Low frequency sounds in dwellings: a case control study

Frits (G.P.) van den Berg

Science Shop for Physics, University of Groningen, Nijenborgh 4, 9747 AG Groningen, the Netherlands
e-mail: < g.p.van.den.berg@phys.rug.nl>

1. Introduction

The occurrence and annoyance of low frequency sounds have been described in a number of publications [e.g. 1,2,3]. In the Netherlands in recent years a growing number of people have brought complaints to authorities or to medical or acoustical experts about persistent low frequency (LF) sounds.

Complainants usually describe a perception of humming or engine-like sounds or a feeling of pressure or vibration. A survey of the personal characteristics or complainants [4] showed that complaints may last for years, threatening the complainants' quality of life and health: the long-term night-time perception of LF sound is an impairment to sleep, an important stressor at night and in the day time and is related to an increased use of tranquillizers and sleeping drugs. In many cases other people (house mates, visitors, the investigator) do not notice any specific LF sound, which is frustrating to complainants as they cannot convince others of the existence of the sound or invoke their help in locating the source.

2. Materials and methods
Cases/controls

Cases are residents, with complaints about LF noise, from all over the Netherlands. They have participated in an earlier study of (a larger group of) LF noise complainants and their partners (as a control group), investigating personal characteristics such as age, gender, occupation,

hearing threshold (at frequencies ≥ 125 Hz), self reported sound sensitivity, time spent home, psychological and health status [4]. The selection from the earlier study was done without any interference by the earlier research group, and based on representing a broad range with respect to location and age. Most of the complainants had heard the LF sound for a long time, typically several years, either more or less continuously (especially at night), or for days or weeks with 'silent' intervals in between. In most cases complainants did not know the source of the noise. Most complainants (77%) considered themselves to be sound sensitive. In this earlier study the hearing threshold of complainants was measured in tones at octave intervals at frequencies from 125 Hz upwards. On average they had a hearing loss of approximately 5 dB with reference to the ISO-7029 hearing threshold for people their age (average: 54 years) [14].

For the measurements in the study reported here, a control group (without LF noise complaints) was composed based on a comparable distribution over the country, types of dwelling and surroundings. The original study has been described in more detail (except for the spectral components section) in a Dutch report [5].

Assessment and analysis method

Criteria to assess LF noise have been proposed by the Swedish Socialstyrelsen [6], Vercammen [7],

The purpose of this study is to systematically assess the level and spectral distribution of low frequency (LF) sounds in dwellings. Measurements of broad and narrow band sound levels have been made in 36 Dutch dwellings in 1998. In 19 dwellings there were complaints about LF noise, in 17 others no complaints had been reported. According to measured broad band and spectral levels complainants' dwellings can be divided into three categories with 'considerable', 'some' and 'no' LF sound. Measured levels and scores on proposed LF noise criteria in complainants' dwellings as a group however are not significantly different from dwellings without complaints. In cases' dwellings more narrow band LF components are present, but on average at a lower level compared to controls' dwellings.

DIN [8] and ANSI [9]. The ANSI procedure will not be taken into account here. The other procedures use a range of LF 1/3 octave band levels that are designated as acceptable at levels below criterion values, or not acceptable otherwise. The LF region differs per procedure: the lowest 1/3 octave band frequencies included are 4, 10 and 31 Hz, the highest 80 (100), 125 and 200 Hz. The frequency range is in fact arbitrary: there is no clear distinction known between low and 'normal' frequencies. At the lower frequencies all criteria are based on a (median or other) hearing threshold, at the higher frequencies the criteria are above this hearing threshold. However, from the studies available it appears that the impact of a LF sound is not related to its level above the hearing threshold: a soft, low tone may lead to complaints in one case whereas elsewhere a louder tone may not lead to complaints [3, 11]. Therefore, it is suggested that LF sounds should be considered potentially annoying when they are audible, i.e. above the (individual) hearing threshold. As LF individual thresholds have not been measured (hearing thresholds below 125 Hz are not determined in medical practice), a reference threshold must be used to relate measured spectra to a measure of audibility. The median ISO threshold for otologically selected young adults [10] has recently been reviewed and expanded below 20 Hz by Passchier [11, see also 12] (see Table I). From 25 Hz and upwards this hearing threshold is the same as stated by ISO 226. In the present investigation the hearing threshold in Table I is used as a reference threshold.

The median hearing threshold for unselected people aged 50 to 60, the age group of most cases, is 9.5 dB above the threshold in Table I; the threshold for the best hearing 10% of this group is 4.5 dB below the threshold in Table I, for the best hearing 5% is still approximately 2 dB lower [11].

