Comments to: Infrasound in residential area

a case study

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This article was published in Low Frequency Noise & Vibration Vol. 13 No. 4. However, the figures referred to in the text were not included, which made the article difficult to understand. The editors apologise to the author and readers for this oversight, and are pleased to reprint below both text and illustrations.

Comments to: Infrasounds in Residential Area – Case Study[1]

The article, published in the most recent issue of the Journal, presents measurements of low and infrasonic noise emitted from an industrial zone and transmitted into a residential area. The measurements seem to have been carried out with relevant equipment and care, and the results are very much in line with, what – I believe – can be found in many residential areas lying close to industrial zones.

However, the authors have used G-weighted levels for evaluation of noise with significant energy in the range about 20 Hz, despite the fact that the G-curve has a low frequency cut-off at 20 Hz. This misunderstanding leads to peculiar conclusions, and it calls for comments. The article may leave the reader with the impression that infrasound having G-weighted levels as low as 62-70 dB can be perceived by humans and give rise to complaints. This indication is far from the presently accepted threshold of perception of 90-100 dB(G), and it certainly cannot be concluded on basis of the observations reported. The authors also use unweighted levels, but filtered with a low pass filter at 20 Hz, and obviously this does not change the problem.

The introduction of the article reports on "reasons for complaints ... of acoustical origin", and on problems relating to infrasound as being "of increasing importance". Measurements within the residential area show G-weighted levels of 62-70 dB, and levels of 57-66 dB, when measured linearly up to 20 Hz (lower limit not reported). The authors do not mention audibility explicitly, but state that these levels are "harmless to the human hearing organs". Taken the introduction into account, the reader may understand that the measured levels can be perceived by humans, but they do not damage the ear.

The authors continue by claiming that the "... possibility of non-auditory effects of infrasound on the housing estate inhabitants cannot be definitely precluded ...". Well - it cannot be precluded, but on the other hand, nothing in the study has suggested that infrasound should be the cause of the effects, and the statement would have been equally true, had the G-weighted levels been even lower. No effort was done to report more precisely on the non-auditory effects and to discuss their existence, nature and origin. Nevertheless, the connection to infrasound is suggested to the reader without the slightest foundation in the study.

The authors seem unnecessarily concentrated on the infrasonic region. Their

Note 1: Jerzy Motylewski, Tomasz Zmierczak, Wladyslaw Nadolski and Tadeusz Wasala: Infrasound in Residential Area - A Care Study. Journal of Low Frequency Noise and Vibration, Vol.13, No. 2, pp. 65-70, 1994.

measurements give an excellent possibility of discussing frequencies also in the low frequency region above 20 Hz. I have taken the liberty of making an approximate calculation of third octave levels for the two measurement positions reported (MP6 and MP9). In Figure 1, these are plotted against frequency together with the hearing threshold (most recent data from ISO[1], complemented at lower frequencies by data from Watanabe and Møller[2,3]).

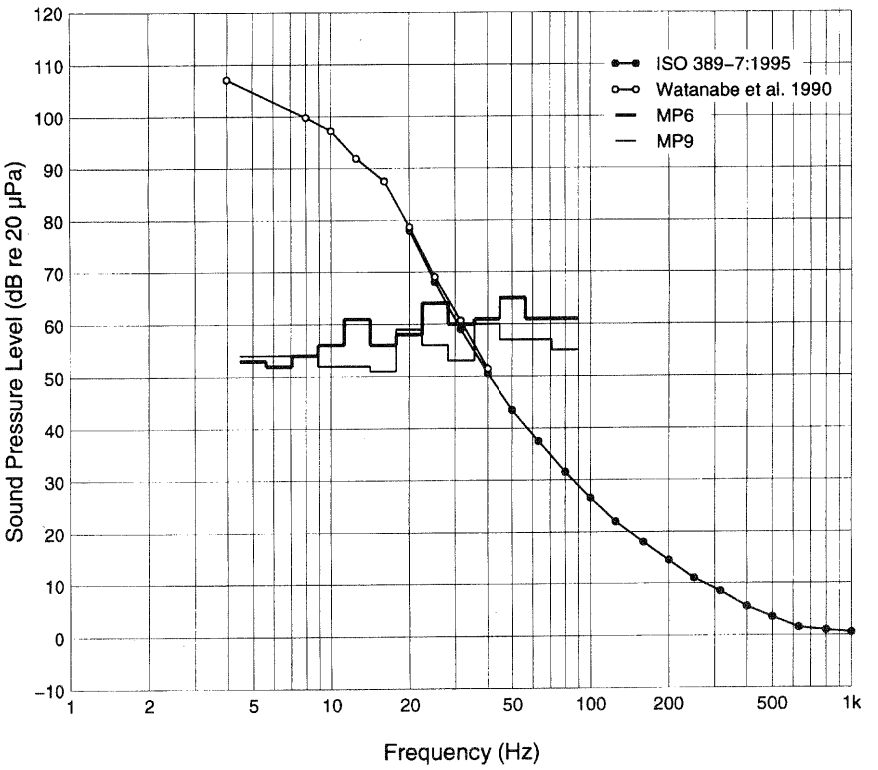

Figure 1. Approximate third octave levels for measuring points MP6 and MP9 together with the most recent hearing threshold from ISO[1], complemented by data at lower frequencies from Watanabe and Møller[2,3] (mean of the two studies for frequencies, where they overlap).

