Coopers Gap
Presentation on Noise

Rhys Brown

16 August, 2012

AECOM

Previous CCC Meeting

- Described the progress of the acoustic assessment to date
- Presented information on the changes in the Draft Updated Acoustic Report
- Question and discussion session
- Information available on CCC website

Purpose of this presentation is to address some of the questions raised at the previous meeting

Agenda – based on previous CCC meeting

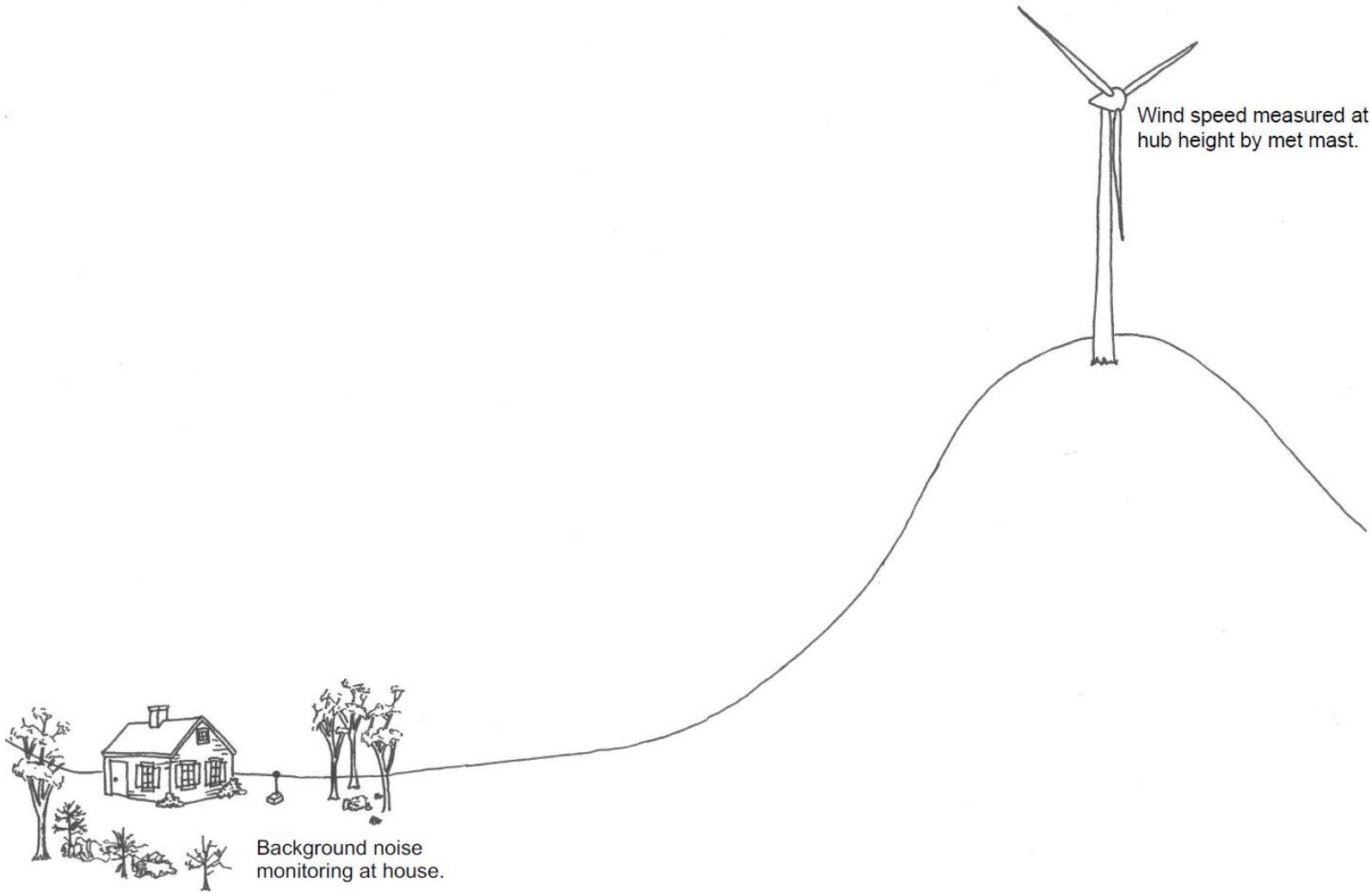
- Discuss background noise logging
- Describe the noise prediction/modelling process
- Provide information on compliance monitoring
- Occupational noise
- Turbine noise data and CID approval
- Façade attenuation
- Questions and Discussion

Background noise logging

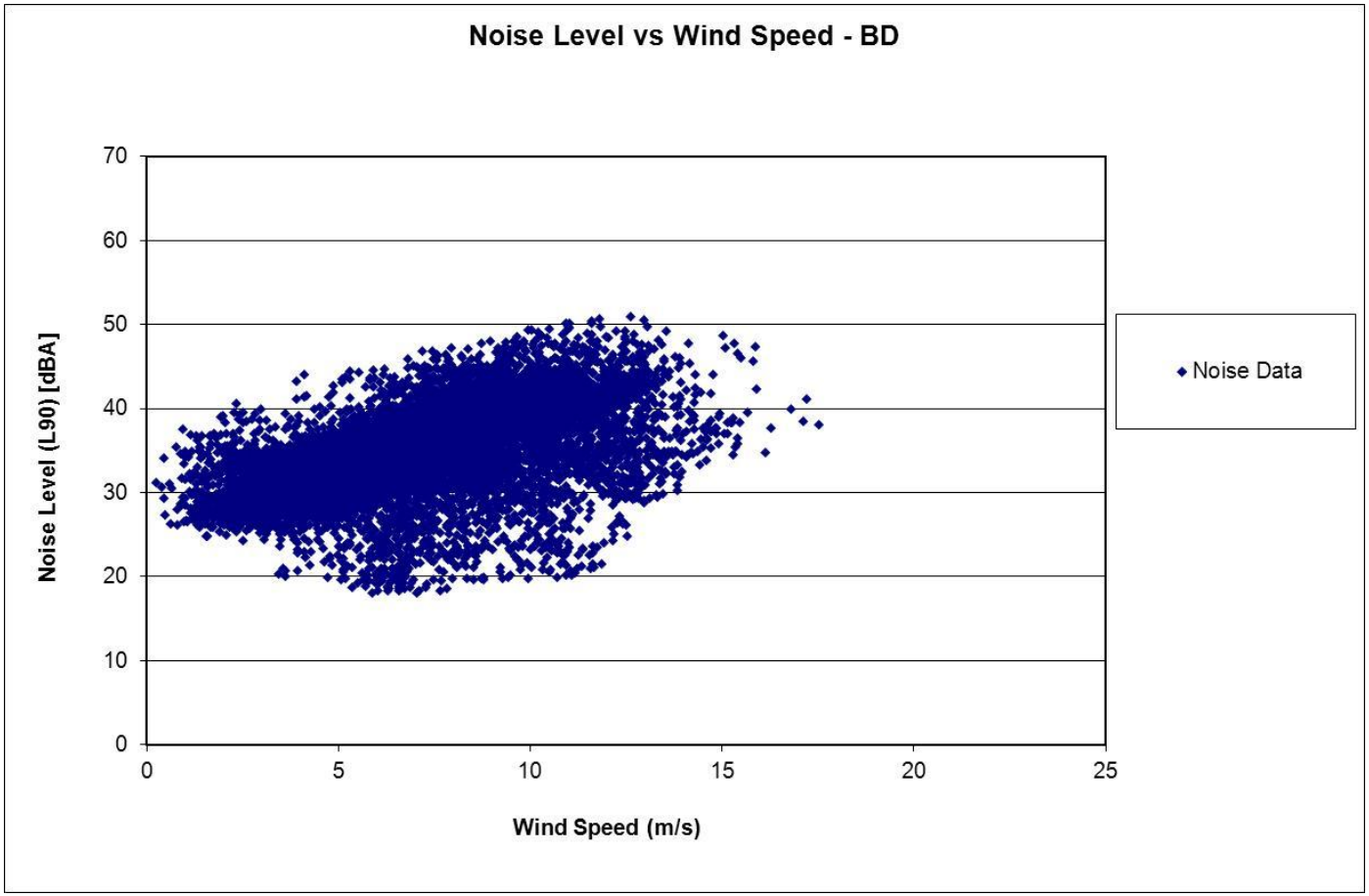
- Background noise logging has been undertaken at 12 houses adjacent the site

