IoA Wind Turbine Noise 7

DECC Research Contract

Analysis of How Noise Impacts are Considered in the Determination of Wind Farm Planning Applications

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Project Aim

- To establish current good practice in assessing and rating wind turbine noise.

Project Objectives

- To investigate the way in which noise impacts for a wind farm are determined in England, including methods used in practice to implement the ETSU-R-97 guidance.

- To provide recommendations to Government on ways in which ETSU-R-97 can be applied in a more consistent and effective manner, taking into account best practice.

Supervison

- Representatives of DECC, DEFRA, DCLG

- Peer Reviewers:
  - Dr Andrew Bullmore – Hoare Lee Acoustics
  - Dani Fiumicelli – AECOM
  - Dr Sabine von Hunerbein – Salford University
  - Prof Nicholas Jenkins – Cardiff University

Review Process

- Aim for review sample of 50 applications
- Installed Capacity > 5MW
- Most recent application for any developer for period 2004 – 2009 as per RESTATS
- 61 sites fulfilling criteria
- Include assessments by Hayes McKenzie

Review Process (cont.)

Exclude sites for which, at 1st November 2010:

- Planning consent not determined
- Planning consent refused <12 months previously by LPA or PINS
  - possibility of re-submission
- Planning consent granted <3 months previously
  - possibility of challenge

Review Process (cont.)

- Exclusions to avoid prejudice to live, consented or re-submittable applications.
- Resulted in severely reduced no. of samples available for review by this criteria.
- Also would have resulted in review of non-current assessment procedures in many cases.

Revised Review Process

- Agreed following stakeholder meeting / presentation November 2010.
- Include sites still in planning.
- Excludes sites at Appeal, subject to Challenge or within timescales for either*.
- Next most recent application by developer used where application excluded due to above.
- Resulted in 58 samples fulfilling criteria.

* at time of submission of report for peer review

Collation of Sample Assessments

- Documents obtained from LPA web sites or directly from developers.
- Total 46 assessments obtained.
- Remainder unavailable for various reasons:
  - Local authority re-structuring
  - Lack of archive material available
  - Lack of response or reluctance by developers.
- Covered 37 Local Planning Authorities
  - Max 3 from any one authority

Review Criteria

- Pilot study of 10 sites to define initial review criteria.
- Criteria discussed at November 2010 stakeholder review meeting.
- Assessments reviewed according to criteria.
- Further evolution of criteria with progress of review.

Assessment Methodology

- ETSU-R-97 or 'other'
  - ETSU-R-97
    - Derivation of 'prevailing' background noise (PBN) for quiet day-time (QD-T) and night-time (N-T).
    - Day-time noise limit = 35 dBL_{A90} or 5 dB above QD-T PBN
    - Night-time noise limit = 43dB L_{LA90} or 5 dB above N-T PBN
    - Land-Owner Limit = 45 dB L_{LA90} or 5 dB above N-T / QD-T PBN
  - Used in 100% of cases studied.

Consultation

- Consultation with LPA (beyond scoping exercise)
  - Primarily noise monitoring locations
  - Carried out in 76% of cases

- LPA Attendance at Installation
  - Agree precise locations
  - Minimisation of local sources
  - LPA attendance in 13% of cases

Baseline - Locations

- Number of Monitoring Locations
  - Depends on number of properties above 35 dB L_{A90} 'simplified' criterion (varied from 2 up to several thousand).
  - Average 5 per site
- % Monitoring Locations at Properties
  - Average 80% per site at properties.
  - Remainder on nearby land

Baseline Data – Reporting

- Map/Arial Photographs Showing Locations - 86%
- Description of Monitoring Locations – 84%
- Description of Noise Environment – 79%
- Photos of Monitoring Environment – 66%
- Height of WS Measurements – 93%
- Wind Direction Information – 52%
- Noise and Wind ‘Histograms’ – 30%
- Calibration Certificates/Dates
  - 39% SLMs, 37% calibrators

Baseline Data – Scope & Quality (1)

- Monitoring Period
  - Average 21 days (max / min 60 / 7)
- Wind Speed Range

	Minimum	Maximum	Mean
Lowest Wind Speed (m/s) Night-Time hours	0	4.0	0.78
Highest Wind Speed (m/s) Night	6	15.5	10.14
Lowest Wind Speed (m/s) Quiet Day-Time hours	0	4.0	0.76
Highest Wind Speed (m/s) Quiet Day-Time hours	8.1	18.9	11.28

- Measurement Equipment
  - Description 96%, Certification 70%
- Field Calibration Eqpt
  - Description 74%

