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Consultant Scientists in Acoustics

27 February 2015

Mr Steven Cooper
The Acoustics Group
20-22 Fred Street
Lilyfield
NSW 2040

Our Reference: LHA365/TAG1

Dear Steven

Firstly, I want to congratulate you on your recent work at the Cape Bridgewater Wind Farm. I fully understand the amount of effort required in analysing many gigabytes of data, which, in part, explains the delay in sending this letter since I must balance my efforts between research and consulting obligations.

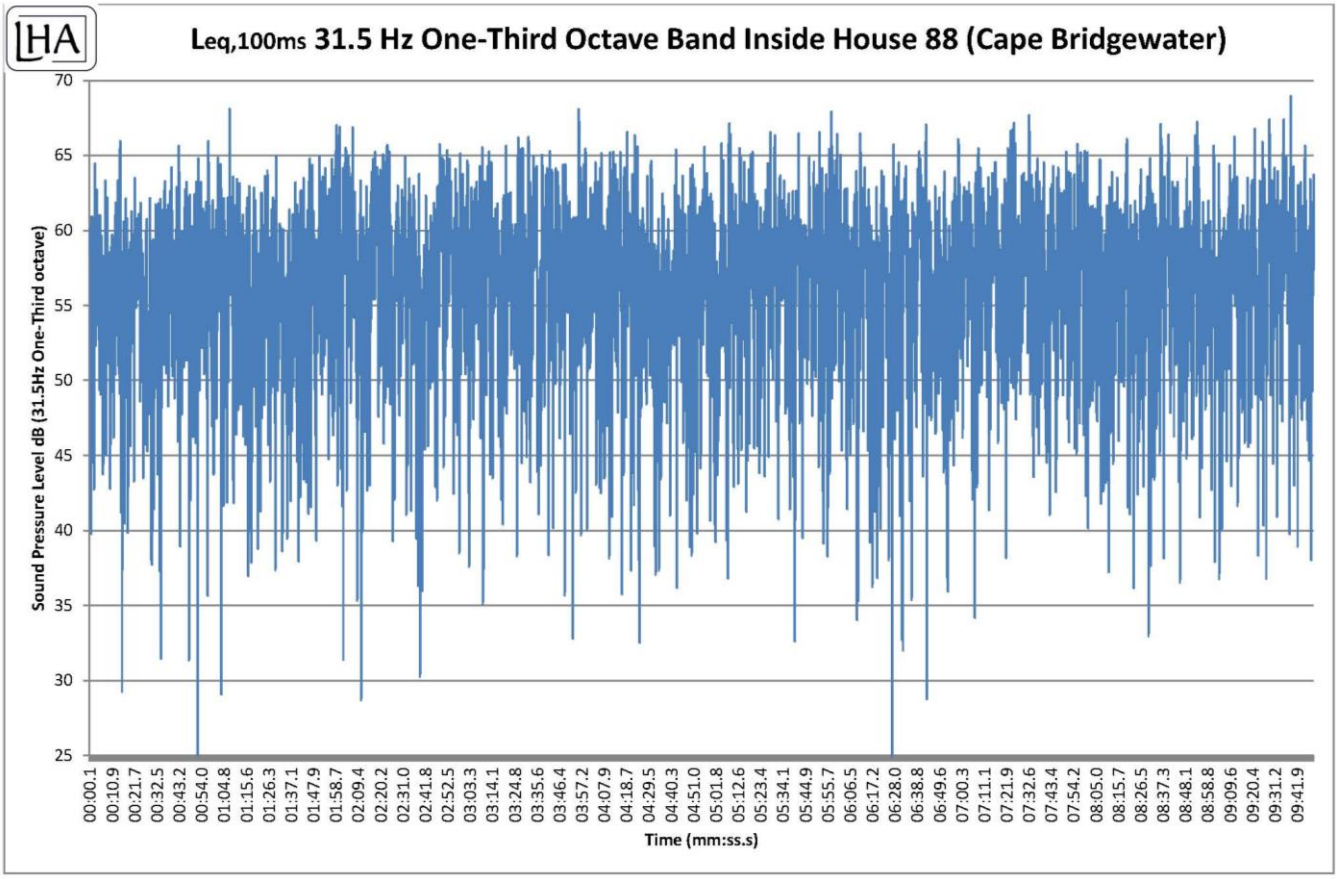
I have been independently gathering sound data in the audible and infrasound parts of the acoustic spectrum at numerous wind farms in Australia, the UK and Ireland over the past three years. Some of my data was recorded inside residences near to the Cape Bridgewater Wind Farm and I would like to corroborate your findings of a 31 Hz tonal signal, with sidebands, at that location. I have recorded audible and infrasound data inside house 88 that you refer to in your report and note from your work that long term monitoring indoors at this property was not part of your study. Perhaps you will find the results of my own work complimentary to your findings.

