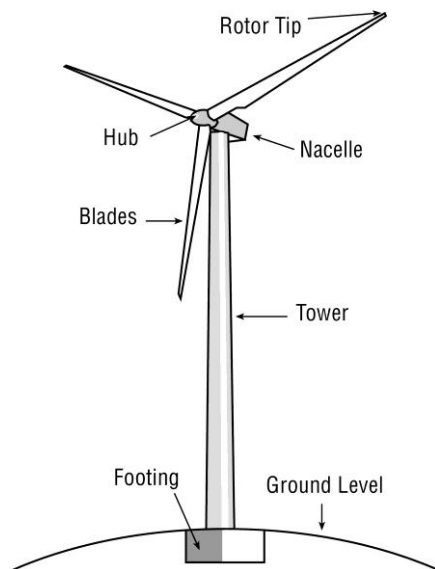


Noise Compliance Information Sheet April 2019

1. What sort of noise is emitted by a wind turbine?

Wind turbines have two potential sources of sound: aerodynamic sound (a turbine blade passing through air) and mechanical sound (such as gearbox or generators inside the nacelle).

Advances in wind turbine technology, manufacturing and blade design have resulted in minimising aerodynamic sound. Sound originating from the gearbox and generator have also been minimised by improvements in sound insulation and isolation materials within the nacelle.



A typical modern wind turbine

2. What is the measurement unit of sound?

A decibel (dB) is the unit used to measure the intensity of a sound. While sensitivity to noise is subjective, a difference of 3dB is considered just perceptible and 5db is clearly noticeable.

The loudness of sound also depends on the frequency it is emitted.

A-weighted decibels (dBA) is the measurement used to indicate how loud a sound is to the human ear, regardless of its frequency.

The table below provides an indication of common situations and the sound level.

Noise source	Sound Level (dBA)
Quiet bedroom	20-25
Rural night-time background	20-40
Typical wind farm (at moderate wind speed of 7m/s)*	35-45
Car at 64km/h at 100m	55
Busy general office	60
Pneumatic drill at 15m	95
Jet aircraft at 50m	105
Threshold of pain	130

* Based on sound level measurements taken from multiple resident locations near two Victorian wind farms, at distances of 500-1,000m from the nearest turbine.

Source: Victorian Department of Health (2013) *Wind farms, sound and health: Technical information*

3. What are the noise regulations for the Mortlake South Wind Farm?

The planning permit for the Mortlake South Wind Farm was issued by the Minister of Planning in 2010 and amended in 2017. Approval of the wind farm establishes that it satisfies relevant state and local planning policies and will not have any significant noise impacts on the local community.

The planning permit states that noise levels from a wind farm at a residential site must not exceed the background noise level by more than 5 decibels (dBA) or a level of 40dBA; whichever is greater.

The wind farm must also comply with the *New Zealand Standard NZS6808:2010 – Acoustics – Wind farm noise* which establishes how noise should be measured. Background noise levels are linked to wind speed at the turbine hub height. A regression curve based on this relationship is used to determine the noise restriction criteria.

The Mortlake South Wind Farm planning permit requires noise criteria and compliance to be determined separately for 24 hour and night time (10pm to 7am) periods, using the methods prescribed by NZS6808:2010.

4. How has ACCIONA designed the wind farm to comply with NZS6808:2010?

To demonstrate that the Mortlake South Wind Farm will comply with the requirements of NZS6808:2010, ACCIONA engaged an expert acoustic engineer to model the noise that will be produced by the wind farm. NZS6808:2010 prescribes the method to be used to predict noise impacts from wind turbines.

Noise emission data provided by the Turbine Manufacturer is incorporated into noise modelling software by a specialist acoustic engineer. The software takes into account a variety of information, including:

- Noise emission data provided by the turbine manufacturer;
- The location of turbines;
- The location of nearby dwellings; and
- The surrounding terrain.

The model makes assumptions that all turbines are operating at full power and that all receptors are downwind of the turbines. These assumptions make the modelling relatively conservative as, in practice, wind turbines are not always operating and wind is not always blowing towards specific residences.

ACCIONA has designed the wind farm so that no receptor will exceed 40dBA as a result of the wind farm.

This noise modelling has been peer reviewed by an independent third party acoustic engineer to confirm compliance with NZS6808:2010 and has been approved by the Minister for Planning.

