Effects of Industrial Wind Turbines on Humans

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Background

• New Generation Wind proposes to install 7 industrial wind turbines with a height of 492 ft (from base to tip of rotor blade), total power of 17 MW
• Setback as close as 800 ft to residential neighborhoods
• According to “Environmental Notification Form – New Generation Wind Project”, by Atlantic Design Engineers:
  – Expected Noise Levels at design wind speed will be between 49.6 dBA and 53.4 dBA (Page 20)
  – Expect up to 40 – 50 hours of Shadow-Flicker per year (Page 16)
Background – Sound

SOUND
The ear and brain detect: pressure waves
loudness and pitch of sound

Engineers use dBA scale to describe sound as perceived:

- Background at night in a rural area: 25 dBA
- Recommended bedroom level: 25 dBA
- Living room: 40 – 45 dBA
- A busy office: 60 – 65 dBA
- Heavy street traffic: 90 dBA

An increase of 3 dBA is noticeable
An increase of 10 dBA is perceived as a doubling
Wind Turbine Sound and Annoyance

Annoyance caused by Wind Turbines was evaluated in 3 Studies in Europe:


Wind Turbine Sound and Annoyance

- Pedersen et al. 2004, 351 Respondents, Sweden
- 600 kW – 660 kW, Rotor Ø 47 m (154 ft), Hub Height 50 m

Graphic: A graph showing the percentage of people highly annoyed by different sources of sound exposure (dB(A)) with annotations for wind turbines, aircraft, road traffic, and railways.
Wind Turbine Sound and Annoyance

- Pedersen et al. 2004, 351 Respondents, Sweden
- Only 25 Respondents exposed to Sound Levels of > 40 dBA
  - A Significant dose-response relationship between sound pressure level and noise annoyance was found
  - Noise annoyance higher than expected
  - 16% (n=20, 95%CI: 11% - 20%) reported Sleep disturbance at sound exposure levels of 35 dBA; Sleep Disturbance increases with higher sound pressure levels
  - Wind turbine noise is more annoying than other community noise sources at comparable sound levels
  - Most people who were annoyed were annoyed every day or every other day, indicating intrusion on people’s daily life
Wind Turbine Sound and Annoyance

- Pedersen et al. 2007: Sweden, 754 Respondents
- Of those, only 20 experienced noise levels of >40 dBA

**Main messages**

- The risk for being annoyed by wind turbine noise increases with increasing A-weighted sound pressure levels. Dose-response relation at noise levels as low as these have not earlier been derived.
- Living in a rural environment, in comparison with a suburban area, increases the risk of perceiving and being annoyed by sound from nearby wind turbines.
- Noise annoyance with wind turbine noise could lead to hindrance of human restoration.
- Seeking information and discussing wind turbines as a coping strategy could decrease adverse health effects.
Wind Turbine Sound and Annoyance

- Pedersen et al. 2007: Sweden, 754 Respondents
- Other Findings / Discussion:
  - Seeing one or more turbines increased the odds of perceiving sound and the odds of being annoyed
  - Odds of being annoyed increase with a negative attitude towards wind turbines
  - Annoyance is an Adverse Health Effect
  - Reported Sleep Disturbance and Uneasiness could be an effect of Noise Exposure
  - Being employed was associated with higher prevalence to perceive noise; Noise Annoyance could lead to hindrance of Human Restoration
Wind Turbine Sound and Annoyance

• Pederson et al. 2009: Netherlands, 725 Respondents
  – Noise from Wind Turbine Noise more annoying than noise from all other Sources (except shunting yards)
  – Do not ceases at night (Traffic and industrial noise return to low levels at night, allowing residents to restore themselves)
  – Wind Turbine Sound can be heard more clearly at night
  – It was confirmed that a correlation exists between Attitude and Annoyance
  – Highest non-acoustical (Attitude) Factor was Economic Benefit
Wind Turbine Sound and Annoyance

