Technical note

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AMENDMENT FOR WIND FARMS ENVIRONMENTAL NOISE GUIDELINES

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At present, South Australia has a number of proposals to establish new wind farms. The State Strategic Plan encourages the use of renewable energy sources and highlights the need for the development of regulations and guidelines preventing the excessive exposure to noise sensitive areas.

It is important to promote wind farm development using contemporary assessment approaches to preserve the environmental and human well-being. The South Australian Environment Protection Authority (SA EPA) Environmental Noise Guidelines (the Guidelines) aim to assist developers, planning and governmental authorities and the general community to evaluate the noise impact from wind farms. The Guidelines were originally published in February 2003 with the intention to review them in the near future. During 2005 and 2006, preliminary compliance research and two rounds of public consultation were carried out. Responses to the consultation were received from the public, the wind farm industry and acoustic consultants. The preliminary research identified that further investigations regarding compliance checking methodology were required. As a result of the findings and consultation responses, the Guidelines were replaced in December 2007 by Interim Guidelines. The 2007 Interim Guidelines did not contain a compliance checking procedure. Other jurisdictions also intend to issue or to update regulation related to wind farm noise. Working groups have presented a draft Australian Standard and an update of the existing New Zealand Standard NZS 6808 for noise from wind turbine generators [1,2].

As there is no widely accepted regulation with respect to environmental impact imposed by wind farm operation, there are still controversial issues that should be addressed. Concerns expressed by the industry centred on whether the existing compliance methodologies could provide an adequate measure of the true contribution of wind turbine noise emissions against other sources (natural background, farming activities etc). Our recent investigations aim to address this issue.

Contemporary scientific methods and instrumentation can find a way to separate the contribution of a wind farm and other sources. However, a method or procedure included as a part of a statute should meet certain requirements. Preferably, the methods should not require employment of complex measurement techniques, special instruments or advanced post-processing of data.

Our research centred on:

- analysis of international practice for predicting and monitoring wind farm noise;
- noise criteria to estimate the noise exposure;
- peculiarities of the data post-processing for the background noise measurements and compliance checking procedures;
- comparison of the predicted noise levels with results of the case studies; and
- alternative methods for compliance checking procedure.

Our investigation suggests that the conventional correction for background technique [5,8] may be used in cases where the previously measured background data are still valid. Frequently, background monitoring is performed before the wind farm construction. Compliance checking measurements might follow a few years later. Validity of the background noise monitoring becomes very important under these circumstances. In this case, other methods can be considered as an alternative.

The correction for the reported sound power method can be used as an alternative procedure if acquisition of valid background noise levels cannot be arranged. Calculation of the wind farm noise is also possible by correction for the reference point sound pressure level (SPL) method. Implementation of the latest method requires a few conditions to be met, otherwise accuracy of the correction for the reference point SPL is doubtful. For example, Figure 1 shows an increase of the wind turbine generator (WTG) SPL over 20dBA if the wind speed varies from the cut-in speed to 12m/s. It is scarcely possible if the reported sound power varies less than 10dBA at the same time. Most likely that the reference point measurements are significantly affected by the operation of other WTGs, local topography and extraneous noise sources. Two other methods generally demonstrate good agreement with results of the case studies.

During our recent noise monitoring program, a BarnOwl directional monitor was used in addition to noise loggers and wind monitoring stations as a reference instrument since it allows the detection of noise contribution from particular directions with an angle resolution of 5º [3]. Comparison of data measured by the directional noise monitor and the calculated contribution (by different methods) from the wind farm demonstrates reasonable compliance with the correction for the reported sound power method (see Figure 2).

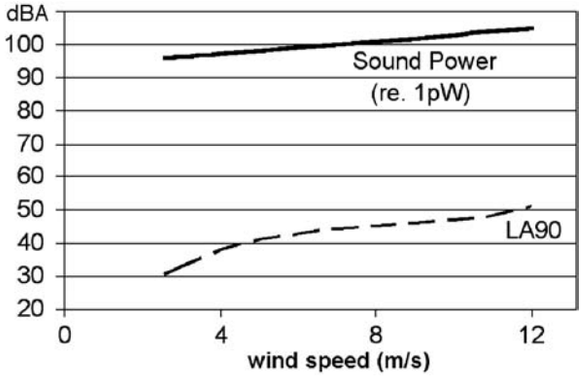

Figure 1 LA90 measurements and reported sound power level at 125m from WTG tower versus wind speed at 10 m height.

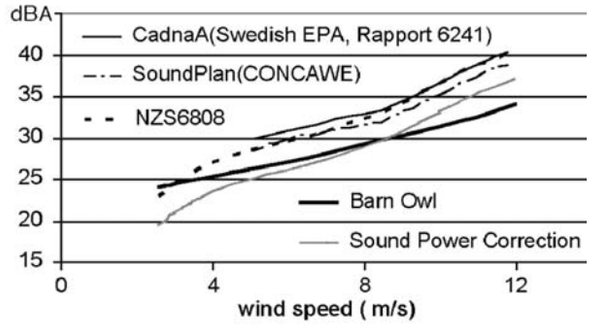

Figure 2 Comparison of wind farm noise measured by the directional monitor and calculated by different methods (versus wind speed at 10m height).

Details of investigations pertaining to the wind farm noise can be found elsewhere [6].

Noise modelling software can incorporate different algorithms to predict wind farm noise. Generally WTGs are represented as elevated point sources. Some researchers state that the ISO9613-2 procedure produces very accurate results for predicting noise impact from the wind farm. However, none of the algorithms can reproduce the pecularities of the noise emission in the source zone. For example, our recent investigations and other research show that the attenuation rate in close proximity to a wind farm can be 2~4dB/doubling of distance [4,7]. None of the commercially available noise prediction software, which utilises the point source representation of a WTG, can reproduce this effect. Generally, the software accuracy for the noise impact from wind farms is unsatisfactory. In practice, a descrepancy up to 10dBA between predicted results and in situ measurements, is not rare. The inability of conventional calculations to reproduce pecularities of wind farm noise immission is due to the fundamental problem of the generator being represented as a point source. This problem should be addressed by the introduction of a more sophisticated model, however, the complications of implementing and applying such a model may be an issue [4,7].

Results of the research are incorporated in the *Draft Wind Farms: Environmental Noise Guidelines*, which are available at www.epa.sa.gov.au/pdfs/. Publication of the final edition is expected soon.

ACKNOWLEDGMENTS

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