Wind farm Noise and vibration issues

There have been many reports of adverse health effects suffered by people living in the vicinity of wind farms. Severe and chronic sleep disturbance (and associated fatigue, loss of concentration, irritability and memory problems have been well documented (Pierpont, 2009 is just one example) as have instances of increases in people's blood pressure and cortisol levels. Wind farm proponents almost universally dismiss studies such as Pierpont''s as being un-scientific, while conveniently ignoring the fact that many people in the vicinity of wind turbines have been forced to leave their homes as they could not put up with the symptoms they were suffering. Other people have reported that they leave their houses at night and sleep in their cars, which they can drive to locations away from the influence of wind turbines.

I believe that there should be a moratorium on new wind farm developments until a proper "scientific" study has been undertaken that does the following:

(a) monitors over an extended period of two to three months (preferably in summer), levels of infrasound and audible sound for a range of different wind conditions with particular attention paid to the times when there is little or no wind in the vicinity of residences while at the same time there is sufficient wind on the ridge tops for the wind turbines to operate. Sound levels should be monitored inside affected residences as well as outside. These sets of data can be used to verify and update existing wind farm noise level prediction models.

(b) Measurements in (a) above should also be done at the same time in rural communities not yet subjected to the influence of wind farm noise,

(b) implements a detailed laboratory study of a range of test subjects exposed to recorded wind farm noise for varying periods of time, including monitoring of blood pressure and cortisol levels.

I also believe that existing wind farm guidelines such as the SA 2009 "EPA Wind farms environmental noise guidelines" should be reviewed on a regular basis by a committee that is independent of the wind farm industry and includes medical personnel as well as acoustics experts.

Some of the problems in measuring and predicting wind farm noise are described in the following paragraphs.

Noise generated by wind farms at nearby and not so close residences is very difficult to assess accurately due to the large variability in wind strength and direction at residential locations as well as at turbine locations. There is also a large variability in the difference in wind speed and direction between residential locations as well as turbine locations. As noise levels generated at residences by wind turbines are strongly dependent on atmospheric temperature profiles as well as wind speed profiles, there is consequentially a large variability in noise levels measured at residences for any given wind speed at the turbines.

When the wind speed at residential locations is very low or nil it is still common for there to be sufficient wind at hill top level to drive the wind turbines. In these conditions, background noise levels at residences will often be very low as there is none of the noise present that is usually associated with local winds. Thus the turbine noise is likely to be very intrusive and

annoying for residences a few kilometres away from the turbines as well as for residences near to the turbines. The level of wind turbine noise measured at residences is also likely to be louder when there is an atmospheric temperature inversion condition, which often happens in summer in the early hours of the morning and when the wind is blowing from the wind farm towards the residences (downwind condition). In such conditions, it is likely that a wind farm could be heard up to 10 km away and a number of residents in the mid-north of SA can confirm this.

To date, compliance noise measurements for wind turbines have not been linked to wind speeds at the site of the noise measurements. Instead, they have been referenced to wind speeds at either a meteorological mast 10 m above the ground and near to the wind turbines or to the wind speed measured at a reference turbine nacelle. Any noise measurements will include background noise due to the wind at the measurement location as well as turbine noise. So far no serious attempt has been made to separate these two contributions, so it is not possible to definitively determine whether a particular wind farm complies with the noise levels that were specified and predicted during the planning stages.

In determining compliance levels, the higher of two criteria is used. The first criterion is a baseline criterion, which is usually highest at low wind speeds at the turbine nacelle. The second criterion is 5 dB above the average background noise measured prior to installation of the wind farm or when the turbines are not in operation. This criterion is determined as a function of wind speed at a meteorological mast 30 m above the ground in the vicinity of the wind turbines. As may be expected, the 10-minute averaged background noise levels measured at residences as a function of wind speed at the top of the meteorological mast have a huge variation of more than 30 dB(A) at the residences, where the wind may be completely uncorrelated with what the wind is doing at the wind measurement location. This means that for any given measured wind speed at the mast, the noise level for a 10-minute average can be 30 dB(A) quieter than another 10-minute average. To determine the background noise level that acts as the basis for the second criterion mentioned above, 2,000 or so data points (each representing a 10 minute average A-weighted noise level dB(A)) are plotted as a function of wind speed at the meteorological mast and a line of best fit through the data is specified as the background noise criterion. It is well known that provided an intrusive noise is less than 5 dB(A) above the existing background noise, almost all people will find it acceptable, which is the basis of the second criterion. However, this conclusion is no longer valid if applied to an average background noise level, if there are many relatively long periods (10 minutes or more) when the background noise is well below the average.

Another difficulty is that the noise measured at any particular residential location near a wind farm can be affected by up to ten or 12 turbines, so the allowable set back distance from the nearest turbine should be a function of the number of turbines that contribute to the noise at the particular location.

All wind farms currently require noise level predictions to be made, using generally accepted noise models, prior to gaining construction approval. The noise predictions are based on sound power data provided by the turbine manufacturers and the accuracy of the measured data as well as whether the measurement procedure actually measures the true sound power has not been independently verified. In addition, the noise models do not account for the lack of atmospheric and ground absorption of low frequency tonal sound when there are temperature inversions or downwind conditions present. This means that it is possible for there to be some locations where the sound will constructively reinforce resulting in low

frequency sound (or infrasound) being much louder than expected. Given the difficulty in determining compliance noise levels due to the turbine alone, there is scope for any inaccuracies in noise level predictions to remain unsubstantiated.

Other factors that will result in some variation in the difference between measured and predicted data include the variability in wind strength and direction profiles over the area of the wind farm and the generally accepted standard that downwind propagation conditions are defined over a relatively wide band of wind direction (± 45º from the direct downwind condition).

Another issue that has not to date been adequately addressed is the long term monitoring of infrasound. The frequency of this noise is below the range of capability of the normal human hearing mechanism, but infrasound can still be detected by people, if it is sufficiently loud, in other ways. People in the past have made spot measurements of infrasound and conclude that it is not a problem as it is below the threshold of human detection. However, there are two problems with this conclusion: first, the measurements have not been done and reported for sufficiently long periods to draw any conclusions and second, there is a significant proportion of the population who are much more sensitive to infrasound than others and they exhibit a number of medical symptoms when exposed to even relatively low levels. Before any conclusions can be drawn as to what infrasound levels exist, it is necessary to undertake long term monitoring of infrasound in rural locations both near and well removed from wind farms. Then a proper laboratory study of medical symptoms needs to be done on a cross section of the population exposed to recorded wind farm infrasound and wind farm total noise at levels that are experienced in rural communities adjacent to wind farms.

This submission is from a university professor who has been teaching, researching and consulting in acoustics, noise control and vibration for more than 30 years.