At the end of 2012 and the beginning of 2013 I completed long term audio recordings in an unoccupied bedroom of house 88 using a Type 1 sound level meter and digital recording equipment. Subsequently, I completed infrasound measurements at the same location at the end of 2013 and the early part of 2014, during which time I too observed a start-up of the wind farm. That information is included in a paper to be presented at the INCE/EUROPE Wind Turbine Noise Conference at the end of April 2015 in the UK.

I have now completed analysis of some of my recordings from 2012/2013 inside house 88 and can inform you of the results.

I have used the DEFRA funded UK research, NANR45 'Proposed criteria for the assessment of low frequency noise disturbance' Feb 2005 as a guide to determine the severity of the 31 Hz tone, and sidebands, that are found in the 31.5 Hz one-third octave band. The DEFRA research recommends a maximum indoor unweighted 31.5 Hz one-third octave band sound level of 56 dB.

The following chart is typical of many 10-minute samples I recorded that presents 100ms Leq values in the 31.5 Hz one-third octave band. The data for this chart was measured inside house 88 around 4am on 19 December 2012.



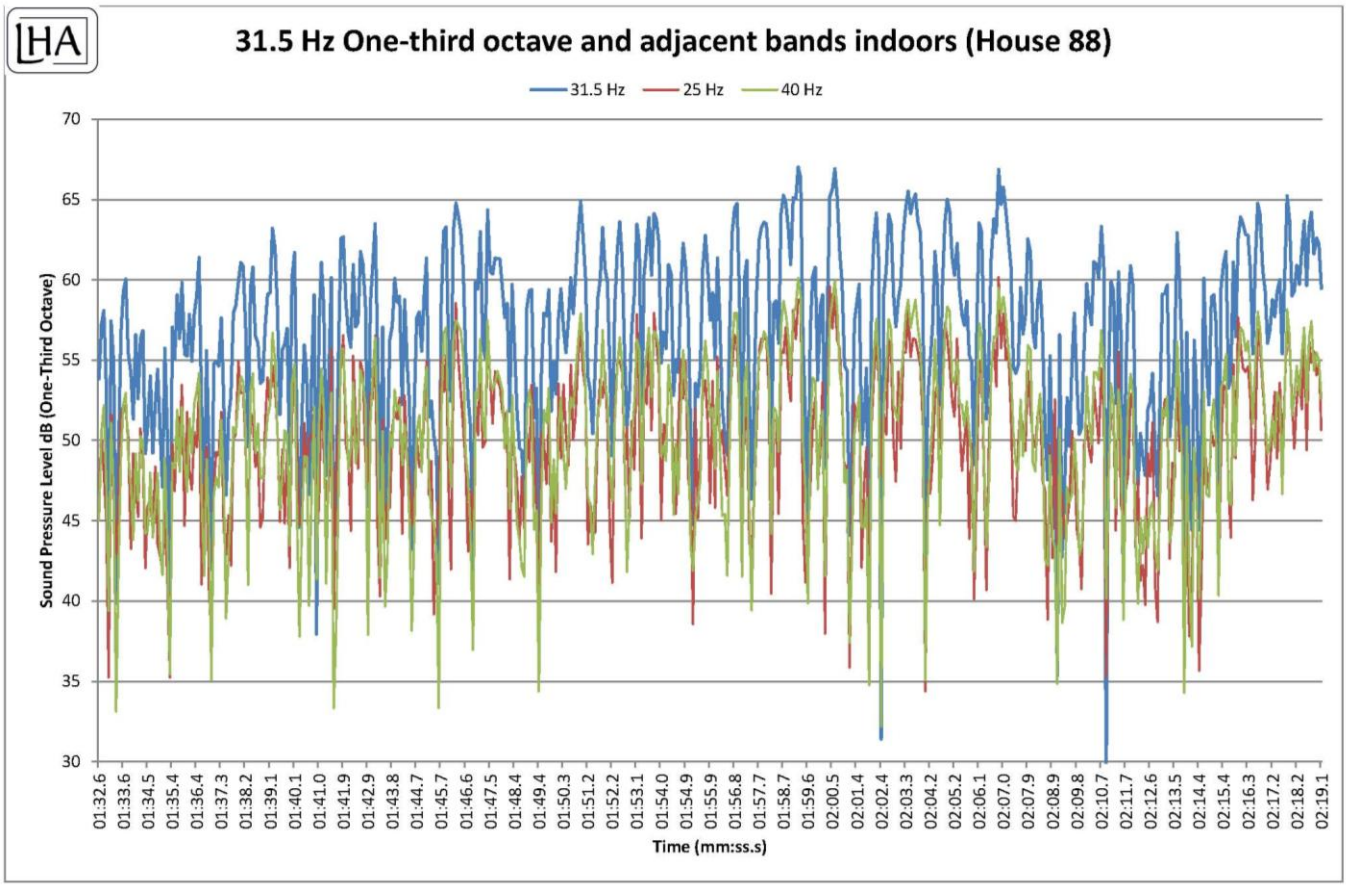
The next chart shows a 'zoomed-in' part of the same data showing the amplitude variation more clearly (amplitude modulation, AM) and the adjoining one-third octave bands that show the prominence of the 31.5 Hz band. It would appear from the randomness of the AM that the tone(s) is (are) formed from multiple sound sources operating with different phase (multiple wind turbines).

