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May 29, 2009

Clayton Town Board Members
Justin Taylor, Supervisor
Bob Cantwell III
George Kittle
Lance Peterson
Donald Turcotte
c/o Town Clerk Kathleen E. LaClair
Town of Clayton
405 Riverside Drive
Clayton, NY 13624

Re: Horse Creek Wind Farm

Dear Mr. Taylor and Members of the Town Board:

On behalf of the Environmentally Concerned Citizens Organization (ECCO), please accept the following comments on the March 13 recommendations of the Clayton Wind Law Committee established by the Town Board. These comments are limited to the town's consideration of limits on the development of *utility-scale, industrial wind turbines*, especially as part of a multi-turbine wind farm, and are prompted both by the content of the March 13 recommendations, which ECCO generally supports, and by responses to the recommendations submitted by Iberdrola to you on May 20. Specifically, ECCO seeks by these comments to avoid town board action that might rubber stamp the most vacuous statements paraded before you by Iberdrola as findings of fact.

I understand that, in addition to the March 13 recommendations, the town through its planning board has before it a report submitted to the board on February 15, 2008 by Cavanagh Tocci Associates (CTA) to evaluate a noise impact assessment submitted to the board by Iberdrola's predecessor PPM Energy for the above-referenced project. At that time, project details were fairly well developed, including 62 turbine sites in the towns Clayton and Orleans, based on land use agreements previously obtained by PPM. However, concerns about the validity of PPM's noise assessment led the planning board to ask CTA to re-evaluate noise impacts of the project, looking particularly to the standards of Clayton's Local Law No. 1 of 2007 governing such projects and the New York State Department of Environmental Conservation's (DEC) guidelines for assessing noise impacts. Among other things, CTA found deficiencies in the town's existing local

law and included in its report an alternative local wind facilities law. I have enclosed copies of both the CTA report and the DEC guidelines.

Local Law No. 1 of 2007 specifically finds that wind energy facilities “are potentially significant sources of noise.” The town’s Wind Law Committee recommends specific noise limits and setbacks based primarily on concerns with potential noise impacts. In developing its recommendations the committee considered recommendations from the wind industry (e.g., GEO Global LLC, *Fundamentals of Acoustics*; American Wind Energy Association, *2007 Wind Energy Basics*), recognized standard-setting agencies (e.g., World Health Organization, *Guidelines for Community Noise*; DEC, *Assessing and Mitigating Noise Impacts*), standards and reports regarding wind facilities by other towns (e.g., *Report from the Bethany [NY] Wind Turbine Study Committee*; Town of Union Rock County, Wisconsin, *Ordinance No. 2008-06*), and recommendations for regulation of wind turbine noise published by acoustic and medical experts (e.g., G. Van der Berg, Dr. Amanda Harry, the French National Academy of Medicine, George W. Kamperman and Richard R. James). To clarify the methodology and conclusions of the CTA report, the committee also heard directly from Greg Tocci, the principle author of the report. Thus the committee explicitly considered the following assertions made in Iberdrola’s May 20 letter and rejected them.

1. “There are no known issues with low frequency sound and wind turbines.”

In fact, wind turbine noise includes a significant low-frequency component, sounds below 500 Hz, including inaudible infrasound (0–20 Hz). For example, according to the manufacturer, at a distance of 200 meters (656 feet), a single 2.5 MW Nordex N80 wind turbine generates 95 decibels, G-weighted, at 10 Hz.¹

At the less-audible and inaudible range, low-frequency sound is often felt rather than heard. Unlike the A-weighted component, weighted to reflect frequencies heard best by most people, the low-frequency component of wind turbine noise “can penetrate the home’s walls and roof with very little low frequency noise reduction.”² Acoustic modeling for low frequency sound emissions of ten 2.5 MW turbines “that the one mile

¹ Nordex, *Measurement of the Infrasound Radiation, Nordex N80*, No. NXX-6-noise-infrasound-en (November 24, 2004), p. 4. I have enclosed a copy of this report.

² George W. Kamperman and Richard R. James, *The “How To” Guide to Criteria for Siting Wind Turbines to Prevent Health Risks from Sound*, p. 3 (October 28, 2008), to which is attached Kamperman and James, *Simple guidelines for siting wind turbines to prevent health risks*, 2008 NOISE-CON (July 28-31, 2008).

low frequency results are only 6.3 dB below the 1,000 foot one turbine example.”³

Very few studies of the effect of low frequency sound of wind turbines on humans have been published.⁴ However, a number of peer-reviewed studies have been published establishing a link between chronic exposure to low-frequency sound and abnormal growth of collagen and elastin in the blood vessels, cardiac structures, trachea, lungs, and kidneys of humans and animals.⁵ While most of these studies address occupational noise, wind turbine noise can be expected to expose residents to low frequency noise much more often because such noise is generated 24 hours per day for days at a time. It is thus disingenuous for Iberdrola to suggest there is no basis for concern with potential impacts of low frequency noise generated by wind turbines.