- Logging is undertaken to quantify the background noise level related to the hub height wind speed, as the hub height wind speed dictates the noise emission of any future wind turbines

Background noise logging

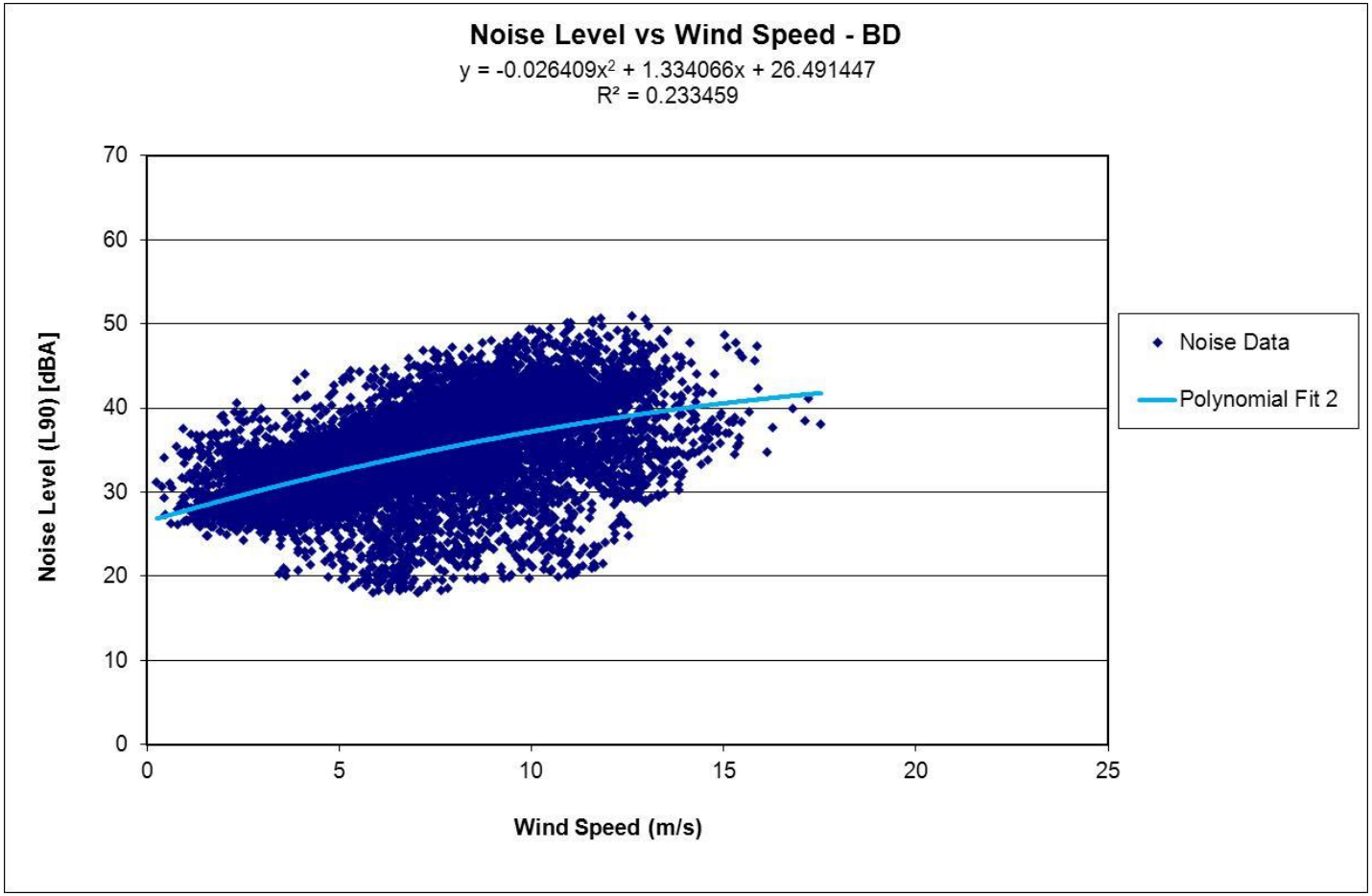


Background noise logging – typical location



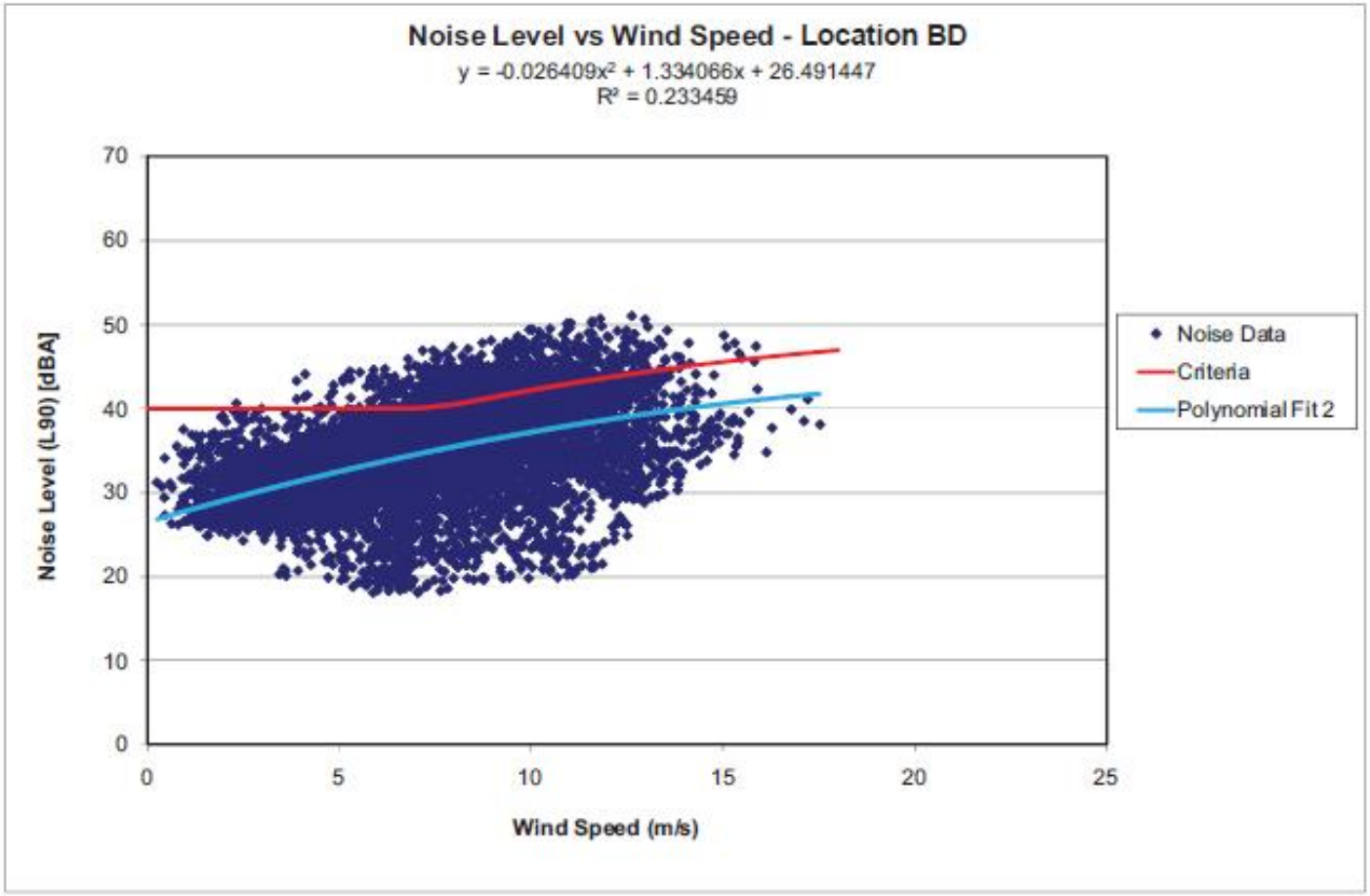
Example of a typical background noise logging location at Coopers Gap

