671  
[www.maine.gov/dep](http://www.maine.gov/dep)

**Wind Turbine Neuro-Acoustical Issues**  
Dora Anne Mills, MD, MPH Maine CDC/DHHS

February 26, 2009

**1. What protections are in Maine law regarding excessive noise and vibrations?**

Maine DEP has rules that apply to all developments in organized areas of the state and in towns without a more restrictive noise ordinance. The rules recognize in its text that excessive noise can degrade health and welfare of nearby neighbors and propose limits based on the type of development in the area surrounding the noise. They limit noise levels for routine operation of a proposed development: to 75 dBA at any time; to 60 dBA during the daytime and 50 dBA during the nighttime for non-commercial and non-industrial areas; and to 55 dBA daytime and 45 dBA nighttime for areas in which ambient sounds are 45 dBA or less daytime or 35 dBA or less nighttime.

Maine DEP also has retained the services of a noise expert to review noise study submissions as part of wind turbine applications and compliance evaluations.

In summary: Maine law appears to essentially place a 45 dBA noise limit on most wind turbine projects in Maine. A 5 dBA variance to limits may be granted upon specific findings that concern pre-development existing ambient noises that are in excess of a particular standard. For compliance with the rule noise levels are measured at the boundary of the property owned by the proposed developer.

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**2. What do different noise levels compare to?**

40 dBA is comparable to a quiet room. 55 dBA is comparable to a household room or office in which there is normal background vibration and sounds such as is commonly found from household appliances.



COMPARISON OF SOUND PRESSURE LEVEL AND SOUND PRESSURE		
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Newspaper Press	100	2
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According to several resources, new wind turbines are relatively quiet, and meet federal and international standards and regulations for noise, including Maine's regulations.

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**4. Are there health effects to the levels of sound heard by wind turbines?**

According to a 2003 Swedish EPA review of noise and wind turbines:

“Interference with communication and noise-induced hearing loss is not an issue when studying effects of noise from wind turbines as the exposure levels are too low.”

In my review I found no evidence in peer-reviewed medical and public health literature of adverse health effects from the kinds of noise and vibrations heard by wind turbines other than occasional reports of annoyances, and these are mitigated or disappear with proper placement of the turbines from nearby residences.

Most studies showing some health effects of noise have been done using thresholds of 70 dBA or higher outdoors, much higher than what is seen in wind turbines.

Sleep disturbance is another issue, and the WHO guidelines for community noise recommend that nighttime outdoor noise levels in residential areas not exceed 45 dBA, which is consistent with Maine law. DEP’s ambient, post development monitoring at the Mars Hill wind farm shows dBA levels higher than 45 – sometimes exceeding 60 when you have windy conditions both at ground level and at turbine height. This presents an example of how ambient noise from wind at these locations (which is why they put turbines there) is in excess of the optimal nighttime 45 dBA. The DEP rules and compliance monitoring provide for distinguishing between the ambient contribution to noise at wind farms.

**Sources:**

- Noise Annoyance from Wind Turbines – A Review 2003 Sweden Environmental Protection Agency  
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This study found no evidence of health problems, reviews the variety of noise regulation laws in place in Europe
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Some have pointed to low frequency vibrations emitted from wind turbines as a possible source of adverse health effects. One recent study commonly cited by proponents of this belief is: "Tuning and sensitivity of the human vestibular system to low-frequency vibration", Todd, et al. Neuroscience Letters, 2008, which can be found at: <http://www.ncbi.nlm.nih.gov/pubmed/18706484>.

This study indicates that the human vestibular system is sensitive, which means it shows a physiological response, to low-frequency and infrasound vibrations of -70 dB, indicating that human seismic receptor sensitivity of the vestibular system may possibly be on par with the frog ear. However, sensitivity, i.e. showing a physiological response, does not mean there are adverse effects.

