October 19, 2013

Falmouth Wind Turbine Noise Studies

Stephen E. Ambrose
Principal Consultant, INCE Board Certified
&
Robert W. Rand
Principal Consultant, INCE

Acoustics, Environmental Sound
& Industrial Noise Control

Themes considered for this presentation:

1. The last thing we need is another study,
2. Blind eyes and deaf ears,
3. History of Falmouth wind turbine studies,
4. Evidence that demands a verdict,

Winner: "Back to the Future"

Acknowledgements: Steven Spielberg, Robert Zemeckis, Michael J Fox, Christopher Lloyd


BE QUIET
BACK TO THE FUTURE

This is a true story, depicted by Marty and Doc.

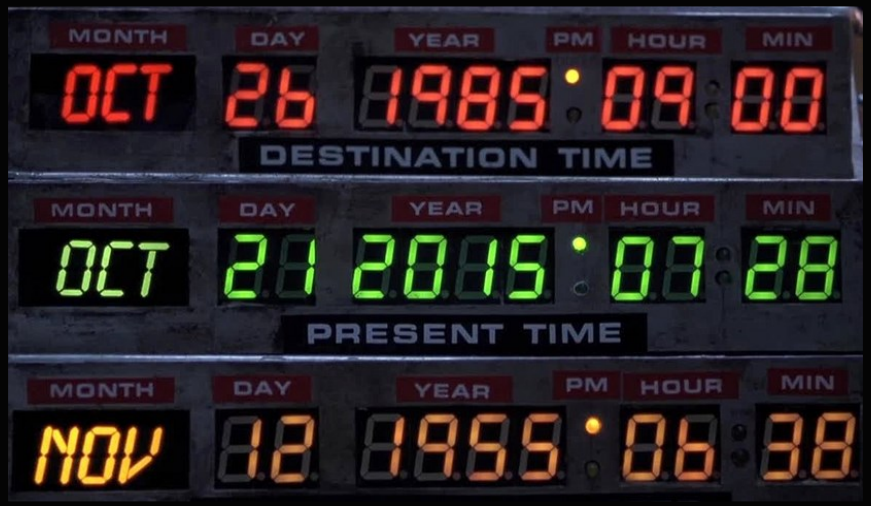
Their mission: identify the ignored warnings in the Falmouth wind turbine studies

Only then can Marty and Doc correct significant warnings in history.

That opened rifts into an alternate universe, where noisy wind turbines were **permitted** to invade homes.

The wayback clock is set

NOV 21 2003 0800



First study

November 21, 2003

Renewable Energy Research Laboratory

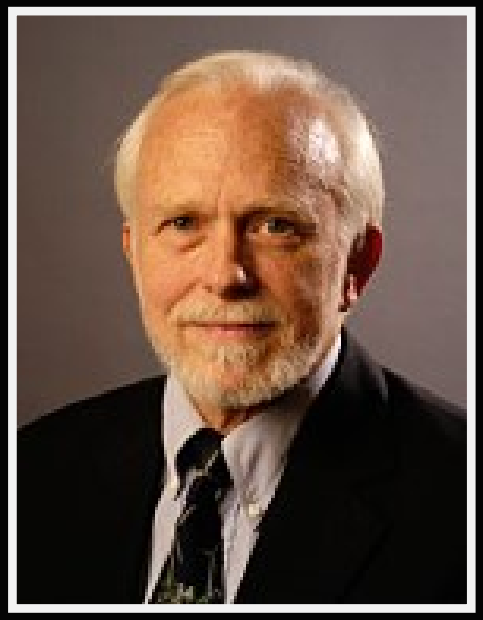
(new name; UMass Wind Energy Center)

University of Massachusetts
Department of Mechanical Engineering

Support from Massachusetts Technology Collaborative

UNIVERSITY OF MASSACHUSETTS

Wind Energy Center



Dr. James Manwell
Director

The University of Massachusetts Wind Energy Center is a leading institution in wind energy engineering nationally and internationally. Since 1972 the Center has worked diligently to maintain and enhance its important wind energy education programs and research activities.

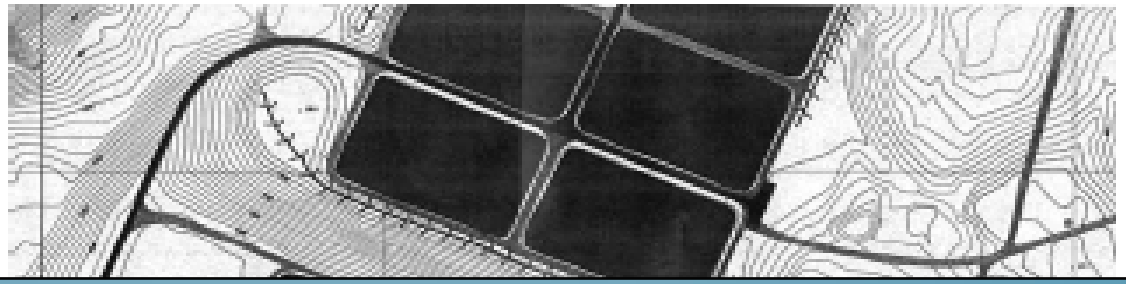
MASSACHUSETTS TECHNOLOGY COLLABORATIVE

NOVEMBER 21, 2003

Renewable Energy Research Laboratory
Department of Mechanical and Industrial Engineering
University of Massachusetts
160 Governor's Drive
Amherst, MA 01003-9265
Phone: 413-545-4359
www.ceere.org/rerl
rerl@rerl.org

Falmouth
Preliminary Site Assessment of Wind Resource and Appropriateness of Anemometry

To:
Steve Weisman
Massachusetts Technology Collaborative
75 North Drive
Westborough, MA 01581-



Renewable Energy Research Laboratory
Department of Mechanical and Industrial Engineering
University of Massachusetts
160 Governor's Drive
Amherst, MA 01003-9265
Phone: 413-545-4359
www.ceere.org/rerl
rerl@rerl.org

Falmouth
Preliminary Site Assessment of Wind Resource and Appropriateness of Anemometry

November 2003

Noise:

Massachusetts state law does not allow a rise of greater than 10 dB above existing background levels at a property boundary (Massachusetts Air Pollution Control Regulations, Regulation 310 CMR 7.10), due to new activities at the site. This sound level is unlikely to be a reached in any case at any of the sites we examined. Furthermore, any eventual turbine will most likely be inaudible or minimally audible at the nearest residences. Due to aesthetic and aromatic considerations, the nearest habitation is several hundred yards away. Possible noise levels can be examined in more detail when a site is chosen. A baseline measurement of the ambient sound level should be measured eventually, so that this study can be done.

Page 3

Renewable Energy Research Laboratory
Department of Mechanical and Industrial Engineering
University of Massachusetts
160 Governor's Drive
Amherst, MA 01003-9265
Phone: 413-545-4359
www.ceere.org/rerl
rerl@rerl.org

Falmouth
Preliminary Site Assessment of Wind Resource and Appropriateness of Anemometry

November 2003

Noise:

Massachusetts state law does not allow a rise of greater than 10 dB above existing background levels at a property boundary (Massachusetts Air Pollution Control Regulations, Regulation 310 CMR 7.10), due to new activities at the site. This sound level is unlikely to be a reached in any case at any of the sites we examined. Furthermore, any eventual turbine will most likely be inaudible or minimally audible at the nearest residences. Due to aesthetic and aromatic considerations, the nearest habitation is several hundred yards away. Possible noise levels can be examined in more detail when a site is chosen. A baseline measurement of the ambient sound level should be measured eventually, so that this study can be done.

Page 3

Renewable Energy Research Laboratory
Department of Mechanical and Industrial Engineering
University of Massachusetts
160 Governor's Drive
Amherst, MA 01003-9265
Phone: 413-545-4359
www.ceere.org/rerl
rerl@rerl.org

Falmouth
Preliminary Site Assessment of Wind Resource and Appropriateness of Anemometry

November 2003

Noise:

Massachusetts state law does not allow a rise of greater than 10 dB above existing background levels at a property boundary (Massachusetts Air Pollution Control Regulations, Regulation 310 CMR 7.10), due to new activities at the site. This sound level is unlikely to be a reached in any case at any of the sites we examined. Furthermore, any eventual turbine will most likely be inaudible or minimally audible at the nearest residences. Due to aesthetic and aromatic considerations, the nearest habitation is several hundred yards away. Possible noise levels can be examined in more detail when a site is chosen. A baseline measurement of the ambient sound level should be measured eventually, so that this study can be done.

Page 3

Doc!
No 10 dB increase,
… won't be audible?

Wait!!
Marty, how can this be?

Renewable Energy Research Laboratory
Department of Mechanical and Industrial Engineering
University of Massachusetts
160 Governor's Drive
Amherst, MA 01003-9265
Phone: 413-545-4359
www.ceere.org/rerl
rerl@rerl.org

Falmouth
Preliminary Site Assessment of Wind Resource and Appropriateness of Anemometry

November 2003

Noise:

Massachusetts state law does not allow a rise of greater than 10 dB above existing background levels at a property boundary (Massachusetts Air Pollution Control Regulations, Regulation 310 CMR 7.10), due to new activities at the site. This sound level is unlikely to be a reached in any case at any of the sites we examined. Furthermore, any eventual turbine will most likely be inaudible or minimally audible at the nearest residences. Due to aesthetic and aromatic considerations, the nearest habitation is several hundred yards away. Possible noise levels can be examined in more detail when a site is chosen. A baseline measurement of the ambient sound level should be measured eventually, so that this study can be done.

Page 3

Geez,
they wrote this … with
no measurements,
no calculations …

GREAT SCOTT!!
Marty, YES! they
failed to design to
be **good acoustic
neighbors**.

Summary

Date	Report	Comment
21 Nov 2003	Preliminary Site Assessment RERL / Umass	Increase Less Than 10 dB Minimally Audible Do Noise Survey

Doc, this report was researched by an academic group that promotes wind turbines.

Yes, and they recognized the need to do an ambient noise survey, … **MEASUREMENTS** !

Second & Third Studies

April 19, 2003 & November 2005

KEMA, Ecology and Environment, Inc.
(now part of DNV; an international risk management company)

Support from Massachusetts Technology Collaborative

TOWN OF FALMOUTH
COMMUNITY WIND PROJECT
FEASIBILITY STUDY

November 2005

KE
Ecology

Funded by the Com
the Renev

TOWN OF FALMOUTH
COMMUNITY WIND PROJECT
SITE SCREENING REPORT

April 19, 2005

Prepared by:

KEMA, Inc. &
Ecology and Environment, Inc.

Funded by the Community Wind Collaborative of the Renewable Energy Trust

MASSACHUSETTS TECHNOLOGY COLLABORATIVE

TOWN OF FALMOUTH COMMUNITY WIND PROJECT SITE SCREENING REPORT

April 19, 2005

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.1.2 Noise Impact — **6.1.2 Nov. 5** — **Same Text**

Noise levels from the proposed turbine should also be considered in the context of the existing features of the landscape. While noise levels from wind turbines can easily be measured, the public's perception of the noise impacts can also be quite subjective. This subjectivity stems largely from the wide variations of individual tolerances for noise, and the inability to precisely predict corresponding reactions of annoyance and/or dissatisfaction. However, with continued advances in wind energy technology, noise produced from modern wind turbines has significantly decreased and is often masked by ambient or background noise of the wind itself.

For reference, a 1 MW Fuhrlander wind turbine can be heard at 42 decibels (dBa) at a point 300 feet away and ten feet from the ground. Forty decibels is the equivalent of noise heard from inside in an urban environment.[12]

Added for 6.1.2 Nov. 5

TOWN OF FALMOUTH COMMUNITY WIND PROJECT SITE SCREENING REPORT

April 19, 2005

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.1.2 Noise Impact **6.1.2 Nov. 5**

Public Reaction Flawed

Noise levels from the proposed turbine should also be considered in the context of the existing features of the landscape. While noise levels from wind turbines can easily be measured, the public's perception of the noise impacts can also be quite subjective. This subjectivity stems largely from the wide variations of individual tolerances for noise, and the inability to precisely predict corresponding reactions of annoyance and/or dissatisfaction. However, with continued advances in wind energy technology, noise produced from modern wind turbines has significantly decreased and is often masked by ambient or background noise of the wind itself. For reference, a 1 MW Fuhrlander wind turbine can be heard at 42 decibels (dBa) at a point 300 feet away and ten feet from the ground. Forty decibels is the equivalent of noise heard from inside in an urban environment.[12]

Added for 6.1.2 Nov. 5

TOWN OF FALMOUTH COMMUNITY WIND PROJECT SITE SCREENING REPORT

April 19, 2005

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.1.2 Noise Impact **6.1.2 Nov. 5**

Modern Turbines Quiet

Noise levels from the proposed turbine should al ting features of the landscape. While noise levels fr the public's perception of the noise impacts can also be quite subjective. This subjectivity stems largely from the wide variations of individual tolerances for noise, and the inability to precisely predict corresponding reactions of annoyance and/or dissatisfaction. However, with continued advances in wind energy technology, noise produced from modern wind turbines has significantly decreased and is often masked by ambient or background noise of the wind itself.

For reference, a 1 MW Fuhrlander wind turbine can be heard at 42 decibels (dBa) at a point 300 feet away and ten feet from the ground. Forty decibels is the equivalent of noise heard from inside in an urban environment.[12]

Added for 6.1.2 Nov. 5

Doc! They're saying public noise reaction is unpredictable??

Marty, it's INCREDIBLE!! They ignored reliable methods to assess community noise reaction!!

Noise Complaint Response Levels

International Standards Organization

ISO 1996-1:2003

dBA above noise level criterion	Estimated Community Response	
	Category	Description
0	None	No Observed Reaction
5	Little	Sporadic Complaints
10	Medium	Widespread Complaints
15	Strong	Threats of Community Action
20	Very Strong	Vigorous Community Action

TOWN OF FALMOUTH COMMUNITY WIND PROJECT SITE SCREENING REPORT

April 19, 2005

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.1.2 Noise Impact **6.1.2 Nov. 5**

Noise levels from the proposed turbine should also be considered in the context of the existing features of the landscape. While noise levels from wind turbines can easily be measured, the public's perception of the noise impacts can also be quite subjective. This subjectivity stems largely from the wide variations of in y predict corresponding reactions of annoyance and/or dissatisfaction. However, with continued advances in wind energy technology, noise produced from modern wind turbines has significantly decreased and is often masked by ambient or background noise of the wind itself.