Background noise logging – typical location



Example of a typical background noise logging location at Coopers Gap

Background noise logging – typical location



Example of a typical background noise logging location at Coopers Gap

Noise predictions/modelling

- Undertaken to determine if the proposed wind farm layout can be constructed and comply with noise criteria

- Undertaken to inform the Community Infrastructure Designation (CID) corridor that forms part of the proposed project

Noise modelling process

- Described in Section 4.1 of the Draft Updated Acoustic Report
- Is undertaken using a computer modelling package which is the most commonly used modelling package in Australia across all industries
- Is based on a number of inputs and assumptions
- The modelling is conservative as the following effects which can reduce noise levels are not considered:
  - Shielding from buildings
  - Reduction due to dense foliage
  - Meteorological conditions other than the worst case
  - Wind directions other than the worst case

Noise modelling inputs

Input	Source
Topography	Ground contours generated by a laser survey (1 metre resolution)
Noise source data	Vestas V112 Datasheet
Source location (turbines)	Developed as the project has progressed, currently 'Revision AA'
Receiver location (houses)	Aerial photograph and cadastral data overlaid on the ground contours
Modelling methodology	See slide over

Noise modelling process

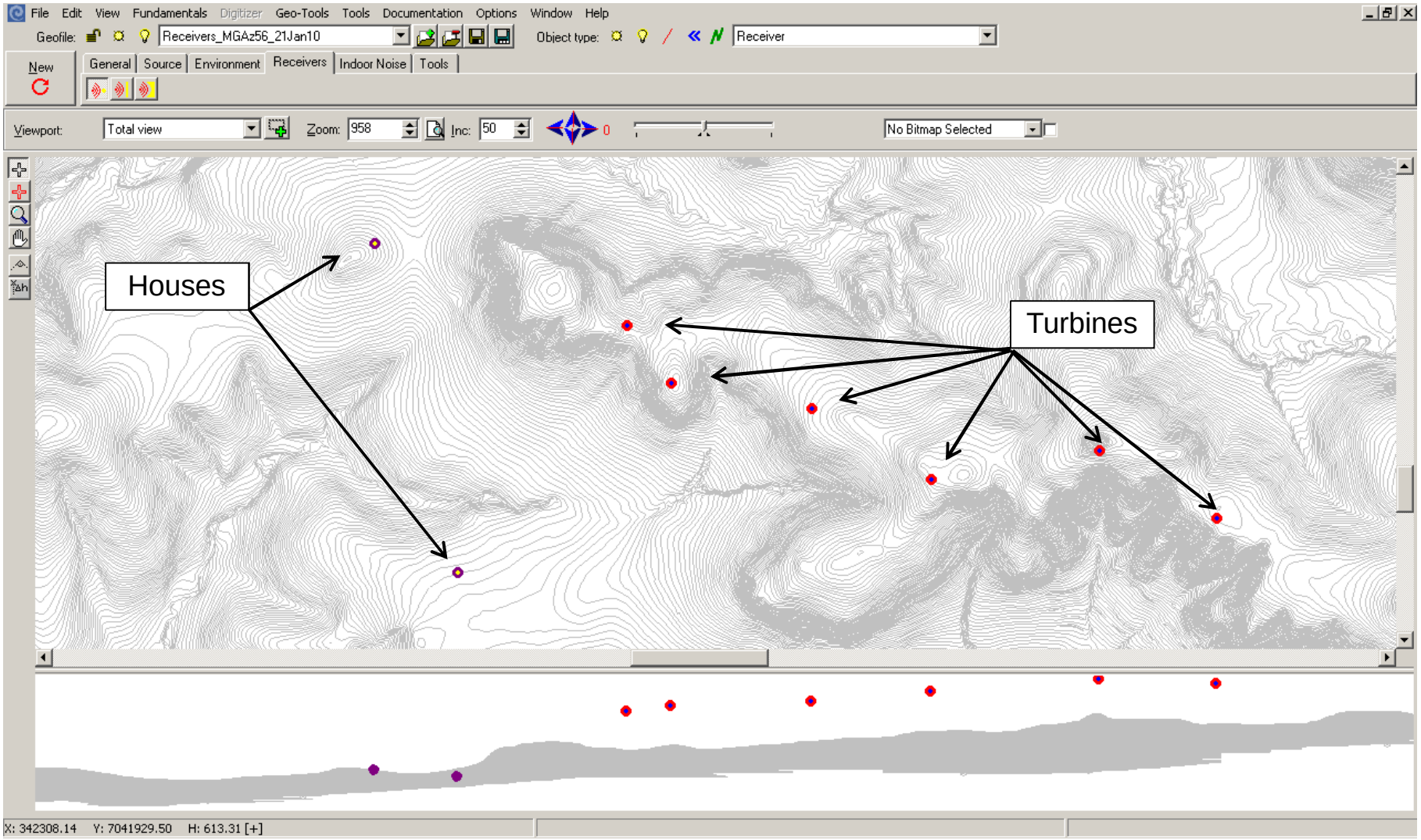
- The noise modelling methodology used was chosen by AECOM as it has been shown to be generally conservative compared to other methodologies

- Commonly used in the industry for the assessment of wind farms in Australia

- AECOM wrote a technical paper which compared four modelling methodologies (including the one used for Coopers Gap) against measured wind farm noise levels, The paper found that the method used for Coopers Gap generally forecast higher noise levels than the noise levels measured from the wind farm