Summary of the Three European Studies:

– Wind Turbine Noise more annoying than other community noises
– Annoyance is directly correlated to Noise Levels
– Annoyance is an Adverse Health Effect
– Wind Turbine Noise was found as a possible cause for Sleep Disturbance
– Attitude towards Wind Turbines one of many factors that impact level of annoyance; Cause and Effect unclear
– Economic Benefit has impact on Level of Annoyance
– Employment Status has impact on Level of Annoyance
Adverse Health Effects

• Health Canada states in “It’s Your Health”
  – The most common effect of community noise is Annoyance
  – Annoyance is an Adverse Health Effect according to the World Health Organization

• The World Health Organization (WHO) states:
  – Sleep disturbance and annoyance are the first effects of night noise and can lead to mental disorder
  – Annoyance and Sleep Disturbance can lead to Stress
Adverse Health Effects

• WHO Nighttime Noise Guidelines for Europe 2009: Some of the documented Adverse Health Effects of Sleep Disturbance include:
  – Poor performance at work
  – Fatigue
  – Memory Difficulties & Concentration problems
  – Mood Disorders (Depression, Anxiety)
  – Alcohol and Substance Abuse
  – Cardiovascular, Respiratory, Renal, Gastrointestinal, Musculoskeletal Disorders
  – Obesity
  – Impaired Immune System Function
  – Increased Risk of Mortality
According to Health Canada:
Stress is considered to be a risk factor in a great many diseases:
- Heart Disease
- Some types of bowel disease
- Herpes
- Mental Health
- Makes it difficult for people with Diabetes to control blood sugar levels
- Alcohol and Substance Abuse
- Weight Loss and Weight Gain
Adverse Health Effects

• WHO Guidelines for Community Noise 1999:
  – Recommends a Noise Level of 30 LAeq dB (average noise level over 24 hours) indoors to protect against sleep disturbance
  – Noise Level should be even lower if noise is composed of a large proportion of low frequency noise

• WHO Nighttime Noise Guidelines for Europe 2009:
  – To prevent Adverse Health Effects, it is recommended that the population is not exposed to noise levels above 40 dB
  – 40 dB Lnight can be considered a health-based limit to protect the public, including its most vulnerable groups such as children, the chronically ill, and the elder, from Adverse Health Effects of night-time noise
Low Frequency Sound

Wind Turbine Sounds seem to have an impact on people that cannot be explained by Noise alone; possibly caused by low frequency Sound:


- Sleep disturbance
- Headaches
- Difficulty concentrating
- Irritability and fatigue
- Dizziness
- Vertigo
- Tinnitus
- Sensation of aural pain or pressure

Similar to other Symptoms reported from Non-Wind-Turbine low frequency noise (Feldmann and Pitten, 2004)
Adverse Health Effects

- Comparative Study Mars Hill, ME (28 Wind Turbines, 1.5 MW, noise up to 52.5 dBA)
  - 22 people within 3,500 ft of Wind Turbines (Exposed)
  - 27 people 3 Miles away (Not Exposed)
  - 82% reported New or Chronic Sleep Deprivation (vs. 4% Control Group)
  - 41% reported New Chronic Head Aches (vs. 4% Control Group)
  - 59% reported Stress (vs. 0% Control Group)
  - 77% reported persistent Anger (vs. 0% Control Group)
  - 36% reported Depression (vs. 0% Control Group)
  - 95% perceived reduced Quality of Life (vs. 0% Control Group)
Falmouth, MA:
- Since it went into operation in early 2010, quite a number of us abutters have suffered serious medical detriments and a gigantic loss of quality of our lives from the noise impact of this machine:
  - anxiety
  - stress
  - nervousness
  - sleep deprivation
  - hypertension
  - migraines
  - dizziness
  - blurred vision
  - palpitations
  - irritability
  - anger
  - upset stomach
  - depression
Barry Funfar, wind-watch.org
Wind–Turbines in the North America