2. “The use of [a] relative sound standard [such] as the proposed 5 dBA above ambient . . . is not an attainable standard because it will change with varying wind speeds.” In the first instance, this assertion is contrary to DEC’s guidance, *Assessing and Mitigating Noise Impacts*, which at page 12 states, “ $L_{(90)}$ is often used to designate the background noise level.” The Wind Law Committee recommends “ambient sound L_{a90} must be measured (using ANSI or IEC Type 1 standard) [during] preconstruction,” thus adopting the DEC guidelines for determining *background noise level*. CTA made the same recommendation (at page 2). Iberdrola is attempting to confuse the question of what baseline for preconstruction sound levels should be adopted in order to assess project impact sound levels.

³ *Id.*, p. 12.

⁴ See National Academy of Sciences, *Environmental Impacts of Wind-Energy Projects* (2007), p. 109, available at <http://www.nap.edu/openbook.php?isbn=0309108349>: “Low-frequency vibration and its effects on humans are not well understood. Sensitivity to such vibration resulting from wind-turbine noise is highly variable among humans. Although there are opposing views on the subject, it has recently been stated (Pierpont 2006) that ‘some people feel disturbing amounts of vibration or pulsation from wind turbines, and can count in their bodies, especially their chests, the beats of the blades passing the towers, even when they can’t hear or see them.’ More needs to be understood regarding the effects of low-frequency noise on humans.”

⁵ See M. Alves-Pereira and N.A.A. Castelo Branco, *Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling*, 93 *PROGRESS IN BIOPHYSICS AND MOLECULAR BIOLOGY* 256–279 (2007); and *Public health and noise exposure: the importance of low frequency noise*, INTER-NOISE 2007 (August 28, 2007) (reviewing literature and discussing impacts on residents near an industrial loading dock and an industrial wind farm). I have enclosed both documents.

In addition, as noted on the first page of their recommendations, the committee specifically relied on “the How to Guide to sighting wind turbines to prevent health risks from sound, Kamperman & James Report, version 2.1 dated October 28, 2008,” which (at page 21) distinguishes “ambient” from “background” sound as follows:

“Ambient Sound” Ambient sound encompasses all sound present in a given environment, being usually a composite of sounds from many sources near and far. It includes intermittent noise events, such as, from aircraft flying over, dogs barking, wind gusts, mobile farm or construction machinery, and the occasional vehicle traveling along a nearby road. The ambient also includes insect and other nearby sounds from birds and animals or people. The near-by and transient events are part of the ambient sound environment but are not to be considered part of the longterm background sound.

I have enclosed a copy of this report; the above excerpt is found on page 21 (emphases above in orig.). As Kamperman and James note (at pages 15-16), measurement of long-term background sound is governed by established professional standards (ANSI S12.9, Part 3) prescribing that “nature sounds not present during all seasons and wind noise are not to be included in the measurement.” Consistent with this standard, the Wind Law Committee recommends using background sound levels, calculated as a long-term value without regard to intermittent wind-related noise.⁶

Iberdrola’s assertion is consistent with misinformation frequently provided by wind developers. According to the wind industry, “Wind plants are always located where the wind speed is higher than average, and the ‘background’ sound of the wind will often ‘mask’ any sounds that might be produced by operating wind turbines - especially because the turbines only run when the wind is blowing.”⁷ However, acoustics experts experienced in assessing wind farm noise have concluded that it is common for calm air to prevail at ground level while at turbine hub height (~80 meters, or 262 feet) winds are sufficient to sustain turbine operations, thus eliminating any masking effect from wind

⁶ Compare Iberdrola’s assertion: “Prescribing how sound measurements should occur is not practical.” As discussed above, this assertion is contrary to established professional standards for background sound measurements.