The predictive noise modelling has been used to determine where background noise monitoring was undertaken and where post-construction noise measurements will be undertaken.

5. How is Noise Monitored?

Noise is monitored by a laboratory calibrated Class 1 environmental noise logger, configured to measure in terms of 10-minute noise levels, concurrent with wind speed measurements.

The microphone of each noise logger is positioned by an acoustic engineer in an appropriate location to record background noise levels. This typically includes locating microphones between 1.2 and 1.5 metres above the ground and at least five metres from any significant reflecting surface or vegetation, where possible.



Typical noise logger unit

All equipment is certified by a National Association of Testing Authorities (NATA) accredited laboratory to ensure it is fit for purpose.

Data from the noise loggers is then paired with wind speed data and analysed for extraneous noise sources that would increase environmental noise levels (such as noise from rain, or crickets chirping close to noise loggers), which is removed. Analysis then determines 'all time' and 'night time' noise levels.

6. What is background noise and why is it monitored?

Background noise (or 'ambient noise') refers to noise generated from sources, other than the wind farm noise, that is experienced at nearby residences. This includes typical environmental noises such as, wildlife noises, leaves rustling, road traffic and wind.

As the speed of wind blowing increases, background noise levels typically increase. As such, it is important to understand how background noise in the area surrounding the wind farm relates to various wind speeds. Noise associated with high wind speeds will often mask the noise produced by wind turbines, making the noise of the wind farm less prominent. This is why ACCIONA's Planning Permit requires noise levels from the wind farm at a nearby residence be no more than 5dBA greater than the background noise level, if the background noise is greater than 35dBA.

When background noise is monitored, it is matched with the wind speeds measured by ACCIONA's meteorological monitoring mast. This enables ACCIONA to understand how loud the background noise is, and compare pre-construction noise levels with operational noise levels.

7. How has ACCIONA measured background noise levels?

Background noise monitoring was initially undertaken in 2012. This monitoring was undertaken in accordance with the NZS6808:1998, which was a requirement of the original planning permit.

The Mortlake South Wind Farm permit was amended in 2017. The amended permit requires compliance with NZS6808:2010. NZS6808:2010 remains the most recent version of this noise standard. The 2010 standard includes a number of updates designed to increase the accuracy of both noise modelling and monitoring exercises.

By undertaking new background noise measurements, ACCIONA Energy is seeking to ensure it remains compliant within the relevant noise limits through using more recent background noise data and using current standards and monitoring techniques.

Background noise monitoring was most recently undertaken at fourteen locations between 28 August 2018 and 12 October 2018. The results of the background noise monitoring has undergone a peer review process with an Environmental Auditor appointed under the *Environmental Protection Act 1970*. The background noise monitoring analysis was finalised in March 2019.

The results of the background noise monitoring have been provided to the Minister for Planning, Moyne Shire Council and land owners who participated in the noise monitoring process.

8. How were the pre-construction (background) monitoring sites selected?

Background noise monitoring sites were identified by an independent acoustic engineer as sites representative of groups of residences, where modelled noise levels emanating from the wind farm has been predicted to exceed 35dBA. When there are groups of residences close to each other, the closest residence to the windfarm was typically selected.

9. How are post-construction monitoring sites selected and how will monitoring occur?

ACCIONA's Noise Compliance Testing Plan has been approved by the Minister for Planning. The plan requires, subject to continued landowner consent, that post-construction monitoring occur at all residences where the predicted noise levels as a result of the wind farm exceed 35dBA.

The compliance noise monitoring process will commence shortly after all turbines enter into the operational phase. The process will include two measurement periods, at different times of the year, for at least four weeks per period.

The results will be analysed for compliance, including consideration of the pre-construction background noise levels. The analysis will be peer reviewed by an Environmental Auditor appointed under the *Environmental Protection Act 1970* and submitted to the Minister for Planning and Moyne Shire Council.

In the event noise at nearby residences has been confirmed as exceeding the noise limits of the planning permit, ACCIONA will implement a range of noise reduction strategies to rectify any non-conformances.

10. Need more information?

We invite you to contact ACCIONA to discuss the wind farm noise if you have further questions.

Please call (free call) 1800 283 550 or email mortlake@acciona.com.