5. Noise and Health Concerns

This section comprises 5 sub-sections:

5.1 ETSU-R-97
5.2 Noise Monitoring by the Developer
5.3 Low Frequency Noise and Amplitude Modulation (AM)
5.4 Infrasound and Vibro-Acoustic Disease (VAD)
5.5 Policies in conflict with this Application

Planning Policies, Laws and Guidelines examined in this section:

INTERNATIONAL: European Human Rights Act, World Health Organisation, French Academy of Medicine.

NATIONAL: PPS22, PPG24, ETSU-R-97, The Human Rights Act 1998, Environmental Protection Act 1990 (Part III)

DEVON COUNTY COUNCIL: CO16, ST1 part 5

TORRIDGE DISTRICT COUNCIL: DVT11, DVT12, DVT13

5.1 ETSU-R-97

5.1.1 Torridge District Council planning officers are duty bound to reference the document ETSU-R-97, *'The Assessment and Rating of Noise from Wind Farms'*, in order to assess the developer's claims that this wind farm will not cause excessive noise pollution in nearby properties. This document was written by a Noise Working Group (NWG) set up in 1995 by the then DTI through ETSU, the Energy Technology Support Unit. The NWG comprised developers, noise consultants, environmental health officers and others. The majority representation was from the wind industry itself.

5.1.2 ETSU-R-97 is a much-criticised document. One member of the NWG, expert acoustician Dick Bowdler, published a paper in July 2005 entitled, *'ETSU-R-97. Why it is Wrong.*' (downloadable from http://www.viewsofscotland.org/library/docs/ETSU-R-97_%20Why_%20it_%20is_%20Wrong.pdf). In the introduction, Mr. Bowdler points out:

> *'1.1 ETSU-R-97 is used throughout the UK to assess wind farm noise in planning applications. It has been incorporated into PAN45 in Scotland and PPS22 in England. Nevertheless it is a thoroughly flawed document and does not deserve the prominence it has been given.*
>
> *1.2 The conclusions of ETSU-R-97 are so badly argued as to be laughable in parts (the daytime standard is based on the principle that it does not matter if people cannot get to sleep on their patio so long as they can get to sleep in their bedrooms). It is the only standard where the permissible night time level is higher than the permissible day time level.*
>
> *1.3 ETSU-R-97 bears no resemblance to standards used for other industrial developments. Other renewable energy developments have to meet much*

stricter standards. Each time the Noise Working Group that drew up the document decide that a particular standard is appropriate, they follow it up by saying (without putting forward any evidence whatsoever) that such a standard would restrict development of wind farms and so find reasons to relax it further. '

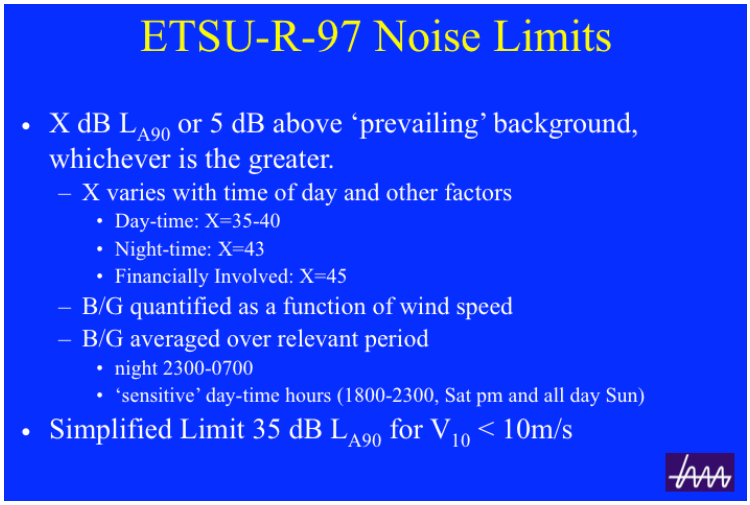
(Mr. Bowdler has been a supporter of renewable energy for 40 years and a noise consultant for 38 years. He has been involved with wind farm assessment since 1993. He was one of the original members of the Institute of Acoustics when it was founded in 1974.)

5.1.3 The range of sounds audible to humans with unimpaired hearing is approximately 20 Hz to 20,000 Hz. 1 Hz, or Hertz, is 1 vibration per second. Sounds in the range 20 Hz - 200 Hz are regarded as low frequency sounds and include bass notes heard in music. Sounds with a frequency less than approximately 20 Hz are inaudible. They are known as infrasound.

5.1.4 Sound pressure is measured in decibels (dB). Electronic filtering systems enable microphones to record sounds in different frequency ranges. The dB(A) weighting system is most commonly used. It purports to represent sounds typically audible to humans. However, this scale underestimates annoyance levels for frequencies that occur below about 200 Hz and is less sensitive to very low and very high frequencies. The dB(C) weighting does pick up low frequency sounds and is sensitive to loud sounds at 100 dB and above, such as those emanating from modern wind turbines. The dB(G) scale specifically measures infrasound. No mention is made of the dB(C) or dB(G) weightings in the Dunsland Cross noise analyses yet these scales are known to be important with regard to health concerns for residents in properties close to wind farms. This is discussed in Section 5.3: Low Frequency Noise and Amplitude Modulation (AM) and 5.4: Infrasound and Vibro-Acoustic Disease (VAD), below.

5.1.5 Before ETSU-R-97 came into being BS4142 was used in noise assessment. BS4142 provides a technical means of assessing whether or not complaints are likely and, in any court, whether or not a nuisance exists. ETSU-R-97 is not a method of assessing impact. With BS4142 in place it was normal to set a limit for noise levels of 'pre-existing background noise + 5dB(A)' for new industrial developments. The NWG questioned whether this was appropriate and asked if an absolute level of noise might be justified instead. This was because in very quiet rural areas, where the night time background noise levels can be as low as 20dB(A), wind turbines would have to be kept quieter than 25dB(A) at nearby properties. This, asserted the NWG, would prove very restrictive to the development of wind energy.

5.1.6 In paragraph 3.12 of his paper Mr. Bowdler explains how the NWG managed to raise the 'pre-existing background noise + 5dB(A)' for general development to 'pre-existing background noise + 11dB(A)' for wind farms, for no acceptable reason. It also chose to treat day time noise and night time noise separately. The ETSU-R-97 noise limits are summarised below in a slide presentation from Dr. Andy McKenzie of the Hayes McKenzie Partnership Ltd entitled, *'Wind Farms - Noise Impact Assessment for Environmental Statements'*:



5.1.7 The simplified limit shown in the slide above refers to a clause on page 170 of the guidelines to PPS22. This clause relates to a single turbine installation or a wind farm with very large separation distance between the turbines. Thus it would not apply at Dunsland Cross.
5.1.8 The $L_{A90,\ 10min}$ measurement ensures that only sounds which persist for a cumulative total of at least 9 minutes in every 10 of the successive sampling periods are retained. This removes any loud, brief, transient sounds such as passing vehicles, motorcycles or dogs barking. The limits only apply in wind speeds up to 10 metres per second. Above this the wind itself is deemed to be loud enough to mask the noise from the wind turbines themselves. In reality it is adding to it, not masking it.

5.1.9 For the Dunsland Cross turbines operating at night the margin above background could be 20 - 30dB(A) or more and still be within ETSU-R-97 guidelines. (An increase of 3dB(A) doubles the existing noise level (see Environmental Statement Noise Glossary). The higher the background noise level the developer can record, the less it has to worry about the impact of the development on the amenity and well-being of nearby residents. This is especially important with wind farms like the one proposed for Dunsland Cross, where 4 turbines are packed as tightly as possible on a small site very close to dwellings. The cumulative noise of 4 turbines is harder to contain than fewer turbines more widely spread.

5.1.10 The World Health Organisation (WHO) *'Guidelines for Community Noise 1999'* and *'Night Noise Guidelines 2007'* clearly state that **noise in a bedroom above 30 dB causes sleep disturbance**. ETSU-R-97 was supposed to reflect guidance from WHO when it set its noise limits, but since ETSU-R-97 was published **the WHO noise-guidance levels have been lowered by 5dB(A).** Since ETSU-R-97 believes that there is a noise reduction of 10 dB through an open bedroom window, in quiet areas such as Dunsland Cross the noise inside a bedroom could still be 43 - 10 = 33 dB which, according to WHO guidelines, is still enough to cause sleep disturbance.

5.1.11 A comparison of ETSU-R-97 with WHO Guidelines is appropriate at this point:

Authority	**DTI Noise Working Group**	**World Health Organisation**
Report(s)	ETSU-R-97	Guidelines for Community Noise (1999) Sleep and Health (2004) Night Noise Guidelines (2007)
Authors & Credentials	Engineers & Acousticians, largely employees of the wind industry or consultants to the wind industry.	International multidisciplinary panel of independent experts on noise and the effects of noise on health (medical & technical expertise).
Scope	Limited to wind turbine noise and based on 0.5 MW turbines with hub-height of 30 m. No allowance in measurement for the effect of pulsating character of wind turbine noise. Dunsland Cross turbines are 2 MW, 105 m.	Inclusive: It is the effect of noise on health that is critical, regardless of the source. Noise with pulsating and/or low frequency character causes more disturbance with recommendations for lower total noise levels allowable.

5.1.12 The case of Jane and Julian Davis, first mentioned in *'A note relating to the final turbine choice'* after paragraph 3.1.35 in Section 3 of this report, was referred to the Ombudsman for Local Administration in England. The Ombudsman stated that a condition based on ETSU-R-97 that referred to background noise as the basis for deciding whether the condition had been met was incapable of being enforced.

5.1.13 The Guidelines to PPS22, on page 168, show typical values for noise events for comparison purposes to wind turbine noise. It gives a quiet bedroom the value of 20dB(A):

Table 1 **Noise generated by wind turbines compared with other everyday activities**	
Source/Activity	**Indicative Noise Level dB(A)**
Threshold of Pain	140
Jet aircraft at 250 m	105
Pneumatic drill at 7 m	95
Truck at 30 mph at 100 m	65
Busy general office	60
Car at 40 mph at 100 m	55
Wind farm at 350 m	35–45
Quiet bedroom	20
Rural night-time background	20–40
Threshold of hearing	0

5.1.14 Bolsterstone has included this table in its Non-Technical Summary for this application. **The Quiet Bedroom value has been altered from 20dB(A) to 35dB(A). This is clearly malpractice.**

Dunsland Cross Windfarm Non-Technical Summary

Source / Activity	Indicative noise level dB(A)
Threshold of pain	140
Jet aircraft at 250m	105
Pneumatic drill at 7m	95
Truck at 30mph at 100m	65
Busy general office	60
Car at 40mph at 100m	55
Windfarm at 350m	35-45
Quiet bedroom	35
Rural night-time background	20-40
Threshold of hearing	0

Source: Planning for Renewable Energy, A companion Guide to PPS22, ODPM 2004

The impression given by this table is that a wind farm at 350m is hardly any noisier than a quiet bedroom. The real situation is that a wind farm at 350m is about 48dB or nearly 30dB more than a quiet bedroom – nearly eight times as loud.

5.1.15 In the research paper, *'Noise Radiation from Wind Turbines Installed near Homes: Effects on Health'*, by Barbara Frey, BA, MA and Peter Hadden, B Sc, FRICS, February 2007, v. 1, (www.windturbinenoisehealthhumanrights.com) page 37, paragraph 34d states:

> *'It is possible to conceive of a position where a lightly constructed dwelling with minimal sound transmission loss between bedroom ceiling and the external wall is subjected to an external wall sound of 45 dB(A) at night. If the WHO 30 dB(A) maximum bedroom level is applied but reduced to reflect the pulsating character and low frequency character, the actual measurement made in the bedroom, with the window open for ventilation, will only be marginally less than 45 dB(A), potentially creating a 15 dB(A) excess of sound* ***which is a staggering 30-fold difference in sound energy****.'*

5.1.16 Developers always claim that computer predictions show that their wind farm will not exceed ETSU-R-97 noise limits at nearby properties. As a result no mitigation will ever be necessary. This application is no different. TDC officers must be wary of such claims if they are to protect the amenity of nearby residents in a way that ETSU-R-97 clearly does not.