⁷ American Wind Energy Association, *Utility Scale Wind Energy and Sound*, available at http://www.awea.org/pubs/factsheets/Utility_Scale_Wind_Energy_Sound.pdf.

sounds.⁸ This phenomenon, known as “wind shear” coupled with near-ground level “atmospheric stability,” refers to the boundary between calm air at ground level and turbulent air at a higher altitude. “A high wind shear at night is very common and must be regarded a standard feature of the night time atmosphere in the temperate zone and over land.”⁹

The most in-depth study of this phenomenon, based on a full year of measurements at a wind farm every half-hour, found:

the wind velocity at 10 m[eters] follows the popular notion that wind picks up after sunrise and abates after sundown. This is obviously a ‘near-ground’ notion as the reverse is true at altitudes above 80 m. . . . after sunrise low altitude winds are coupled to high altitude winds due to the vertical air movements caused by the developing thermal turbulence. As a result low altitude winds are accelerated by high altitude winds that in turn are slowed down. At sunset this process is reversed.¹⁰

Thus, when ground-level wind speed calms after sunset, wind speed at typical hub height for large wind turbines (80 meters) commonly increases. As a result, turbines can be expected to operate, generating noise, while there is no masking effect from wind-related noise where people live. Such calm or stable atmosphere at near-ground altitude accompanied by wind shear near turbine hub height occurred in the Van den Berg measurements 47% of the time over the course a year on average, and most often at night.¹¹ Thus, there should be no expectation that wind turbine noise will be regularly masked by wind rustling trees and other vegetation at near-ground altitudes since such

⁸ See G.P. van den Berg, *The sound of high winds: the effect of atmospheric stability on wind turbine sound and microphone noise*, Doctoral Dissertation (May 12, 2006), Groningen Univ. (Rotterdam); Kamperman and James, *Simple guidelines for siting wind turbines to prevent health risks*, July 28-31 2008 NOISE-CON. The latter article is attached to and is part of the Kamperman and James document on which the Wind Law Committee relied and which is enclosed with these comments.

⁹ G.P. van den Berg, *The sound of high winds*, p. 104. See also Acoustic Ecology Institute (Santa Fe, NM), *Wind Turbine Noise Impacts* (January 6, 2009), available at <http://www.acousticecology.org/srwind.html>.

¹⁰ G.P. van den Berg, *The sound of high winds*, p. 90.

¹¹ *Id.*, p. 96.

masking is likely not to occur about half the time, and would occur less often at night when noise protection is most needed.

3. “Additionally, sound standards are traditionally applied to the outside of a dwelling, as there is measurable attenuation between the inside and the outside of a dwelling, even with the windows open. The proposal [of the Clayton Wind Law Committee] to adopt a sound standard as it applies to a property line has not been applied to any other sound emitting source and has consequences for any type of development or improvement within the town.” These assertions are addressed to the legitimate and common concern that, should noise limits apply only to the walls of a dwelling, a property owner would lose the benefit of the noise limit for any future improvement made in the area between his or her existing dwelling and the noise source. Iberdrola does not want the town board to consider this concern.

More importantly, there are two assertions Iberdrola makes here that are demonstrably false. First, as shown above, low frequency sound is not significantly attenuated by the walls of a dwelling; low frequency sound levels are about the same on the outside and inside of a dwelling, and are perceived more easily inside where the expectation and reality is a much quieter acoustic environment than outside. Second, DEC’s *Assessing and Mitigating Noise Impacts*, at page 13, discusses the manner in which noise receptor locations should be selected for purposes of assessing noise impacts:

Appropriate receptor locations may be either at the property line of the parcel on which the facility is located or at the location of use or inhabitation on adjacent property. The solid waste regulations require the measurements of sound levels be at the property line. The most conservative approach utilizes the property line. The property line should be the point of reference when adjacent land use is proximal to the property line. Reference points at other locations on adjacent properties can be chosen after determining that existing property usage between the property line and the reference point would not be impaired by noise, i.e., property uses are relatively remote from the property line.

Thus, it is not the case that selecting the property line has not been applied when assessing noise impacts. DEC’s solid waste regulations specifically require this approach, and DEC’s guidance recognizes this as a legitimate approach unless “existing property usage between the property line and the reference point would not be impaired by noise.” DEC’s guidance supports the concern underlying ECCO’s and others’ requests that Clayton apply noise limits at the property line because some property owners wish to use

their property near their property line in ways that could be interfered with by industrial wind turbine noise.

4. Iberdrola agrees “with the establishment of a ‘not-to-exceed’ standard for any sensitive receptor . . . There have been many scientific studies which suggest such limits to protect against impacts to education, sleep, speech or occupation. Many of these are appropriately summarized in the *World Health Organization Guidelines for Community Noise* document as summarized by the Committee.”