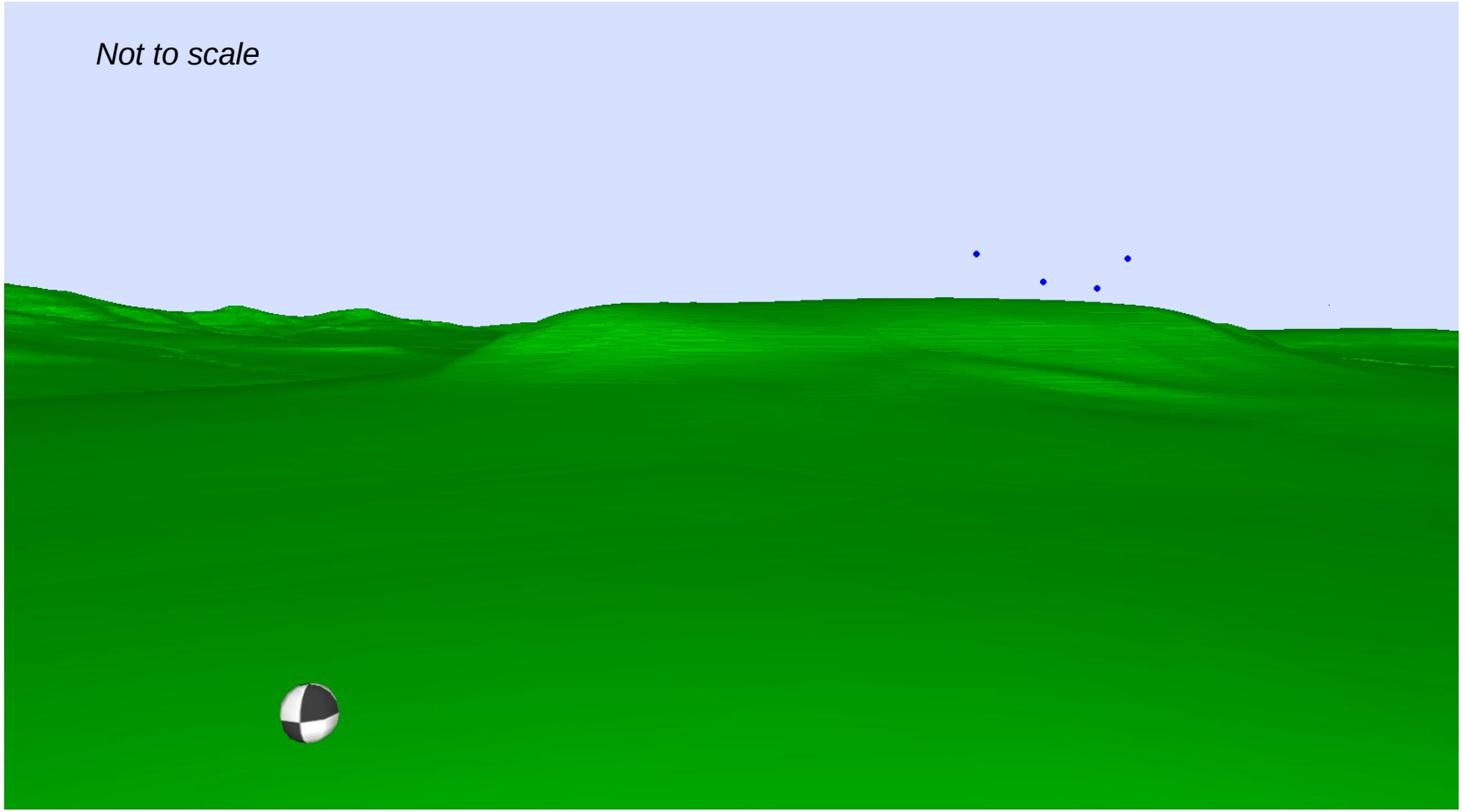
REF: Evans, T and Cooper, J “Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms” Paper Number 30, Proceedings of Acoustics 2011.

Noise modelling process



Noise modelling process

- Blue = turbine hub height, Black and White ball = house

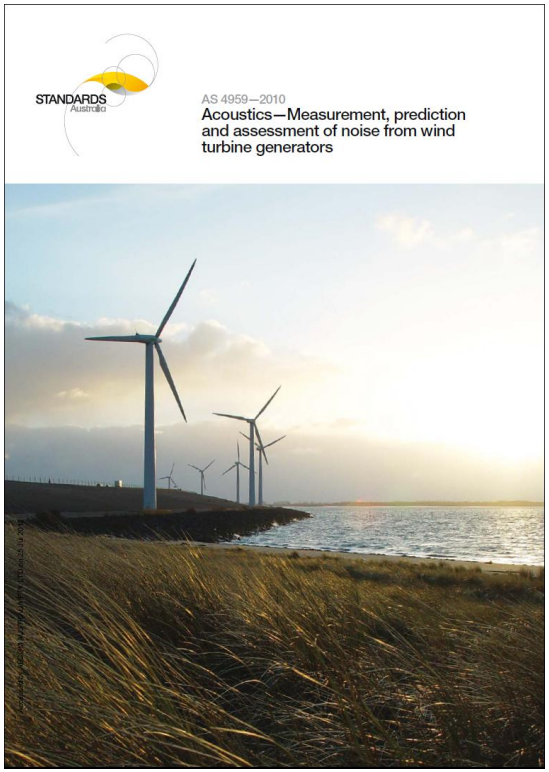


Compliance Monitoring – once wind farm is operating

- Once the wind farm is operational, it must comply with its operating conditions as issued by the regulatory authority
- Compliance monitoring determines if a constructed wind farm is operating in accordance with its operating conditions
- When the wind farm is operating, compliance is determined on the basis of the actual measured wind farm noise levels (not computer modeled levels)

Compliance Monitoring – once wind farm is operating

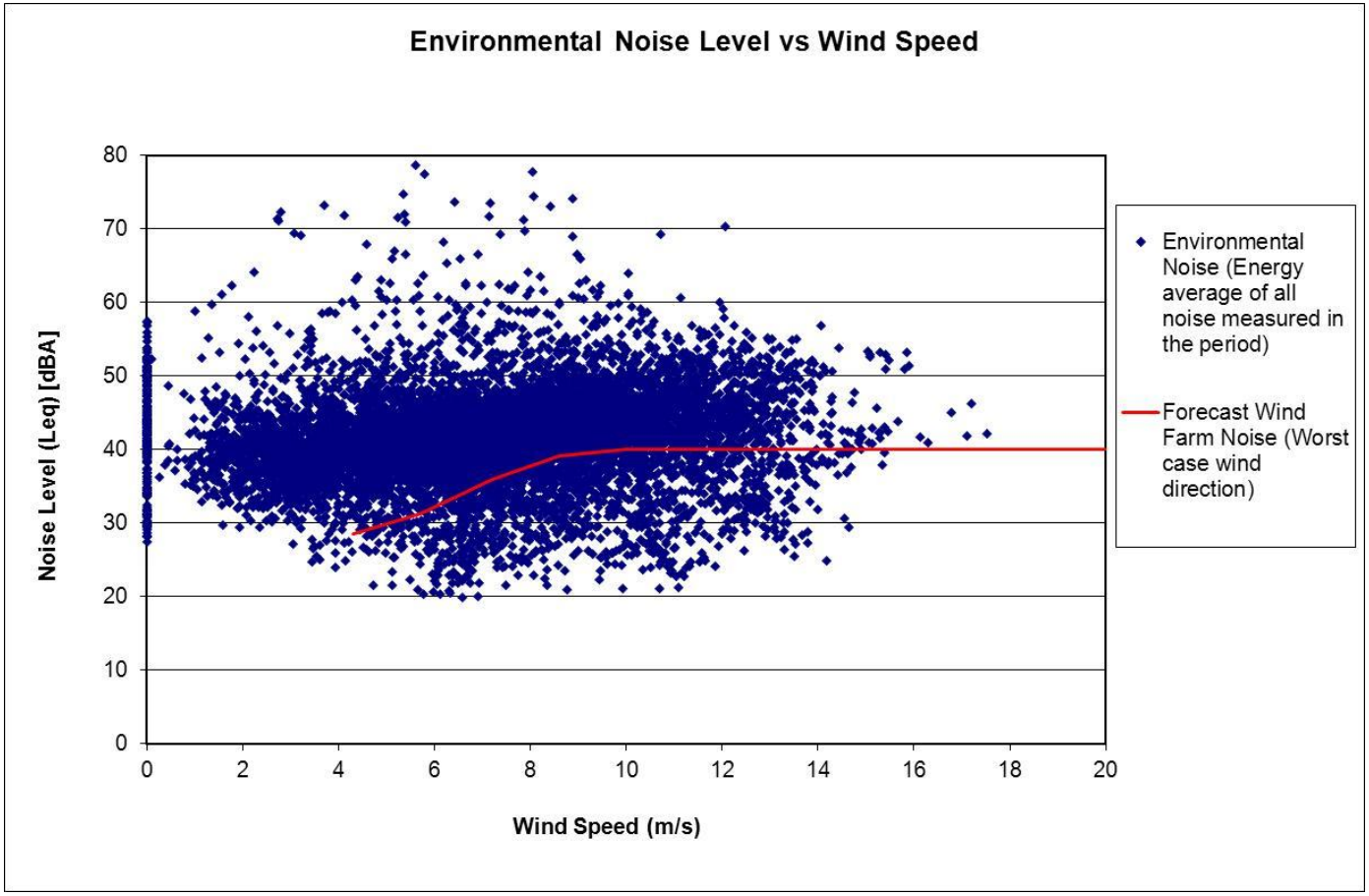
- Compliance monitoring procedures are described in:
  - SA2009 guidelines
  - Australian Standard AS4959-2010 *Acoustics – Measurement, prediction and assessment of noise from wind turbine generators.*