5.1.17 Acknowledging the criticism that ETSU-R-97 is now 11 years out-of-date and does not reflect current research, the government has re-convened a Noise Working Group in 2008. Once again the wind industry is well-represented and, this time, is even chairing the group. This conflict of interest has not gone unnoticed by MPs and national and local newspaper editors.

5.1.18 Disquiet with ETSU-R-97 has now reached local government level. TDC Cllr. Adam Symons has tabled a motion to the council which calls for ETSU-R-97 to be reviewed. (See paragraph 5.5.9 below and Appendix D).

5.2 Noise Monitoring by the Developer

5.2.1 The assessment of whether or not a wind farm will exceed permitted noise limits at nearby properties or workplaces is essentially a 6 stage process:

Stage 1 Use computer software to model the situation to see how many properties are likely to be affected and how high the noise level might be.

Stage 2 In the light of the modelling results obtained, either declare the site unsuitable and abandon the project or approach the local authority to agree noise limiting parameters and methodology and continue with the project.

Stage 3 Set up and maintain recording equipment to measure background noise levels at locations which represent the most affected properties.

Stage 4 At the end of the recording period, filter out inadmissible data and analyse that which remains to derive background noise levels at the most affected properties. If not enough representative data has been collected, repeat Stage 3 until it has.

Stage 5 From the derived background noise levels set daytime and night time noise limits for these properties.

Stage 6 Compare the results from Stage 5 with those from Stage 1 to see if noise limits will be breached. If they will, consider mitigation or redesign the wind farm and repeat the whole process. If no solution can be found, abandon the project and look for a more suitable site. If noise limits will not be breached, continue with the project.

In this section DTOG will show that, in this application, there are serious flaws in all 6 stages of this process. All of the noise assessment work has been done by Arcus Consulting Ltd. on behalf of Bolsterstone.

Stage 1

5.2.2 The initial computer modelling was done using a software suite called SoundPLAN. This software has limitations which are clearly identified in the user manual. The first limitation is even given by Arcus in section 11.2.3 of the Environmental Statement when it states that the accuracy of the result is +/- 3dB(A). This is rather significant, as Arcus states in the Glossary in section 11.10 that *'Each increase of 3dB on the scale represents a doubling in the Sound Pressure level.'* If the worst-case scenario is always going to be presented, as required in the guidelines, then this 3dB(A) margin of error should have been added to all the results in the prediction. It has not.

5.2.3 Another significant limitation in SoundPLAN is that it cannot accurately model multiple reflections of sound waves such as would occur, for example, in the cluster of houses around Brandis Corner to the north of the proposed site or the clutch of properties near the Station Cottages to the south west. Multiple reflections can also promulgate as a result of hard bounces from road surfaces near such properties. The result can be noise levels which turn out to be higher than those predicted by the software.

5.2.4 The software can trace a single reflection until it dissipates and this appears to have been catered for in the run parameters used by Arcus. But the problem of multiple reflections remains

unaddressed and no allowance has been made for hard road surfaces in the ground absorption parameters.

5.2.5 The manual (section 6.2.5: Unsolved Modeling Problems) suggests using a higher input source level to compensate for this problem:

> *'SoundPLAN cannot process the multiple reflections in the retained cut … To accommodate for multiple reflections, an addition to the emission levels (or basic noise level), depending on height and width of the retained cut, accounts for the additional noise input.'*

Arcus might argue that it has used 106dB(A) as the source level instead of the 105dB(A) warrantied by the manufacturer of the REpower MM82 turbine used in all of the calculations. The reasons for doing so are nothing to do with this weakness in the software. They are to cover for the possibility of using bigger, noisier turbines at the site in future. DTOG questions whether this fortuitous extra +1dB(A) correction is enough to compensate for the multiple reflections error in the predictions.

5.2.6 The intention to pave the way for larger turbines is also inferred from Table 11.1 in the Environmental Statement. This shows turbine noise emissions data for the REpower MM82 Evolution model with an 80 metres hub-height configuration. This would give a total turbine height of 121 metres (see ES Technical Appendix A11). The current application is for a turbine with hub-height 64 metres and total height 105 metres.

5.2.7 Another indication of a future intention to apply for taller turbines can be found in the developer's current application for an anemometer mast at the site (1/1286/2008/FUL), which should be considered alongside this application since it relates to the same wind farm project. In the Design & Access Statement for that application, section 3.3, the applicant states that *'the hub-height of the turbines will not exceed 80 m…'*

5.2.8 Notwithstanding the inherent multiple reflections error in the software, Arcus has also chosen not to apply any Tone Penalty to the emissions from the turbines. There are two criteria for assessing whether a Tone Penalty should be applied. The first is that the sound level difference between any two contiguous ⅓ Octave bands must be greater than 5dB(A). This is stated on page 69 of ETSU-R-97:

> *'Methods Based on ⅓ octave bands. BS7445 (16) (ISO 1996, DIN 45 465) indicates that a prominent tone may be identified when the level difference between contiguous third octaves is greater than 5dB. This definition of prominent tone is satisfactory when the frequency of interest is above 500Hz.'*

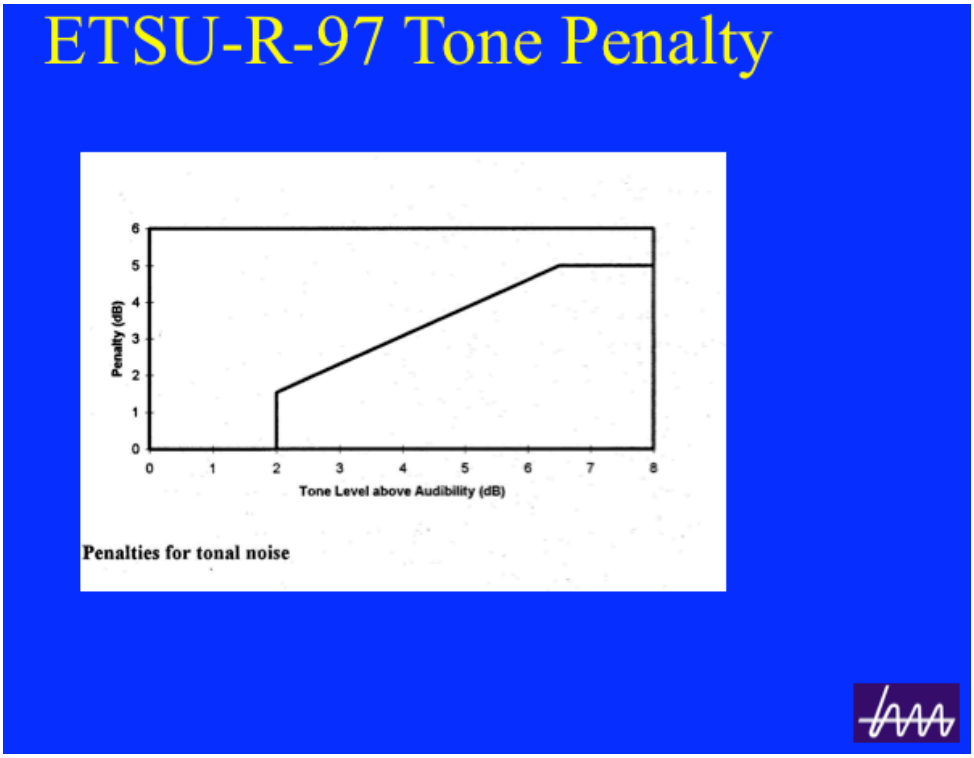
5.2.9 The second criteria is that there must be at least 3dB difference between the audibility and tonality readings. Both of these criteria are met on page 2 of the manufacturer's WINDTEST report given in the ES Technical Appendix A11. Arcus appears to have tried to conceal the contiguous octave band link by omitting data in the Source Details section of the same Appendix. Both sets of ⅓ Octave bands data from this Appendix are reproduced here:

⅓ Octave Frequency (Hz)	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
REpower MM82 @ 105 dB(A)	75.8	78.9	81.8	84.7	87.7	88.9	92.1	95.2	95.4	95.0	95.0	94.0	91.9	92.0	90.8	89.5	89.4	88.2	86.8	84.0	81.0	78.3	73.4	67.0
Contiguous Difference		3.1	2.9	2.9	3.0	1.2	3.2	3.1	0.2	-0.4	0.0	-1.0	-2.1	0.1	-1.2	-1.3	-0.1	-1.2	-1.4	-2.8	-3.0	-2.7	-4.9	**-6.4**
																								TONAL PENALTY APPLIES
Arcus @ 106dB(A)	77.5	80.6	83.5	86.4	89.4	90.6	93.8	96.9	97.1	96.7	96.7	95.7	93.6	93.7	92.5	91.2	91.1	89.9	88.5	85.7	82.7	80.0	75.1	**?**
Contiguous Difference		3.1	2.9	2.9	3.0	1.2	3.2	3.1	0.2	-0.4	0.0	-1.0	-2.1	0.1	-1.2	-1.3	-0.1	-1.2	-1.4	-2.8	-3.0	-2.7	-4.9	**?**

It can be seen from this that Arcus has dropped the 10,000Hz figure from its table because it reveals a 6.4dB change from the 8,000Hz figure, thus signalling the requirement for the Tone Penalty.

5.2.10 The effect of omitting the Tone Penalty is to give a false impression of the true noise level at nearby properties since the noise level quoted will be less than the reality.

5.2.11 Hayes McKenzie, in the presentation mentioned in paragraph 5.1.6, quantifies the magnitude of the Tone Penalty to be applied in the following slide:



5.2.12 By applying the 3dB(A) error margin identified in paragraph 5.2.2 above and an estimated 2.5dB(A) Tone Penalty it can be seen that the SoundPLAN software indicates that ETSU-R-97 noise limits will be exceeded in no fewer than 35 properties around the site. These corrections also assume that +1dB(A) is enough for the multiple reflections problem, which it may not be. If this was increased to +2dB another 4 properties can be added to the list. **Approximately 70 people live in those properties.** The corrected results are shown in the table on the next page.

5.2.13 Arcus makes frequent mention of the landowner's 'consented house' and the 'amended consented house location'. The 'consented house' refers to an initial application for an agricultural worker's dwelling in 1990 in the name of Wilson (1/2073/1990). This was refused by TDC. A subsequent application (1/897/91/10/19) for an agricultural worker's dwelling at Fernlea Park, Brandis Corner was also made in the name of Wilson. This application lapsed in 1996. It exists only on microfiche at Riverbank House. The 'amended consented house location' has not yet been the subject of a fresh planning application by the current landowner, Mr. Marsh. As a result it has been left out of the table. Its inclusion in the application is to try to stop the main access to the site being the existing entrance from the A3072. The 'amended location' is right behind the tractor shed (shown on photomontage view 1) which would have to be demolished for the access road. This consideration should not be given any weight. It is far less environmentally damaging to make this entrance the access point for the site than it is to destroy 40 metres of hedgerow on the A3079. This hedgerow is a confirmed habitat for protected Dormice and is an important feeding corridor for bats (see Section 4:Wildlife, Ecology and Biodiversity).

5.2.14 TDC needs to realise that the noise in question requiring a Tone Penalty is either the whining of the generator or the drone from the gearbox or both. It also needs to remember that the REpower MM82 turbine is also the one causing all the problems for the Davis Family in Lincolnshire (see Section 3 - 'A note relating to the final turbine choice' after paragraph 3.1.35) In that case the turbine is 930 metres from their house. At Dunsland Cross it will be only 416 metres from the nearest property.