Low frequency and infrasound (lower than what is perceptible) vibrations are very common in our background, and known to be emitted from many household appliances and vehicles. Exposure to very intense low frequency noise can be annoying and may adversely affect overall health, though these levels appear to be more intense than what is measured from modern wind turbines.

Reviews found in peer reviewed journals of the possible health effects of low frequency noise have not found any health effects (several articles and additional references in them below).

#### Sources:

- Infrasound from Wind Turbines: Fact, Fiction, or Deception? Journal of Canadian Acoustics, Volume 34, no 2, 2006.  
<http://www.wind.appstate.edu/reports/06-06Leventhall-Infras-WT-CanAcoustics2.pdf>
- Sources and Effects of Low-Frequency Noise 1996  
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- Characteristics of low frequency signals emitted from home electric appliances:  
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- Magnetic Emission Ranking of Electrical Appliances:  
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### 6. What are the health benefits to wind turbines?

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- There are tremendous potential health benefits to wind turbines, including reductions in asthma, other lung diseases, heart disease, and cancer.
- Wind turbines mean less dependency on foreign oil and coal that contribute to global warming and pollution (coal produces carbon dioxide, acid rain, smog, particulate pollution, carbon monoxide, and mercury). Maine's highest in the nation rates of asthma and high rates of cancer can be positively impacted by less dependency on these sources.
- According to the Maine DEP, if Maine generated 5% of its electricity from wind power, there would be significant pollution cuts:
  - 464,520 tons per year of CO2
  - 252 tons per year of SO2
  - 147 tons per year of NOx

#### 7. What about a moratorium on wind turbine projects?

- I do not find evidence to support a moratorium on wind turbine projects at this time. The articles cited by those who are in favor of a moratorium are either from non-peer reviewed journals or are misinterpreted analysis from peer reviewed journals.
- If there is any evidence for a moratorium, it is most likely on further use of fossil fuels, given their known and common effects on the health of our population.

#### Basic Wind Turbine Noise-Related Resources:

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[http://www.windpoweringamerica.gov/ne\\_issues\\_sound.asp](http://www.windpoweringamerica.gov/ne_issues_sound.asp)
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*Produces a "pure tone" condition - when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more.*  
*These criteria are measured both at the property line and at the nearest inhabited residence.*  
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"Turbine noise can be caused by rotor speed, blade shape, tower shadow, and other factors. The program is sponsoring both wind tunnel and field tests to develop a noise prediction code that turbine manufacturers can use to ensure that new rotor designs and full systems aren't too noisy. This is especially true for high-growth U.S. markets for small wind turbines that will demand quieter rotors, especially when turbines are sited in residential neighborhoods. Small turbines

DRAFT Wind Turbine Neuro-Acoustical Issues

February 11, 2009

Dora Anne Mills, MD, MPH Maine CDC/DHHS

BY DEP

**1. What protections are in Maine law regarding excessive noise and vibrations?**

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In summary: For quiet rural locations, Maine law essentially places a 45 dBA noise limit on most wind turbine projects in Maine. These noise levels are measured at the boundary of the property owned by the proposed developer, which creates a more conservative threshold than measuring directly at a home or other occupied location.

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**2. What do different noise levels compare to?**

40 dBA is comparable to a quiet room. 55 dBA is comparable to a household room or office in which there is normal background vibration and sounds such as is commonly found from household appliances. Many rural locations where wind turbine facilities are located or proposed to be located can routinely have ambient noise levels in excess of 50 dBA as a result of wind generated noise.

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### 3. What kinds of noises are expected from wind turbines?

According to several resources, new wind turbines are relatively quiet, and meet federal and international standards and regulations for noise, including Maine's regulations.

They do however generate noise that can be measured and assessed for compliance with the state's regulations.

According to the US Department of Energy, a modern wind farm at a distance of 750 – 1,000' is no louder than a kitchen refrigerator or a moderately quiet room.