Many authors state that LF noise complaints are caused by tonal components [11]. Complaints indicate that, when the sound is perceptible, it is continuous and constant or may vary in loudness with a period of one to several seconds. Consequently, when measuring a time-averaged LF spectrum with no other disturbing LF sounds present, and with instrument noise levels below the hearing threshold, one expects the annoying sound to be recognizable as a (local) maximum in the spectrum.

Therefore, equivalent unweighted 1/3 octave band sound levels over at least 5 minutes were determined in the LF region (frequencies $\leq$ 200 Hz). For frequencies from 10 to 100 Hz (inclusive) the 1/3 octave band sound levels were compared to the reference threshold (Table I) as a measure of audibility. Also, the 1/3 octave band sound levels were compared to criterion values according to the Socialstyrelsen, Vercammen and DIN [6,7,8]. Line spectra (line width 0.4 Hz) were used to more precisely determine frequencies of narrow band components. Finally, broad band equivalent sound levels have been determined: the A- and C-weighted level L_{Aeq} and L_{Ceq}, and the LF part of the A-weighted level $L_{Aeq(LF)}$ (L_{Aeq} with $f_{1/3 octave} \leq$ 100 Hz).

Much care has been taken to avoid disturbing sounds (preferable no one in the room, no clocks etc.). Unavoidable disturbances (from a person leaving /entering the room, passing cars and trains, a bark or shout, etc.) have not been taken into the analyses afterwards.

Table I.

Reference threshold: median hearing threshold for young adults [11]

Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200
Hearing threshold (dB)	96	92	88	78	66	59	51	44	38	32	27	22	18	15

Disturbances were identified by listening to the recordings and by analysis of time histories of the overall C- and A-weighted levels.

The measurement and analysis method described here has been adopted in a recent guideline for measuring LF sounds in case of complaints, issued by the Dutch Noise Annoyance Foundation (NSG) [12,13]. In this guideline, the measured levels are compared to the 90% hearing threshold levels for (otologically non-selected) people aged 50 to 60 years as determined by Passchier-Vermeer [11].

Measurement time and place

To eliminate any uncertainty about the presence of the LF sound at the time of measurement, recordings were made at a time the complainants positively stated the sound as audible. To achieve this, complainants have recorded the sounds themselves after practical (hands on) instructions to operate the recorder. The microphone was placed at a position where complaints were positive the LF sound was usually present. In almost all locations a position could be chosen in a corner of the bedroom (height 1 to 1.5 m, about 0.4 to 0.5 m from both walls); this was also the standard position in the controls' dwellings. The equipment was left long enough (days, sometimes up to some weeks) to ensure relevant recordings could be made.

Measuring instruments

For the measurements in the dwellings a TASCAM DA-P1 digital recorder was used with a high quality Sennheiser MKH 20 P48 microphone. The microphone was hung in rubber bands on a tripod to provide vibration protection. Before and after measurements a 1000 Hz, 94 dB sound from a Quest calibrator type CA-22 was recorded.

Recordings were analysed afterwards with a Larson Davis 2800 analyser. The entire measurement chain could measure down to a few Hz and had a flat frequency response (± 0.5 dB) at frequencies of 20 Hz up to several kHz. The instrument noise level was at least 10 dB below the REFERENCE hearing threshold in the LF region.

3. Measurement results

A total number of 93 sound recordings have been made: 34 at night and 25 at daytime in 19 dwellings of cases (complainants); 17 at night and 17 at daytime in 17 dwellings of controls. More recordings in cases' dwellings have been made so as to be able to compare possible variations in sound levels, as indicated by the complainant (e.g. audible or not, loud or soft). Of the 34 nighttime recordings in cases' dwellings 27 were recorded at a time when the LF noise was heard by the complainants, 7 were recorded at a time of 'LF silence'. Daytime recordings (most of them around noon) were made to compare the sound levels at that time with those at night. Each recording is about 10 – 15 minutes long. Disturbing sounds, typically for a few minutes per recording, have not been taken into the analyses or date reported here.

All sound levels reported here are equivalent broad band, 1/3 octave band or narrow band (0.4 Hz per line) sound pressure levels per recording without disturbances. The analysed time per recording (without disturbances) is approximately 8 minutes.

Broad band sound levels

Table II presents an overview of the (arithmetic) average equivalent broad band sound levels in cases' and controls' dwellings at day and night. The difference $L_{Ceq} - L_{Aeq}$, used (*e.g.* by DIN [8]) to distinguish between situations with and without substantial LF sound, evidently does not distinguish between situations with and without complaints (cases /

controls). In fact, in contrast to expectation this difference is somewhat smaller in cases' dwellings. Figure 1 shows cumulative distributions of A- and C-weighted equivalent sound levels of all recordings separated in time (day/night) and group (cases/controls). As expected, daytime sound levels are higher than night-time levels. In controls' dwellings the sound levels, especially at daytime, tend to be higher than in those of cases'.