1 MW turbine 42 dBA at 300-ft

For reference, a 1 MW Fuhrlander wind turbine can be heard at 42 decibels (dBa) at a point 300 feet away and ten feet from the ground. Forty decibels is the equivalent of noise heard from inside in an urban environment.[12]

Added for 6.1.2 Nov. 5

Marty, This is INCREDIBLE! Falmouth's property line noise limit is **40 dBA**.

42 dBA is TOO LOUD !!

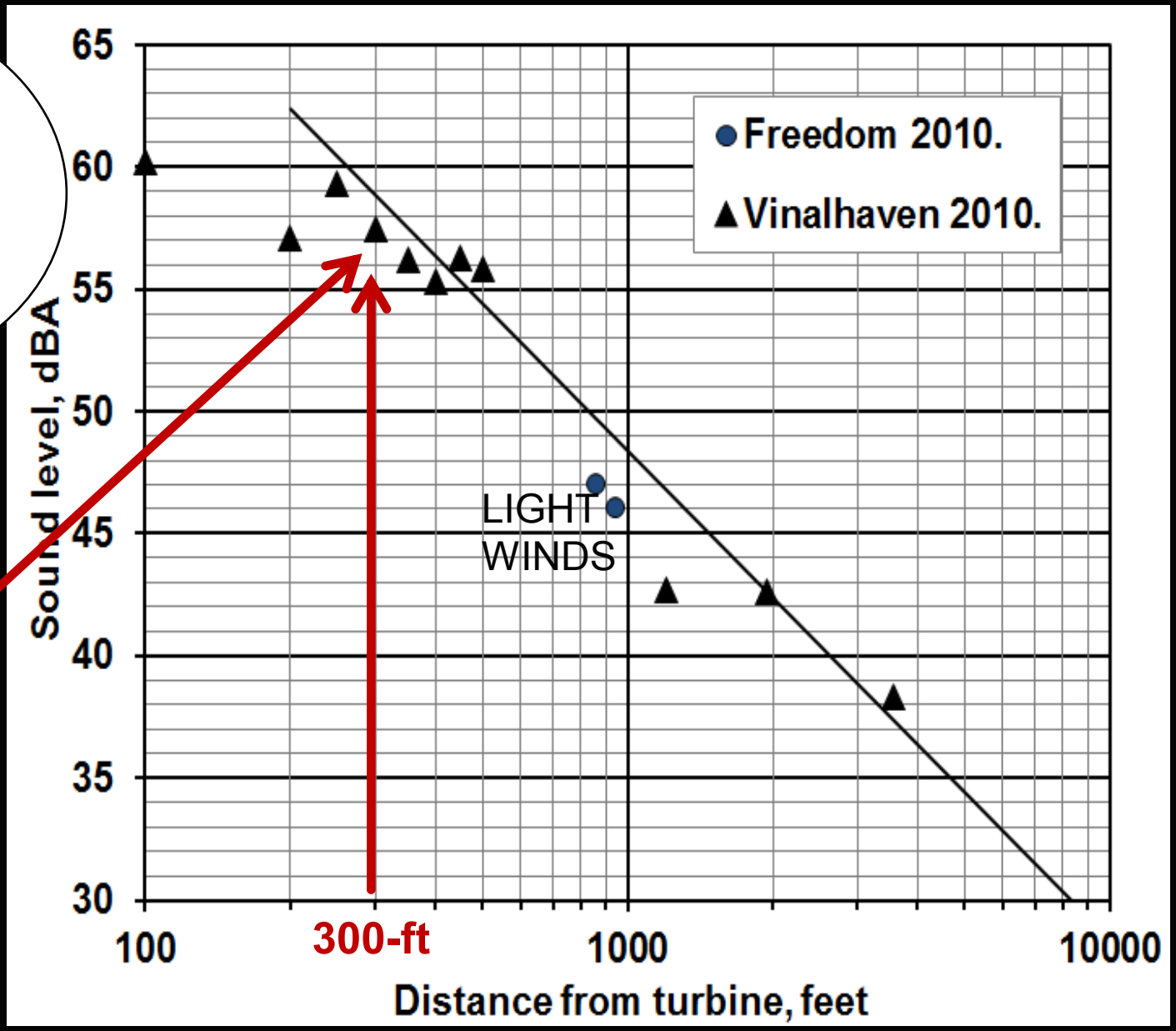
The're headed straight for **TROUBLE** !!

Doc, is **42 dBA** true … 1 MW turbine at 300-ft?

Marty, NO!! we need to ask Rob. He MEASURES wind turbine noise by DISTANCE.

Measured **57 dBA** … 300-ft from 1.5 MW turbines.

Robert Rand, Rand Acoustics



TOWN OF FALMOUTH COMMUNITY WIND PROJECT SITE SCREENING REPORT

April 19, 2005

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.1.2 Noise Impact **6.1.2 Nov. 5**

Noise levels from the proposed turbine should also be considered in the context of the existing features of the landscape. While noise levels from wind turbines can easily be measured, the public's perception of the noise impact [illegible]ite subjective. This subjectivity stems largely from the wide variations of indi[illegible] for noise, and the inability to precisely predict corresponding reactions of annoyance and/or dissatisfaction. However, with continued advance[illegible]nergy technology, noise produced from modern wind turbines has significantly decreased and is often masked by ambient or background noise of the wind itself. For reference, a 1 MW Fuhrlander wind turbine can be heard at 42 decibels (dBa) at a point 300 feet away and ten feet from the ground. Forty decibels is the equivalent of noise heard from inside in an urban environment.[12]

40 dBA

Urban

Added for 6.1.2 Nov. 5

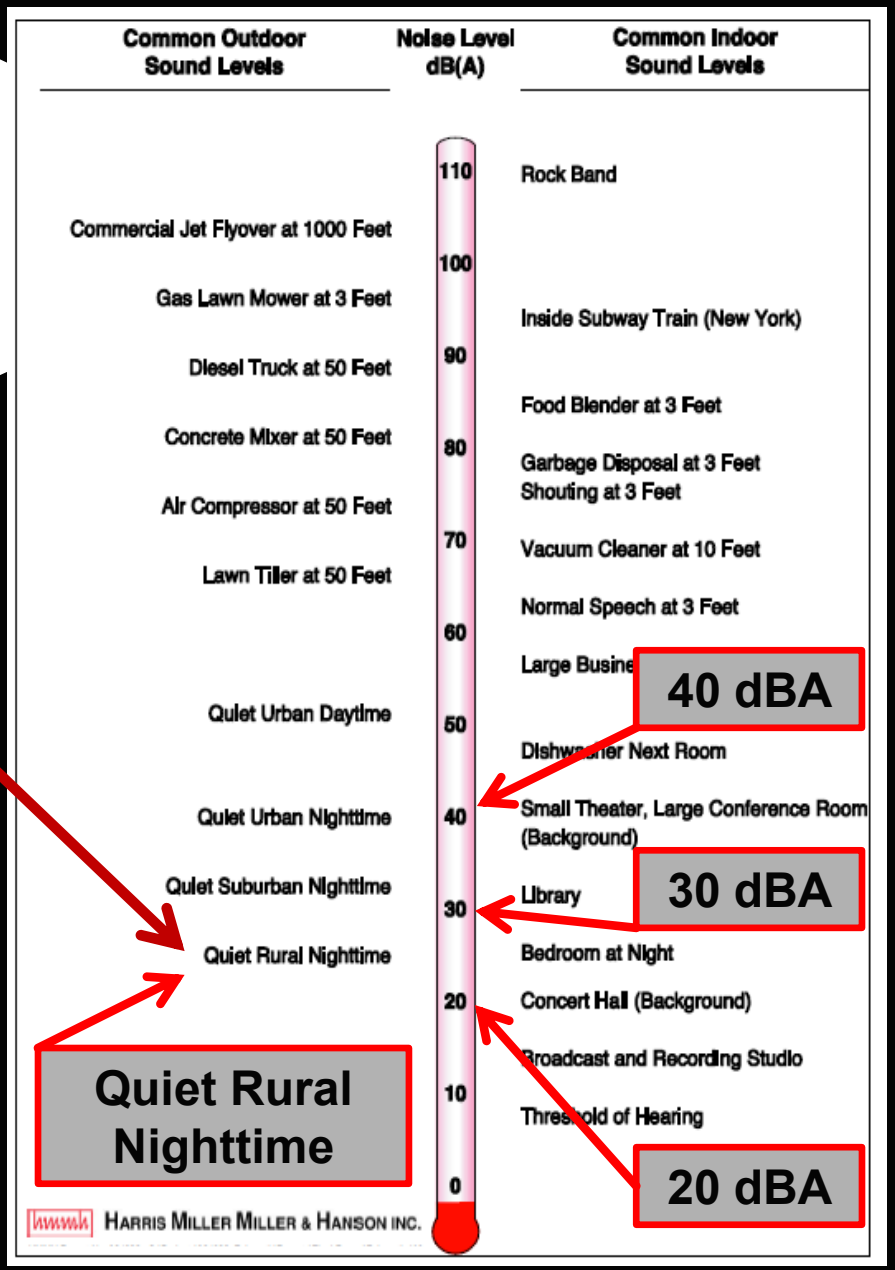
Is Falmouth an urban environment?

NO!! Hey- let's ask Chris for help.

Falmouth's quietest nighttime measurement is 27 dBA. HMMH's chart identifies area as "Quiet Rural Nighttime"

Christopher Menge
Senior Vice President and Principal Consultant

Harris Miller Miller & Hanson Inc.
Burlington, MA



TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

GE 1.5 MW Residential PL = 42 - 44 dBA

The following figures estimate the maximum noise impact (broadband noise) for a GE 1.5 MW (65 meters (213 feet) hub height) and a GE 2.5 MW turbine (84 meter (278 feet) hub height). The 2.5 MW turbine has a slightly higher impact than the 1.5 MW turbine. In both cases, the estimated maximum impact is about 42 to 44 dB (A) at the property line of residences to the west or the south.[17] Measured from outside the houses that are closest to the WWTF site, the sound of a wind turbine generating electricity is likely to be about the same level as no
stream about 150 feet away; a car going 40 mph will have an impact of abou
300 feet away. As noted earlier, several factors will further mitigate the overa
residential neighbors to the south and west. These include: 1) predominant wind direction from the southwest to the northeast; 2) terrain and foliage, and 3) existing background noise. Consistent with the Town Ordinance, there should not be excessive noise from the wind turbine above 40 dB (A) at the property line of the site.

Falmouth Noise Limit 40 dBA

Exceed by 2 - 4 dB !!

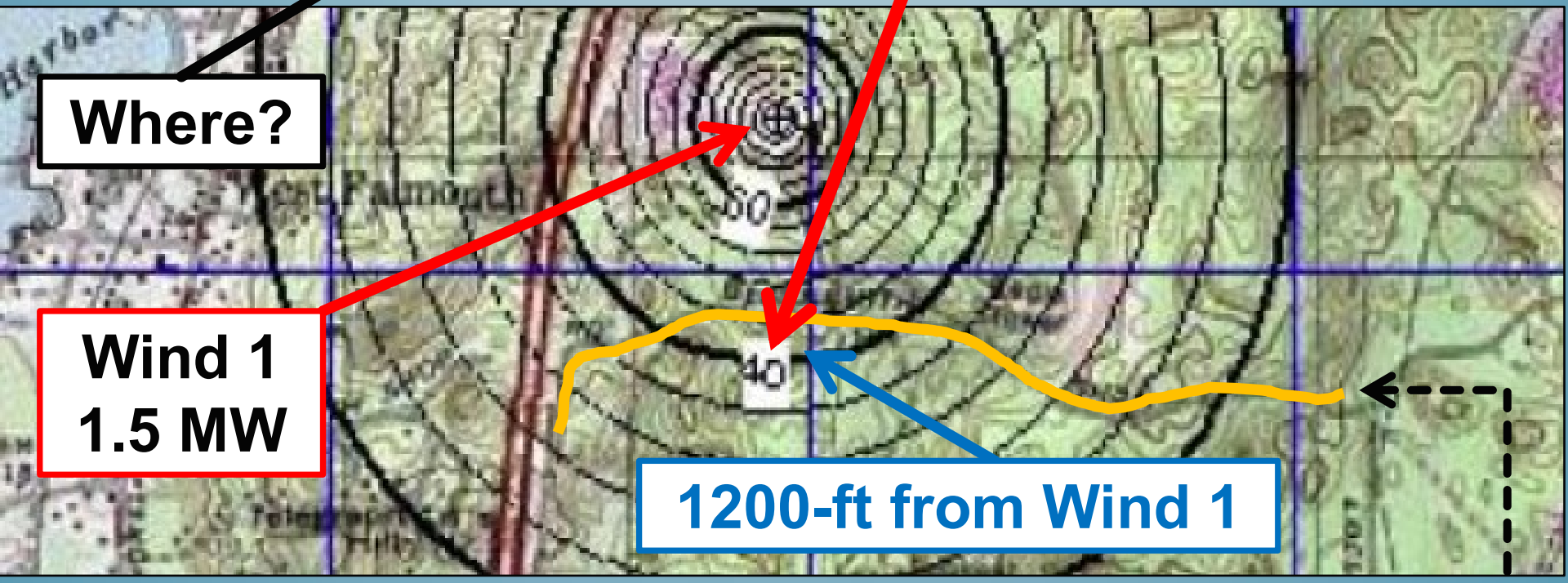
Doc! They're saying the Falmouth noise limit is 40 dBA, yet they predicted 42- 44 dBA!

GREAT SCOTT!! You're CORRECT! And all presented without any MEASUREMENTS!

Marty, … we can see this on Figure 17 in the Feasibility Study.

How can they show this on a topo map?

"Consistent with the Town Ordinance, there should not be excessive noise from the wind turbine above 40 dB (A) at the property line of the site."