PROPERTY	DISTANCE FROM NEAREST TURBINE (metres)	SoundPLAN PREDICTED NOISE LEVEL (dB(A))	SoundPLAN WORST-CASE ERROR CORRECTION +3dB(A)	ETSU-R-97 & Hayes McKenzie TONAL NOISE PENALTY +2.5dB(A)
The Vale	416	42.7	**45.7**	**48.2**
Fairlawns	458	42.5	**45.5**	**48.0**
Cranmore	463	42.2	**45.2**	**47.7**
Little Copse	471	42.1	**45.1**	**47.6**
Lyne Akres	455	41.9	**44.9**	**47.4**
Moyles Moor	487	41.6	**44.6**	**47.1**
5 Station Cottages	494	41.4	**44.4**	**46.9**
6 Station Cottages	488	41.4	**44.4**	**46.9**
4 Station Cottages	499	41.3	**44.3**	**46.8**
3 Station Cottages	503	41.2	**44.2**	**46.7**
Bickford Cottage	489	41.2	**44.2**	**46.7**
2 Station Cottages	506	41.1	**44.1**	**46.6**
1 Station Cottages	513	41.0	**44.0**	**46.5**
Bickford Arms	505	40.9	**43.9**	**46.4**
Old Post Office	513	40.8	**43.8**	**46.3**
The Firs	521	40.6	**43.6**	**46.1**
The Nook	522	40.6	**43.6**	**46.1**
Bickford Lodge	547	40.3	**43.3**	**45.8**
Tembani	554	40.0	43.0	**45.5**
6 The Gardens	578	39.9	42.9	**45.4**
Eden Park	567	39.8	42.8	**45.3**
The Retreat	579	39.8	42.8	**45.3**
5 The Gardens	593	39.7	42.7	**45.2**
Freshfields	579	39.7	42.7	**45.2**
The Laurels	583	39.7	42.7	**45.2**
4 The Gardens	615	39.4	42.4	**44.9**
Oakfield	609	39.3	42.3	**44.8**
1 The Gardens	620	39.2	42.2	**44.7**
2 The Gardens	621	39.2	42.2	**44.7**
3 The Gardens	622	39.2	42.2	**44.7**
Old Chapel	625	39.2	42.2	**44.7**
Woodlands	637	39.2	42.2	**44.7**
Carley	644	38.9	41.9	**44.4**
View Farm	687	38.4	41.4	**43.9**
New Buildings	718	38.1	41.1	**43.6**
Miksam Barn	764	37.4	40.4	42.9
Moorfield House	775	37.3	40.3	42.8
Longfield	785	37.1	40.1	42.6
Manor Farm	822	36.8	39.8	42.3
Kenneland	967	35.2	38.2	40.7
Bradford House	973	35.0	38.0	40.5

5.2.15 DTOG also notes that **no correction has been applied for the impulsiveness of the sound**. This impulsiveness is inevitable when constructive and destructive interference occurs at nearby properties when the incident sound waves from the four separate turbines arrive and interact in an unpredictable phase relationship.

5.2.16 In addition to audible frequency predictions, **low frequency sound and infrasound analyses and predictions should have been supplied with this application**. None has.

Stage 2

5.2.17 In light of the above, had the noise prediction been done properly, the project would have been abandoned. This is probably the reason why nPower rejected this site and why E.On will not site a turbine within 750 metres of any occupied property. Bolsterstone has never built a wind farm before. Undaunted, or unaware, it decided to continue with the project.

Stage 3

5.2.18 At the end of April 2008, Mr. Michael Reid of Arcus made preliminary enquiries to the Environmental Protection Office of Torridge District Council with regard to background noise monitoring. In an email reply dated 30th April, on file with DTOG, Mr. Steve Wells, Environmental Protection Officer, reiterated that TDC would expect Bolsterstone to comply with the noise limits of ETSU-R-97 as stated in paragraph 5.1.6 above.

5.2.19 Arcus then set about finding sites for microphones to be placed at suitable locations around the site to measure background noise levels. This was the first time the local residents became aware of the plans for the wind farm (see Section 12: Public Consultation). The news was generally not welcomed.

5.2.20 Mr. Reid felt the need to update Mr. Wells with regard to the resistance encountered. On 13 May he sent an email stating:

> *'Unfortunately, the local residents were not very co-operative when it came to allowing equipment to be placed in their gardens. We contacted a number, but only managed to obtain agreement from one householder, in The Gardens in Brandis Corner. Many of the others wanted to be paid to allow the survey.'*

The number of residents contacted was 9 out of approximately 50 in 27 properties near the perimeter of the site (see paragraph 2.4.11-12 and Figure 2 in paragraph 2.4.22). The 'many' who wanted payment was 1 person. The full contact list and the method of contact was attached to this email. One resident in Station Cottages told neighbours that she found the Arcus representative's tone 'intimidating' in his 25-minute telephone call to her. The overall effort made by Arcus to find suitable locations for microphones was very poor.

5.2.21 Mr. Reid's email continued:

> *'As a consequence, we have had to place the monitoring equipment in alternative locations within the land owned by the site landowner. I have attached a plan showing these locations.*
>
> *Locations 2 and 3 are intended to provide a representation of the background noise levels in the View Farm / Station Cottages area. 3 is located a similar distance from the road as the roadside houses, and 2 is in a similar setting to View Farm.*
>
> *Location 4 is situated close to Cranmore and should provide a representation of background noise levels at this property.*

On page 84 of ETSU-R-97 it suggests the use of alternative noise monitoring locations for monitoring existing wind turbine noise in situations where free-field conditions at the property in question cannot be obtained. Whilst this is not an exactly equivalent situation, we believe that this general approach is supported. It is also common practice to undertake background noise surveys at alternative representative locations for other types of assessments, such as BS4142 and MPG11. For these reasons, we believe that this approach is justified in the circumstances and provides the best practicable solution where consent for monitoring has been withheld.

I trust that you will find these measures acceptable.'

5.2.22 The locations described above are shown in Figure 23 below.

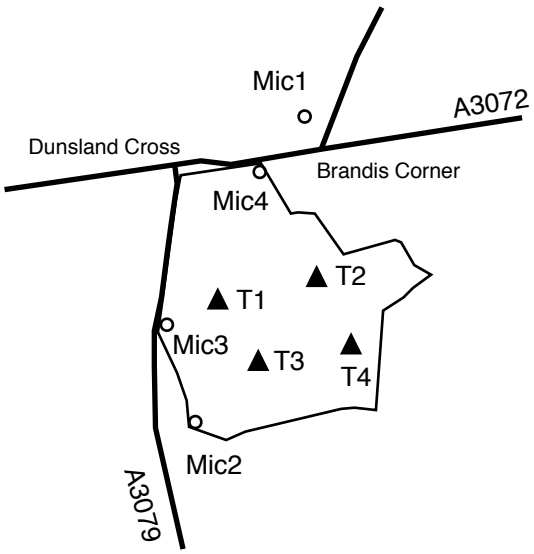


Figure 23

5.2.23 Mr. Wells replied in an email the following day:

'Hi Michael, an unfortunate response from the populus! I think your proposal is reasonable in the circumstances.'

5.2.24 This email exchange is included here because it raises a number of concerns. Mr. Wells' ill-chosen remark regarding the 'local populus' has not gone unnoticed. He may wish to explain, from his strictly impartial viewpoint, why he considers the response 'unfortunate'. That he thinks the 'proposal is reasonable in the circumstances' is poor judgement indeed.

5.2.25 The proposal was not 'reasonable in the circumstances'. Firstly, the circumstances would not have arisen if many more residents had been contacted with a view to finding enough acceptable locations for microphones. It is yet another indication of the unwillingness of both Arcus and Bolsterstone to engage with the public (see Section 12: Public Consultation). Secondly, there were not enough microphones in suitable locations to enable the developer to assess and evaluate the derived noise limits at nearby properties in all **worst-case scenarios**. This is a noise monitoring requirement and in most cases will be as a result of **noise propagated downwind of the turbines**. Properties north-east of the turbines have not been catered for in this regard.

5.2.26 The measurements were taken between 8th - 27th May, 2008. A 10-metres anemometer mast was placed near the top of the hill (without first obtaining the necessary planning permission) so that weather events could be recorded, since these are needed to correlate and filter the noise level data. In certain weather events, such as heavy rain, the noise data must be discarded.

5.2.27 DTOG wishes to draw the attention of TDC to the following:

- Microphone 1 was sited in the populated cul-de-sac known as The Gardens near the centre of the village of Brandis Corner, close to the Public House which would be a source of noise in quiet daytime hours and some night time hours. It was placed near a constantly-running sewage-aeration pump. This pump is far enough away from the houses so as not to be noticeable, but close-up it is quite audible. DTOG questions why the developer chose to site microphone 1 near to this constant source of sound without declaring it, since the sources of noise at this location are listed as road noise, wind, trees and birds (crows) in Table 11.3 of the Environmental Statement.

- Microphone 2 was placed in a quiet field near the dwelling known as The Vale, over 100 metres away from any tarmac road. Sources of noise here are listed as road noise, trees, birds, sheep and dogs in Table 11.3. The dogs at The Vale are small puppies. Their occasional barking is not intrusive and would not register in any $L_{A90,\ 10min}$ measurement.

- Microphone 3 was in a field behind the hedgerow next to the A3079. It proved attractive to sheep grazing in the field. It was used as a rubbing post and in the week beginning 18th May the sheep had knocked it over. It was next seen righted again a few days later. Sources of noise at this location are listed as road noise, trees, birds and sheep in Table 11.3.

- Microphone 4 was sited next to the landowner's tractor shed, an area where farm machinery is often audible. Some residents reported increased levels of machinery noise during the monitoring period, particularly at night. Road noise, trees, birds, sheep and farm machinery are in the listing in Table 11.3.

Stage 4

5.2.28 Based on the information above, any local or independent person might logically guess that the noise recorded, in the order from most noise to least noise, would be as follows:

Microphone 1 - Most noise
Microphone 4
Microphone 3
Microphone 2 - Least noise

5.2.29 It comes as some surprise, therefore, that the result obtained by Arcus was as follows:

Microphone 2 - Most noise
Microphone 3
Microphone 4
Microphone 1 - Least noise

This complete reversal of the expected results from microphones 1 and 2 requires further investigation. How could it be that the microphones placed in what are clearly the noisiest locations could emerge with the quietest readings?

5.2.30 DTOG also notes the following:

- By having three of the four microphones within the landowner's site boundary there can be no independent verification that the data collected at these positions is a fair representation of the actual background noise levels pertaining at the time the readings were taken. The public could not have access to the land, other than looking over the A3079 gate at microphone 3, to see that no malpractice was taking place.

- Although the monitoring period was from 8th - 27th May, **microphone 2 was taken out of service after its inspection on 19th May. No reason has been given for this.**

- Microphone 3, the sheep rubbing post seen to have been knocked over when viewed in the week beginning 18th May, was inspected on 19th May and was stood up again. No end date is given for the readings from this microphone. Perhaps it was damaged when it went over. **No acknowledgement of this incident is given in the Environmental Statement.**

- **Only microphones 1 and 4, the two predicted to be the most noisy locations in paragraph 5.2.28 above, completed the assessment period intact.**

5.2.31 In order to complete a valid noise assessment, **two weeks' worth of raw data** should be collected in conditions which enable a full worst-case scenario to be established. This means a full range of wind directions and a range of wind speeds from 0 - 12 m/s are required. In section 11.3.3 of the ES Arcus explains how it (correctly) excluded the data from the 8 rain event days and then announces that *'An equivalent of a minimum of **one week of data** was obtained for each monitoring location.'* **Only the release of the raw noise data for independent analysis and verification can confirm this assertion.**

5.2.32 Arcus admits in the Environmental Statement (11.4 - Information Gaps) that it did not have any data at all for daytime wind speeds above 8 m/s and night time wind speeds above 7 m/s. It also discards any data below 4 m/s, saying that since they are below the cut-in speed for the turbines under consideration they are not relevant to this assessment (section 11.3.5). This is an invalid move because it dismisses an important phenomenon known as the Van den Berg effect which can add up to 15dB(A) to the readings, especially at night in calm or low wind conditions (see paragraph 5.2.49 below).