Iberdrola’s response is calculated to distinguish a “not-to-exceed” sound limit from a limit on increases over background sound levels. The Wind Law Committee clearly recommends both, “Generated sound by Wind Energy Conversion Systems (WECS) shall not exceed ambient L_{a90} sound level more than 5 dBA at all non-participating property lines,” and “Generated sound L_{90} by WECS shall not exceed 50 dBA as measured at any public and private dwellings or residences including churches, schools, hospitals and libraries.” Thus, Iberdrola’s “agreement” with the Committee is misleading.

More specifically, the audible component of wind turbine noise can cause chronic sleeplessness, apparently because of its rhythmic, unnatural nature, and its intrusion at night, a time when most people expect little or no noticeable noise. The World Health Organization (WHO) considers sleep disturbance to be an adverse health impact.¹² Chronic sleeplessness, in turn, causes a variety of health effects, including “primary physiological effects . . . induced by noise during sleep, including increased blood pressure; increased heart rate; increased finger pulse amplitude; vasoconstriction; changes in respiration; cardiac arrhythmia; and an increase in body movements.”¹³ “Exposure to night-time noise also induces secondary effects, or so-called after effects . . . includ[ing] reduced perceived sleep quality; increased fatigue; depressed mood or well-being; and decreased performance.”¹⁴ Waking up in response to nighttime noise decreases as people get habituated to the noise; however, “habituation has been shown for awakenings, but not for heart rate and after effects such as perceived sleep quality, mood and performance.”¹⁵

¹² WHO, *Guidelines for Community Noise*, ch. 3, “Adverse health effects of noise,” pp. 44-46 (1999), available at <http://www.who.int/docstore/peh/noise/guidelines2.html>.

¹³ *Id.*, p. 44.

¹⁴ *Id.*, pp. 44-45.

¹⁵ *Id.*, p. 45.

5. Setbacks. ECCO is in general agreement with Iberdrola's resistance to the setbacks recommended by the Wind Law Committee, but for reasons that differ from Iberdrola's. We agree with the committee that special protection should be extended to the waterfront areas of the Chaumont and St. Lawrence Rivers, consistent with the special consideration given these areas in the town's comprehensive plan. We also agree that the two population centers in the town, the Village of Clayton and the Hamlet of Depauville, should benefit from special protections, consistent with the principles discussed above regarding the adverse health effects of chronic exposure to audible and low frequency sound emitted by industrial wind turbines, and the heightened risk of such effects where population is concentrated. However, we believe that the recommended noise limits are sufficient to achieve these goals without specific setback distances. In most cases, adopting the recommended noise limits will result in comparable setbacks. However, noise impacts vary by topography, and appropriate acoustic modeling may show that lesser setbacks can achieve the recommended noise limits.

6. Conclusion. There is no basis for the factual assertions regarding acoustic measurement methods and noise impacts of industrial wind farms provided to you by Iberdrola, and Iberdrola makes no effort to supply appropriate supporting information comparable to the information considered by the Wind Law Committee.

We all believe that society should utilize all forms of renewable energy to achieve important policy goals. However, the Town Board should also be interested in getting to the truth about what noise impacts and other adverse impacts can be reasonably expected as a result of adopting standards for large wind turbines. Wind energy may provide an important element of a program to increase renewables, but this does obviate the need to ensure that local wind farm regulations avoid significant harm.

Respectfully,

Gary A. Abraham



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- encs: 1. Kavanagh Tocci Associates, *Clayton Wind Farm Project - Executive Summary* (August 25, 2008), attaching CTA, *Clayton Wind Farm Project [Full Report]* (February 15, 2008), and CTA, *Draft Noise Ordinance, Town of Clayton, New York* (March 14, 2008)
2. New York State Department of Environmental Conservation, *Assessing and*

Mitigating Noise Impacts, No. DEP-00-1 (February 2, 2001)

3. Nordex, *Measurement of the Infrasound Radiation, Nordex N80*, No. NXX-6-noise-infrasound-en (November 24, 2004)

4. George W. Kamperman and Richard R. James, *The “How To” Guide to Criteria for Siting Wind Turbines to Prevent Health Risks from Sound* (October 28, 2008), attaching Kamperman and James, *Simple guidelines for siting wind turbines to prevent health risks*, NOISE-CON 2008 (July 28-31 2008)

5. M. Alves-Pereiraa and N.A.A. Castelo Branco, *Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling*, 93 PROGRESS IN BIOPHYSICS AND MOLECULAR BIOLOGY 256–279 (2007)

6. M. Alves-Pereiraa and N.A.A. Castelo Branco, *Public health and noise exposure: the importance of low frequency noise*, INTER-NOISE 2007 (August 28, 2007)