

Wind turbines and adverse health effects: Applying Bradford Hill's criteria for causation by Anne Dumbrille, Robert McMurtry, and Carmen Krogh – 'Big noises: Tobacco and Wind'

In the absence of a direct means of assessing causality by experiment, Dumbrille, McMurtry, and Krogh^[1] have resorted to the nine criteria devised^[2] by the English Statistician, Austin Bradford Hill, to assign causality. They have applied them to the putative adverse health effects associated with wind farm noise and have found all nine to be upheld.

Bradford Hill's outstanding contribution to Public Health, with Richard Doll, was assembling a cohort of 40,000 British Doctors to study the epidemic of lung cancer that emerged in the first half of the 20th century. They showed^[3] extremely strong associations between the number of cigarettes smoked and the development of lung cancer and other diseases. These associations were well known to the Tobacco Industry, which had suppressed the scientific evidence for years,^[4] but eventually, the companies were made to apologize to the public.^[5] For how long have the adverse health effects of wind turbine noise been known?

In 1967, a UNESCO publication discussed,^[6] "...the dangers of sounds we cannot hear," defining Infrasound as <30 Hz. By 1973, the Russians had defined safe upper limits for Infrasound (<20 Hz) in various settings.^[7] In the 1980s, Kelley *et al.* investigated a single turbine in America where around 12% of families within 3 km were impacted by noise emissions.^[8] The passage of the rotors past the turbine's supports caused low-frequency pressure pulsations to be directed into the complainants' dwellings. The situation was aggravated by a complex sound propagation process controlled by terrain and atmospheric focusing. The impulsiveness of the emitted low-frequency acoustic radiation was identified as a major problem. Various recommendations were made concerning noise reduction and as to how the Low-Frequency Noise should be measured.^[9]

In the UK in 1990, The Batho (Noise Review Working Party) Report devoted^[10] a single, important, page to Low-Frequency Noise, observing that it could have a serious

effect on the lives of those affected by it: "The noise may be inaudible to the Environmental Health Officer (EHO) and its measurement often requires sophisticated monitoring techniques." It was stated that the normal A-weighted scale was not appropriate for its measurement, and the problem was a real one, recommending in bold: "...that full support should be given to the current program of research."

In the UK in 2001, a Report on Low-Frequency Noise by Stanger was prepared for the UK's Department of Environment, Food and Rural Affairs.^[11] It drew on the Batho Report but went much further. Two years later, when the British Prime Minister launched^[12] his country's "Our Energy Future," largely based on wind energy, there was no mention whatsoever of Low-Frequency Noise. What had happened? Although all potential sources of renewable energy were being considered in the early 1980s, by the mid-1990s, wind energy was deemed paramount by the UK's Government.^[13] In 1996, the Department of Trade and Industry, whose remit was to create the optimal environment for business success, with no brief for environmental protection, established The Working Group (WG) on Noise from Wind Turbines.^[14]

The WG brief was to identify noise levels thought to offer a reasonable degree of protection, without unreasonably restricting development. Of its 14 members, six were directly, and two indirectly, connected with the wind industry, three were civil servants and three EHOs, with no medical or planning input whatsoever. The impact of Low-Frequency Noise was discounted, so A-weighted noise measurements were recommended, and only turbines to a hub height of 32 m were considered.^[14] The WG's chief concern was to promote wind energy, irrespective of its impacts on rural communities. This resulted in the highest night-time noise limits permitted anywhere. A proposed review 2 years after 1996 never took place.

In 2011, a letter written by the CEO of the Danish wind turbine manufacturer, Vestas, to the Danish Environment

Minister, which was leaked and translated, asked why it was:^[15]

...that Vestas does not just make changes to the wind turbines so that they make less noise? The simple answer is that at the moment it is simply not possible to do so, and it requires time and resources because presently we are at the forefront of what is technically possible for our large wind turbines, and they are the most efficient of all.

It seems that, in common with the tobacco industry, the wind industry was well aware that its products were inimical to health. The introduction of larger turbines is also problematic because the larger the turbines, the more noise they produce.^[16]

Over half a century ago, Hill wrote^[17] that Public Health should be, "...ever striving for improved environmental quality with the accompanying reduction in disease morbidity and mortality." We still have a long way to go to adequately protect people's health from the impact of wind farm noise, as the authors' findings have so amply demonstrated.

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