It is obvious that the hearing threshold is exceeded for the individual third octave bands from 31.5 or 40 Hz and upwards. The level of 61 dB measured in the 80 Hz band at position MP6 corresponds to nearly 50 phon[4], which is a rather loud noise to be exposed to at all hours in a residential area.

The levels in the infrasonic region are far below the threshold, and I would suggest that the nuisances, whatever they are, are caused by the mere annoyance from being exposed to loud noise at frequencies above 20 Hz.

The study in concern exposes another problem, though. The 61 dB noise in the 80 Hz band mentioned above is well within the audio range, and the A-weighted level would normally be used to characterize its level. However, the A-curve is 22.5 dB down at 80 Hz, and the A-weighted level of this third octave band would be 38.5 dB. This is below the restrictions in many areas, but still the noise is loud and annoying! Evidently, the A-weighted level does not sufficiently reflect the human perception of sound dominated by frequencies in the low audio band.

In order to keep the reader updated, it is relevant to mention that the standard, which specifies the G-weighting is not lacking. It was circulated as a Draft International Standard in 1992, and it was finally approved by December

1993. It should be available from ISO early 1995[5]. And remember: It covers only the frequency range 1-20 Hz, and no attempt should be made to use if for evaluating sound outside this frequency range. The curve is shown in Figure 2.

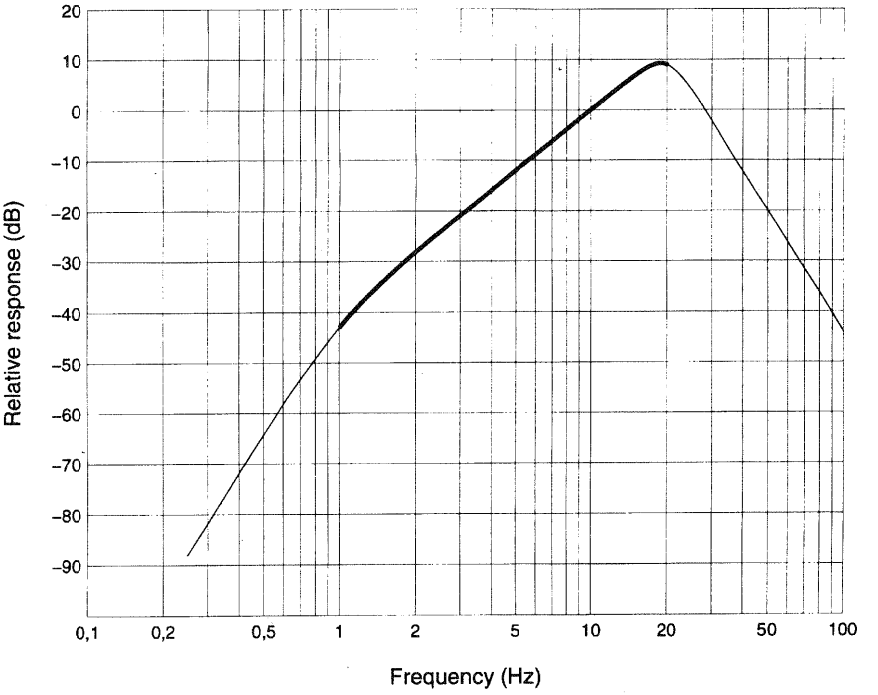

Figure 2. The G frequency weighting[5] with the frequency range of intended use in bold line.

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1. **ISO 389-7:1995.** *Acoustics – Reference zero for the calibration of audiometric equipment - Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions.*

2. **Toshio Watanabe and Henrik Møller:** *Hearing thresholds and Equal Loudness Contours in Free Field at Frequencies Below 1 kHz. Journal of Low Frequency Noise and Vibration, Vol. 9, No. 4, pp. 135-148, 1990.*

3. **Toshio Watanabe and Henrik Møller:** *Low Frequency Hearing Thresholds in Pressure Field and in Free Field. Journal of Low Frequency Noise and Vibration, Vol. 9, No. 3, pp. 106-115, 1990.*

4. **ISO 226:1987.** *Acoustics – Normal equal loudness level contours.*

5. **ISO 7196:1995.** *Acoustics – Frequency-weighting characteristic for infrasound measurements.*