- Vinalhaven, ME:
  NY Times, Oct 5, 2010
  - “In the first 10 minutes, our jaws dropped to the ground,” Mr. Lindgren said. “Nobody in the area could believe it. They were so loud.”
  - “The quality of life that we came here for was quiet”
  - “They told us we wouldn’t hear it, or that it would be masked by the sound of the wind blowing through the trees,” said Sally Wylie “I feel duped.”
  - “It would seem to be time for the wind utility developers to rethink their plans for duplicating these errors and to focus on locating wind turbines in areas where there is a large buffer zone of about a mile and one-quarter between the turbines and people’s homes,” said Mr. James, the principal consultant with E-Coustic Solutions, based in Michigan.
Wind–Turbines in the North America

- Minnesota:
  Star Tribune, Jan 12, 2010
  
  "We can pull our drapes, we can put earplugs in, or we can wear dark glasses, I guess, but it doesn't really make the problem go away," said Patti Lienau.

  After complaining to the developer, they received two large evergreen trees to partly block the view, and $3,000 a year to compensate for the noise. But Lienau said that no money can restore tranquility for her "shell-shocked" 85-year-old father, who struggles with panic attacks and anxiety.
Wind–Turbines in the North America

• De-Kalb, IL:
  Chicago Tribune, March 14, 2010
  – “I never had problems sleeping. I went to the Veterans Administration, and they put me on sleeping pills. They continuously had to upgrade them because they weren’t working”.

• Fond Du Lac, WI:
  – “Last night it was whining. It wasn’t just the whoosh whoosh whoosh or the roaring. It was a high pitched whine. And I don’t just hear them, I can feel them.” She describes feeling like a beat in her head. A pulse that matches the turbine’s rhythm. - Ann Wirtz, whose home is located 1,800 feet from an industrial wind turbine
  – "Sometimes so loud it makes it seem like we live in an industrial park. The noise dominates the 'sound scape.' It's very unsettling/disturbing especially since it had been so peaceful here. It is an ongoing source of irritation. Can be heard throughout our house even with all the windows and doors closed."
Wind–Turbines in the North America

• Fairfield, NY:

Utica Observer Dispatch, Letter to the Editor

“Day and all night long, I hear grinding and grinding, whooshing and whooshing, non-stop. I live right under the wind turbines in Fairfield. We cannot carry on conversations outside due to the constant noise level. There is a constant droning sound inside my home that was never there before. I can’t even begin to imagine the noise when the turbines are going full force and in the summer; I bet I won’t even be able to have my windows open due to the high noise levels.”
Wind–Turbines in the North America

• Ontario, CA:
  – Simcoe Island:
    • “Since the operation of these giants, I’ve experienced never-before health events, including loss of balance, mini-strokes, dizziness and suspected peripheral neuropathy.”
  – Amherstberg:
    • “There’s no garden this year. My yard is a mess. I can’t go out more than 20 minutes to do anything.”
Wind–Turbines in the North America

• Ontario, CA:
  – Aramanth:
    • I have been renting other accommodations to sleep in at night since May 1, 2009
    • I have been to my family doctor and have exhausted the headache, tinnitus testing regimen of my physician, including a MRI, CT scan, neurologist and a pain management clinic, etc.
    • The conclusion reached by the medical profession after all of these tests seems to be that the problem is not with me. The pain management clinician told me “this is my shortest diagnosis ever. You already know what the problem is. What are going to do to move out?”
Conclusions

- Industrial Wind Turbine Noise causes Annoyance, Stress, and Sleep Disturbance
- It is established medical science that Annoyance, Stress and Sleep Disturbance cause Adverse Health Effects
- Adverse Health Effects are observed all over North America:
  - Falmouth
  - Maine
  - New York
  - Illinois
  - Wisconsin
  - Ontario
  - Don’t add BOURNE to the List...