In terms of residential wind turbines, another Department of Energy source states, "The sound level of most modern residential wind turbines is slightly above the ambient wind noise. This means that while the sound of the wind turbine may be picked out of surrounding noise if a conscious effort is made to hear it, a residential-sized wind turbine is not a significant source of noise under most wind conditions."

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Most studies on health effects of noise have been done using thresholds of 70 dBA or higher outdoors, much higher than what is seen in wind turbines.

Sleep disturbance is another concern, and the WHO guidelines for community noise recommend that outdoor noise levels in living areas for nighttime not exceed 45 dBA, which is consistent with Maine law.

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Maine noise regulations assess the distribution of noise generated by a regulated project based on its frequency and can regulate noises with a specific tonal contribution that outweighs the other frequency components of the generated noise.

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- o Characteristics of low frequency signals emitted from home electric appliances: <http://sciencelinks.jp/j-east/article/200507/000020050705A0229983.php>,
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### 6. What are the health benefits to wind turbines?

- o Wind turbines mean less dependency on foreign oil and coal that contribute to global warming and pollution (coal produces carbon dioxide, acid rain, smog, particulate pollution, carbon monoxide, and mercury). Maine's highest in the nation rates of asthma and high rates of cancer can be positively impacted by less dependency on these sources.
- o According to the Natural Resources Council of Maine: *"If Maine generated five percent of its electricity from wind power by 2010, as called for by the Council,*



*there would be significant pollution cuts: 480,000 tons of carbon dioxide; 1,680 tons of sulfur dioxide; and 1,152 tons of nitrogen oxides annually. 'We believe the development of wind power, properly located, should be a centerpiece of Maine's policies to generate clean power, reduce air pollution and halt climate change,' said Peter Didisheim."*

#### **7. What about a moratorium on wind turbine projects?**

I do not find evidence to support a moratorium on wind turbine projects at this time.

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**DRAFT Wind Turbine Neuro-Acoustical Issues**

FOAA 26

February 15, 2009

Dora Anne Mills, MD, MPH Maine CDC/DHHS

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<http://www.who.int/mediacentre/factsheets/fs258/en/>
- o World Health Organization 2002 Technical Meeting on Relationship Between Noise and Health  
<http://www.euro.who.int/document/NOH/exposeresnoise.pdf>  
Page 52 says that WHO standard is for nighttime noise not to exceed 45 dB.

Deleted: living

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Comment [Waterboy1]: Our ambient, post development monitoring at Mars Hill shows dBA levels higher than 45 – sometimes exceeding 60 when you have windy conditions on the ground and at turbine height. This presents an example of how ambient noise from wind at these locations (which is why they put turbines there) is in excess of the optimal nighttime 45 dBA without even having the turbine noise considered. I'm not sure how you simply express this point here, but I think its worth noting given the "rarely noted" comment. When we evaluate just turbine noise (at calm ground level conditions) we can see numbers just above 50 dBA at Mars Hill for those properties closest to the turbines, which we allowed for in the variance provided to that facility.

### 5. What about low frequency noises?

Some have pointed to low frequency vibrations emitted from wind turbines as a possible source of adverse health effects. One recent study commonly cited by proponents of this belief is: "Tuning and sensitivity of the human vestibular system to low-frequency vibration", Todd, et al. Neuroscience Letters, 2008, which can be found at: <http://www.ncbi.nlm.nih.gov/pubmed/18706484>.

This study indicates that the human vestibular system is sensitive, which means it shows a physiological response, to low-frequency and infrasound vibrations of -70 dB, indicating that human seismic receptor sensitivity of the vestibular system may possibly be on par with the frog ear. However, sensitivity, i.e. showing a physiological response, does not mean there are adverse effects.

Low frequency and infrasound (lower than what is perceptible) vibrations are very common in our background, and known to be emitted from many household appliances and vehicles. Exposure to very intense low frequency noise can be annoying and may adversely affect overall health, though these levels appear to be more intense than what is measured from modern wind turbines.