Figure 1 and Table II include the measurements when at night complainants do not hear the LF sound. These levels do not cluster in certain areas of figure 1, except that they do not appear in the low-level 40% (100%-60%) of the day and night-time L_{Ceq}-distribution.

$L_{Aeq(LF)}$ correlates well with L_{Ceq}: the correlation coefficient is 0.95. The correlation coefficient between L_{Aeq} and L_{Ceq} is 0.82.
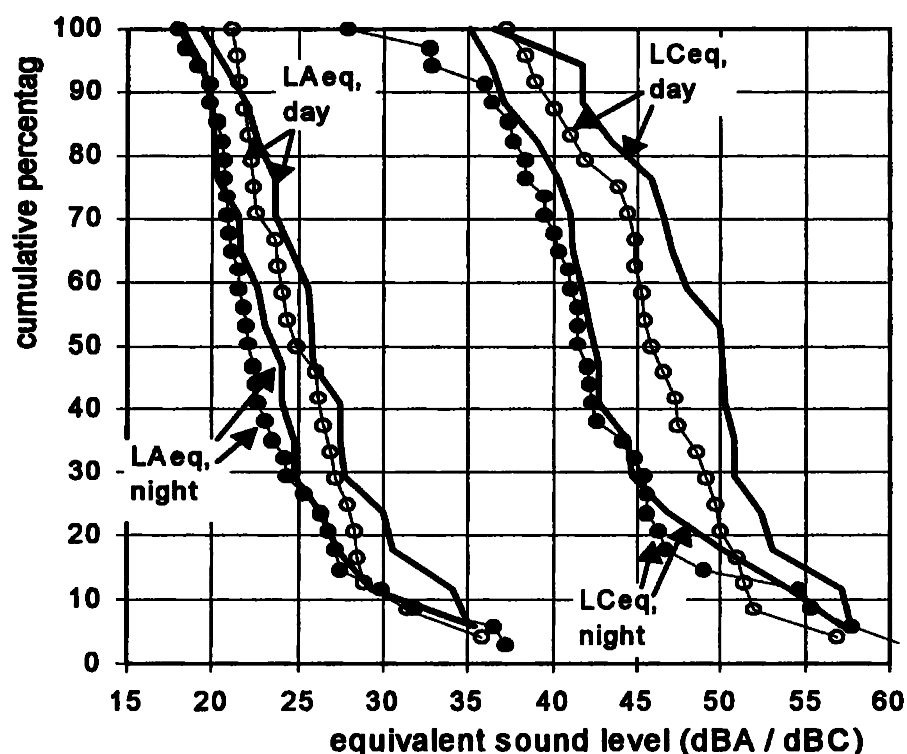

Figure 1. cumulative night and daytime distributions of A- and C-weighted equivalent broad band sound pressure levels in dwellings of cases (lines with circles) and controls (lines)

Table II. Average broad band sound levels

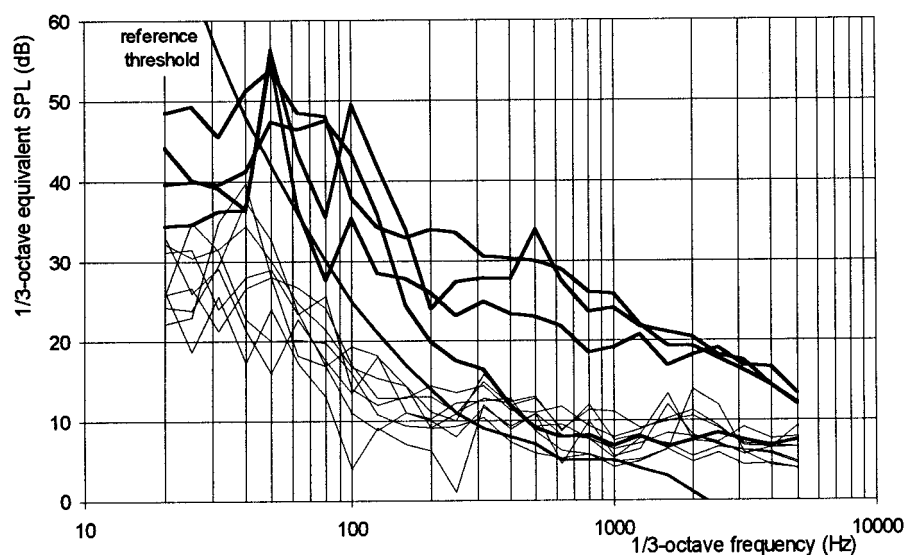|			cases	controls
L_{Ceq}: total C-	day		46	48
weighted sound level		night	43	43
L_{Aeq}: total A-	day		25	26
weighted sound level		night	24	24
L_{Ceq} – LAeq: difference C- and	day		21	22
A- weighted sound level		night	18	20
L_{Aeq} (LF): A-weighted level	day		17	19
for frequencies ≤ 100 Hz		night	14	15

