Impact Brief: Wind Turbine Noise and Vibration – Scientific Evidence and Community Implications

1. Ground Vibrations and Seismic Radiation

Study: Seismic radiation from wind turbines: observations and analytical modeling of frequency-dependent amplitude decays (2018)

Authors & Qualifications:
- Thomas Zieger – Seismologist, Federal Institute for Geosciences and Natural Resources (BGR), Germany.
- Wolfgang Stammler – Senior Seismologist, BGR, seismic monitoring networks.
- Lothar Ceranna, PhD – Head of Seismology Group, BGR; expert in seismic signal analysis and infrasound.

Findings:
- Wind turbines produce distinct seismic signals between 1–8 Hz.
- Low-frequency waves (1–2 Hz) travel several kilometres, detectable beyond 4 km.
- Higher frequencies decay quickly, but multiple turbines can interfere and amplify ground shaking.
- Vibrations travel further in hard rock than in soft soil.

Key Point: Vibrations persist over long distances and overlap with frequencies affecting homes, livestock, and monitoring systems.

2. Low-Frequency Noise and Annoyance Mechanism

Study: A Methodology for Assessment of Wind Turbine Noise Generation (1982)

Authors & Qualifications:
- Neil D. Kelley, MSc – Principal Scientist, Solar Energy Research Institute; specialist in wind turbine aerodynamics and noise.
- Richard R. Hemphill, MSc – Senior Engineer, expert in wind turbine structural dynamics and acoustics.
- Michael E. McKenna, BEng – Research Engineer, Solar Energy Research Institute; turbine design and performance testing.

Findings:
- Field studies of the 2 MW MOD-1 turbine found severe complaints up to 3 km away.
- Residents reported thumping, vibration, rattling objects, and pressure wave sensations.
- Turbine impulses excited house resonances (walls, floors, cavities) and matched human body resonances (5, 12, 17–25 Hz).
- Caused sensations of whole-body vibration indoors, even when outdoor noise was minimal.

Key Point: The main risk is low-frequency impulsive noise coupling with homes and human physiology, not captured by dB(A) standards.

Unified Conclusions

- Turbines emit most energy below 100 Hz, especially in the 1–8 Hz range.
- Vibrations and low-frequency noise can travel and cause annoyance several kilometres away.
- Indoor environments amplify effects due to structural resonance.
- Human and livestock body resonances overlap with turbine frequencies.
- Current noise standards fail to capture these low-frequency and impulsive impacts.

Implications for Rural Landholders

- Families may face sleep disturbance, stress, and vibration-related health issues even at 2–4 km distances.
- Livestock and pets are vulnerable to low-frequency vibration.
- Homes resonate with turbine impulses, worsening indoor exposure.

- Current regulations underestimate risks, leaving communities unprotected.

Plain Takeaway: Evidence from seismology experts (Zieger, Stammler, Ceranna) and engineering acoustics specialists (Kelley, Hemphill, McKenna) demonstrates that wind turbines generate low-frequency vibrations and impulsive noise that travel kilometres, resonate with homes, and overlap with human and animal body frequencies. These impacts explain why rural landholders experience real disturbances, despite turbines meeting regulatory dB(A) limits.