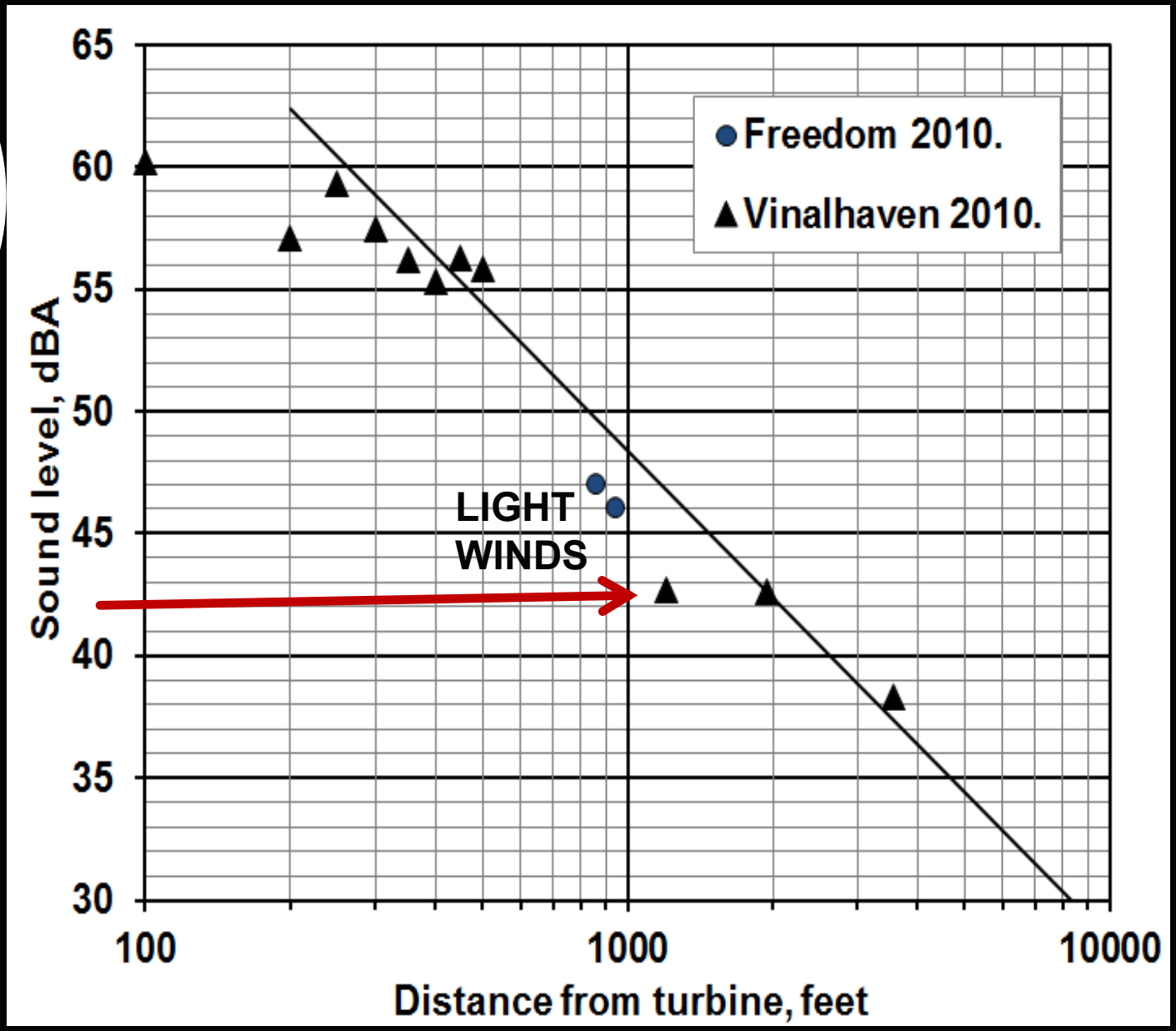


Doc! … Neighbors live on Blacksmith Shop Road. Figure 17 shows noise levels louder than 40 dBA !

Marty, we need to ask Rob for more MEASUREMENTS!

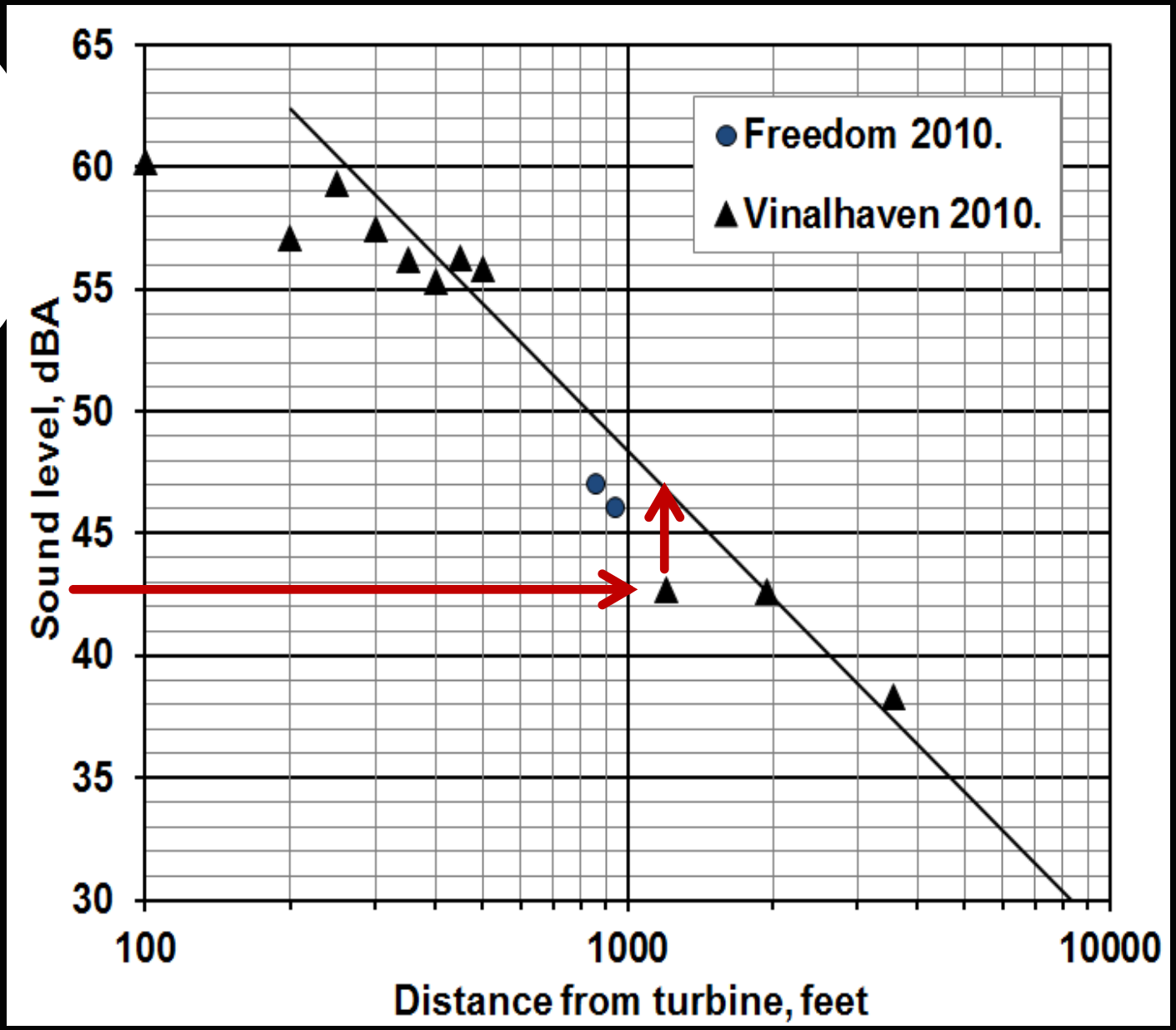
1.5 MW turbine, 42 dBA at 1200-ft **and** 2000-ft

Robert Rand, Rand Acoustics



Caution! Trend line shows potential for 47 dBA at 1200-ft

Robert Rand, Rand Acoustics



Doc,
42, 47 dBA at
1200-ft !!

Marty, … measurements
should not be ignored.

They are more reliable
than predictions.

Measurements are used to
validate predictions.

42 dBA is louder than Falmouth's 40 dBA noise limit!

INCREDIBLE! No one noticed this in the Nov. 2005 report.
Wind 1 is TOO LOUD !
… right from the get go!

A reviewer will catch this **MISTAKE** !

Marty, this is why neighbors can rely on the **state to protect** them.

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.3.2 State Permits

The following table outlines relevant state permitting requirements and their likelihood of applying to the proposed wind turbine at the WWTF.

Permit/Approval	Responsible Agency	Description	Applicable to Project?
Wide Load Permit	Massachusetts Department of Highways	Required for transportation of turbine components, construction materials and equipment.	Likely
Project Notification Form	Massachusetts Historical Commission	Must describe the project and any impact on historic or archaeological properties.	Likely
MEPA Determination: Environmental Notification Form	Massachusetts Executive Office of Environmental Affairs	Required for projects altering 25 or more acres of wetlands.	Voluntary
Noise Control Policy	Massachusetts Department of Environmental Protection	MA DEP policy discourages a broad-band noise level in excess of 10 dB(A) above ambient, or pure tone noise.	Unlikely
General Access	Massachusetts	Needed if alterations are made to	Unlikely

There were no plans for the MassDEP to review Wind 1 reports.

Are Falmouth planners vigilant enough to protect ?

Marty, let's read more of the report and find out.

TOWN OF FALMOUTH
COMMUNITY WIND PROJECT
FEASIBILITY STUDY

November 2005

Anticipated ? … Why Not Predicted ?

6.4 Anticipated Level of Community Acceptance

The Town of Falmouth has been pursuing a wind project at the WWTF. With leadership provided by local citizen champions (i.e., Falmouth Energy Committee members) and support from the town government, the Town has taken a proactive approach to community outreach, engaged the community, and laid the groundwork for a successful wind project. The Town plans to continue community outreach efforts based on this feasibility study. For more background on the town's community outreach see Section 5.5 of the Site Screening Report.

TOWN OF FALMOUTH
COMMUNITY WIND PROJECT
FEASIBILITY STUDY

November 2005

6.4 Anticipated Level of Community Acceptance

The Town of Falmouth has been pursuing a wind project at the WWTF. With leadership provided by local citizen champions (i.e., Falmouth Energy Committee members) and support from the town government, the Town has taken a proactive approach to community outreach, engaged the community, and laid the groundwork for a successful wind project. The Town plans to continue community outreach efforts based on this feasibility study. For more background on the town's community outreach see Section 5.5 of the Site Screening Report.

TOWN OF FALMOUTH
COMMUNITY WIND PROJECT
FEASIBILITY STUDY

November 2005

6.4 Anticipated Level of Community Acceptance

The Town of Falmouth has been pursuing a wind project at the WWTF. With leadership provided by local citizen champions (i.e., Falmouth Energy Committee members) and support from the town government, the Town has taken a proactive approach to community outreach, engaged the community, and laid the groundwork for a successful wind project. The Town plans to continue community outreach efforts based on this feasibility study. For more background on the town's community outreach see Section 5.5 of the Site Screening Report.

Strong Motivation to Approve

TOWN OF FALMOUTH COMMUNITY WIND PROJECT FEASIBILITY STUDY

November 2005

5.5.3 Abutters Survey

100% Very Concerned or Concerned

FALMOUTH COMMUNITY WIND PROJECT
SITE SCREENING REPORT

Issue	Very Concerned	Concerned	Not Concerned	More Info Needed
Visual	2	3	1	1
Bird Interactions	5	2	1	
Construction	2		3	
Environmental Impacts	2	2	1	1
Financing		3		2
Noise	6	1		
Property Values	3	3	1	
Other	Interference with radio, TV, and cell phone signals			

Yikes! …
How could this be missed? **Everyone** who replied was **CONCERNED** about **NOISE** !

Summary

Date	Report	Finding / Comment
21 Nov 2003	Preliminary Site Assessment RERL / UMass	Increase less than 10 dB, Minimally audible, **Do Noise Survey**
19 Apr 2005 Nov 2005	Site Screening Report Site Feasibility Report KEMA & Ecology and Environment, Inc.	Noise complaints subjective, 40 dBA limit, Falmouth urban, Wind 1 predicted 42-44 dBA, **Do Noise Survey**

EGADS !
These reports were done by groups that promote wind turbines !

Marty, this is INCREDIBLE !!!
They're unable to admit that WIND 1 IS TOO LOUD !

Fourth study

September 2010

Harris Miller Miller & Hansen, Inc.

Falmouth Wind Turbine Noise Study

Falmouth, Massachusetts

HMMH Report No. 304390
September 2010

Prepared for:

Weston & Sampson Engineers, Inc.
5 Centennial Drive
Peabody, MA 01960

and

Town of Falmouth
59 Town Hall Square
Falmouth, MA 02540

HARRIS MILLER MILLER & HANSON INC.

Executive Summary

Harris Miller Miller & Hanson Inc. (HMMH) was retained by Weston & Sampson Engineers, Inc. under contract to the Town of Falmouth, MA to conduct a noise measurement and modeling study in connection with the Town's two new wind turbines at the Falmouth Wastewater Treatment Facility located off Blacksmith Shop Road. The first turbine, denoted Wind-1, became operational in March of this year. Wind-2 is under construction and expected to be commissioned in the Fall of 2010. Both turbines are Vestas V82 1.65 MW turbines. The study was prompted by concerns and complaints about noise from the Wind-1 turbine from a few nearby residents, mostly located along Blacksmith Shop Road, and by the Town's interest in understanding the noise implications of the Wind-2 turbine in the surrounding community prior to the erection of that turbine.

The purpose of this study was twofold. The first purpose was to conduct a noise measurement program at some of the closest community locations during times when the turbine was operating and when it was turned off for maintenance, to establish background noise levels. The noise levels measured during these different periods were to be compared to determine the significance of the increased noise, particularly in the context of the Massachusetts Department of Environmental Protection's (Mass DEP's) Noise Guidelines. The second purpose of the study was to model the noise levels in the surrounding community that would be expected from the operation of both the Wind-1 and Wind-2 turbines. This model would project where potential noise impact would occur with respect to the Mass DEP Noise Guidelines.

The purpose of this study was twofold. The first purpose was to conduct a noise measurement program at some of the closest community locations during times when the turbine was operating and when it was turned off for maintenance, to establish background noise levels. The noise levels measured during these different periods were to be compared to determine the significance of the increased noise, particularly in the context of the Massachusetts Department of Environmental Protection's (Mass DEP's) Noise Guidelines. The second purpose of the study was to model the noise levels in the surrounding community that would be expected from the operation of both the Wind-1 and Wind-2 turbines. This model would project where potential noise impact would occur with respect to the Mass DEP Noise Guidelines.