Figure 2. Nighttime unweighted equivalent 1/3 octave band sound spectra in cases' dwellings with 'considerable' (thick lines) and 'no' (thin lines) LF sound, at times that complainants do perceive LF noise; and reference hearing threshold
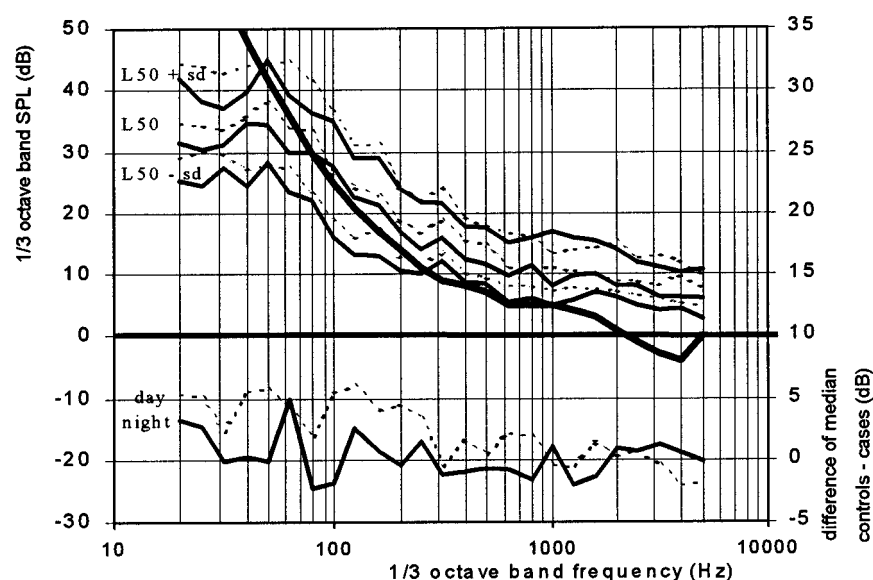

Figure 3.
*above: median of equivalent 1/3 octave band sound levels and median +/- one s.d. at
night (dark lines) and daytime (dotted) in dwellings of cases, and reference hearing
threshold (thick line);*
*below: difference between median sound levels in controls' and cases' dwellings for night
and daytime*

1/3 Octave band levels

In figure 2, 1/3 octave band sound spectra of night-time recordings in 8 dwellings of cases (with 1 or 2 recordings per dwelling) have been plotted. In these 8 dwellings either 'considerable LF sound' was measured or, in contrast, 'no LF sound'. Dwellings of the intermediate 'some LF sound' category have been omitted from figure 3. For a description of these three categories see the section on 'Classification' below. Only measurements where LF sound was
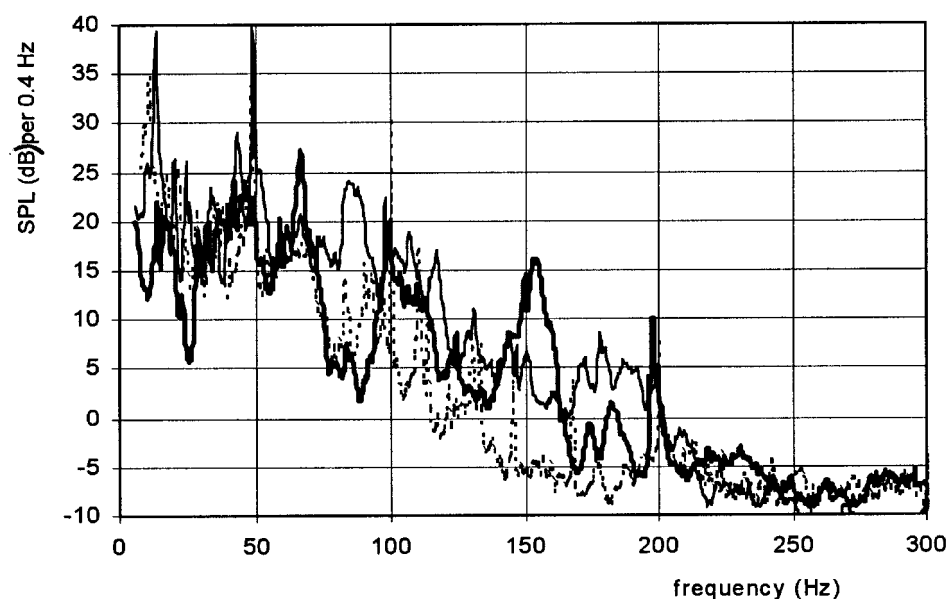
Figure 4. Unweighted equivalent line spectra (0.4 Hz line width) of nighttime recordings in dwellings of 3 cases with 'some' LF sound

perceived have been included here. From figure 2 it is clear that the LF sound level may vary considerably between dwellings: in some cases there is sound well above the REFERENCE threshold for frequencies above 40 Hz, whereas in other cases the REFERENCE threshold is not exceeded at all for frequencies below 200 Hz, i.e. the entire LF region.