Reviews found in peer reviewed journals of the possible health effects of low frequency noise have not found any health effects (several articles and additional references in them below).

#### Sources:

- Infrasound from Wind Turbines: Fact, Fiction, or Deception? Journal of Canadian Acoustics, Volume 34, no 2, 2006.  
<http://www.wind.appstate.edu/reports/06-06Leventhall-Infras-WT-CanAcoustics2.pdf>
- Sources and Effects of Low-Frequency Noise 1996  
<http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=JASMAN00099000005002985000001&idtype=cvips&gifs=yes>  
J. Acoust. Soc. Am. Volume 99, Issue 5, pp. 2985-3002 (May 1996)
- Characteristics of low frequency signals emitted from home electric appliances:  
<http://sciencelinks.jp/j-east/article/200507/000020050705A0229983.php>
- Magnetic Emission Ranking of Electrical Appliances:  
<http://rpd.oxfordjournals.org/cgi/content/abstract/nem460v1>

### 6. What are the health benefits to wind turbines?

- There are tremendous potential health benefits to wind turbines, including reductions in asthma, other lung diseases, heart disease, and cancer.
- Wind turbines mean less dependency on foreign oil and coal that contribute to global warming and pollution (coal produces carbon dioxide, acid rain, smog, particulate pollution, carbon monoxide, and mercury). Maine's highest in the

nation rates of asthma and high rates of cancer can be positively impacted by less dependency on these sources.

- According to the Maine DEP, if Maine generated 5% of its electricity from wind power, there would be significant pollution cuts:
  - 464,520 tons per year of CO<sub>2</sub>
  - 252 tons per year of SO<sub>2</sub>
  - 147 tons per year of NO<sub>x</sub>

#### 7. What about a moratorium on wind turbine projects?

- I do not find evidence to support a moratorium on wind turbine projects at this time. The articles cited by those who are in favor of a moratorium are either from non-peer reviewed journals or are misinterpreted analysis from peer reviewed journals.
- If there is any evidence for a moratorium, it is most likely on further use of fossil fuels, given their known and common effects on the health of our population.

#### Basic Wind Turbine Noise-Related Resources:

- US Dept of Energy's New England Wind Power Website on Wind Turbine Sound – this has a good summary and links to references  
[http://www.windpoweringamerica.gov/ne\\_issues\\_sound.asp](http://www.windpoweringamerica.gov/ne_issues_sound.asp)
- Canada Center for Occupational Health and Safety, Noise: Basic Information  
[http://www.ccohs.ca/oshanswers/phys\\_agents/noise\\_basic.html](http://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html)
- Massachusetts DEP Regulations  
<http://www.nonoise.org/lawlib/states/mass/mass.htm>  
*A source of sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) if the source:*  
*Increases the broadband sound level by more than 10 dB(A) above ambient, or*  
*Produces a "pure tone" condition - when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more.*  
*These criteria are measured both at the property line and at the nearest inhabited residence.*  
*Ambient is defined as the background A-weighted sound level that is exceeded 90% of the time measured during equipment operating hours. The ambient may also be established by other means with the consent of the Department.*
- Ongoing Research is being done by the US Dept of Energy Wind Turbine Aeroacoustic Research:  
[http://www1.eere.energy.gov/windandhydro/wind\\_research\\_enable.html#research](http://www1.eere.energy.gov/windandhydro/wind_research_enable.html#research)  
“Turbine noise can be caused by rotor speed, blade shape, tower shadow, and other factors. The program is sponsoring both wind tunnel and field tests to develop a noise prediction code that turbine manufacturers can use to ensure that new rotor designs and full systems aren't too noisy. This is especially true for high-growth U.S. markets for small wind turbines that will demand quieter rotors, especially when turbines are sited in residential neighborhoods. Small turbines operate at high rotational speeds and tend to spin even if they are furlled (pointed out of the wind).