5.2.33 This leaves Arcus with precious little data to work with. It gets worse, however, when an examination is made of the total range of wind directions it is likely to have recorded for this assessment.

5.2.34 During the monitoring period, only light winds blew from an eastern quadrant for 90% of the time. This is confirmed by the wind data from Chivenor and also by the two Wunderground Weather Stations in Holsworthy, which, although not reliable for wind speed readings, are adequate for wind direction readings.

5.2.35 This means that the only microphones which were ever in a position downwind of the proposed turbine positions were microphones 2 and 3, the two microphones which did not survive the whole of the assessment period. **Microphones 1 and 4 were never downwind of the turbine positions so no data was collected at these microphones which can truly represent the worst-case scenario as required.** The wind directions for the period are shown below:

CHIVENOR 03707 WIND DATA		km/h		km/h		km/h		km/h		km/h		km/h		km/h		km/h		Ave Speed in km/h	Ave Speed in m/s		IENGLAND32 HOLSWORTHY	IENGLAND34 HOLSWORTHY
Time (GMT)	11:50		02:50		05:50		08:50		11:50		14:50		17:50		20:50							
08/05/2008	ESE	13.0	ESE	13.0	ESE	14.8	SE	37.0	SE	38.9	SE	38.9	SE	22.2	E	14.8		24.1	6.7		ESE	ENE
09/05/2008	SE	13.0	W	9.3	W	9.3	W	9.3	WNW	9.3	N	14.8	W	11.1	SW	11.1		10.9	3.0		NNW	W
10/05/2008	SE	5.6	E	9.3	SSW	1.9	SE	13.0	SE	20.4	SSE	24.1	W	13.0	NW	3.7		11.4	3.2		ESE	SE
11/05/2008	E	1.9	E	5.6	E	5.6	WSW	16.7	SW	24.1	SW	18.5	WSW	16.7	WSW	5.6		11.8	3.3		NNW	NW
12/05/2008	ESE	9.3	E	9.3	E	7.4	N	1.9	E	16.7	ESE	20.4	E	16.7	E	22.2		13.0	3.6		E	NE
13/05/2008	E	16.7	ESE	16.7	E	5.6	SE	14.8	ESE	24.1	ESE	24.1	E	25.9	E	29.6		19.7	5.5		E	NE
14/05/2008	E	18.5	E	7.4	ESE	9.3	E	18.5	E	18.5	ENE	25.9	E	27.8	E	20.4		18.3	5.1		E	NE
15/05/2008	E	16.7	E	14.8	E	11.1	E	11.1	ESE	20.4	ESE	16.7	ESE	18.5	E	11.1		15.1	4.2		E	NNE
16/05/2008	E	3.7	E	11.1			SE	11.1	ESE	16.7	E	13.0	E	5.6	E	7.4		9.8	2.7		E	NE
17/05/2008	SE	5.6	E	1.9	ENE	5.6	ESE	16.7	ESE	16.7	ESE	18.5	ESE	13.0	E	9.3		10.9	3.0		E	NE
18/05/2008	SE	13.0	E	9.3	E	24.1	E	20.4	ESE	24.1	NE	24.1	E	18.5	E	11.1		18.1	5.0		E	E
19/05/2008	ESE	7.4	ESE	13.0	ESE	13.0	ESE	22.2	E	24.1	E	20.4	E	20.4	NE	14.8		16.9	4.7		E	NE
20/05/2008	E	9.3	E	9.3	E	20.4	ESE	25.9	SE	24.1	SE	22.2	SE	20.4	SE	13.0		18.1	5.0		ESE	ESE
21/05/2008	ESE	9.3	ESE	11.1	ESE	16.7	SE	24.1	SE	25.9	SSE	29.6	SSE	27.8	ESE	22.2		20.8	5.8		ESE	ESE
22/05/2008	ESE	20.4	ESE	24.1	E	22.2	ESE	16.7	ESE	22.2			WNW	9.3	ESE	13.0		18.3	5.1		SE	SE
23/05/2008	E	14.8	E	14.8	SE	13.0	ESE	7.4	ESE	13.0	SE	20.4	ENE	18.5	E	9.3		13.9	3.9		ESE	ENE
24/05/2008	E	16.7	E	20.4	E	29.6	ENE	33.3	E	42.6	ENE	44.4	E	31.5	NE	35.2		31.7	8.8		ENE	NE
25/05/2008	NE	35.2	ENE	42.6	E	20.4	ENE	35.2	ENE	33.3	ESE	25.9	ENE	29.6	ENE	25.9		31.0	8.6		ENE	NNE
26/05/2008	E	31.5	E	25.9	NE	38.9	ENE	46.3	ENE	55.6	ENE	61.1	ENE	51.9	E	40.7		44.0	12.2		ENE	NNE
27/05/2008	ENE	33.3	ENE	29.6	ESE	18.5	E	27.8	ESE	18.5	SE	16.7	E	16.7	E	13.0		21.8	6.0		E	NE
N	0		0		0		1		0		1		0		0	2	1.3%	Average blowing from NE-SSE for 89.2% of the time the noise readings were being taken.	5.3 m/s		These Wunderground stations at Holsworthy confirm the strong easterly component in the wind during the monitoring period (90.0% NNE-SE)	
NNE	0		0		0		0		0		0		0		0	0	0.0%					
NE	1		0		1		0		0		1		0		2	**5**	**3.2%**					
ENE	1		2		1		3		2		3		3		1	**16**	**10.1%**					
E	9		12		9		4		4		2		8		11	**59**	**37.3%**					
ESE	5		5		5		5		8		5		2		2	**37**	**23.4%**					
SE	4		0		1		5		4		4		2		1	**21**	**13.3%**					
SSE	0		0		0		0		0		2		1		0	**3**	**1.9%**					
S	0		0		0		0		0		0		0		0	0	0.0%					
SSW	0		0		1		0		0		0		0		0	1	0.6%					
SW	0		0		0		0		1		1		0		1	3	1.9%					
WSW	0		0		0		1		0		0		1		1	3	1.9%					
W	0		1		1		1		0		0		2		0	5	3.2%					
WNW	0		0		0		0		1		0		1		0	2	1.3%					
NW	0		0		0		0		0		0		0		1	1	0.6%					
NNW	0		0		0		0		0		0		0		0	0	0.0%					

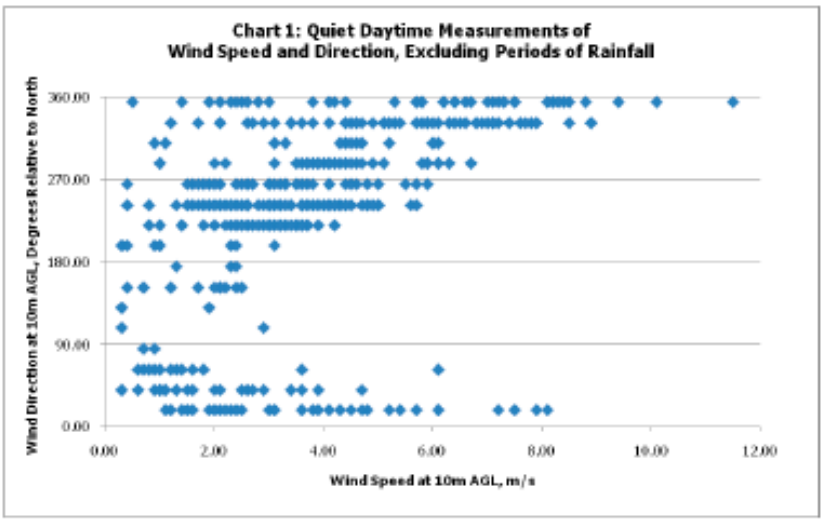
5.2.36 This hardly represents the worst-case scenario since Bolsterstone claims the prevailing wind direction is 235˚ (see Section 2, paragraph 2.6.35). DTOG has pointed out in Section 2 that there are actually two prevailing wind directions of 263˚ and 100˚ respectively. The noise readings were all taken on an occasion when the latter situation was prevailing. Whichever of the three claimed prevailing wind directions is accepted, microphones 1 and 4 were never downwind of any of them.

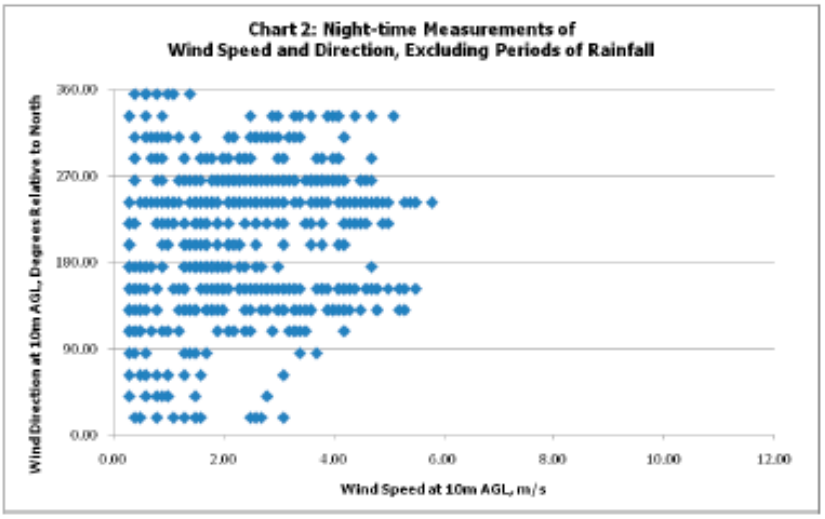
5.2.37 Arcus' dilemma was almost complete. It could not, or did not want to, use data from microphones 2 and 3 and it had no downwind readings from microphones 1 and 4. The obvious solution was to start again and take the readings again. This would involve obtaining planning permission for the anemometer and leaving the equipment in situ until it had captured enough robust, valid data.

5.2.38 Arcus had been in this situation before. It also did the noise assessment for Bolsterstone in its twice-failed bid to Carlisle City Council for the Newlands Wind Farm proposal. There are a number of similarities between the two applications. The nearest properties were just over 400 metres from the turbine positions and there was a reluctance from residents to have sound equipment in their gardens. Arcus first took readings from 5th July - 1st August, 2007 but **cited a battery failure on the anemometer for disqualifying all the readings** from 12th - 24th July and heavy rain for disqualifying the readings taken on 6th, 7th, 25th, 26th and 27th July. So it only had 11 days of readings from a possible 26. There were very few, if any, downwind readings. Arcus does, indeed, seem to be unfortunate when it tries to take noise measurements.

5.2.39 Unlike at Dunsland Cross, Arcus decided to take a second set of readings 9 months later, from 3rd - 16th April, 2008, just before the Dunsland Cross ones were due to commence. This time it included a location in the nearest village, previously un-monitored territory. It also managed to get a microphone in the garden of the nearest property and did manage to get some downwind readings.

5.2.40 During its deliberations on the application, Carlisle City Council wanted to know more about the noise assessment. Ms Fiona Donald of the Environmental Health Department had a conversation with Mr. Reid of Arcus in which she requested information about the wind directions during his assessments, since none had been supplied with the application. In a letter to Ms Donald dated 17th September, 2008, Mr. Reid sent in the following diagrams:





5.2.41 Since the worst-case scenario for properties in Brandis Corner remains unknown, TDC should demand similar information from Mr. Reid for the Dunsland Cross application. **It should also demand an explanation as to why this information was not volunteered in the first place**, since the Dunsland Cross noise assessments would have been complete by the time this information exchange with Ms Donald was taking place.