In figure 3 spectra have been plotted of the median value and the median value plus and minus one standard deviation (s.d.) of all 1/3 octave band sound levels in cases' dwellings, separately for day (07:00 – 20:00 hours) and night-time (22:00 = 07:00 hours). The area between the upper and lower lines contains 74% of all measured 1/3 octave band sound levels for each period. For frequencies < 40 Hz all 1/3 octave band sound levels are below the REFERENCE threshold: thus, with respect to audibility, no significant infrasound is present. For frequencies > 80 Hz, more than half of all 1/3 octave band sound levels are above the REFERENCE threshold, for frequencies ≥ 300 Hz virtually all 1/3 octave levels are above

this threshold. At approximately 50 Hz the sound spectra reach a maximum, indicating a relatively large amount of sound energy present at and near this frequency.

In the lower part of figure 3 the differences between controls' and cases' median day and night-time 1/3 octave band sound levels have been plotted. There is a marked difference for daytime sound levels: in controls' dwellings the median level is approximately 5 dB higher at frequencies ≤ 250 Hz. This difference corresponds to the difference in daytime L_{Ceq} distributions in figure 1.

Spectral components

As is clear from a comparison of sound levels (figure 1 and lower part of figure 3), sound levels in cases' dwellings do not differ clearly from those in controls' dwellings, and indeed appear, at least in daytime, to be lower rather than higher. Simply the sound level, either broad band or 1/3 octave, therefore does not explain the occurrence of complaints. One might postulate that complaints may be caused by narrow band components

that, because of a relatively low energy content, do not contribute much to a broad band or 1/3 octave sound level. This would be in agreement with the conclusion of several studies that tonal components cause the complaints. It also could be in agreement with the somewhat lower LF sound levels in cases' dwellings: LF tonal components could be more audible when less other (broad band) LF sound is present. Figure 4 gives three spectra of 0.4 Hz line width of the equivalent sound level over some 10 minutes (without disturbing sounds) from three different cases' dwellings where 'some' LF sound was found (for 'some': see section on 'Classification' below). Some tonal components in these spectra are easily identified, but also broader and less prominent peaks are visible: apparently not every local maximum in a spectrum can be defined as a tonal component. Moreover, for a tonal component to be heard, it must be loud enough compared to its critical bandwidth threshold level. The level in the critical bandwidth, however, cannot be established easily: to estimate it, it seems reasonable to include only sound exceeding the hearing threshold, but as sound levels are close to the hearing threshold, it is not possible to accurately estimate the critical bandwidth level without knowledge of the individual hearing threshold.

A simple procedure has been followed to gain some insight into the occurrence of spectral components: all peaks exceeding their immediate surroundings in the spectrum by at least 5 dB and with a bandwidth of less than 10 Hz have been identified and the level calculated by integration over the peak (summation of the narrow band sound levels that contribute to the peak). Peaks with a narrow bandwidth (here: less than 3 Hz) may be considered tonal components and are presented as a separate group. A broader peak (here: up to 10 Hz) might

be the time average of one or several narrow bandwidth components of varying frequency.

In the upper part of figure 5a the average level and standard deviation of 'broad' peaks in nighttime recordings have been plotted for cases and controls. In the lower part of figure 5a the same is plotted for 'narrow' peaks. Figure 5b shows the same results for daytime recordings. Results are plotted only if the incidence in either or both groups (cases and controls) exceeded 20 % (see below). The centre frequencies of the spectral peaks are aggregated in intervals of 5 Hz: e.g. the frequency band of 50 Hz contains all peaks with a centre frequency between 47.5 and 52.5 Hz. To have an indication of audibility the reference threshold has been added. It is clear that for very low frequencies (< 30 Hz) spectral peak levels are well below the reference threshold. At frequencies ≥ 40 Hz peak levels in at least some recordings are above the reference threshold. The level in cases' dwellings may be higher as well as lower compared to controls' dwellings, in most cases the difference between the average levels is less than 5 dB. In daytime recordings the average peak levels in cases' dwellings tend to be lower than in controls' dwellings.