- It is common for compliance monitoring to be undertaken in the same or similar locations to background logging locations

Compliance Monitoring – once wind farm is operating

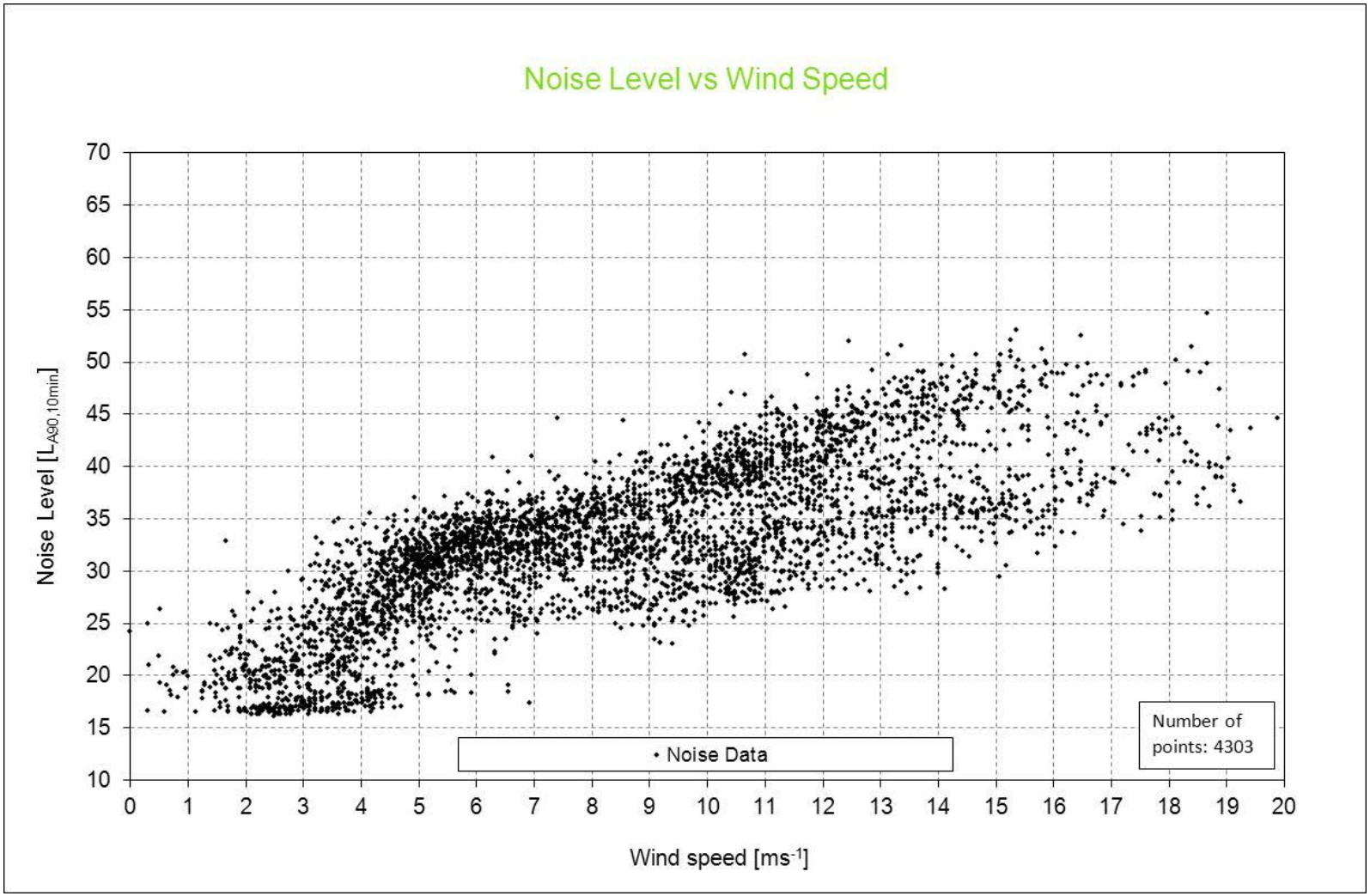
- Noise monitoring undertaken after a wind farm is constructed will capture a combination of wind farm noise and background noise