Stage 5

5.2.42 Rather than start again at Dunsland Cross, Arcus decided to devise a way of utilising the inadequate data from microphones 1 and 4 so that they could be used to apply noise limits to all properties surrounding the proposed site. This masterplan is described in 11.3.5 of the Environmental Statement. In it Arcus suggests that:

- The daytime readings from microphone 4 are the lowest so they can be applied to all the properties around the site
- The night time background noise assessment can be an amalgamation of the lower wind speed readings of microphone 4 and the remaining (limited) wind speed readings from microphone 1 and that this can apply to all the properties around the site.

5.2.43 Arcus insists that this is a conservative approach which *'underestimates background noise levels at the houses around the site, as there are likely to be additional background noise*

sources at the houses, such as household appliances, cars, garden vegetation, pets, etc.' DTOG would like to point out that household appliances, cars and pets are unlikely to register anything on an $L_{A90,\ 10min}$ measurement.

5.2.44 In section 11.5.2 of the Environmental Statement Arcus concludes:

> *'**Station Cottages and View Farm Area:** the property in this area with the highest predicted noise levels is The Vale, which has been assessed against daytime limits derived from background noise levels at Monitoring Location 1 and night-time limits derived from the composite derived background noise level curve; …'*

5.2.45 So here we have The Vale, a property which had a perfectly good microphone sited right next to it recording very low night time background noise levels. The microphone was taken away halfway through the monitoring period for no explained reason. The readings taken from microphones 1 and 4, the two predicted to be the noisiest at the outset, but magically becoming the quietest, have been substituted instead. They were situated over 1 km away from The Vale on the opposite side of the wind farm site. None of the readings from microphones 1 and 4 can be valid because they were not downwind readings. Even if they were, The Vale would still be upwind of the proposed turbine positions at the same time as the readings were taken, so they would not be relevant. Opposite sides of the wind farm cannot be downwind at the same time.

Stage 6

5.2.46 Table 11.9 in Chapter 11 of the ES shows the Operational Noise Assessment for The Vale. It shows that it is within the limits allowed by just 0.3dB(A). The table following paragraph 5.2.14 shows that the original Arcus forecast for The Vale is likely to be 5.5 dB(A) below the probable level if the wind farm is ever built. Instead of being 0.3dB(A) inside the limit, the noise level at The Vale is likely to be nearly 5.2dB(A) above it. The same trend can be shown for many of the other properties. As Arcus has stated, a 3dB(A) rise is a doubling of Sound Pressure at the property.

This completes the analysis of Stages 1 - 6.

5.2.47 The Companion Guide to PPS22, paragraph 41, page 167, states:

> *'41. Well-specified and well-designed wind farms should be located so that increases in ambient noise levels around noise-sensitive developments are kept to acceptable levels with relation to existing background noise. **This will normally be achieved** through good design of the turbines and **through allowing sufficient distance between the turbines and any existing noise-sensitive development so that noise from the turbines will not normally be significant.'***

5.2.48 This DTOG document has made it clear that the turbines are sited too close to each other and to nearby occupied properties. The most likely turbine, the REpower MM82, produces 101.7 dB(A) at 5m/s wind speed at 10m agl, rising to 105 dB(A) as the wind picks up to 12m/s. The Enercon E82 has noise levels of 96.3 dB(A) to 104 dB(A) over the same wind speed range. (Table 11.1 Environmental Statement) **These noise level are the equivalent of a pneumatic drill at 7 metres and a jet aircraft at 250 metres respectively.** (PPS22 Companion Guide, Table 1 page 168) The only possible protection for nearby properties against this noise is separation distance. The distances proposed by this developer to mitigate this noise nuisance do not concur with those adopted by other, more experienced, developers.

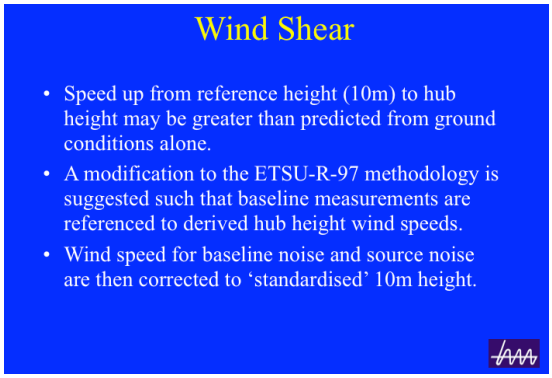
5.2.49 Since separation distance is the only protection nearby residents will have against excessive noise, DTOG would like to draw the attention of TDC to the first part of a press release from the Renewable Energy Foundation, shown below:

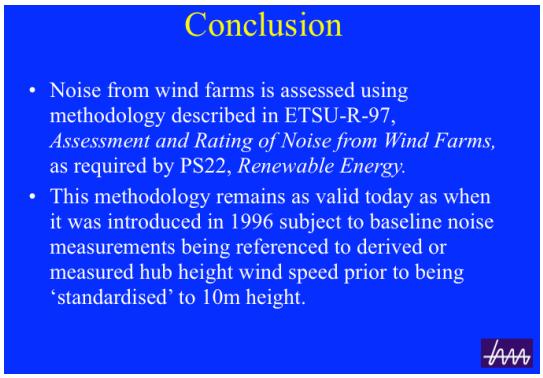
> *'20th September 2004*
>
> *NEW RESEARCH EXPLAINS WIND TURBINE NOISE PROBLEMS*
>
> *In a major new article published this month in the Journal of Sound and Vibration, G. P. Van den Berg, a physicist at the University of Groningen in the Netherlands, believes that he has at last explained the mystery of why modern onshore wind turbines can cause noise problems for residents* ***at distances of a mile or more.***
>
> *For his article, "Effects of the wind profile at night on wind turbine sound" (Journal of Sound and Vibration, 277 (2004), 955–970), Van den Berg measured sound around the Rhede wind-farm (an installation of 17 turbines), on the Dutch/German border.* ***"Residents living 500 m and more from the park have reacted strongly to the noise; (and) residents up to 1900m distance expressed annoyance" particularly at night. Yet, conventional wind industry calculations have assumed that turbines would present no noise problem over 500m.***
>
> *After extensive measurements, Van den Berg discovered that t****he methods used by wind turbine developers, in the UK and elsewhere, to predict noise are seriously flawed*** *because of their assumption that wind speeds measured at a height of 10 metres are representative of wind speed at the greater heights of modern turbines (often 100 metres and above).*
>
> *The importance of this analysis is further exacerbated when measured at night, when though wind speeds may fall at ground level (to near zero), they remain fast enough at 60 metres (and above) to turn the turbine blades. In fact, his measurements show, wind speeds at night are up to 2.6 times higher than expected.*
>
> *Even in the day background noise is not good at covering the rhythmical thumping caused by the blade as it passes the tower. Consequently, against expectations, the turbines were turning at night and the noise propagating down into an area at ground level where this was no background noise to mask it, and consequently* ***residents were experiencing sound levels 15dB higher than expected****. Though turbines were making as much noise as normal, it was carrying much further, and especially at night when it was particularly troublesome …'*

5.2.50 Of particular note in the above is the phrase, '***conventional wind industry calculations have assumed that turbines would present no noise problem over 500m.'*** In the Dunsland Cross application, 11 properties (19 people) will be within 500 metres of a turbine and this would rise to 18 properties and 32 people if micrositing was allowed (paragraph 5.2.14 above). Bolsterstone's calculations for this wind farm must be **unconventional** if it expects no noise problems under 500 metres.

5.2.51 Table 11.4 in the Environmental Statement shows background noise levels of 22.4dB(A) at microphone 1 in the conditions where the Van den Berg effect would occur. This reading is already above the level of a quiet bedroom according to the PPS22 Guidelines. With a 15dB(A) Van den Berg increase, which is **a 32-fold increase in the noise level** (5 x 3dB doublings), the resultant figure of 37.4dB(A) far exceeds the WHO limit of 30dB(A) which it regards as the minimum for undisturbed sleep at night. The supposed attenuation of 10dB(A) through an open window is irrelevant. The noise will vibrate into the bedroom via the roof space and ceiling.

5.2.52 The SoundPLAN software makes an allowance for a moderate temperature inversion at night. (This is when the air temperature at ground level is colder than the air aloft. Normally it is the other way round. It occurs in light winds and causes sound waves which would normally escape and dissipate upwards to bend back down to ground level. In this way distant sources of noise can sound much closer than they really are.) This is not the same as the Van den Berg Effect described above. The Van den Berg research explains why Hayes McKenzie is now suggesting a modification to the ETSU-R-97 methodology to allow for greater wind shear. Hayes McKenzie acknowledges a weakness in ETSU-R-97 by suggesting that wind speed for baseline noise and source noise should be shown to be corrected to 'standardised' 10m height. The following two slides for the aforementioned Hayes McKenzie presentation illustrate this concern:





5.2.53 **There is no proof in Bolsterstone's application that baseline measurements have been referenced to derived hub-height wind speeds.** The only error-free way to have done this would have been to have had a hub-height anemometer on-site when the noise readings were taken. Hub-height anemometers have several sensors at different heights so the simultaneous wind speeds can be compared and the wind shear derived from them. This cannot be done with the single sensor 10-metres mast which Arcus used.

5.2.54 There is no proof that the data has been filtered correctly to exclude non-quiet daytime periods, but DTOG would be extremely surprised if any error or malpractice had occurred in this respect. The only way to be sure, though, is for TDC to **demand the release of the raw noise data and have it independently scrutinised by an Acoustics expert**.

5.2.55 Any concerns arising from considering the developer's noise assessment make it essential that there is full disclosure to the decision-making authority, and to families likely to suffer violation to their homes from environmental noise pollution, of the full details of the background noise levels measured by the developers, including narrative of methodology, instrumentation, **weather conditions for each daily measurement** and comment if extraneous (or erroneous) noise interfered with any measurement.

5.2.56 There is Judicial precedent for this information to be provided and for both TDC and DTOG and any other affected person to be given reasonable time to appraise and comment on the information. Furthermore, any condition attached to a permission when the condition is based upon incorrect/inappropriate information may be termed unlawful. (Tesco Stores Ltd v Secretary of State for the Environment and Others [1995] 1 WLR 759.)

5.2.57 The release of raw noise data by the developer has now happened in two wind farm applications and is likely to become more common as noise assessments by developers fail to allay suspicions of malpractice. In the Den Brook Wind Farm submission in Devon the raw noise data was eventually prised from the developer after a 3-year delay. 'Errors' were found to have been made in the processing of the data by the developer. In Milton Keynes, the Council obtained both raw noise and wind data from the developer of the Petsoe Wind Farm (see paragraphs 5.3.21 to 5.3.23 below).

5.2.58 Any attempt at micrositing in the Dunsland Cross project will make the noise situation even worse, so **micrositing cannot be allowed in this project.** If the turbines are moved any nearer to the properties the noise levels will increase further. If they are moved nearer to each

other, the increased wake vortices on the downwind turbines will lead to more noise through Amplitude Modulation (see section 5.3 below). It would also lead to a drop in the electrical output of the downwind turbines.

5.2.59 Mitigation by running the turbines in noise suppression mode would have a similar detrimental effect. The noise levels are so high in this application that full noise reduction Mode 6 would be required. This may not be enough. Mode 6 also results in an electrical output drop of 30%. This would make a mockery of the claims by the developer with regard to the number of homes supplied and the amount of CO_2 saved (see Section 3: Misleading Claims). Instead of providing just over 15 hours worth of electricity each year (compared to Didcot A), this wind farm would provide only 11.

5.2.60 It is imperative that TDC planning officers ensure that the noise level predictions in this application are correct. The consequences of their not being correct are serious. Officers have a duty of care to the people of Torridge to ensure that the figures supplied with the application are subject to the most rigorous scrutiny in order that they may be validated. If there is **any** doubt in the minds of the planning officers as to the adequacy of the figures, then refusal of the application is the only option.