Thus the level of spectral peaks in cases' dwellings does not seem to differ notably from controls' dwellings. However, spectral peaks may not be louder but occur more often in cases' dwellings. To examine this, the incidence of 'broad' peaks in the recordings has been plotted in figure 6 for night and daytime recordings and for cases and controls separately. Again, results are plotted if the incidence in either or both groups exceeded 20 % and peaks are aggregated in 5 Hz intervals. As can be seen in figure 6, in most frequency bands the incidence in cases' dwellings is higher, in many bands with 20 or 30%, in daytime recordings up to 40%. This is not, as is
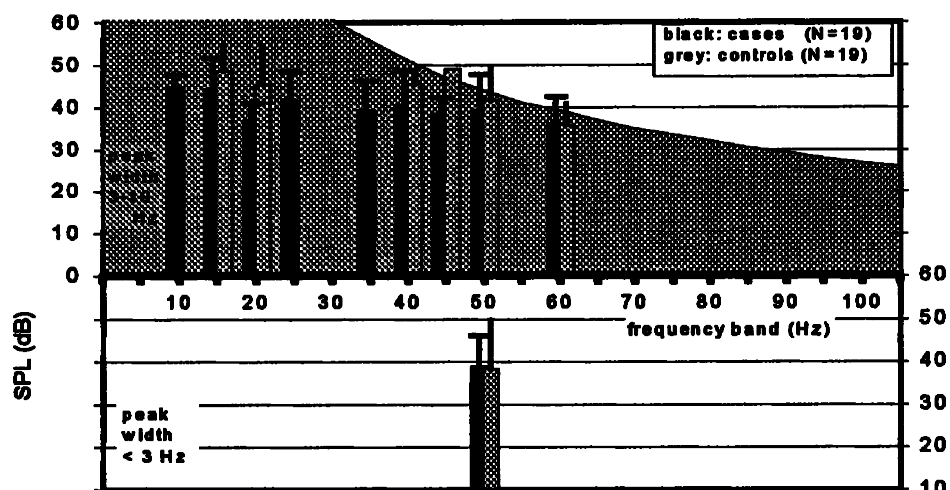
Figure 5a. Average level and standard deviation of 'broad' (3-10 Hz band width, above) and narrow (< 3 Hz, below) spectral peaks in night time recordings in dwellings of cases (black bars) and controls (grey bars), aggregated in 5 Hz intervals); grey: area below reference hearing threshold
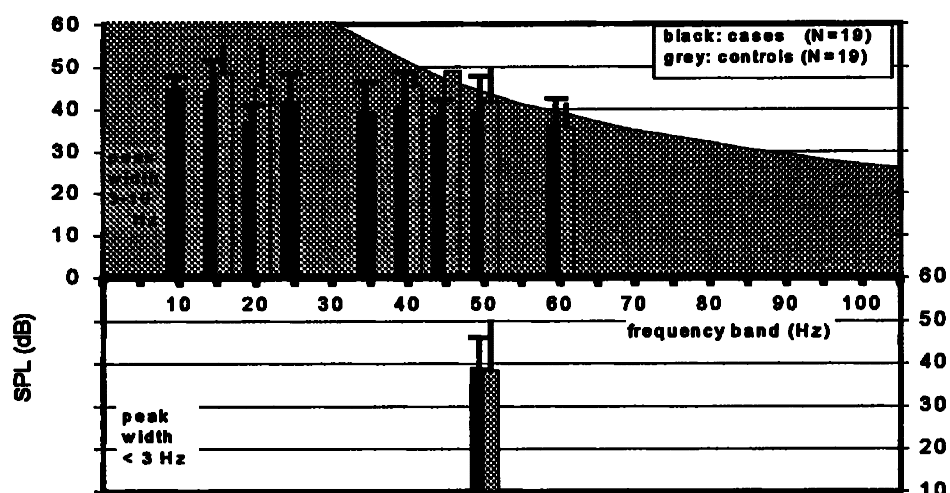

Figure 5b. same as figure 5A for daytime recordings

clear from figure 5, a consequence of higher levels. Apparently in the spectra of cases' recordings peaks are more distinct, possibly because of the lower background LF sound levels in cases' dwellings, especially in day time (compare lower part of figure 3). Thus, more peaks of lower level lead to a lower average level in cases' dwellings.

