

Characteristics of Sound

Sound is made up of waves of pressure that travel through the atmosphere. These waves have two key attributes, namely pressure and frequency. The nature of a given noise wave will determine how it spreads through the air and in turn how it is perceived by a human ear. The volume of sound is measured in decibels (dB). While the experience of sound is ultimately subjective, an increase of 3 dB is commonly considered to be the smallest change in volume that a human can hear—meaning increases of 1 dB or 2 dB generally go unnoticed—while an increase of 5 dB is commonly considered to result in a sound being clearly noticeable. The experience of sound also depends on the frequency at which it is emitted, with high pitch noises generally experienced at a higher volume than low pitch ones when emitted with the same amount of energy. It is for this reason that sound levels are described in different frequency weightings, with the A-weighted scale (LA dB or dBA) designed to represent how sound is experienced by the human ear.

Sound Emitted by Wind Turbines

Wind turbines emit sound in two different ways:

- Firstly, they emit aerodynamic sound, which is created by the interaction between the turbine blades and the air; and
- Secondly, they emit mechanical sound, which is created by mechanisms within the wind turbine nacelle such as gearboxes and generators.

While the rotor diameter and power output of wind turbines has increased significantly over the previous ten years, advances in technology (such as blade serrations) have resulted in the sound levels emitted by wind turbines remaining generally unchanged or even reducing over the same period.

Background Noise


Background noise, or ambient noise, refers to the baseline in a given location. This baseline is made up of noise emitted by a range of sources other than the wind farm, including traffic, wildlife, farming activities and wind in vegetation. Background noise levels are used to determine applicable noise limits and as part of post-construction noise assessments.

Wind Farm Noise Limits

In Victoria, the allowable noise limits for wind farms are set by the Environment Protection Regulations 2021, which themselves sit under the Environment Protection Act 2017. For new wind farms, the applicable noise limits are taken from New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise. These noise limits apply outside a receiver (e.g. dwelling, camping ground, hotel, etc.) and are summarised in the table below.

New Zealand Standard NZS 6808:2010 – wind farm noise limits	
Noise receiver	Noise limit
Noise receiver outside of the wind farm site	40 dB LA90 or background noise level (LA90) plus 5 dB LA90, whichever is the greater.
Noise receiver on wind farm site	No strict noise limit. Reference level of 45 dB LA90 or background noise level (LA90) plus 5 dB LA90, whichever is the greater.





As you can see in the table above, a base noise limit of either 40 dB L₉₀ or 45 dB L₉₀ applies to wind turbine noise. As such, background noise monitoring is not critical to determine compliance with the relevant noise limits if wind turbine noise is predicted to be below the applicable base noise limit 40 dB L₉₀ or 45 dB L₉₀. However, it should be noted that NZS 6808:2010 recommends that background noise monitoring be undertaken at representative locations if wind turbine noise levels are predicted to be above 35 dB L₉₀ at one or more noise receivers not on the wind farm site.

Wind Farm Noise Predictions

As part of the wind farm planning process proponents must show that, if built, a proposed wind farm will comply with NZS 6808:2010. In order to meet this requirement an independent acoustic consultant must prepare noise predictions for the planning application. These noise predictions are calculated using International Standard ISO 9613-2 Acoustics – Attenuation of Sound During Propagation Outdoors, as well as other guideline documents such as the UK Institute of Acoustics publication A Good Practice Guide to the Assessment and Rating of Wind Turbine Noise. Importantly, these noise predictions are based on a worst-case scenario in which noise receivers are assumed to be downwind of all wind turbines at the same time and all wind turbines are operating at full power. These are conservative assumptions as wind will never blow from all directions at the same time and wind turbines will not always operate at full power. As part of the planning process the noise predictions are made available for public comment during the notice period.

Auditing of Noise Predictions

In Victoria it is a requirement of the planning process that noise predictions are reviewed by an Environmental Auditor appointed under the Environment Protection Act 2017. The purpose of this review is to ensure that the noise predictions have been prepared correctly. The audit report is also made available for public comment during the notice period.

Regulation of Noise Levels During Operation

Once a planning permit has been issued for a wind farm, the wind farm development process enters the construction and operational phases. During these phases the wind farm will undergo a number of compliance tests to ensure that it continues to comply with NZS 6808:2010.

The first of these is preparation of a noise management plan. This plan must set out the noise controls that apply to the wind farm, and how the operator's noise control responsibilities will be fulfilled. This plan must also be audited by an Environmental Auditor appointed under the Environment Protection Act.

The second compliance test takes place at the end of construction. At this point the wind farm operator must engage an independent acoustic consultant to measure the noise levels of the wind farm and confirm that they comply with the relevant noise limits. This testing must be completed in accordance with NZS 6808:2010 and the procedures outlined in the noise management plan, and the results must be submitted to the Environment Protection Authority.

The third ongoing noise compliance activity consists of ongoing testing of the wind farm. This consists of monitoring that takes place every five years for the life of the wind farm. This testing must also be completed in accordance with NZS 6808:2010 and the procedures outlined in the noise management plan, and the results must also be submitted to the Environment Protection Authority.

The fourth and final noise compliance activity consists of the production of annual statements. These statements must document and confirm ongoing compliance with all relevant noise obligations, and must also be submitted to the Environment Protection Authority.