Decipher:

1) Measure wind turbine ON and OFF, Context of MassDEP compliance.

The purpose of this study was twofold. The first purpose was to conduct a noise measurement program at some of the closest community locations during times when the turbine was operating and when it was turned off for maintenance, to establish background noise levels. The noise levels measured during these different periods were to be compared to determine the significance of the increased noise, particularly in the context of the Massachusetts Department of Environmental Protection's (Mass DEP's) Noise Guidelines. The second purpose of the study was to model the noise levels in the surrounding community that would be expected from the operation of both the Wind-1 and Wind-2 turbines. This model would project where potential noise impact would occur with respect to the Mass DEP Noise Guidelines.

Decipher:

2) Model wind turbine noise levels, Determine MassDEP compliance.

Why measure noise levels, and then **model for compliance** ?

Measurements should be used for compliance. Let's look at the **measurement** data.

September 2011

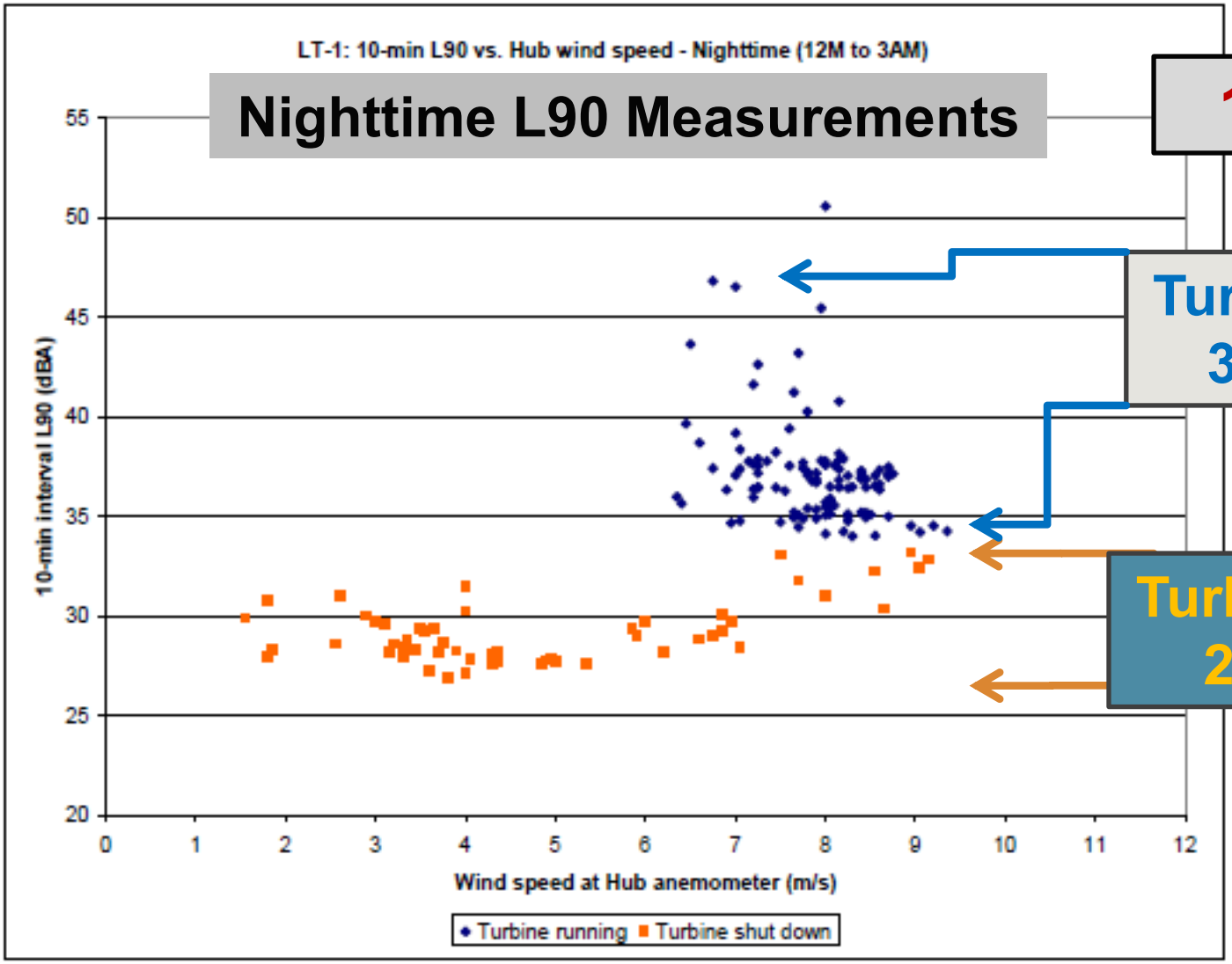


Figure 5 Nighttime L90 Noise Levels vs. Hub Wind Speed

10-min avg

Turbine ON L90s
34 to 47 dBA

Turbine OFF L90s
27 to 33 dBA

September 2011

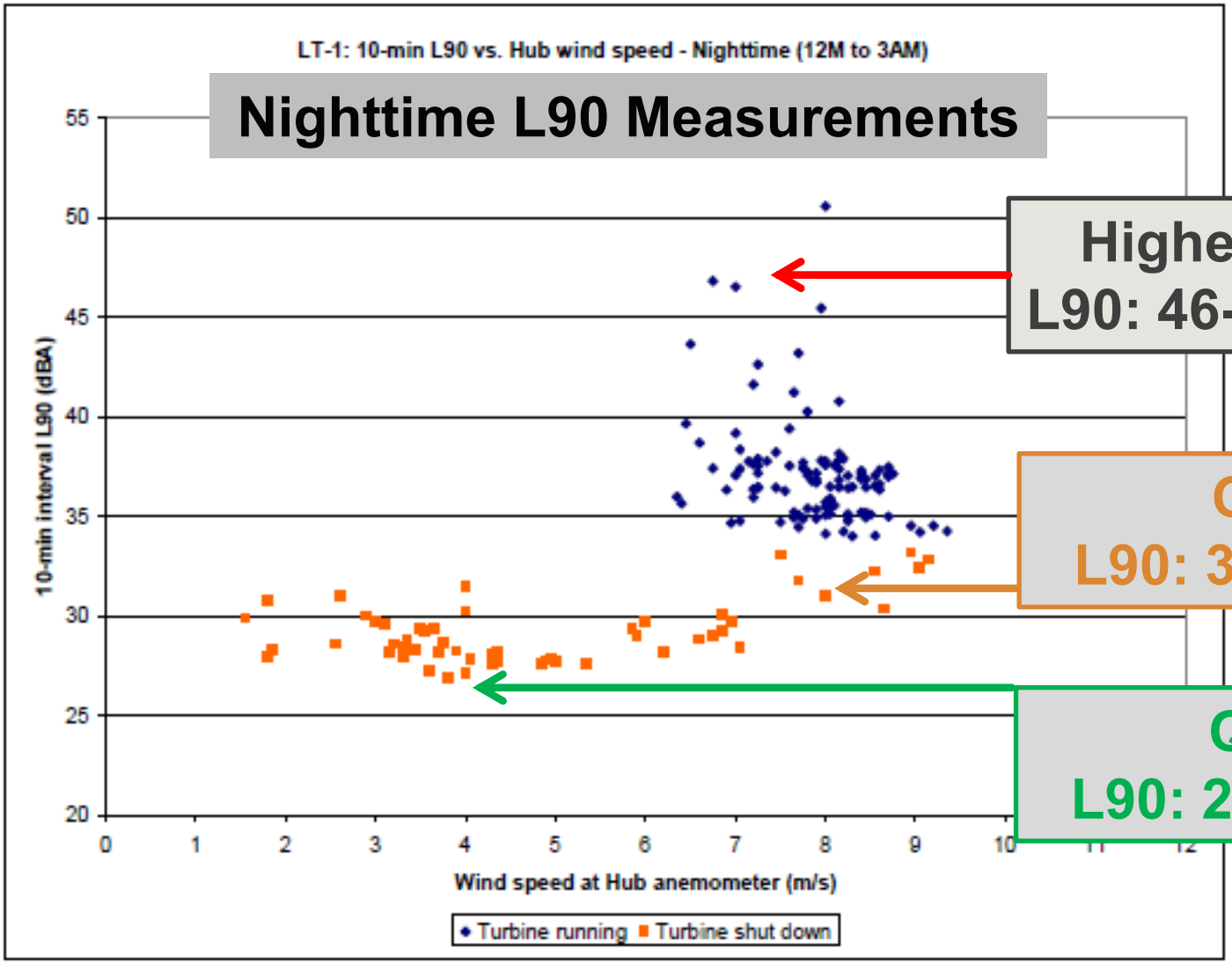


Figure 5 Nighttime L90 Noise Levels vs. Hub Wind Speed

Highest Repeated L90: 46-47 dBA, 8 m/s

Quietest L90: 31 dBA, 8 m/s

Quietest L90: 27 dBA, 4 m/s

September 2011

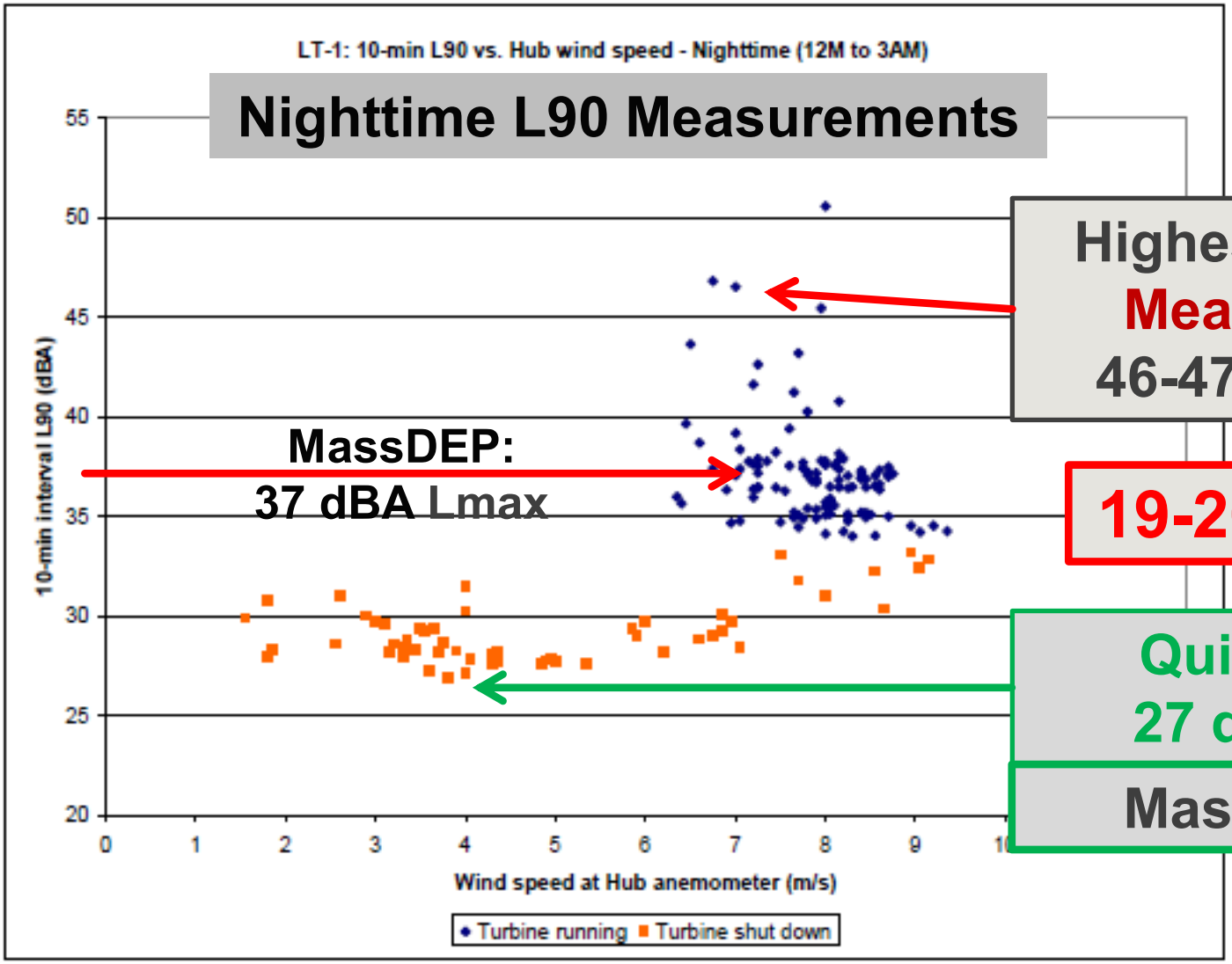


Figure 5 Nighttime L90 Noise Levels vs. Hub Wind Speed

Doc !
This chart proves WIND 1 TOO LOUD !

Marty !
This is INCREDIBLE !
Measured WIND 1 L90s are 9-10 dB higher than MassDEP's Lmax limit.

Table 7 Background and Computed Turbine Noise Levels at Measurement and Property-line Sites, with Wind Speed 8 m/s at 10m, 11 m/s at Hub

HMMH Computed L90 >

Measured 27 to 34 dBA

Site ID	Address	Nighttime Bkgrnd L90 (dBA)	Computed Turbine Leq (dBA)		Turbine Leq plus Bkgrnd (dBA)		Increase above Bkgrnd (dB)	
			Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2
LT-1	211 Blacksmith Shop Rd.	37.5	39.1	39.8	41.4	41.8	3.9	4.3
LT-2	124 Ambleside Drive	37.5	35.0	40.6	39.4	42.3	1.9	4.8
ST-1	161 Blacksmith Shop Rd.	37.5	36.0	37.4	39.8	40.5	2.3	3.0
ST-2	27 Ridgeview Street	37.5	37.7	40.2	40.6	42.1	3.1	4.6
ST-3	Research Rd & Thomas B Landers Rd.	37.5	28.2	33.0	38.0	38.8	0.5	1.3
ST-4	30 Durham Rd.	37.5	33.7	35.1	39.0	39.5	1.5	2.0
PL-1	South property line	37.5	39.5	40.3	41.6	42.1	4.1	4.6
PL-2	Prop. line west of Wind-1	37.5	38.9	42.0	41.3	43.3	3.8	5.8
PL-3	Prop. line west of Wind-2	37.5	36.7	46.0	40.1	46.6	2.6	9.1
PL-4	Northeast property line	37.5	30.8	35.0	38.3	39.4	0.8	1.9
PL-5	Southeast property line	37.5	36.8	37.8	40.2	40.7	2.7	3.2

How'd they get a L90 37.5 dBA for background with Wind 1 OFF ?