5.2.61 DTOG believes the noise assessment supplied by the applicant is seriously flawed. As a consequence, it has approached the top two acousticians with experience in wind farm applications in the UK for a professional opinion. Mr. Mike Stigwood was unable to take on any more work at the present time and Terri Stigwood replied on his behalf:

> *'Thank you for your email to which I am replying in Mike's absence. I have relayed the content of your email to Mike and he makes the following comments:*
>
> > "This application requires an Environmental Impact Assessment and as a consequence the LPAs should give 3 months to respond. I strongly recommend you consult solicitors without delay to send an initial warning letter to the LPA. I recommend Richard Buxton, Environmental Lawyer (19B Victoria Street Cambridge CB1 1JP Tel: 01223 328933 General email: law@richardbuxton.co.uk) as they have successfully judicially reviewed a number of LPA and Planning Inspectorate decisions on windfarms.
> >
> > I cannot respond by 24th January as I am dealing with an unacceptable workload and have a windfarm Inquiry over the next two weeks.
> >
> > This application is cause for serious concern.
> >
> > Regards Mike Stigwood"
>
> *Kind regards*
>
> *Terri Stigwood*
> *Partner'*

(Email correspondence dated 7th January, 2008, on file with DTOG)

5.2.62 Mr. Dick Bowdler of New Acoustics, first mentioned at the start of this section of the report, was available, however, and he was commissioned to produce a report in which he:

- Examined all of the Noise section in the applicant's Environmental Statement and Appendices

- Constructed a computer model of the development and checked the turbine noise levels
- Commented on the background noise levels in the applicant's Environmental Statement
- Produced a comprehensive critique of the applicant's Noise section in the Environmental Statement.

Mr. Bowdler has also offered to analyse the raw noise data for the application if it were to become available at a future date.

5.2.63 Mr. Bowdler's report is attached as Appendix E. The summary of his findings is reproduced here:

> **1 SUMMARY**
>
> 1.1 The background noise levels measured by the applicant are a cause for concern. There is a lack of data at higher wind speeds. The curves do not display the normal shape and there is not the expected relationship between day and night curves. Even if some of the curves are correct for the measurement location it may not be appropriate to use them for other locations. In order to carry out an assessment I have used generic wind related background noise.
>
> 1.2 I have used a turbine noise prediction method which has been validated by recent research and this has resulted in turbine noise levels 2dB in excess of those calculated by the applicant.
>
> 1.3 There are two parallel tests for wind farm noise set out in Government policy in PPS22. The first is that the increase in ambient noise levels should be minimised, the second is that ETSU-R-97 should be used as a test.
>
> 1.4 The applicant has not considered the question of minimising ambient noise increases at all. In fact I find fourteen properties will be subject to a high impact of noise during the day and all but six properties will be subject to a high impact at night.
>
> 1.5 The applicant claims that the ETSU test is met. I do not agree. Because the turbine noise levels are understated and the background noise levels overstated it is my opinion that almost all the listed properties fail the day time test and at least seven of them fail the night time test.

5.2.64 Mr. Bowdler has reached the same conclusion as DTOG but has done so by professionally approved modelling techniques. It is noticable that, even though he started out with quieter turbines (105 dB(A) as opposed to the applicant's 'conservative' 106 dB(A)) he has found noise levels 2 dB(A) higher at nearby properties than did the applicant. It is also significant that the applicant has ignored the need to assess the ***impact*** of the noise of the turbines at nearby properties as required in PPS22. This is shown to be high at 10 of the named properties around the site during the daytime and at 37 of these properties at night (adding the 5 other houses at The Gardens and at Station Cottages left out of Mr. Bowdler's list in his Table 3).

5.2.65 Also significant is Mr.Bowdler's comment in paragraph 7.3 of his report:

> 7.3 ETSU-R-97 has already built in a balance between the impact on neighbours and the need for renewable energy. It is therefore an absolute test and any single failure means that the development must be refused.

5.2.66 In view of all preceding paragraphs in this section, TDC cannot allow this application to be approved. This wind farm can never satisfy ETSU-R-97 and so can never satisfy PPS22, since the former is a condition of the latter. Even if the applicant was able to produce figures which showed that ETSU-R-97 was satisfied, the application would still fail to satisfy the noise impact assessment requirement of PPS22.

5.2.67 If litigation were to become necessary in the event of noise pollution becoming a nuisance as a result of this wind farm ever being built, then sub-paragraphs 13(8), 16, 19, 24-27, 31-33, 35 and 37 et seq. of paragraph 13.7.1 in Section 13: Litigation would be relevant.

5.2.68 Recommendation: REFUSAL

The collection and processing of the raw noise data in this application is seriously flawed and the methodology used by the applicant fails to meet the requirements of PPS22. An independent, expert acoustician has shown that noise levels at many nearby properties will exceed those permitted by ETSU-R-97. For this reason the application must be refused.

5.2.69 Recommendation: CONDITION

If the applicant wishes to continue with this application it must supply copies of the raw noise data and TDC should submit it for rigorous independent analysis, preferably at the applicant's expense. Alternatively, the applicant should re-do the noise assessment in full, with planning permission sought and obtained for the anemometer. This second assessment should also be analysed independently to ensure probity.

5.3 Low Frequency Noise and Amplitude Modulation (AM)

5.3.1 The audible noise coming from wind turbines will comprise a range of frequencies. High frequency sounds attenuate (die down) relatively quickly with distance in open air. Of greater concern are low frequency sounds in the range 20 - 200 Hz since these are more penetrating and carry further, as anyone subjected to bass music nuisance from neighbours can testify.

5.3.2 In a wind farm, low frequency sounds are produced by the turbines in the form of a 'swish' and a 'thump' from the rotating blades. The 'swish' is caused by the blades carving the air. To a nearby observer a Doppler Effect will be superimposed on the swish resulting in a pulsing characteristic which will not be apparent further away. The cause of the 'thump' is harder to pin-point, but it is believed to be created as a result of turbulent air striking the blades and reflecting or rebounding from them. A second cause of 'thump' may be the compression and subsequent release of the air between the tower and the passing blade giving a pulsing characteristic to the low frequency sound produced. This pulse can travel some distance from the turbine.

5.3.3 In Cadillac, Michigan, acoustics expert Rick James has been explaining the low frequency noise problem. In an article by Ashley Box on the Cadillac News website (www.cadillacnews.com) on 5th December, 2008, the following was written:

> *'… James has been working since 2006, consulting and sharing current research results that shed more light on this issue.*
>
> *While wind turbines produce a relatively quiet sound when compared to other common noises such as cars, airports, or railroads, a study in Sweden showed that people find the sound more annoying.*

"It causes the problem with sleep disturbance not because it's overly loud, but because it can be equated to Chinese water torture. It's the constant, drop, drop, drop. One factor we didn't understand is that people choose to live in rural communities to get away from the noise," James explained. "What they are looking for is something only rural America can offer - peace and quiet."

Low-frequency sounds, which are created by large and stable sound waves, are known to travel for great distances and penetrate nearly every substance.

5.3.4 Amplitude Modulation (AM) occurs when sound waves created by the turbines constructively or destructively interfere with each other. This can increase or decrease the level of sound leaving the wind farm, but it will not be easy to predict since it will depend on factors including wind speed and direction, local topographical obstructions, turbine size and separation distances. This topic is discussed in another paper by Dick Bowdler called, *'Amplitude Modulation of Wind Turbine Noise: A Review of the Evidence'* (downloadable from http://www.windaction.org/documents/16734). This paper concludes by saying:

'It seems possible that there are two distinct mechanisms in operation to create AM. The first is swish which is a function of the observer's position relative to one turbine. The second is thump which is due to turbine blades passing through uneven air velocities as they rotate. In the second case the uneven air may be due to interaction of other turbines, excessive wind shear or topography. These two mechanisms are entirely separate though it is possible that they interact. If this is the case there is little that can be done about swish but further research into thump would help to avoid excessive AM in future developments.'

5.3.5 If one can get past the temptation to see 'swish' and 'thump' as pantomime characters in need of treatment there are some serious points being made here, with implications for Dunsland Cross. *'There is little that can be done about swish'* means that **the only mitigation is not to allow turbines too close to houses in the first place**. That 'thump' is caused by *'interaction of other turbines, excessive wind shear or topography'* is significant because this wind farm will experience air turbulence as a result of all three of these circumstances. (See sections 2.3, 2.4 and 2.5 for coverage of these topics.)

5.3.6 Planning officers unfamiliar with audible wind turbine noise are recommended to view two short videos available on You Tube. They demonstrate exactly what the audible component of the noise sounds like. Without absolute measurement by a calibrated meter no conclusion can be reached about the *volume* of the noise in these recordings. They have been made using camcorders with automatic sound systems which will increase the gain until the sound is successfully captured, then scale back a little to avoid distortion. The purpose of pointing officers to these recordings is so that they can become familiar with the nature of the sound, which is principally a tonal 'drone' from the gearbox, a 'whine' from the generator and the 'swish' from the blades. When watching the videos officers will need to be mindful of two things: AM cannot be demonstrated in the recordings nor can the inaudible infrasound be detected. Both of these are as damaging to human and animal health as continuous, excessive audible sound (see Section 5.4 below).

5.3.7 The video clips can be accessed at:

http://uk.youtube.com/watch?v=mablINxg3zE (3 families forced from homes by turbines 700 metres away)

http://uk.youtube.com/watch?v=27fusaCE6YQ (Aberdeenshire, 2MW turbine 90 m in height)

5.3.8 At a noise conference in the USA this year, George Kamperman and Richard James considered the noise problems from wind turbines:

NOISE-CON 2008
2008 July 28-31
Simple guidelines for siting wind turbines to prevent health risks
By:
George W. Kamperman, INCE Bd. Cert. Emeritus
Kamperman Associates, Inc.
george@kamperman.com

Richard R. James, INCE
E-Coustic Solutions
rickjames@e-coustic.com

They concluded:

> *'This will result in setbacks in the range of **1 km or greater** for the current generation of wind turbines if they are to be located in rural areas where the L90A background sound levels are 30 dBA or lower.'*

5.3.9 As recently as 25th November, 2008, NASA (http://www.nasa.gov) issued a press release entitled, *'NASA Announces Virginia Aeronautics Research Award'*, which had as its first paragraph:

> *'NASA's Aeronautics Research Mission Directorate has awarded $170,146 to Wyle Laboratories Inc. of Arlington, Va., for work described in its NASA research announcement proposal entitled "A Research Plan to Determine the Effects of Low-Frequency Noise on Humans."'*

This shows that this area of research is now being taken very seriously around the world.

5.3.10 In January 2008, Dan Rogerson MP had asked the Secretary of State for Environment, Food and Rural Affairs what steps he is taking to measure the low level sounds produced by wind turbines. (Hansard 180993).

On 23rd January, 2008, Jonathan Shaw replied (Hansard column 2026W):

> *'In 2004, the then Department for Trade and Industry (DTI) (now the Department for Business, Enterprise and Regulatory Reform—DBERR) commissioned Hayes McKenzie to report on claims that infrasound or low frequency noise emitted by wind turbine generators were causing health effects. Hayes McKenzie reported to the then DTI in May 2006 that there was no evidence of health effects arising from infrasound or low frequency noise generated by wind farms. The report recommended further work on the specific issue of Aerodynamic Modulation (AM).'*

(On 7th March, 2006, Dr. Nina Pierpont had testified before the New York legislature with regard to infrasound from wind turbines. (see paragraph 5.4.9 below). Yet 2 months later, in May, 2006, Hayes McKenzie said no evidence was available. If no evidence was available, why did they also recommend further research into AM?)