As is clear from figures 5 and 6, 'broad' spectral peaks occur at a wider range of frequencies, but predominantly at lower frequencies. 'Narrow' spectral peaks seem to occur at frequencies related to the power

frequency (50 Hz): 33, 50 and 100 Hz. Most of the peaks in the 100 Hz band have exactly 100 Hz centre frequencies, in the 50 Hz band most are at 48.6 ± 0.8 Hz, and in the 35 Hz band half of the peaks are at 33 ± 0.4 Hz, the rest at frequencies above 35 Hz. The incidence of narrow peaks in cases' and controls' dwellings (not depicted in figure 6) is not clearly different: in fact, incidence is higher in controls' dwellings in frequency bands of 35 and 100 Hz and at 50 Hz at night (resp. + 6%, + 6%, + 18%); only at 50 Hz in daytime is incidence in cases' dwellings
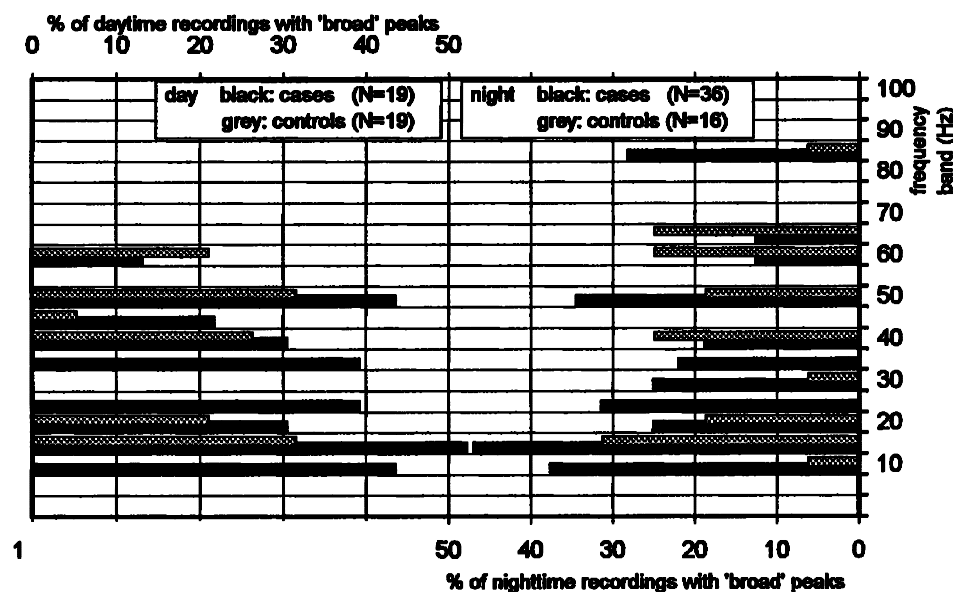
Figure 6. Incidence of 'broad' spectral peaks (3-10 Hz bandwidth) in day (left) and nighttime (right) recordings in dwellings of cases (black bars) and controls (grey bars), aggregated in 5 Hz intervals

higher (+ 12%). Also, the level of the peaks, arithmetically averaged per frequency band, is not clearly different (see figure 5): for peaks in the 35 Hz band the difference between groups is negligible (1 dB), at 100 Hz the average level in controls' dwellings is 12 dB higher, at 50 Hz it is the same (day) or 5 dB lower (night).

Scores on LF noise criteria

The results may be compared to the criteria according to DIN, Socialstyrelsen and Vercammen. The reference threshold (Table I) for frequencies between 10 and 100 Hz (inclusive) serves as a fourth criterion. Only nighttime recordings where the LF sound is heard are considered. The

average scores given in Table III are the (arithmetic) average differences between the values determined according to a criterion and the criterion value. For the DIN criterion this is the difference between 25 dB(A) and the sum of all A-weighted 1/3 octave band levels with $10 \leq f_{1/3 \, octave} \leq 100$ Hz (according to the DIN procedure, only in one case a tonal component was decisive); for the other criteria it is the distance of the maximum 1/3 octave band level to the criterion.

As Table III shows, all mean scores are below the criterion values, except for the reference threshold. This regards the average scores: in fact, in 10 to 25% of the dwellings sound levels

Table III. Average score relative to criterion according to ...

	average score		# locations above criterion	
	cases	controls	cases	controls
DIN	-10	-8	3	2
Socialstyrelsen	-7	-4	5	3
Vercammen	-8	-5	4	4
reference threshold	1	3	13	10

do exceed the criterion values, again except for the reference threshold that is exceeded in 60 to 70% of the dwellings. There is little difference between cases and controls, although controls tend to have somewhat higher average scores.

Correlation coefficients of the scores on the four criteria (Vercammen, Socialstyrelsen, DIN, reference threshold) with L_{Ceq} are within 2% of 0.92.

4. Classification of night-time lf sound levels

The measured nighttime sound levels in cases' dwellings can be classified according to the scores on proposed criteria as indicated above. Also they can be classified according to the presence of audible LF tonal components. This has been implemented by identifying local maxima (relative to the reference threshold) in the 1/3 octave band spectra with a sound level above or not less than 5 dB below the reference threshold. Then, in narrow band line spectra the frequency and frequency bandwidth of the spectral peak causing each maximum was identified. These could be divided into two classes: narrow peaks of less than 3 Hz bandwidth ('tones') and broader peaks with a bandwidth of 3 to 10 Hz ('broad tones').