Baseline Data – Scope & Quality (2)

- Wind Shields
  - 4% ETSU, 68% other ‘high performance’, remainder un-clear or not specified.
- On-site Rainfall Measurements – 50%
- Data during rainfall specifically excluded – 59%
  - origin of rainfall data not always clear
- Other Exclusions – 50% (often un-clear)
  - Data from certain wind directions excluded – 4%

Baseline Data – Scope & Quality (3)

- Calibration Drift Reported
  - 63%. (max 1.5 dB included)
- Potential for noise from existing wf – 11%
  - Turbines shut-down or too low to have effect.
  - No filtering of bg noise by direction to remove/minimise effects.
- Effects of season not specifically taken into account

Noise Predictions - General

- Prediction Methodology
  - 93% ISO9613-2
  - Remainder hybrids of other methods
    - Assumed source sound power data
    - Propagation factors

Noise Predictions – Source Data (1)

- Candidate Turbine – 83%
  - Range of turbines in 2 cases.
- Overall Source Noise Level Data
  - Provided in 93% of cases
  - 27% including reference to documentation or test reports
- Wind Speed Range
  - 33% 4 - 12 m/s, 20% 3 – 12 m/s, 7% 4 – 10 m/s
  - Remainder variable, 1 only gave data for single wind speed.

Noise Predictions – Source Data (2)

- Warranted, Measured or Indicative data
  - Precise position not always clear (see report appendix)
- Provision of Octave Band Data
  - Provided in 78% of cases
  - 24% including reference to documentation or test reports

Noise Predictions – Propagation (1)

- Atmospheric Attenuation
  - Assumed Temp and RH

10°/70%	15°/70%	20°/70%	Not stated or Not Applicable
35%	33%	4%	28%

- Ground Attenuation
  - Assumed ground category and receiver height*

* where non-zero ground factor assumed

0	0.5	0.7	1	0 and 1	Not stated or Not Applicable
50%	15%	2%	2%	2%	29%

	1.2 m	1.5 m	2 m	4 m	Not stated
Assumed Receiver Height Day	18%	9%	9%	45%	19%
Assumed Receiver Height Night	18%	0%	9%	54%	19%

Noise Predictions – Propagation (2)

- Barrier/Screening Attenuation
  - Included in 7% of cases
  - Not-included in 70%
  - Remainder un-clear
- Effect of Wind Direction
  - Downwind propagation assumed in 100% of cases
  - Effect of wind direction not included in any cases*