They could have averaged L90 background measurements?

Doc, This **MAKES NO SENSE !!!**

Marty, you're on to something, let's **Compare Data Tables**.

Table 7 Background and Computed Turbine Noise Levels at Measurement and Property-line Sites, with Wind Speed 8 m/s at 10m, 11 m/s at Hub

Site ID	Address	Nighttime Bkgrnd L90 (dBA)	Computed Turbine Leq (dBA)		Turbine Leq plus Bkgrnd (dBA)		Increase above Bkgrnd (dB)	
			Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2
LT-1	211 Blacksmith Shop Rd.	37.5	39.1	39.8	41.4	41.8	3.9	4.3
LT-2	124 Ambleside Drive	37.5						
ST-1	161 Blacksmith Shop Rd.	37.5						

Turbine ON Quieter Than OFF

Table 2 Median L90 Values at Long-Term Sites with Turbine Running and Shut Down

Condition	Median L90 Values (in dBA) and Median Hub Wind (m/s)					
	Daytime: 7AM to 6PM			Nighttime: 12Mid to 3AM		
	LT-1 L90 (no. per.)	LT-2 L90 (no. per.)	Wind Speed	LT-1 L90 (no. per.)	LT-2 L90 (no. per.)	Wind Speed
Turbine Running	42.8 (295)	47.8 (295)	7.0	36.8 (108)	33.6 (108)	8.0
Turbine Shut Down	41.4 (160)	46.4 (78)	7.3	28.8 (54)	29.5 (18)	4.2
Difference	1.4	1.4	-0.3	8.0	4.2	3.8

Measured 27 to 34 dBA

Model data **conflicts** with measurements.

They should not consider models superior to measurements. This will cause more **ERRORS** !

Table 7 Background and Computed Turbine Noise Levels at Measurement and Property-line Sites, with Wind Speed 8 m/s at 10m, 11 m/s at Hub

Site ID	Address	Nighttime Bkgrnd L90 (dBA)	Computed Turbine Leq (dBA)		Turbine Leq plus Bkgrnd (dBA)		Increase above Bkgrnd (dB)	
			Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2
LT-1	211 Blacksmith Shop Rd.	37.5	39.1	39.8	41.4	41.8	3.9	4.3
LT			0	40.6	39.4	42.3	1.9	4.8
ST			0	37.4	39.8	40.5	2.3	3.0
ST			7	40.2	40.6	42.1	3.1	4.6
ST-3	Thomas B Landers Rd.		28.2	33.0	38.0	38.8	0.5	1.3
ST			7	35.1	39.0	39.5	1.5	2.0
PL			5	40.3	41.6	42.1	4.1	4.6
PL-2	Prop. line west of Wind-1	37.5	38.9	42.0	41.3	43.3	3.8	5.8
PL-3	Prop. line west of Wind-2	37.5	36.7	46.0	40.1	46.6	2.6	9.1
PL-4	Northeast property line	37.5	30.8	35.0	38.3	39.4	0.8	1.9
PL-5	Southeast property line	37.5	36.8	37.8	40.2	40.7	2.7	3.2

Wind 1 measured 46 dBA

All Predicted Values

~ 5 dB too low

Table 7 Background and Computed Turbine Noise Levels at Measurement and Property-line Sites, with Wind Speed 8 m/s at 10m, 11 m/s at Hub

Site ID	Address	Nighttime Bkgrnd L90 (dBA)	Computed Turbine Leq (dBA)		Turbine Leq plus Bkgrnd (dBA)		Increase above Bkgrnd (dB)	
			Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2	Wind-1 alone	Wind-1 & Wind-2
LT-1	211 Blacksmith Shop Rd.	27 to 34	39.1	39.8	46	41.8	12 to 19	4.3
LT		37.5	35.0	40.6	39.4	42.3	1.9	4.8
ST		37.5	36.0	37.4	39.8	40.5	2.3	3.0
ST-2	27 Ridgeview Street	37.5	37.7	40.2	40.6	42.1	3.1	4.6
PL-2	Prop. line west of Wind-1	37.5	38.9	42.0	41.3	43.3	3.8	5.8
PL-3	Prop. line west of Wind-2	37.5	36.7	46.0	40.1	46.6	2.6	9.1
PL-4	Northeast property line	37.5	30.8	35.0	38.3	39.4	0.8	1.9
PL-5	Southeast property line	37.5	36.8	37.8	40.2	40.7	2.7	3.2

Measured

Wind 1 measured

Predicted Wind 1 Leq quieter than measured L90
Exceeds MassDEP Lmax by 2 to 9 dB

GREAT SCOTT !!
Marty, their tables are full of ERRORS.

Doc, this confirms noise model predictions are no substitute for real measurements.

Summary

Date	Report	Finding / Comment
21 Nov 2003	Preliminary Site Assessment RERL / UMass	Increase less than 10 dB, Minimally audible, **Do Noise Survey**
19 Apr 2005 Nov 2005	Site Screening Report Site Feasibility Report KEMA & Ecology and Environment, Inc.	Noise complaints subjective, 40 dBA limit, Falmouth urban, Wind 1 predicted 42-44 dBA, **Do Noise Survey**
20 Sep 2010	Falmouth Wind Turbine Noise Study / HMMH	Increase >10 dB, turbines audible Wind 1 too loud


What's going on? Can't anyone read, … where's the comprehension ?
IMPOSSIBLE !! Don't they understand ? WIND 1 IS TOO LOUD !

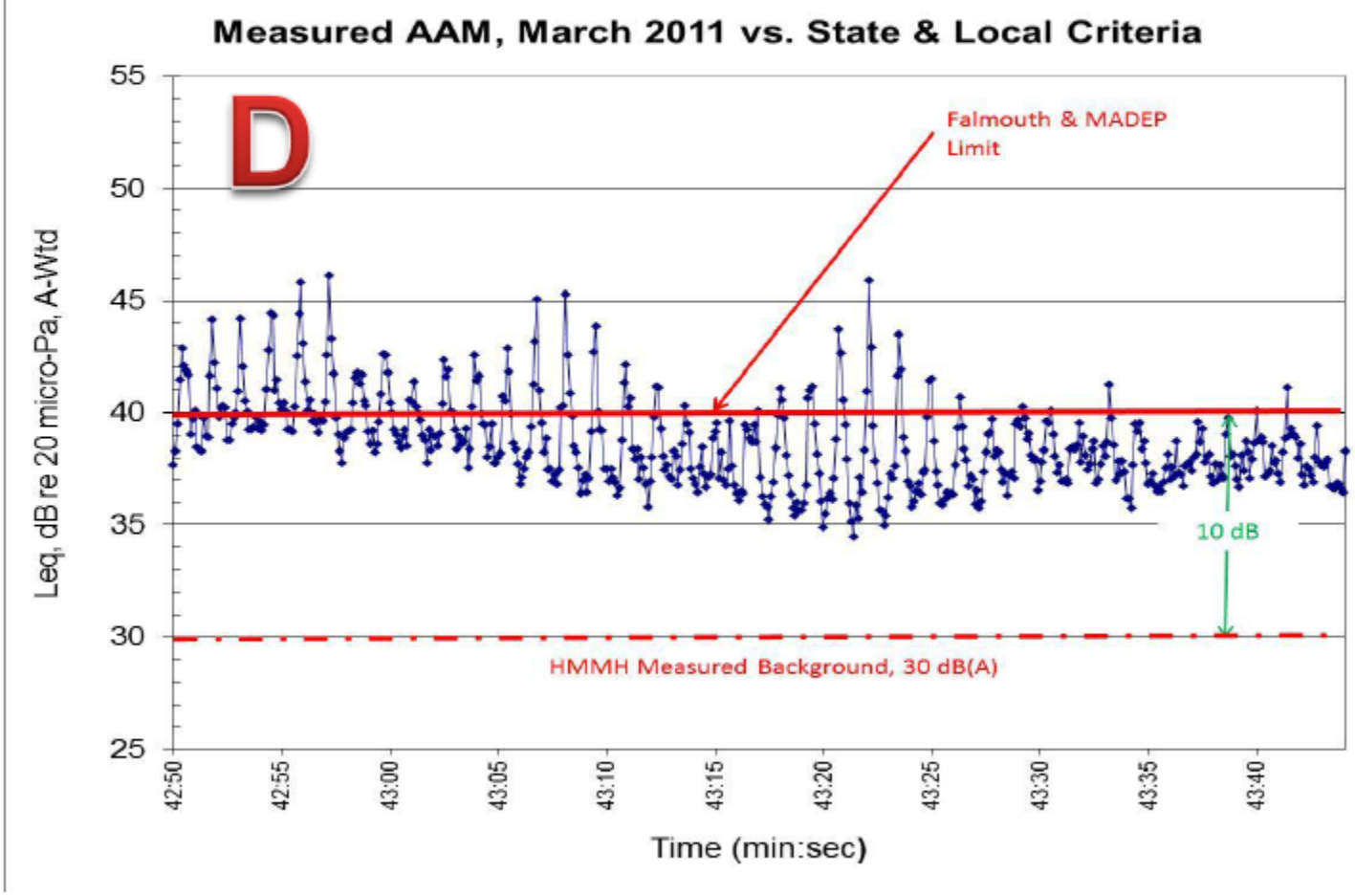
Fifth study

June 6, 2010

Noise Control Engineering, Inc.

Aerodynamic Amplitude Modulation (AAM) is Important for the Evaluation of Wind Turbine Noise.

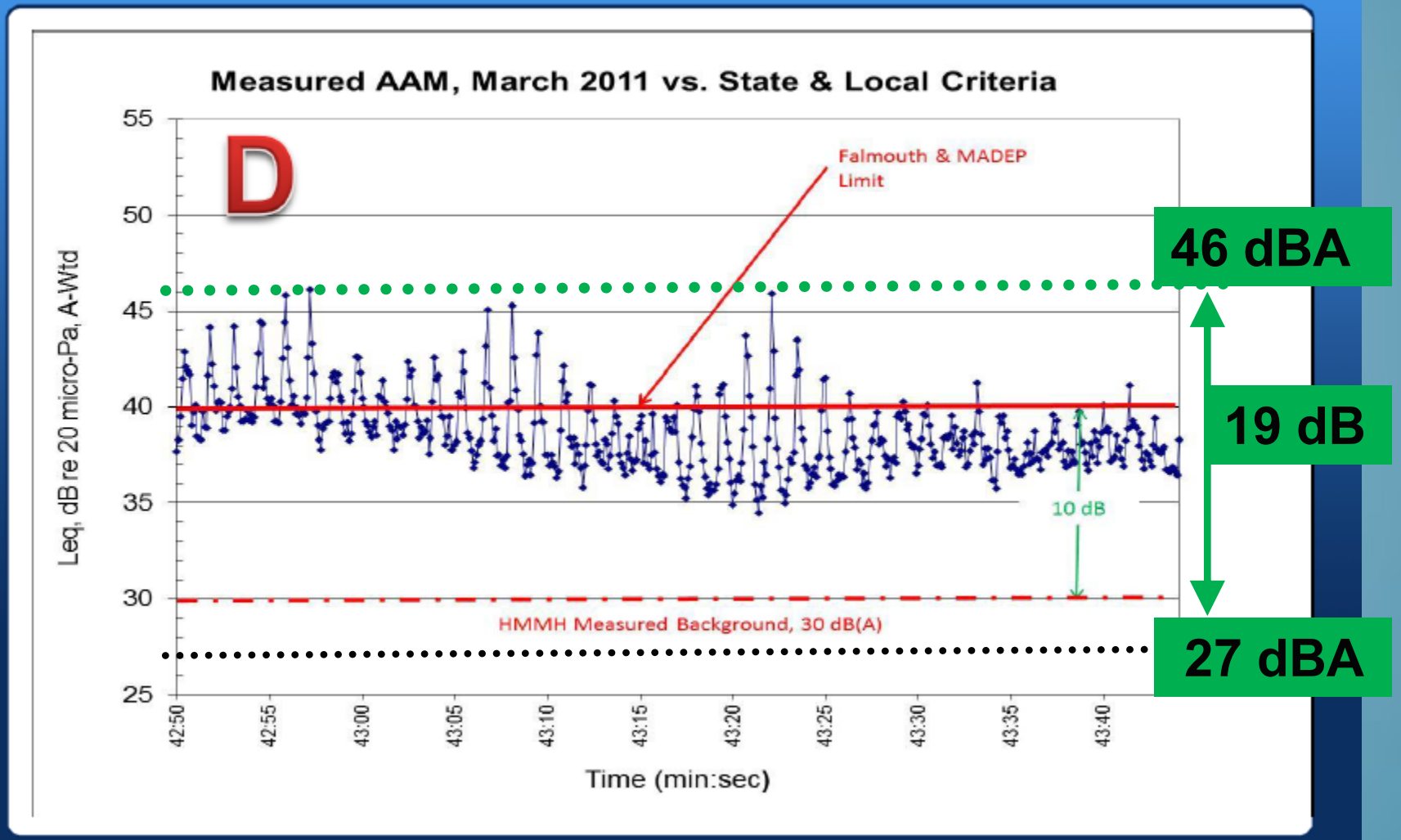
Presented By
Michael Bahtiarian, INCE Bd. Cert
Noise Control Engineering, Inc.
June 6, 2011



Noise Control Engineering, Inc., 799 Middlesex Turnpike, Billerica, MA 01821
Phone: 978-670-5339 Fax: 978-667-7047 nonoise@noise-control.com

This chart shows noise levels vs. time measurements.

Again, measured 46 dBA, … Wind 1 too loud.



Noise Control Engineering, Inc., 799 Middlesex Turnpike, Billerica, MA 01821
Phone: 978-670-5339 Fax: 978-667-7047 nonoise@noise-control.com

Wind 1 noise levels are 9 dB above the MassDEP Lmax noise limit.

This is AMAZING !!
Again, measurements-
… Wind 1 too loud !