5.3.11 A Government-funded research study, entitled *'Research into Aerodynamic Modulation (AM) of Wind Turbine Noise'*, was undertaken by Salford University in 2007. It concluded that AM has occurred at only a small number (4 of 133) of windfarms in the UK, and for only between 7% and 15% of the time. **So it does exist.**

5.3.12 The Salford University study also stated that the causes of AM are not understood as yet and that prediction of the effect is not currently possible. **But no prediction is needed. AM does exist.** The question is how severe will it be in different wind farm applications? Obviously, the closer the turbines are to dwellings, the more severe will be the impact of AM on the people and animals in those dwellings.

5.3.13 Predictably, the Salford study gave the recommendation the government required, but with a caveat:

> *"Considering the need for further research, the incidence of AM and the number of people affected is probably too small at present to make a compelling case for further research funding in preference to other types of noise which affect many more people. On the other hand, since AM cannot be fully predicted at present, and its causes are not fully understood we consider that it might be prudent to carry out further research to improve understanding in this area."*

5.3.14 On consideration of the Salford report recommendations the government decided that there was not, at present, a compelling case for further work into AM, and that it would not carry out further research, but it would 'continue to keep the issue under review.' This provides no security for residents close to wind farms seeking protection from wind turbine-created noise.

5.3.15 Following the release of the Salford University report in 2007, Dick Bowdler quit the NWG in protest, saying that it had become redundant and that the Salford report was 'misleading'.

5.3.16 The Companion Guide to PPS22, paragraphs 45 and 46, page 170, states:

> *'45. There is no evidence that ground transmitted low frequency noise from wind turbines is at a sufficient level to be harmful to human health. A comprehensive study of vibration measurements in the vicinity of a modern wind farm was undertaken in the UK in 1997 by ETSU for the DTI (ETSU W/13/00392/REP). Measurements were made on site and up to 1km away – in a wide range of wind speeds and direction.*
>
> *46. The study found that:*
>
> *• Vibration levels 100m from the nearest turbine were a factor of 10 less than those recommended for human exposure in critical buildings (i.e. laboratories for precision measurement).*
>
> *• Tones above 3.0 Hz were found to attenuate rapidly with distance – the higher frequencies attenuating at a progressively increasing rate.'*

5.3.17 These statements show why ETSU-R-97 needs updating. They refer to research undertaken 11 years ago in 1997 when turbines were much smaller than they are today. The statement, '*There is no evidence that ground transmitted low frequency noise from wind turbines is at a sufficient level to be harmful to human health'* is misleading. The low frequency noise which is causing the problems is not just ground-transmitted vibration. Most of it is pressure waves transmitted through the air where it promulgates much greater distances. Also, by restricting the phrase to refer to just human health, no consideration is given to fish, amphibians or reptiles which may inhabit nearby ponds and watercourses. The effect of continuous ground vibration on them is not known. Fish stocks in angling ponds may be affected. This, in turn, may affect tourism (see Section 7: Tourism).

5.3.18 Planning officers are once again reminded of the case of Jane and Julian Davis, first mentioned in *'A note relating to the final turbine choice'* in Section 3 after paragraph 3.1.35. Mr. and Mrs. Davis cannot sleep in their house at night because of the REpower MM82 turbine **930 metres away**. They sleep in a rented house 5 miles away from the wind farm at Deeping St. Nicholas in Lincolnshire, returning to their now-worthless home to work in the daytime. The REpower MM82 turbine is the one most likely to be chosen for Dunsland Cross. Four of them will be sited between 416 and 750 metres from 35 dwellings and 6 places of work. 69 residents live in those dwellings.

5.3.19 At the public exhibition for the Dunsland Cross wind farm Mike Corker of Bolsterstone was questioned about the problems being caused by the REpower MM82 in Lincolnshire. (Both Mr. Corker (for) and Mrs. Davis (against) made personal representations in Bolsterstone's Newlands Wind Farm proposal before Carlisle City Council.) Mr. Corker said that he 'can't understand why they haven't sorted it', giving the impression that he knows how to do it. The Davis' case has been ongoing for years. The council has reduced their council tax to the lowest band. The turbines are as noisy as they ever were. More experienced personnel cannot solve this problem. Mr. Corker's comment shows how little he understands about the complexity of wind farm noise emissions.

5.3.20 As stated in paragraphs 5.1.9 and 5.1.16 above, having managed to record the highest possible background noise levels, by fair means or foul, the computer predictions always show that there will not be a noise problem at nearby properties. In applications where there are sufficient grounds for doubt, such as this one, planning officers should not accept such claims at face value. **The raw noise data should be demanded from the developer** and it should undergo independent expert analysis to ensure that it is valid, robust and capable of confirming Bolsterstone's predictions for derived noise limits at nearby properties.

5.3.21 Raw noise (or wind) files comprise many thousands of data items and can only be analysed realistically by using appropriate computer software and CD or DVD data discs. In printed form they would take up thousands of pages. Precedents have been set, however, in terms of demanding and getting this data from developers.

5.3.22 The Den Brook team, campaigning against a proposal by Renewable Energy Systems (RES) for a 9-turbines wind farm near North Tawton in Devon, succeeded in getting the raw noise data after taking the case to Judicial Review. In a press release dated 3rd August, 2008, the Den Brook team stated:

> *'The case sets a precedent that wind farm neighbours have the right to raw environmental data. As the Den Brook team discovered, the noise measurements and subsequent data analysis by the developer, Renewable Energy Systems [RES], contained inaccuracies. Even though RES commissioned a leading independent noise expert to confirm the reliability of their own noise assessment, it is now beyond doubt that the assessment contained errors.*
>
> *For three years, RES refused to release the vital noise assessment data to the Den Brook team. Amongst other reasons, RES maintained that the Den Brook team were incapable of assessing the data appropriately. However, at this point, in spite of only having received part of the data, the acoustician for the team has uncovered errors demonstrating that the developers significantly underestimated the noise impact of this wind farm on neighbouring homes.'*

5.3.23 Milton Keynes Council succeeded in getting both wind and noise raw data from Your Energy Limited in regard to the Plestoe Wind farm near Olney. (A transcript of the hearing for an application for Judicial Review, dated 10.10.2008 can be read at http://www.richardbuxton.co.uk/v3.0/?q=node/359.)

5.3.24 Recommendation: REFUSAL

The application should be refused on the grounds that the distances between turbines and dwellings and the separations between turbines themselves are too small to guarantee no low frequency and AM noise problems at nearby properties.

5.3.25 Recommendation: CONDITION

TDC should demand the raw noise data from the developer so that it can be independently analysed to verify the developer's claims.

5.4 Infrasound and Vibro-Acoustic Disease (VAD)

5.4.1 Whilst audible noise from a wind turbine can be the cause of serious annoyance and distress to nearby residents, inaudible noise, or infrasound, is an area of equal concern to medical and other professionals investigating ill health in wind farm neighbours. Human hearing has a lower threshold of approximately 20 Hz (Hertz, or vibrations per second). **Wind turbines emit inaudible noise below this frequency threshold. This infrasound, as it is known, penetrates buildings and human bodies with ease.**

5.4.2 In the Rick James news article mentioned in paragraph 5.3.3 the following is written:

> *'The second health concern related to wind turbines is connected to the inaudible, low-frequency sound produced. While this concern has been rejected by wind companies, James himself has done research that proves that windmills produce a constant low-frequency sound. "I found it dominant, omnipresent. Unlike the audible whooshing, which is there only part of the time when the wind is just right, the low frequency is there all of the time," James said.'*

5.4.3 As stated in paragraph 5.1.4, infrasound is measured on the dB(C) and dB(G) scales. The dB(G) weighting is most appropriate for measuring infrasound but the dB(C) weighting is more common. The dB(A) scale misses most of the infrasound content in any individual measurement. Only the dB(A) scale is used in predicting derived noise limits at noise-sensitive properties for wind farm developments.

5.4.4 Infrasound has been measured coming from the Forest Moor Wind Farm turbines at Bradworthy in Torridge District. The readings are included in a report by John Stewart for the UK Noise Association (UKNA) published in August 2006. The report is called 'Location, Location, Location'. (downloadable from http://www.windaction.org/documents/4281) In this report, charts are presented which show dB(C) readings **29 dB and 30 dB higher** than the corresponding dB(A) readings at Bradworthy. The report has two pages of conclusions and recommendations, one of which is that turbines should not be sited **within a mile** of where people live.

5.4.5 Infrasound is used as a weapon of control. The Frey and Hadden research paper, (see paragraph 5.1.15), paragraph 4 on page 23 states:

> *'Military weaponry exists that relies on low-frequency sound to disperse crowds or control crowd behaviour. The effect of low-frequency noise at high intensities creates discrepancies in the brain, producing disorientation in the body:*
>
> > *'The knees buckle, the brain aches, the stomach turns. And suddenly, nobody feels like protesting anymore. The latest weapon in the Israeli army's high-tech tool kit.*

> *The intention is to disperse crowds with sound pulses that create nausea and dizziness. It has no adverse effects, unless someone is exposed to the sound for hours and hours.' '*
>
> (The inner quotation is from The Cutting Edge: Military Use of Sound, The Toronto Star (Canada), 6 June 2005.)

The final part of the inner quotation, '*unless someone is exposed to the sound for hours and hours'* is relevant to wind farm neighbours.

5.4.6 The research paper by G. Rasmussen, 'Human Body Vibration Exposure and its Measurement' lists symptoms when people are exposed to infrasound of different frequencies:

Frequency	Symptom
4-8 Hz	Influence on breathing movements
4-9 Hz	General feeling of discomfort
4-10 Hz	Abdominal pains
5-7 Hz	Chest pains
10-18 Hz	Urge to urinate
12-16 Hz	Lump in throat
13-20 Hz	Head symptoms, Influence on speech

Further details and references to this research paper can be found in the UKNA report (paragraph 5.4.4) and Frey and Hadden's report (paragraph 5.1.15).

5.4.7 As reports of health problems in people living near wind farms began to be reported, where before the arrival of the wind farm there had been none, further world-wide research was started to try to identify the causes of the problems.

5.4.8 In February 2007, Plymouth-based GP Dr. Amanda Harry M.B.Ch.B. P.G. Dip E.N.T. published the findings of her research in a paper entitled, *'Wind Turbines, Noise and Health'.* In it Dr. Harry concludes:

> *'From my discussions with people suffering ill health who live near wind farms, it seems that the symptoms suffered can occur up to a mile from the wind farm. Until further independent medical and epidemiological research has been carried out I would suggest that no wind turbines should be sited closer than **1.5 miles** away from the nearest dwelling.'*

5.4.9 In the USA, a great deal of research has been undertaken in the last 5 years into Vibro Acoustic Disease (VAD) by New York-based Dr. Nina Pierpont. Her book, “Wind Turbine Syndrome” has just been published (October 2008). She has testified before the New York State Legislature Energy Committee regarding wind farm development:

Wind Turbine Syndrome

Testimony before the New York State Legislature Energy Committee
March 7, 2006

Nina Pierpont, MD, PhD
MD, The Johns Hopkins University School of Medicine, 1991
PhD, Population Biology, Princeton University, 1985
BA, Biology, Yale University, 1977
Fellow of the American Academy of Pediatrics
www.ninapierpont.com

(This testimony can be read at http://www.savewesternny.org/docs/pierpont_testimony.html).