I have also completed audio recordings near to the Leonards Hill Wind Farm in Victoria that has two MM82 wind turbines. Data from those recordings were part of a paper prepared in March 2014 on AM.

A key finding from comparing the data at Cape Bridgewater to that from Leonards Hill is that the 31 Hz tones are absent at Leonards Hill, despite the turbines being of the same MM82 nameplate as those at Cape Bridgewater. It may be that the 31 Hz tone (which I believe to be a resonance associated with the Cape Bridgewater wind turbines) may have been identified by the manufacturer and fixed prior to the construction of the Leonards Hill Wind Farm in 2012. Alternatively, it may be that the wind turbines may be of different 'flavours' since there is a low speed and high speed option available, for example.

My measurements at Deeping St Nicholas (UK) in 2014, that also has MM82 wind turbines, did not show signs of the 31 Hz family of tones, despite that wind farm being completed in 2006. However, my measurements at the Earls Hall Wind Farm (UK) in 2014, that uses MM92 wind turbines and was constructed in 2012, does show the family of tones around 31 Hz.

It would obviously pay dividends in such research if the turbine manufacturers would be willing to assist by sharing information from their dynamic analyses of these machines.



Steven, you will see that the proposed acceptable sound level (56 dB) in the 31.5 Hz one-third octave band is exceeded by up to 10 dB.

Notwithstanding the findings of 'sensations' attributable to the wind turbine signature in your report for Cape Bridgewater it is also apparent that indoor audible sounds far exceed, the widely accepted, UK limits in house 88.

The residents of house 88 reported to me regular feelings of vibration. Although I have not taken any vibration measurements at Cape Bridgewater I have listened to the audio samples recorded and can understand why the 31.5 Hz tone could be classed as a 'vibration' by the lay person.