Summary

Date	Report	Finding / Comment
21 Nov 2003	Preliminary Site Assessment RERL / UMass	Increase less than 10 dB, Minimally audible, **Do Noise Survey**
19 Apr 2005 Nov 2005	Site Screening Report Site Feasibility Report KEMA & Ecology and Environment, Inc.	Noise complaints subjective, 40 dBA limit, Falmouth urban, Wind 1 predicted 42-44 dBA, **Do Noise Survey**
20 Sep 2010	Falmouth Wind Turbine Noise Study / HMMH	Increase >10 dB, turbines audible Wind 1 too loud
6 June 2011	Evaluation of Noise Data Noise Control Engineering	**Wind 1 too loud**

Sixth study

March 15, 2012

DNV KEMA Services for Managing Risk

also

(DNV KEMA Energy & Sustainability)

DRAFT
DNV Review of the Falmouth, MA Wind-1 and Wind-2 Mitigation Report

CONFIDENTIAL

Town of Falmouth
Board of Selectmen
c/o Massachusetts Clean Energy Center
55 Summer Street, 9th Floor
Boston, MA 02110
Attention: Nils Bolgen

DNV Report No.: DDRP0091
March 15, 2012

1. EXECUTIVE SUMMARY

The Massachusetts Clean Energy Technology Center (MassCEC) retained DNV to provide wind turbine technology and control system expertise to the town of Falmouth, Massachusetts. The support being provided addresses concerns about noise levels around the two town-operated wind turbines at the wastewater treatment plant (WWTP). As part of this effort, this report presents DNV's review of a report by Weston & Sampson Engineers, Inc. (W&S) entitled "*Town of Falmouth, MA Wind Energy Facility Mitigation Alternatives Analysis*" [1] (the "W&S Report") and supporting material, including a report by Harris Miller Miller & Hanson, Inc. (HMMH) entitled *"Falmouth Wind Turbine Noise Study"* [2] (the "HMMH Report"). The report also includes information on additional possible mitigation measures that might be considered with a brief evaluation of the advantages, disadvantages, costs and possible effectiveness of these options.

1. EXECUTIVE SUMMARY

Mar 15, 2012

The Massachusetts Clean Energy Technology Center (MassCEC) retained DNV to provide wind turbine technology and control system expertise to the town of Falmouth, Massachusetts. The support being provided addresses concerns about noise levels around the two town-operated

The Massachusetts Clean Energy Technology Center (MassCEC) retained DNV to provide wind turbine technology and control system expertise to the town of Falmouth, Massachusetts.

also includes information on additional possible mitigation measures that might be considered with a brief evaluation of the advantages, disadvantages, costs and possible effectiveness of these options.

What's going on ?
These are the **same** agencies that did the **first** site assessment in 2003!

Review of Weston & Sampson Falmouth, MA
Wind Energy Facility Mitigation Alternatives Analysis

MANAGING RISK

Mar 15, 2012

1. EXECUTIVE SUMMARY

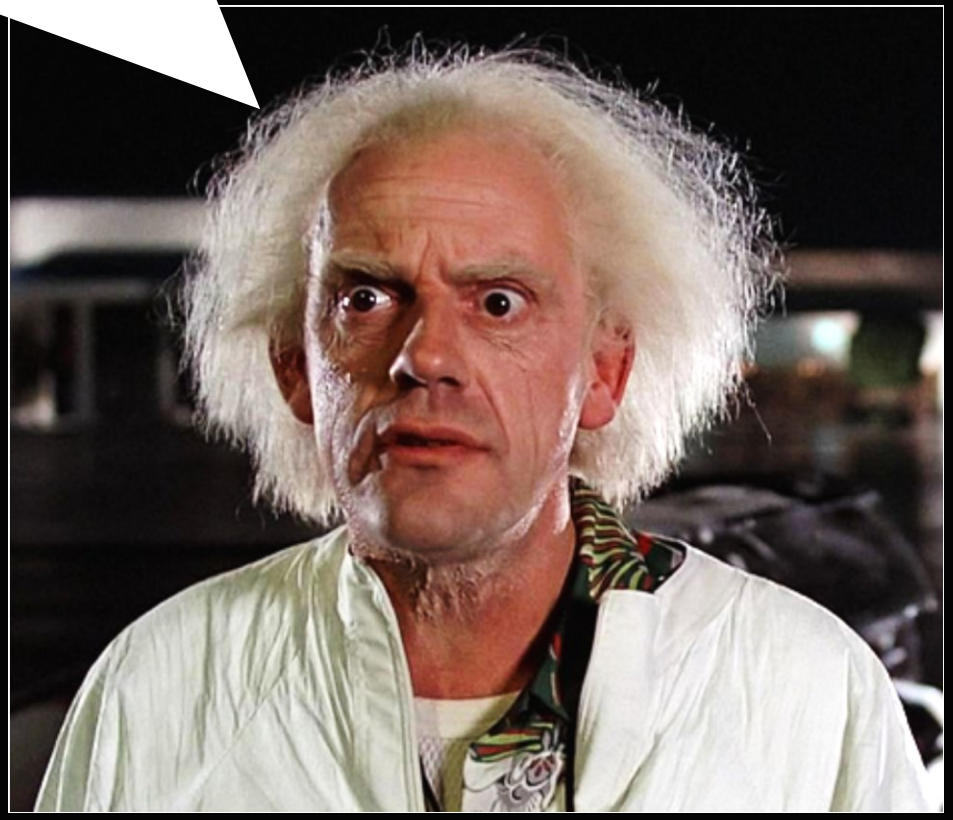
The Massachusetts Clean Energy Technology Center (MassCEC) retained DNV to provide wind turbine technology and control system expertise to the town of Falmouth, Massachusetts. The support being provided addresses concerns about noise levels around the two town-operated wind turbines at the wastewater treatment plant (WWTP). As part of this effort, this report presents DNV's review of a report by Weston & Sampson Engineers, Inc. (W&S) entitled "*Town of Fa*

The support being provided addresses concerns about noise levels around the two town-operated wind turbines at the wastewater treatment plant (WWTP).

Repo
(HM
also i
with
option

port
d
hese

Marty! ... You're right! … Neighbors can't be protected when DNV and KEMA both support wind energy.



DNV's most significant general observations on the two reports are:

- The approach and work of W&S and HMMH is professional and with the standard of care ordinarily expected of an acoustical engineer. Nevertheless, DNV has come to
- **… ambient sound levels based on only one condition understates the range of possible ambient noise levels at receptors and when problematic conditions might occur.**

basis, a characterization of ambient sound levels based on only one condition understates the range of possible ambient noise levels at receptors and when problematic conditions might occur.

Based on these observations, DNV suggests that additional measurements be made to understand better under what conditions neighbors of the Falmouth wind turbines experience which noise levels and when state or local noise guidelines might be exceeded.

DNV's most significant general observations on the two reports are:

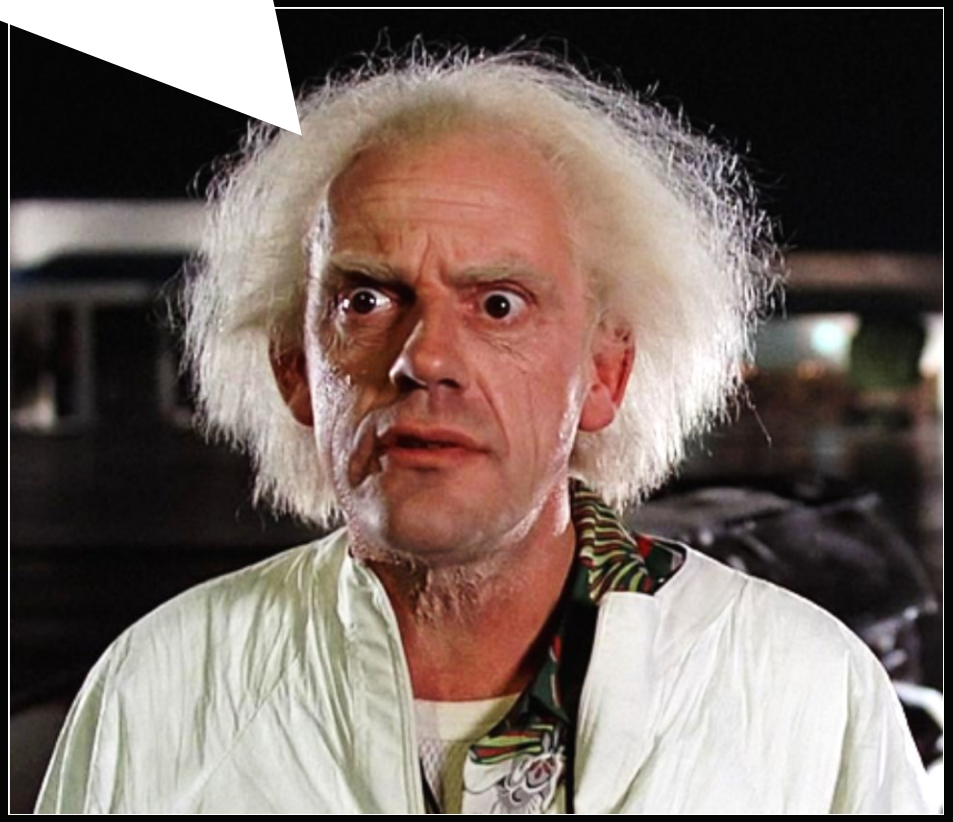
- The approach and work of W&S and HMMH is professional and with the standard of care ordinarily expected of an acoustical engineer. Nevertheless, DNV has come to alternate conclusions in some instances.
- The dominance of turbine noises over background noises depends on the relative

Based on these observations, DNV suggests that additional measurements be made to understand better under what conditions neighbors of the Falmouth wind turbines experience which noise levels and when state or local noise guidelines might be exceeded.

Based on these observations, DNV suggests that additional measurements be made to understand better under what conditions neighbors of the Falmouth wind turbines experience which noise levels and when state or local noise guidelines might be exceeded.

Doc, … 9 years after the first study, they are still asking for more noise measurements??

Marty! ... This is proof ! …
They do not know how to be
GOOD ACOUSTIC NEIGHBORS !



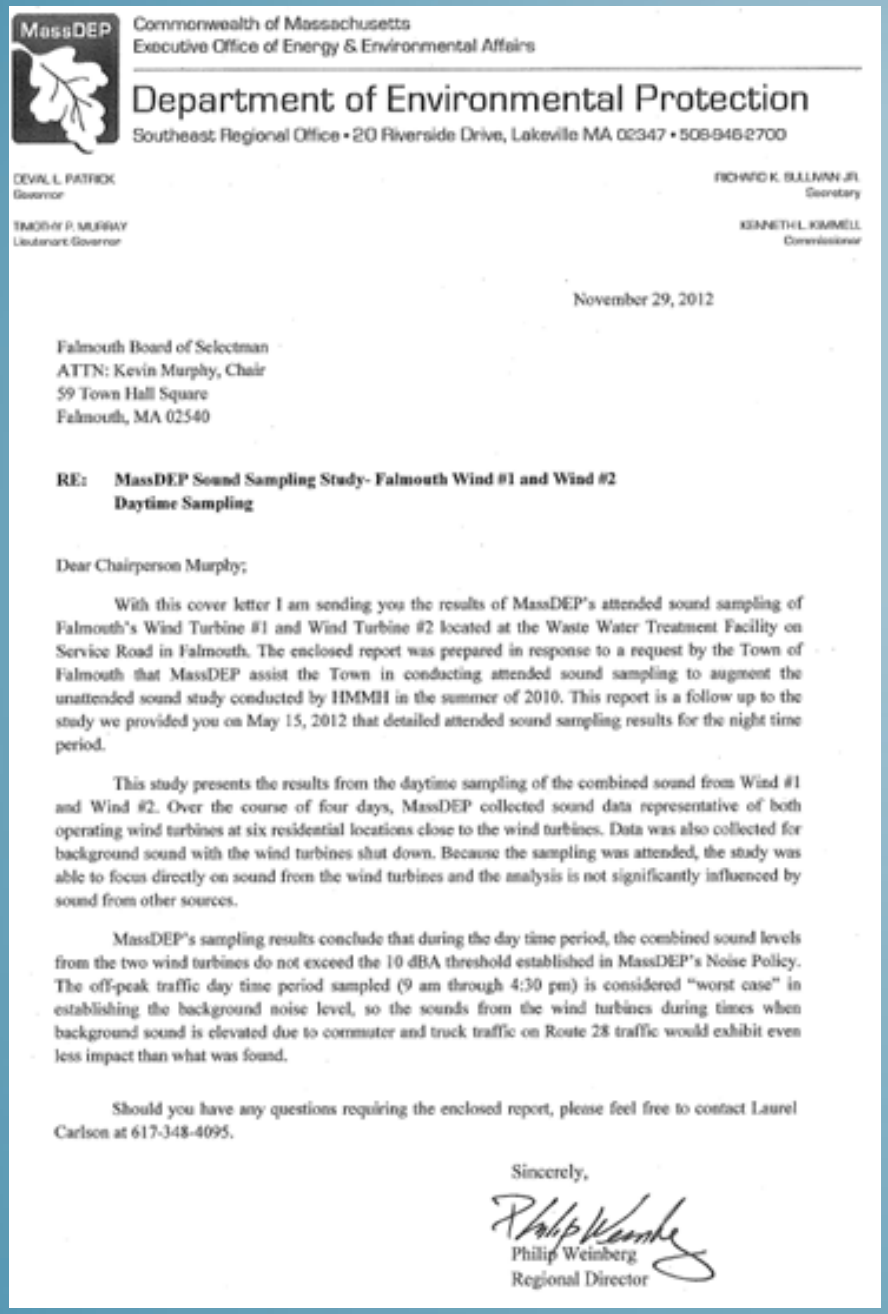
Summary

Date	Report	Finding / Comment
21 Nov 2003	Preliminary Site Assessment RERL / UMass	Increase less than 10 dB, Minimally audible, **Do Noise Survey**
19 Apr 2005 Nov 2005	Site Screening Report Site Feasibility Report KEMA & Ecology and Environment, Inc.	Noise complaints subjective, 40 dBA limit, Falmouth urban, Wind 1 predicted 42-44 dBA, **Do Noise Survey**
20 Sep 2010	Falmouth Wind Turbine Noise Study / HMMH	Increase >10 dB, turbines audible Wind 1 too loud. More Measurements
6 June 2011	Evaluation of Noise Data Noise Control Engineering	**Wind 1 too loud** **More Measurements**
15 Mar 2012	DNV Review Mitigation Report Wind 1 & Wind 2	**More Measurements to understand why there are complaints**

Seventh study

November 29, 2012

Massachusetts Department of Environmental Protection



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

November 29, 2012

Falmouth Board of Selectman
ATTN: Kevin Murphy, Chair
59 Town Hall Square
Falmouth, MA 02540

RE: MassDEP Sound Sampling Study- Falmouth Wind #1 and Wind #2
Daytime Sampling

Dear Chairperson Murphy;

With this cover letter I am sending you the results of MassDEP's attended sound sampling of Falmouth's Wind Turbine #1 and Wind Turbine #2 located at the Waste Water Treatment Facility on Service Road in Falmouth. The enclosed report was prepared in response to a request by the Town of Falmouth that MassDEP assist the Town in conducting attended sound sampling to augment the unattended sound study conducted by HMMH in the summer of 2010. This report is a follow up to the study we provided you on May 15, 2012 that detailed attended sound sampling results for the night time period.