A brief press report summarised her work:

> *'Dr. Nina Pierpont of Malone, N.Y., coined the phrase "wind turbine syndrome" for what she says happens to some people living near wind energy farms. She has made the phrase part of the title of a book she's written called "Wind Turbine Syndrome: A Report on the Natural Experiment." It is scheduled for publication next month by K-Selected Press, of Santa Fe, N.M.*
>
> *In contrast to those who consider wind turbines clean, green and an ideal source of renewable energy, Pierpont says living or working too close to them has a downside. Her research says wind turbines should never be built closer than **two miles** from homes.*
>
> *Pierpont, 53, is a 1991 graduate of Johns Hopkins University School of Medicine and has a doctorate in population biology from Princeton University. Her interest was piqued by a wind farm being built near her upstate New York home, and she studied 10 families living near wind turbines built since 2004 in Canada, England, Ireland, Italy and the United States.*
>
> *Effect on inner ear*
>
> *Pierpont's findings suggest that low-frequency noise and vibration generated by wind machines can have an effect on the inner ear, triggering headaches; difficulty sleeping; tinnitus, or ringing in the ears; learning and mood disorders; panic attacks; irritability; disruption of equilibrium, concentration and memory; and childhood behavior problems.*
>
> *Concerns also are coming out of Europe about low-frequency noise from newly built wind turbines. For example, British physician Amanda Harry, in a February 2007 article titled "Wind Turbines, Noise and Health," wrote of 39 people, including residents of New Zealand and Australia, who suffered from the sounds emitted by wind turbines.*
>
> *According to Pierpont, eight of the 10 families in her study moved out of their homes. "All these problems were resolved as soon as these people got away from the turbines, got in the car and drove away from the house," she said.*
>
> *If Pierpont's theories gain acceptance, decisions on where future wind energy farms are built could be affected.'*

5.4.10 In Portugal, a research paper published in May 2007 entitled, *'Industrial Wind Turbines, Infrasound and Vibro-Acoustic Disease (VAD)'*, by Professor Mariana Alves-Pereira and Nuno Castelo Branco MD, prompted the French National Academy of Medicine to call on the French Government to stop all wind turbine construction **within 1.5 Km of people's homes**:

> *"You should understand that VAD is well established in the clinical literature; it is not conjectured. It has been amply documented and is readily detected by a variety of diagnostic tests."* (See Dr. Chantal Gueniot: 'Panorama du Médicin"'. 20 March 2006)

Mariana Alves-Pereira is a professor in the School of Health Sciences (ERISA), Lusofona University, Portugal and Department of Environmental Sciences & Engineering, New University of Lisbon, Portugal. Nuno Castelo Branco, MD, is Surgical Pathologist and President of the Scientific Board, Center for Human Performance (CPH). (The CPH was founded in 1992 and is the organization which coordinates all the different teams that work on vibro-acoustic disease research, and that includes (in Portugal) the cardiology and pulmonary departments of the

Cascais Hospital, the neurophysiology department of the National Institute of Cancer, the department of human genetics of the National Institute of Public Health and the department of speech pathology of the School of Health Sciences of the Polytechnical Institute of Setúbal.) The conclusion reached in their work is that:

> *'These results irrefutably demonstrate that wind turbines in the proximity of residential areas produce acoustical environments that can lead to the development of VAD in nearby home-dwellers.'*

5.4.11 The Portugese research into VAD has been ongoing since 1980 and concluded in 2004 that excessive exposure to infrasound and low frequency noise (ILFN, defined as all acoustical phenomena occurring at or below the frequency bands of 500 Hz) can cause vibro-acoustic disease. (Castelo Branco NAA, Alves-Pereira M. (2004) Vibroacoustic disease. Noise & Health 2004; 6(23): 3-20)

5.4.12 A press release posted in Portugal on 9th June, 2007 (see http://www.wind-watch.org/news/2007/06/09/industrial-wind-turbines-infrasound-and-vibro--acoustic-disease-vad/) reveals that in the previous three years, several families had contacted the CPH team complaining of noise caused by the proximity of industrial wind turbines. However, only in April 2007 had the team obtained detailed acoustical measurements within a home surrounded by four recently installed industrial wind turbines. This acoustical data was essential in order to compare in-home, turbine-produced acoustical environments with other residential, ILFN-rich environments that are known to be conducive to VAD.

5.4.13 The scientific report on this was formally presented at Internoise 2007 conference, held on 28-31 August in Istanbul, Turkey (www.internoise2007.org.tr). The results irrefutably demonstrated that **wind turbines in the proximity of residential areas produce acoustical environments that can lead to the development of VAD in nearby home-dwellers**. The conclusion reached was that in order to protect Public Health, **ILFN-producing devices must not be placed in locations that will contaminate residential areas with this agent of disease.**

5.4.14 The existence, or otherwise, of infrasound as a result of a wind farm development can only be established once the wind farm is built and operating. If it is detected, and is found to be causing health problems for residents, the only mitigation is to stop the turbines rotating. Since this nullifies the *raison d'être* for the wind farm, **it makes more sense to site the turbines a safer distance from properties in the first place.**

5.4.15 Recommendation: REFUSAL

The application should be refused on the grounds that the distances between turbines and dwellings are too small to guarantee no infrasound noise problems, and consequent health problems, for nearby residents.

5.5 Policies in conflict with this Application

5.5.1 On page 88 of the Frey and Hadden report (see paragraph 5.1.15) there is the following statement:

> *'Landowners have many rights pertaining to their property, but there are legal restrictions, requirements and liabilities. A property related activity that produces an environmental pollution escaping onto a neighbour's property, causing a mischief and health problems, may trigger an interference with Article 8 of the European Human Rights Act, enacted in the UK as The Human Rights Act 1998. In the UK, a liability may arise in Tort (Rylands v Fletcher). The Environmental Protection Act 1990 (Part 3) may trigger a statutory nuisance.'*

The Human Rights Act and the case of Rylands v Fletcher is revisited in Section 13: Litigation.

5.5.2 On page 94 of the Frey and Hadden report, paragraph 20 states:

> *'Regarding a wind farm, it is incumbent on the site owner to produce a layout design that prevents or limits to reasonable levels the environmental pollution entering the neighbours' properties, which is most likely achieved by ensuring a suitable distance between the noise source and the neighbours' properties.*
>
> *The landowner may argue that the State has set Guidance on the level of noise pollution that the State believes is at an acceptable level to neighbours. However, compliance with these Guidance levels may not satisfy the Human Rights Act. The status of the Guidance is worth considering:*
>
> > *Planning Policy PPG24: Planning & Noise - General principle (2) states:*
> >
> > *"The Planning system has the task of guiding development to the most appropriate locations. It will be hard to reconcile some land uses, such as housing, hospitals and schools, with other activities which generate high levels of noise but the Planning system should ensure that, wherever practicable, noise sensitive developments are separated from major sources of noise (such as road … and certain types of industrial development). It is equally important that new development involving noisy activities should, if possible, be sited away from noise sensitive land uses."*
> >
> > *Planning Policy Statement PPS22 (2004) S.22 'Noise', states:*
> >
> > *"Renewable technologies may generate small increases in noise levels … Local Planning authorities **should** ensure that renewable energy developments have been located and designed in such a way as to minimise increases in ambient noise levels … The 1997 report by ETSU for the Dti **should** be used to assess and rate noise from wind energy developments".*
>
> *The use of the word "**should**" - rather than the phrase 'will be used' - allows the decision maker to use the ETSU-R-97 **together with any other relevant considerations.**'*

The whole of Section 5: Noise and Health Concerns, has provided plenty of 'other relevant considerations'. DTOG expects TDC planning officers to examine closely all noise documents supplied in respect of this application, including this one. If necessary, officers should take independent expert advice to assist them in their fair determination of whether the likely increases in ambient noise levels are, indeed, minimal and within the limits set by ETSU-R-97.

5.5.3 The Environmental Protection Act 1990, Part III: Statutory Nuisances and Clean Air states:

> ***79 Statutory nuisances and inspections therefor***
>
> *(1) Subject to subsections (2) to (6) below, the following matters constitute "statutory nuisances" for the purposes of this Part, that is to say—*
>
> *(g) noise emitted from premises so as to be prejudicial to health or a nuisance;*

Subsections (2) to (6) do not apply to criterion (g) above.

5.5.4 Devon County Council Policy CO16: Noise Pollution, states:

> *'Development should not be located where it would result in a significant increase in the level of noise affecting existing or proposed land uses in the vicinity, and noise sensitive land uses should not be located in areas affected by significant existing noise.'*

The first part of this policy is the relevant part in this application.

5.5.5 DCC Policy ST1: Sustainable Development, part 5 states:

> *'5) assessing the impact of proposals against national and regional indicators of sustainable development - **to make positive improvements to quality of life**.'*

The quality of life of nearby residents will not be improved by approval of this application.

5.5.6 Torridge District Council Policy DVT11: Impact of Development on Amenity, states:

> *'Development will be required to secure or maintain amenity appropriate to the locality, **with special regard to the likely impact on**:*
>
> *(a) **neighbours** and the operation of neighbouring uses'*

With turbines so close to houses the impact on neighbours of this application, if approved, will be severe. In the guidelines accompanying this policy is the statement, 'The policy should ensure that neighbourhood amenity is not compromised.' (Paragraph 3.137)

5.5.7 TDC Policy DVT12: Pollution and Hazardous Substances, states:

> *'Development that may be liable to cause pollution or that is likely to be hazardous will be permitted only where there is:*
>
> *(a) **no unacceptable risk to public health** or environmental safety, to local air quality, or to the quality or quantity of controlled waters; and*
>
> *(b) **no unacceptable risk of nuisance by reason of noise, vibration**, smell, gases, fumes, smoke, steam, soot, ash, dust, grit, light, or other pollution.*

This policy applies the precautionary principle to potentially polluting development and to the limitation of risk. There is considerable risk to public health from infrasound if this application gains approval.

5.5.8 TDC Policy DVT13: Noise Emission and Disturbance, states:

> *'(1) Noise sensitive development or noise generating development **will not be permitted where nuisance or significant disturbance could arise** unless adequate attenuating measures are included as an integral part of the scheme.*
>
> *(2) Noise generating development in the open countryside will be permissible **only where it will not affect adversely any recreational, wildlife, or amenity interests.'***

If excessive audible noise or debilitating infrasound is detected after this development is completed then no adequate mitigation, other than stopping the turbines completely, will be possible. This application, if approved, will adversely affect wildlife and amenity interests.

5.5.9 The problem of low frequency noise and infrasound has been brought to the attention of Torridge District Council's Community Development Committee in October, 2008. Cllr. Adam Symons has raised a motion calling on the council to make a request to Government to

i) update ETSU-R-97 in the light of the latest research

ii) adopt a minimum separation distance of 2 km between turbines and the edge of towns and villages

iii) invite developers to compensate property owners living within a fixed distance of a wind turbine by guaranteeing a price for their property for a period of years.

The full motion is given in Appendix D.

5.5.10 While ETSU R 97 is the guidance under Town Planning Guidance for the consideration of noise from wind turbines, there is no doubt that where the noise emission from an industrial plant (wind turbine) produces a threat to the health and well being of adjoining families, then the noise levels and restrictions must also be considered under Environmental Protection, and in particular nuisance, and indeed under the Human Rights Act 1998 and the European Convention for Human Rights to which the UK is a signatory.

5.5.11 Recommendation: REFUSAL

The application is in conflict with policies CO16, ST1 (pt5), DVT11, DVT12 and DVT13. It is likely to conflict with the Environmental Protection Act 1990. It may also result in action being taken under the terms of The Human Rights Act 1998 and the landowner may be liable in Tort. For these reasons the application should be refused.

Summary of this section:

ETSU-R-97 is flawed and out-of-date.

The Developer's assessment of pre-existing background noise levels is incorrect. It has not been done in accordance with the requirements of PPS22. This has been confirmed by an independent, expert acoustician. The noise levels at many nearby properties will exceed those allowed by ETSU-R-97 meaning the application must be refused.

Research has shown that the proposed separation distances between turbines and dwellings will be insufficient to prevent noise nuisance to neighbouring properties.

Infrasound, low frequency sounds and Amplitude Modulation are likely to cause health problems for nearby residents so close to the turbines.

The application is in conflict with policies CO16, ST1(pt5), DVT11, DVT12 and DVT13.