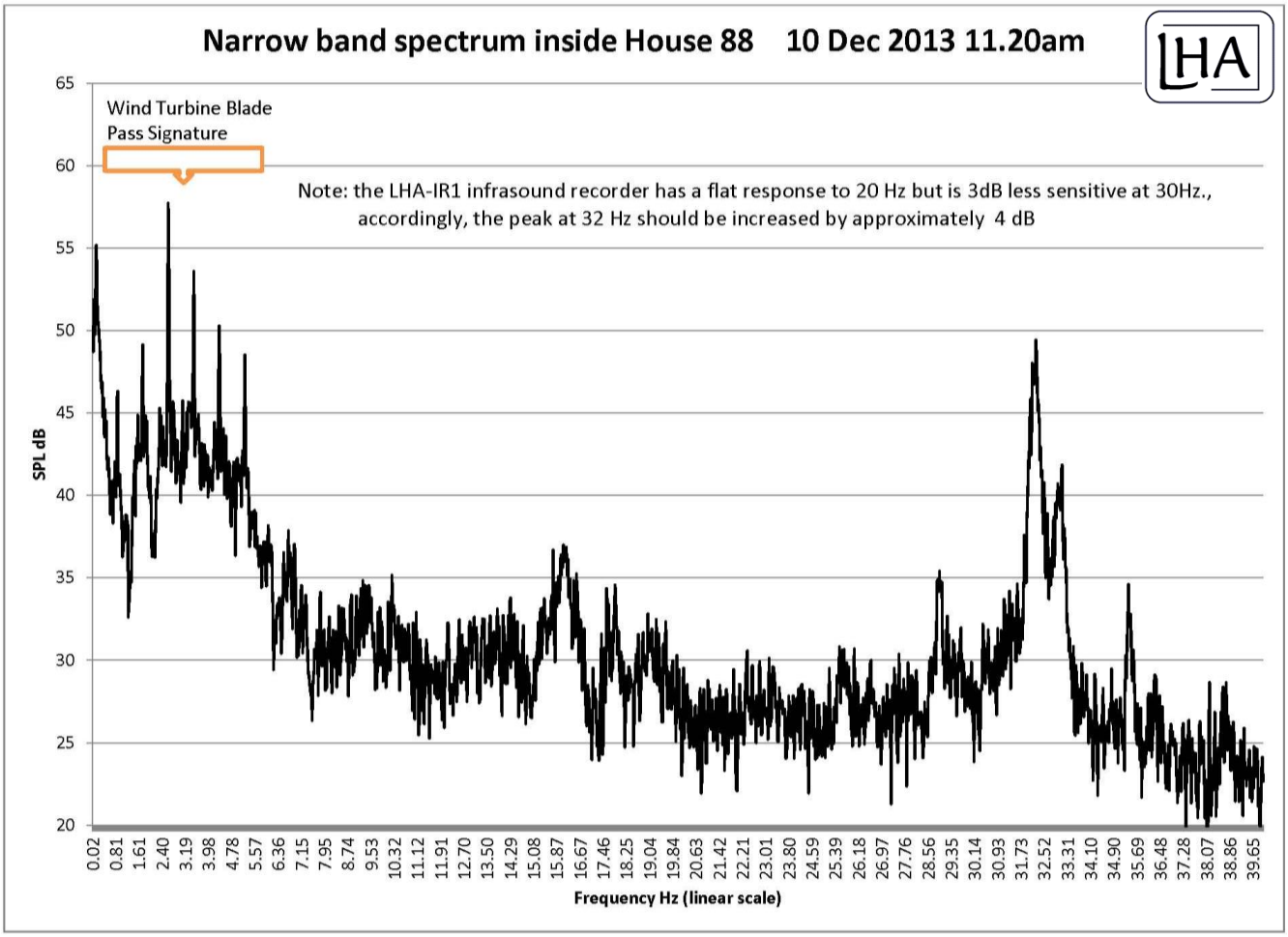
This data and more will form part of another paper that I intend to publish later in 2015.

I have also recorded infrasound levels in house 88 at the end of 2013 through to the beginning of 2014 using a microbarometer based LHA-IR1 infrasound recorder. This recorder captures infrasound signals faithfully up to 20 Hz but also records the lower audible frequencies with slightly reduced sensitivity.

The following chart is a sample of the LHA-IR1 results which typically show the blade pass frequency and harmonics you describe in your report as WTS and extends to include frequencies above 20 Hz.

The peaks in this chart (11.20am 10 Dec 2013) show narrow band spectrum results around 32 Hz consistent with measurements from the year before.

It is clear that the audible spectrum peaks in the 31.5 Hz one-third octave band have been present for a number of years and that the infrasound blade pass frequencies match those from your study.



I have no issue with my results being shared and hope that you find the above of interest.

If you wish to discuss any of my findings, please call.

Yours sincerely,

W Les Huson BSc(Hons) MSc CPhys MInstP MIoA MAAS MEIANZ