This study presents the results from the daytime sampling of the combined sound from Wind #1 and Wind #2. Over the course of four days, MassDEP collected sound data representative of both operating wind turbines at six residential locations close to the wind turbines. Data was also collected for background sound with the wind turbines shut down. Because the sampling was attended, the study was able to focus directly on sound from the wind turbines and the analysis is not significantly influenced by sound from other sources.

MassDEP's sampling results conclude that during the day time period, the combined sound levels from the two wind turbines do not exceed the 10 dBA threshold established in MassDEP's Noise Policy. The off-peak traffic day time period sampled (9 am through 4:30 pm) is considered "worst case" in establishing the background noise level, so the sounds from the wind turbines during times when background sound is elevated due to commuter and truck traffic on Route 28 traffic would exhibit even less impact than what was found.

Should you have any questions requiring the enclosed report, please feel free to contact Laurel Carlson at 617-348-4095.

Sincerely,

Philip Weinberg
Regional Director

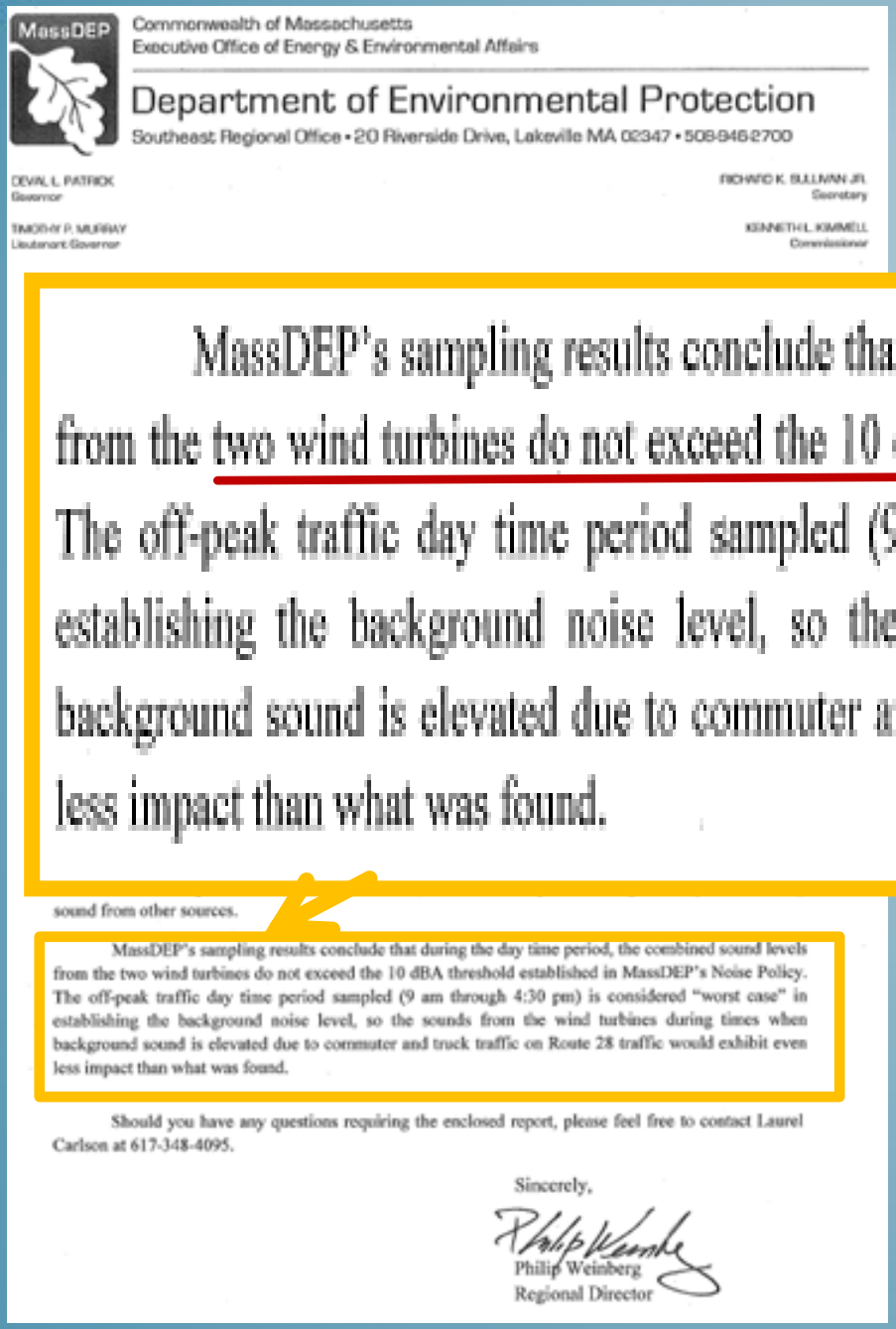
MassDEP Letter

To: Falmouth BOS

Sound Sampling Study

November 29, 2012

November 29, 2012



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

MassDEP's sampling results conclude that during the day time period, the combined sound levels from the two wind turbines do not exceed the 10 dBA threshold established in MassDEP's Noise Policy. The off-peak traffic day time period sampled (9 am through 4:30 pm) is considered "worst case" in establishing the background noise level, so the sounds from the wind turbines during times when background sound is elevated due to commuter and truck traffic on Route 28 traffic would exhibit even less impact than what was found.

sound from other sources.

MassDEP's sampling results conclude that during the day time period, the combined sound levels from the two wind turbines do not exceed the 10 dBA threshold established in MassDEP's Noise Policy. The off-peak traffic day time period sampled (9 am through 4:30 pm) is considered "worst case" in establishing the background noise level, so the sounds from the wind turbines during times when background sound is elevated due to commuter and truck traffic on Route 28 traffic would exhibit even less impact than what was found.

Should you have any questions requiring the enclosed report, please feel free to contact Laurel Carlson at 617-348-4095.

Sincerely,

Philip Weinberg
Regional Director

"… day time … two wind turbines do not exceed 10 dB threshold established in MassDEP's Noise Policy"

Doc, again,
… Noise Regulation,
… Noise Guideline,
… Noise Policy, ... I
am confused?

Marty, Regulation
means Law,
whereas, Guideline,
Policy implies less.

November 29, 2012

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

MassDEP's sampling results conclude that during the day time period, the combined sound levels from the two wind turbines do not exceed the 10 dBA threshold established in MassDEP's Noise Policy. The off-peak traffic day time period sampled (9 am through 4:30 pm) is considered "worst case" in establishing the background noise level, so the sounds from the wind turbines during times when background sound is elevated due to commuter and truck traffic on Route 28 traffic would exhibit even less impact than what was found.

able to focus directly on sound from the wind turbines and the analysis is not significantly influenced by sound from other sources.

MassDEP's sampling results conclude that during the day time period, the combined sound levels from the two wind turbines do not exceed the 10 dBA threshold established in MassDEP's Noise Policy. The off-peak traffic day time period sampled (9 am through 4:30 pm) is considered "worst case" in establishing the background noise level, so the sounds from the wind turbines during times when background sound is elevated due to commuter and truck traffic on Route 28 traffic would exhibit even less impact than what was found.

Should you have any questions requiring the enclosed report, please feel free to contact Laurel Carlson at 617-348-4095.

Sincerely,

Philip Weinberg
Regional Director

"… (9 am through 4:00 pm) is considerered "worst case" in establishing the background noise levels, …"


Daytime makes NO SENSE ! Complaints occur at NIGHT !
Marty, nobody wants to stay up and witness measurements in the dark at 2 am.

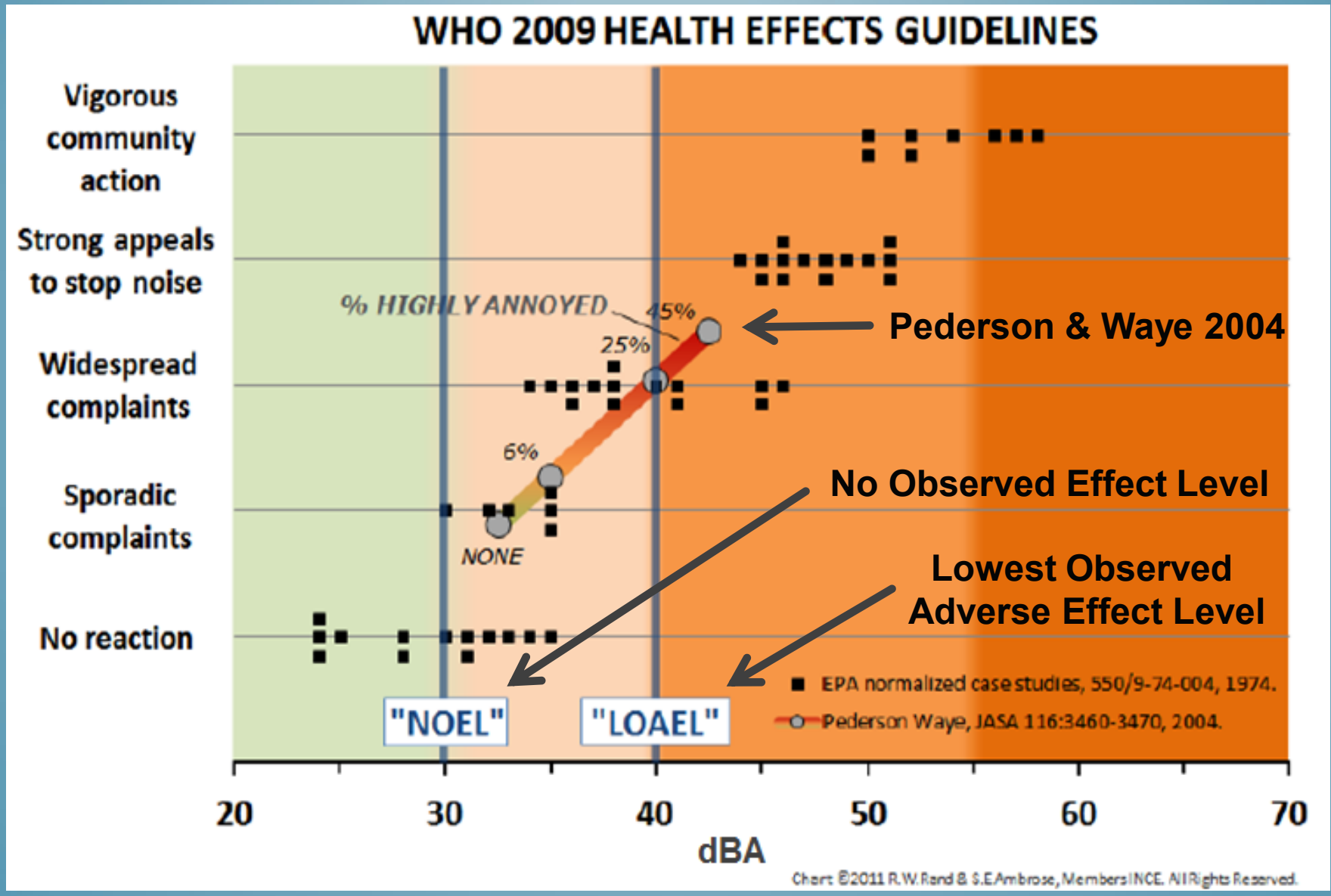
Summary

Date	Report	Finding / Comment
21 Nov 2003	Preliminary Site Assessment RERL / UMass	Increase less than 10 dB, Minimally audible, **Do Noise Survey**
19 Apr 2005 Nov 2005	Site Screening Report Site Feasibility Report KEMA & Ecology and Environment, Inc.	Noise complaints subjective, 40 dBA limit, Falmouth urban, Wind 1 predicted 42-44 dBA, **Do Noise Survey**
20 Sep 2010	Falmouth Wind Turbine Noise Study / HMMH	**Increase >10 dB,** turbines audible Wind 1 too loud More Measurements
6 June 2011	Evaluation of Noise Data Noise Control Engineering	**Wind 1 too loud** **More Measurements**
15 Mar 2012	DNV Review Mitigation Report Wind 1 & Wind 2	**More Measurements to understand why there are complaints**
29 Nov 2012	MassDEP Letter	**Daytime "worst case"** **Noise Increase < 10 dB**