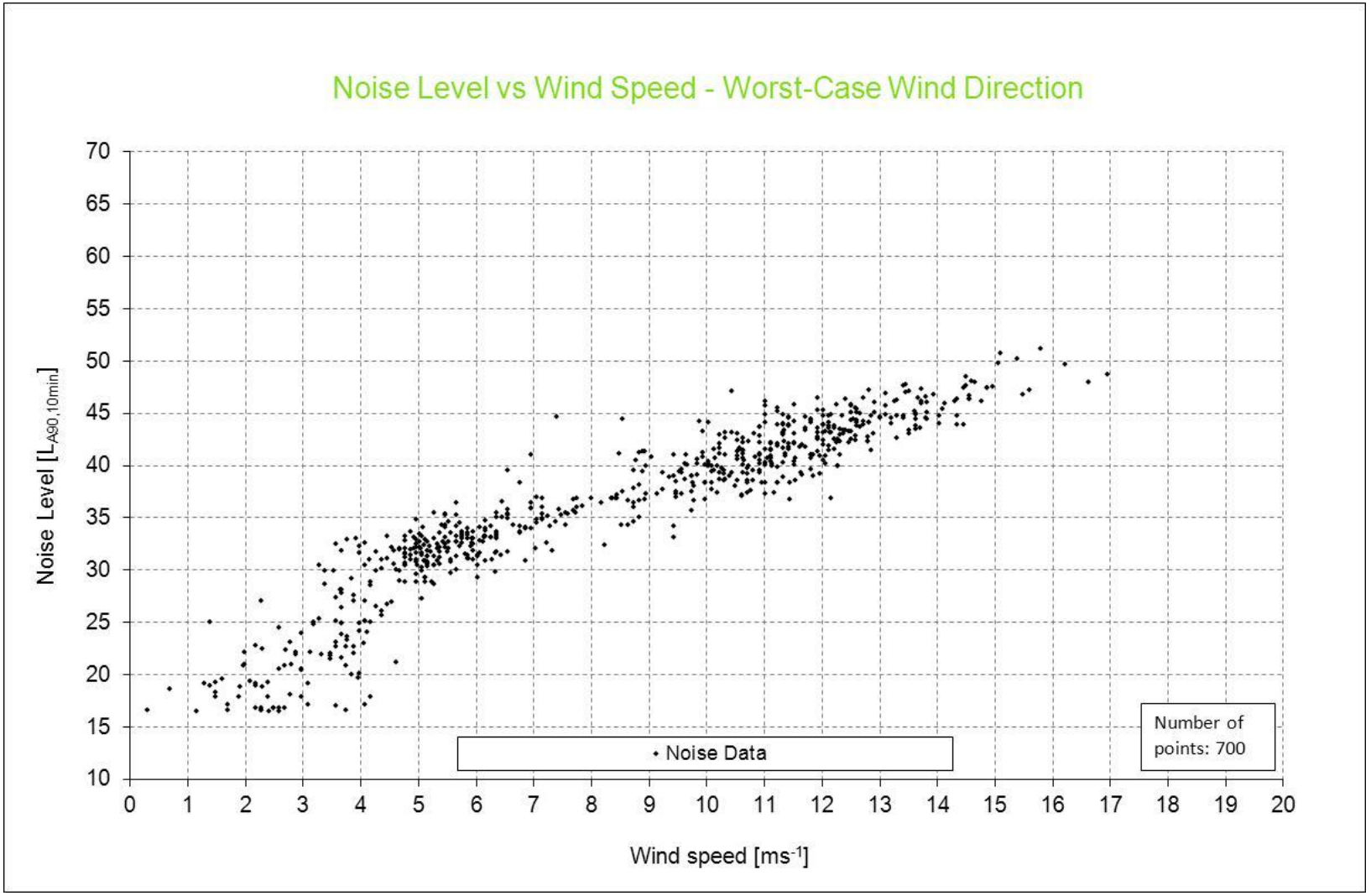
Compliance monitoring calculation procedure

- A minimum number of 500 10-minute data points in the worst case wind direction is required (nearest turbine to house)
- Compliance analysis is conservative in that anything that is not in the worst case wind direction is not included in the analysis
- Regression (averaging) is then undertaken on this dataset
- The regression analysis does not average periods of low wind speed with periods of high wind speed

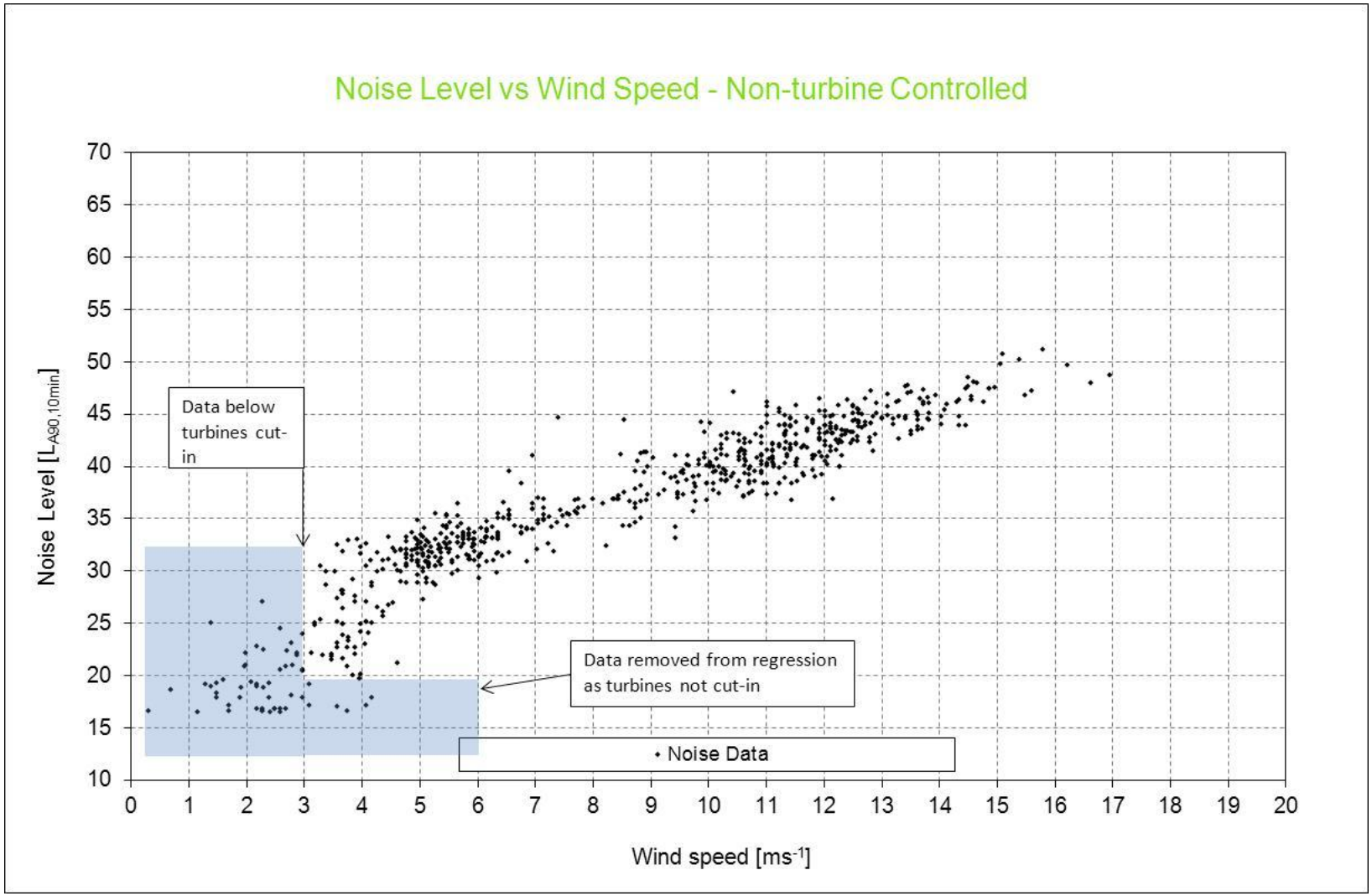
Compliance monitoring calculation procedure