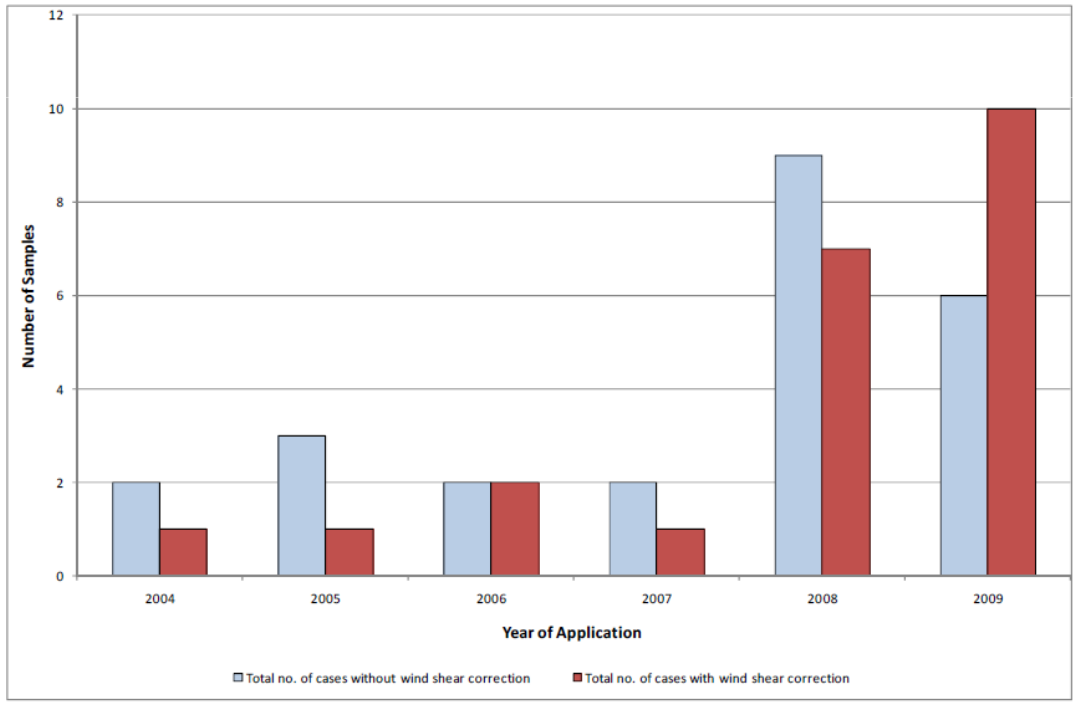
    * not usually required

Assessment – Wind Shear

- The problem
  - Mismatch between ETSU-R-97 and IEC61400-11
  - Wind speed measurement height
- The solution
  - Correct turbine noise data for arbitrary site wind shear
  - Correct background noise data to same format as turbine data
  - Variations in both methodologies

Assessment – Wind Shear

- Wind shear taken into account in 47% of cases
  - 41% of cases referenced b/g noise to hub height wind speed (as per 2009 IoA Acoustics Bulletin Article)



Assessment – Derivation of PBN

- Type and ‘Order’ of Best Fit Line/Curve
  - linear regression used in some cases where higher orders more appropriate
  - some increases in b/g noise at lower wind speeds
- Scatter data not always shown on Plots

Assessment – Derivation of Limits (1)

- Day-Time Noise Limit
  - 50% of cases show ‘both’ daytime noise limits
  - 32% of cases show one limit with no justification
  - Limits merge in remainder
- Night-Time Noise Limit
  - 100% of cases use ETSU specified limit
- ‘Involved’ Noise Limit
  - Used in 39% of cases at appropriate properties
  - no discussion as to how involvement defined
  - no discussion of how to deal with in Conditions

Assessment – Derivation of Limits (2)

- No Allowance for High Level of Scatter
  - Not required by ETSU-R-97
- Capping of Noise Limits in 25% of cases
- Data for w/s below cut-in discarded in some cases.

Assessment – Acoustic Features

- Potential Tonal Content
  - Mentioned in 76% of cases, no mention in remainder
  - No penalty/correction in any case
- Potential for Amplitude Modulation
  - Mentioned in 63% of cases, no mention in remainder
  - No correction or other allowance made in any case.

Assessment – Other

- Correction from L_{Aeq} to L_{A90}
  - 80% 2 dB, 1 case 1.5 dB, Remainder Un-stated
- Properties Covered by Assessment
  - 56% of cases referred to properties not covered by baseline measurements
- Incorporated Mitigation
  - 15% assumed turbines running in noise reduced mode
  - Others may also have assumed noise reduced mode without stating specifically

Assessment – Reporting (1)

- Noise Contours Provided – 56%
- Presentation –
  - Graphical 91%
  - Tabular 63%
  - Both 54%
- Cumulative Issues
  - Considered in 17% of cases
  - No discussion of ‘using up’ of noise limits by other sites

Assessment – Reporting (2)

- Assessment Beyond Requirements of ETSU-R-97
  - Considered in 17% of cases (audibility and/or sleep disturbance)
  - One assessment of effects on zoo animals
- Planning Conditions
  - Specific conditions recommended in 17% of cases
  - Some reference to post-commissioning monitoring but no real discussion about measurement difficulties

Conclusions (1)

- Variation in:
  - Structure of reports
  - Interpretation of data
  - Assumptions used
- Clarity required for LPAs
- Requirement for best practice guide or similar

Conclusions (2)

- Background noise monitoring
  - More prescriptive approach required?
  - Agreement on specific monitoring locations
- Prediction Methodology
  - Assumptions can make significant difference
  - IoA Acoustics Bulletin Article helpful but possibly further clarity required?

Conclusions (3)

- Wind Shear
  - Not always covered
  - Alternative approaches used.
  - IoA Acoustics Bulletin article approach accepted by many but requires ‘official’ acceptance.
- Noise Limits
  - More prescriptive and definitive approach required for day-time limits
  - Financial involvement requires more clarity and should possibly be defined in planning conditions

Conclusions (4)

- Acoustic Character
  - Correction / penalty for tonal content not included at assessment stage.
  - Lack of requirement for correction/penalty for modulation in noise needs re-stating or otherwise addressing in line with current research.
- Cumulative Impact
  - How to address in the absence of strategic approach
- ‘Compliance’ Measurements
  - More guidance needed

Conclusions (5)

- Other Issues for Best Practice Guidance
  - Consideration of ‘fixed’ limit applicable at rated power
    - Should not preclude consideration of background noise level.
  - Advice on structure of planning conditions
  - Acknowledge and possibly review changes to some documents informing recommendations in ETSU-R-97

Questions