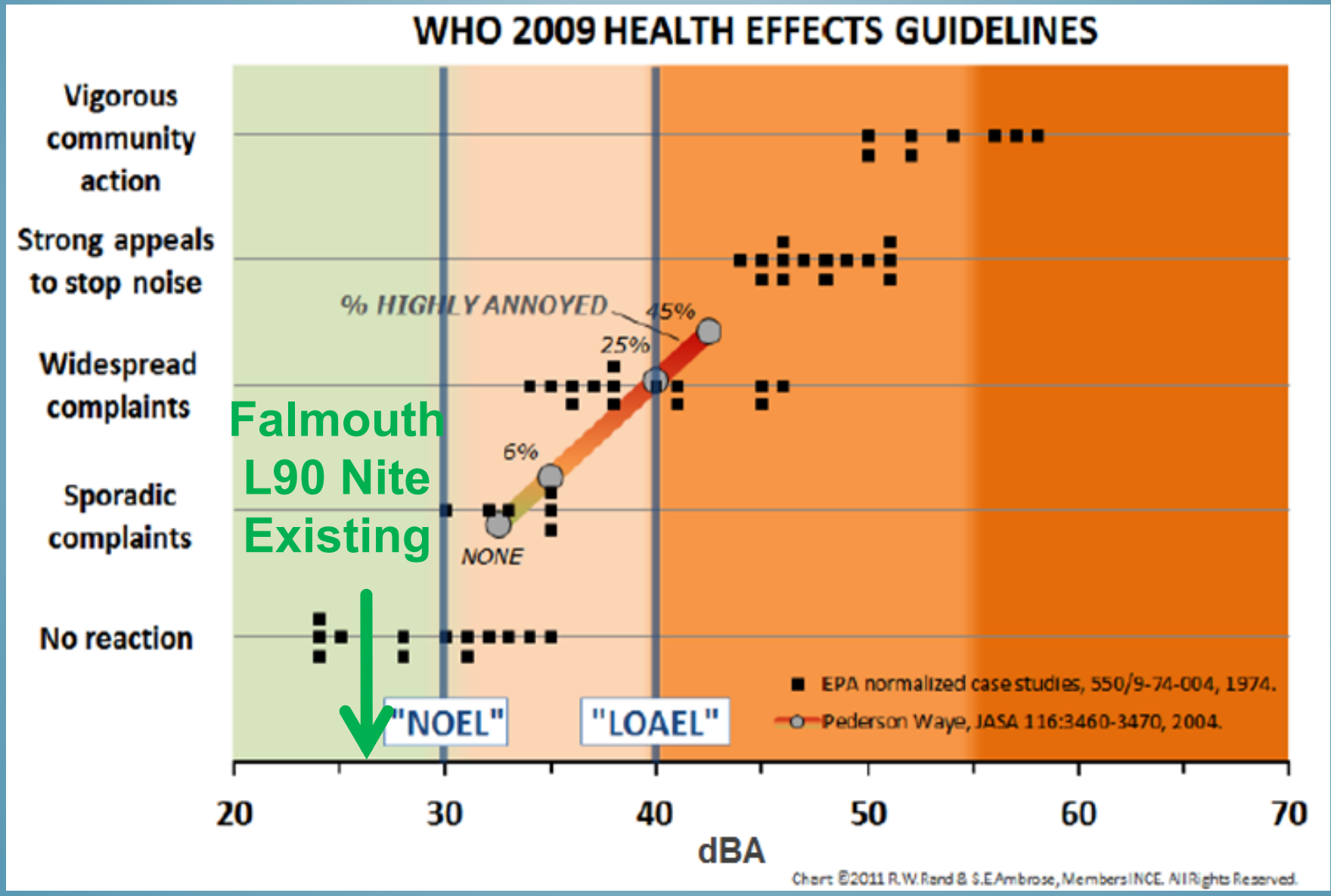
Doc! This is proof, neighbors are protected by blind eyes and deaf ears.

Marty, you're right, these reports all present evidence that demands a verdict.

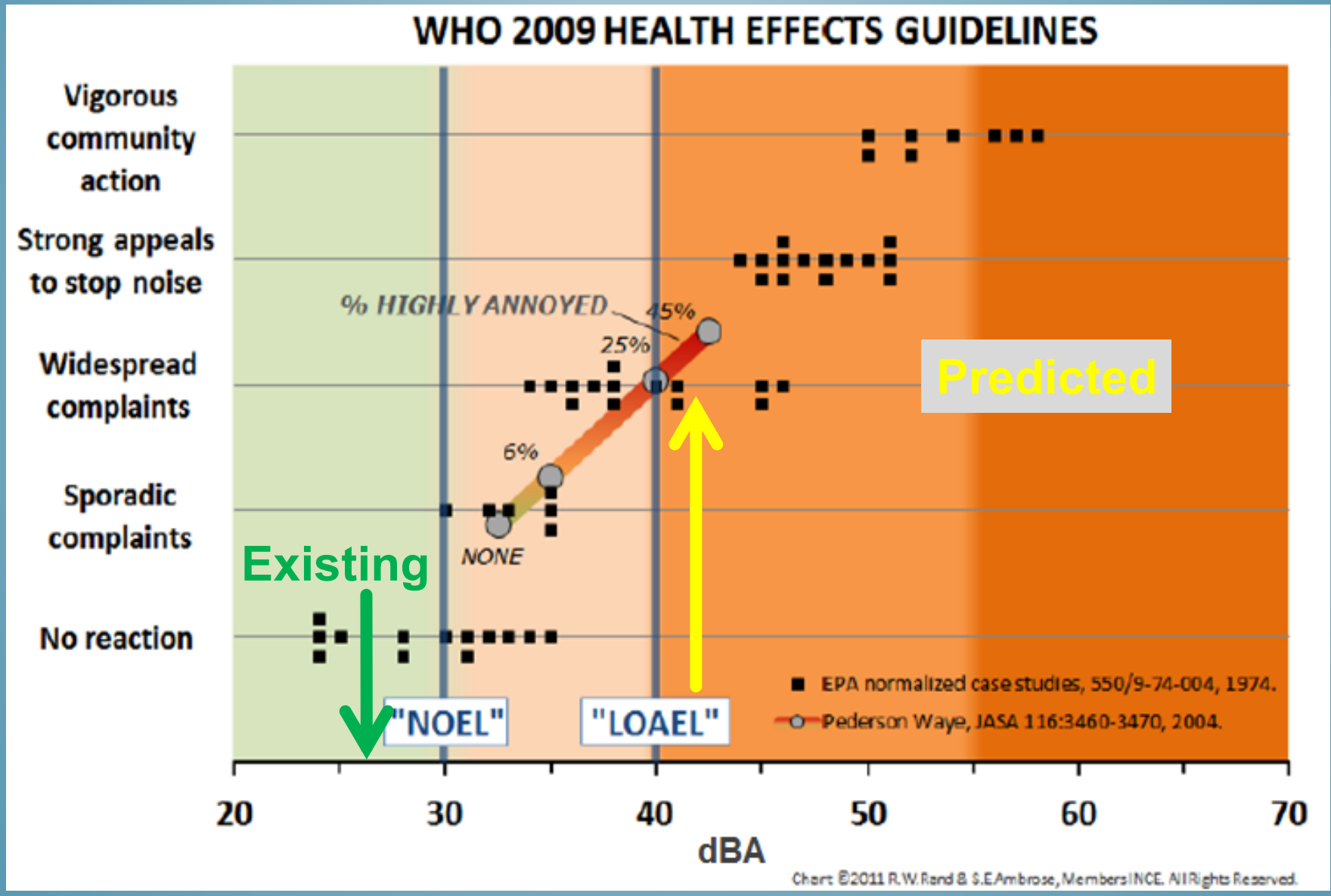
Community Response Prediction



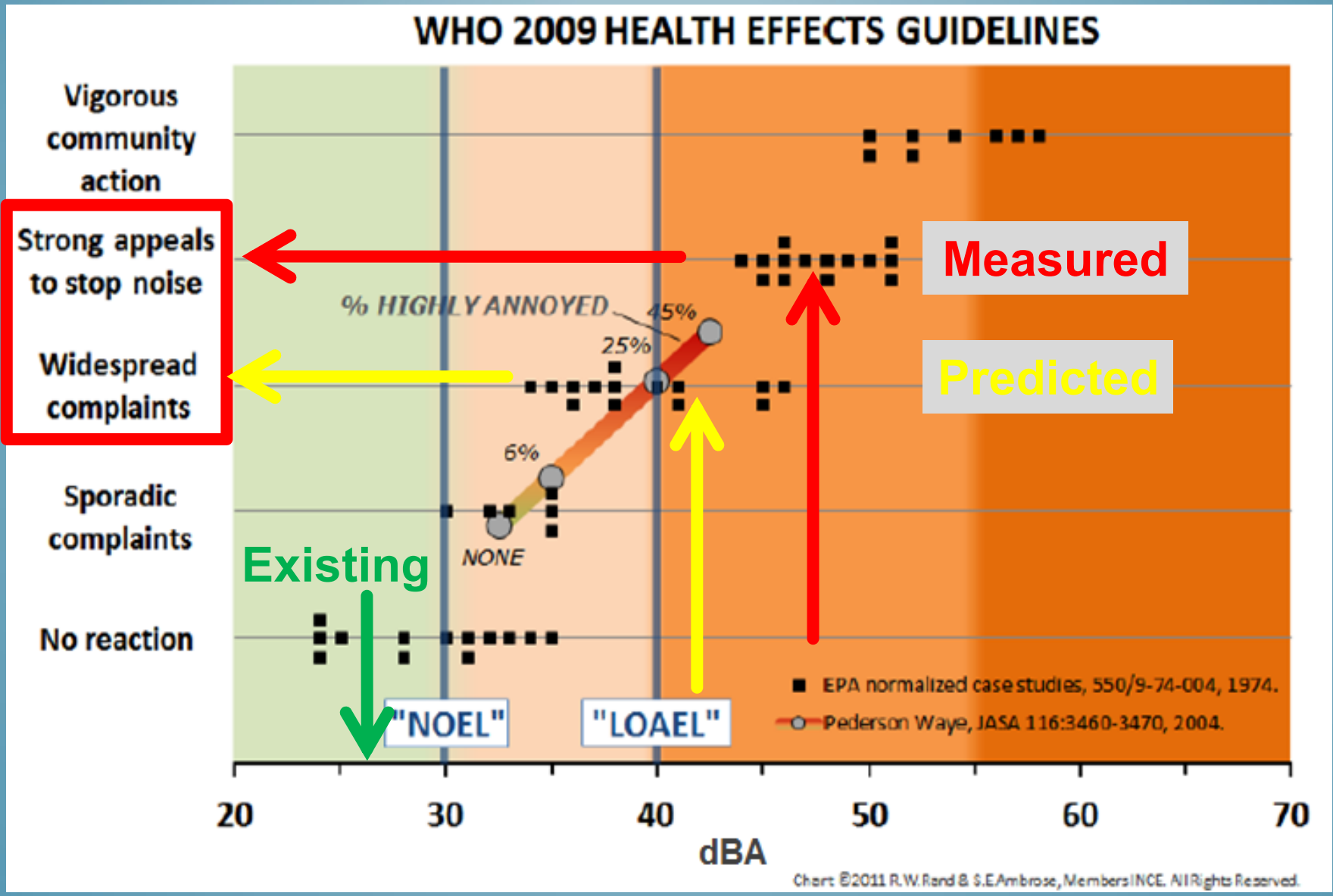
Community Response Prediction



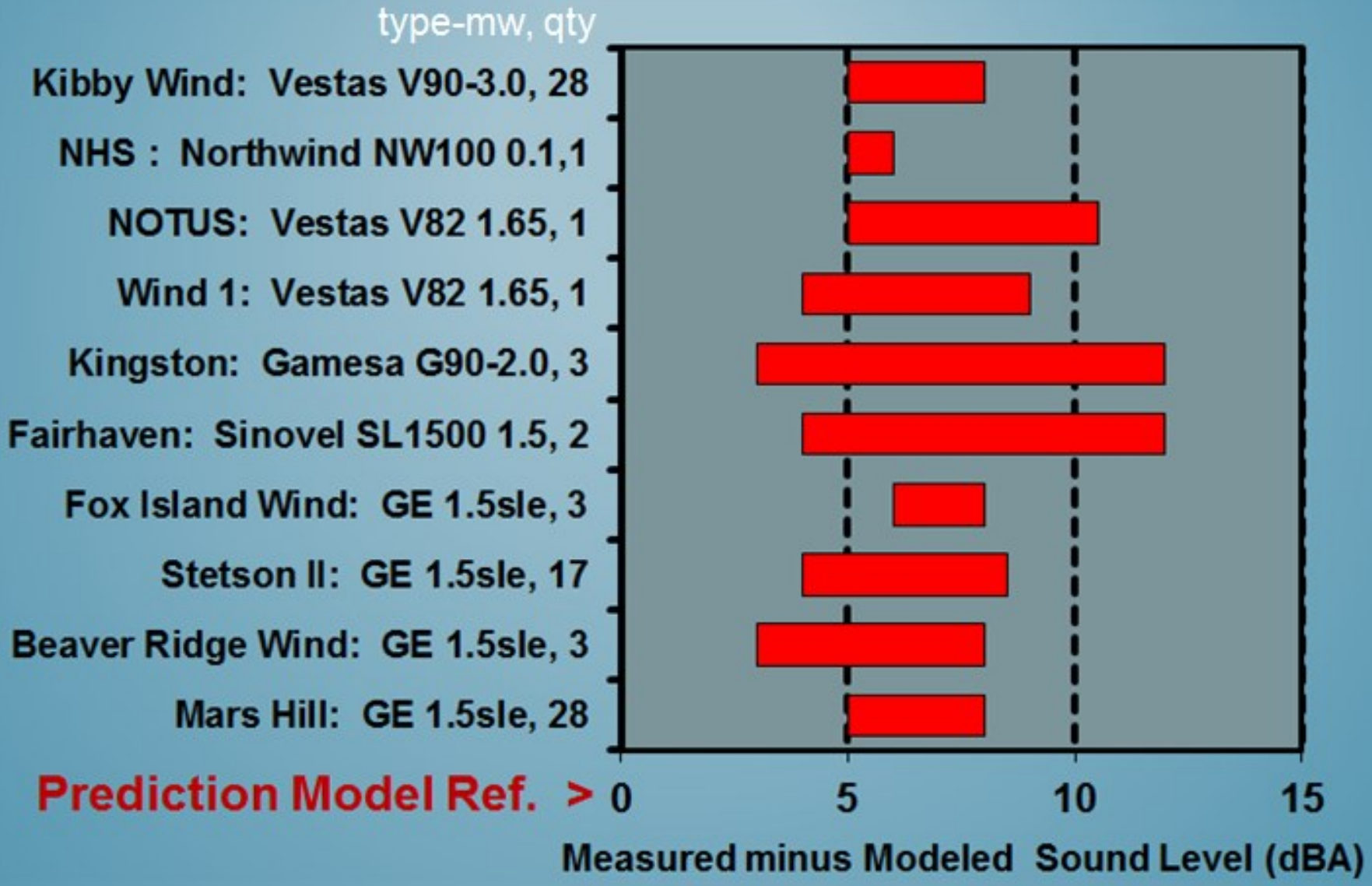
Community Response Prediction



Community Response Prediction



Measured Louder Than Predicted



BACK to the Present

Thank You

Stephen E. Ambrose
Principal Consultant, INCE Board Certified
&
Robert W. Rand
Principal Consultant, INCE

Acoustics, Environmental Sound & Industrial Noise Control