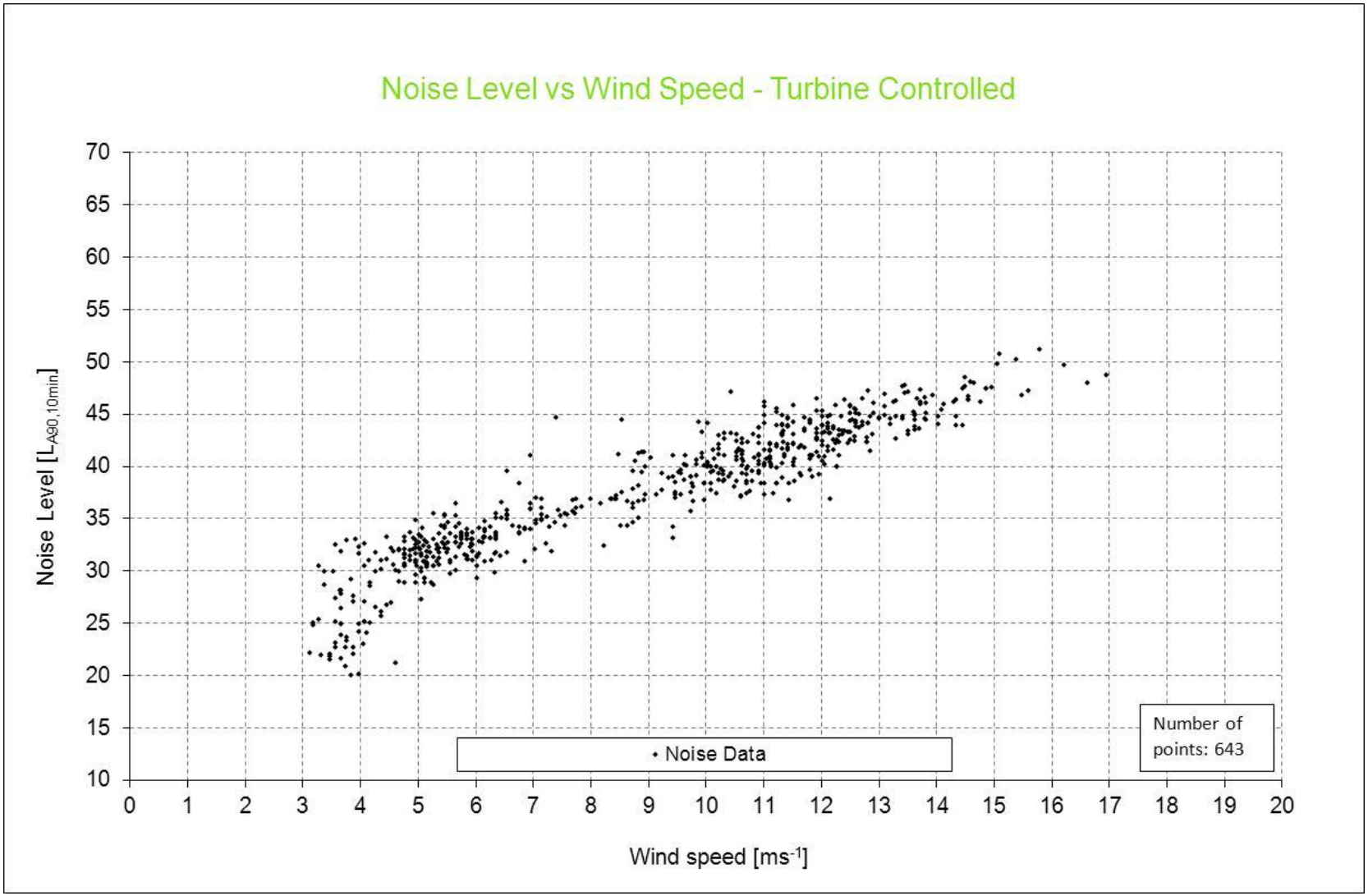
Compliance monitoring calculation procedure



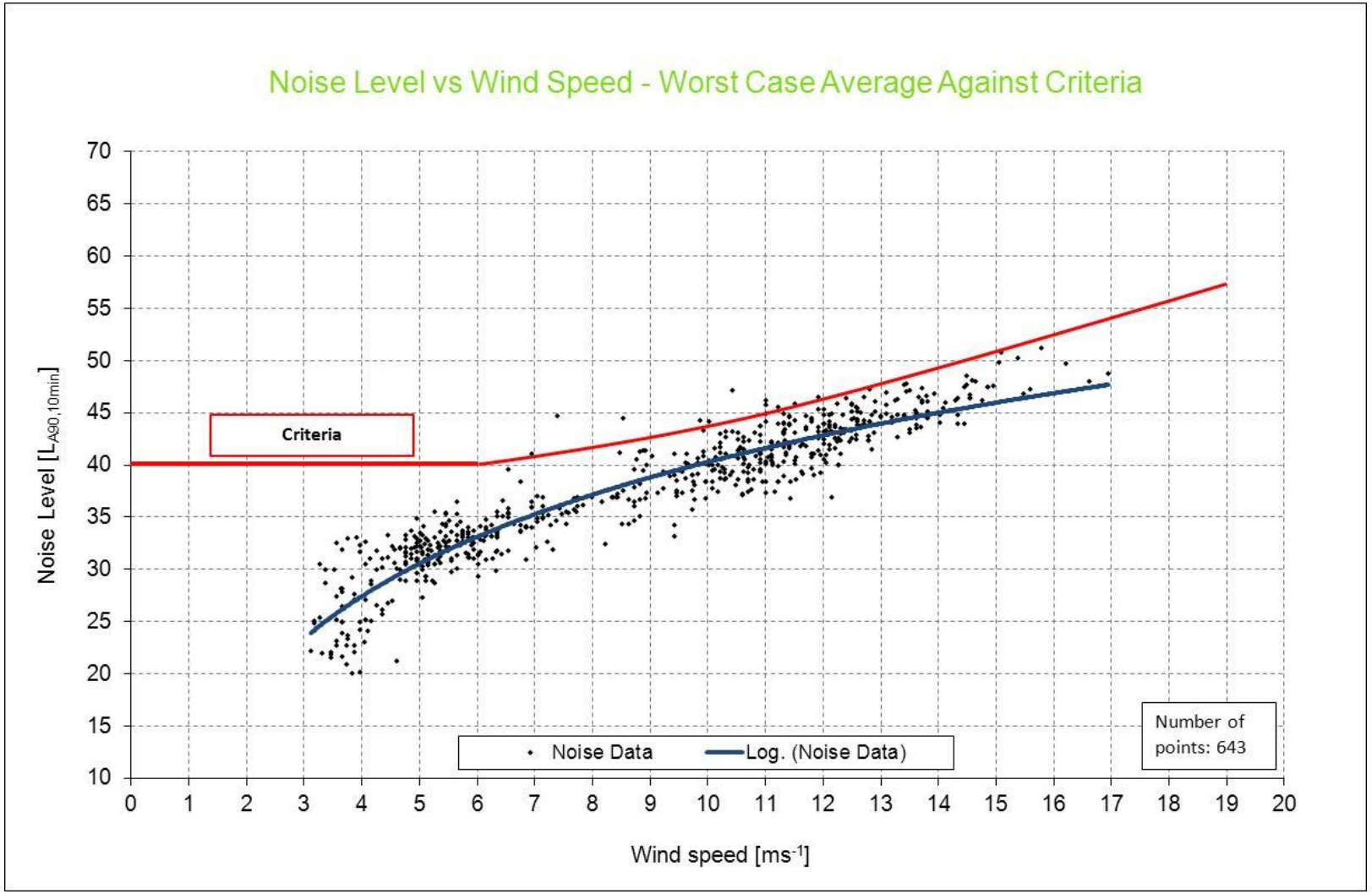
Compliance monitoring calculation procedure



Compliance monitoring calculation procedure

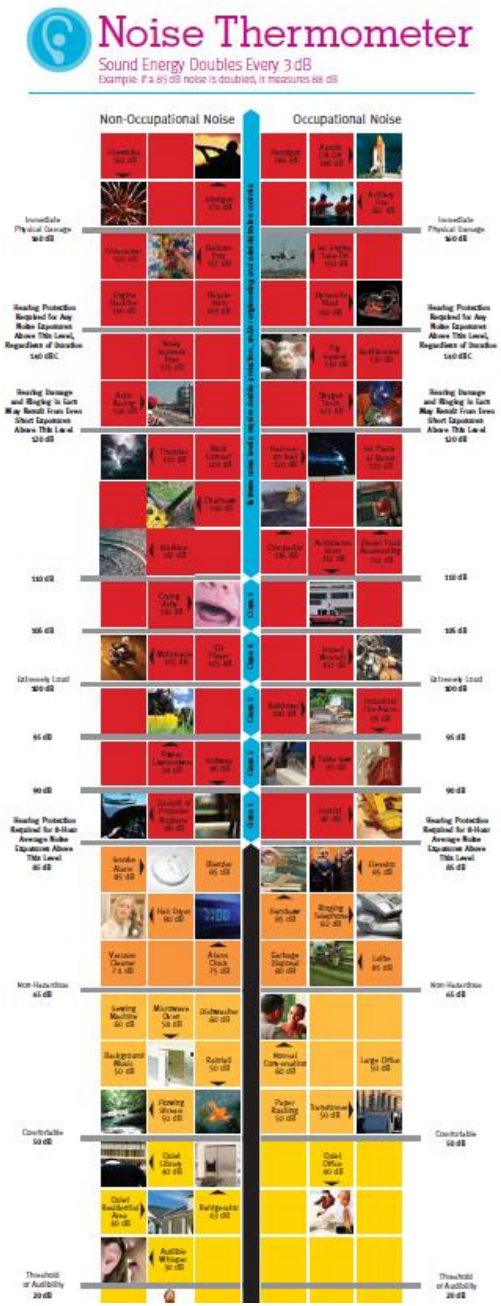


Compliance monitoring calculation procedure



Occupational Noise

- The *National Standard for Occupational Noise* sets workplace health and safety standards for noise
  - *eight-hour equivalent continuous A-weighted sound pressure level, $L_{Aeq,8h}$, of 85dB(A)*
  - *for peak noise, the national standard is a C-weighted peak sound pressure level, $L_{C,peak}$ of 140dB(C).*



Occupational Noise - Noise thermometer

- At the base of the turbine the noise from a wind turbine is approximately 60 - 65 dB(A).
- L_{Aeq} noise exposure from standing at the base of a turbine for 8 hours continuous is around 20 dB(A) below the exposure limit for occupational health and safety noise.
- At a distance of 150 meters from a V112 turbine the measured noise level was around 55 – 57 dB(A) at high wind speeds

Occupational Health and Safety

- Base of wind turbine 60 – 65 dB(A)
- Wind turbine at 150 meters = 57 dB(A)

Vestas V112 Sound power measurements

- The current turbine layout has been modeled using sound power levels provided in the V112 General Specification

- Since the initial modeling, sound power measurements have been undertaken on a V112 turbine installed in Germany

- The sound power measurements in the report are referenced against 10 meter wind speeds, where the sound power levels in the specification and our model and report are referenced against hub height wind speed

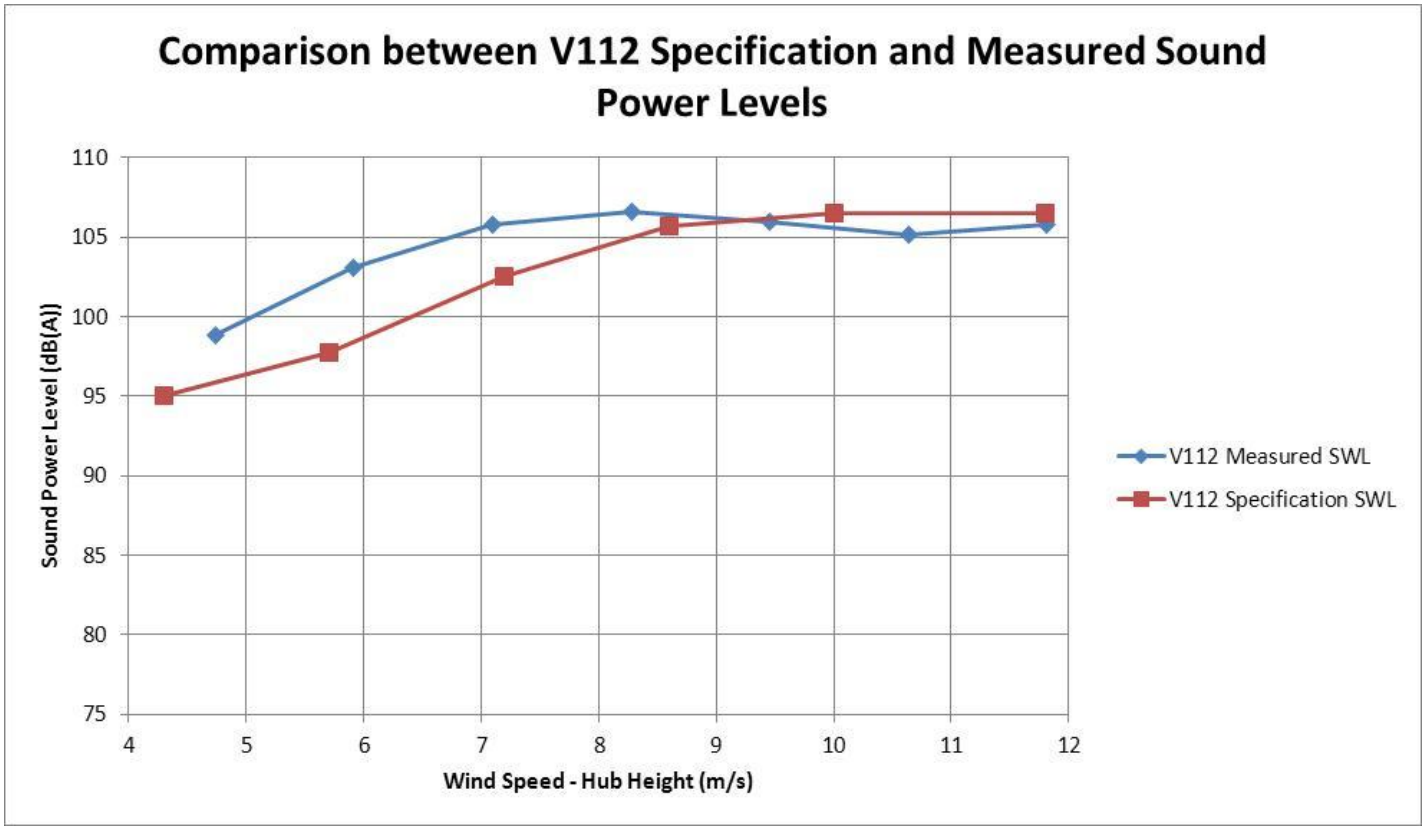
Vestas V112 Sound power measurements

- The V112 turbine has been tested in accordance with IEC 61400-11:2002 “Wind turbine generator systems – Part 11: Acoustic noise measurement techniques”

- This standard requires that measurements are referenced against wind speed at 10 metres off ground, not at hub height

- To compare the results, the wind speed needs to be adjusted using wind shear measurements, which are presented in the sound power measurement report

Vestas V112 Sound power measurements



- It is important to note that the final turbine layout and turbine model and associated sound power level will be remodeled prior to the construction of the wind farm

Noise reduction of a façade with open windows

- Literature review of façade testing showed that the assumption of a 10 dB(A) reduction for an open or partially open window is an appropriate assumption for a majority of dwellings

- Details of the review contained in Appendix I of the Draft Updated Acoustic Report

Next Steps

- As per the last presentation, outcomes of today's CCC discussion will provide feedback on the Draft Updated Acoustic Report
- Report to be finalized to be included in the Revised Assessment Report (RAR)
- Opportunity to provide comment on the Revised Assessment Report will then follow

Questions and discussion

Thank You