With these two classification methods ('scores' and 'tones') all measured sound levels could be separated into three classes: *'considerable'*, *'some'* and *'no'* LF sound. Only nighttime measurements in complainants' dwellings have been considered, as complaints are caused by night-time exposure.

- In some cases (15% of 19 complainants' dwellings) there is *'considerable'* LF sound: all criteria are exceeded, the REFERENCE threshold by 13 to

18 dB. The (arithmetic) average sound level in these dwellings is 57 dB(C) and 34 dB(A). It is obvious that the complaints are caused by these high sound levels. In fact a separate criterion for LF noise is not necessary here: even according to standard Dutch regulations the sound level would be considered high. It is noteworthy that in two of these three cases the sound source was unknown.

- In most cases (60%) there is *'some'* LF sound: there is a LF sound above or just below the reference threshold (excess of 11 to -3 dB), but only one or no other criterion is (just) exceeded. In some dwellings the excess is ambiguous because the spectrum of one recording is different from another for no obvious reason. The average sound level in these dwellings is 42 dB(C) and 24 dB(A). From narrow band analysis it can be concluded that it usually concerns tonal sound (approximately 49 Hz and harmonics; once 100 Hz) or sound in a relatively narrow frequency band ('broad tones' such as 35-40 and 75-80 Hz). In one case the main spectral component identified was above 100 Hz, viz. At 155 Hz.

- Sometimes (25%) *'no'* LF sound can be identified that reasonably can explain LF noise complaints: the LF sound level is well (> 6 dB) below the reference threshold, no criterion is exceeded and no obvious spectral component can be identified. The average sound level in these dwellings is 36 dB(C) and 21 dB(A). In these cases the silence, the relative absence of (LF) sound, seems characteristic and

possibly a factor related to the complaints. Maybe some of these complainants hear extremely well or there is a lack of indoor sound masking body sounds such as blood flow or LF tinnitus. In some recordings taken in these dwellings the sound level is closer to the reference threshold, but the LF sound was perceptible to the complainant also at a time when a lower level was measured. The lower level then was used in this classification.

Rather similar results, with comparable percentages, were obtained in earlier measurements in 10 dwellings of complainants [3].

Although in most cases (75%) a LF sound above or just below the reference threshold could be demonstrated, there is no proof that the sound indeed was the cause of complaints.

There is no clear relation between the classification given and the number of complainants in a household. In cases were 'some' or 'no' LF sound can be demonstrated either both or just one of the adults present may claim to perceive a LF sound.

5. Discussion and conclusions

In most dwellings with complaints about LF noise a LF sound can be identified that may explain complaints. It is as yet not proven that these LF sounds indeed cause the complaints. In most cases this sound is not obvious to others (e.g. a house mate or an investigator) and the source is unknown, even to the complainant.

Differences between the sound levels in cases' and controls' dwellings are relatively small. On average the sound level in dwellings of complainants (cases) is somewhat lower than in dwellings without complaints (controls), especially at daytime and at low frequencies. As a consequence cases score less (1 – 4 dB) on proposed LF noise criteria. In most cases these criteria are not exceeded. The criteria therefore have no simple relation to complaints: complaints are not always accompanied by high scores (cases) and vice versa (controls).

Narrow band spectral components (< 10 Hz bandwidth) can be distinguished in the indoor sound spectra but the incidence and average level of these components in cases' dwellings is not clearly different from those in controls' dwellings. 'Broad' spectral peaks (3-10 Hz bandwidth) do occur more often in cases' dwellings, but, especially in daytime recordings, they tend to have lower average levels than in controls' dwellings. The higher incidence in cases' dwellings is at least partly a consequence of the fact that peaks are more distinct because of the (in daytime recordings) lower overall sound levels at low frequencies compared to controls' dwellings.

Most 'broad' peaks have low frequencies (< 70 Hz). However, most spectral peaks are at levels well below the reference threshold. Measured LF sounds have some frequency components related to the electric power frequency (50 Hz; 47 – 49 Hz from asynchronous motors) and the number of revolutions of car engines (approximately 2000 – 3000 min-1 = 33 – 50 Hz). Thus at least some of the 'sounds of silence' appear to be the sounds of engines.

In some cases ('considerable LF sound') it is clear that the measured sound level is high enough to explain complaints (over a broad, not just the low frequency range). In some other cases however ('no LF sound'), the level of all LF sounds is so low they must be considered inaudible, even for well-hearing persons; and even at

higher frequencies the sound level is still very low in these dwellings. It seems more likely that either these cases have a hearing defect, or that sounds originating within the complainant are the cause of complaints in this category; this may be LF tinnitus, or internal body sounds, perhaps audible because of a lack of external masking sounds. Tinnitus at low frequencies may not be recognized as such, as a humming sound may resemble very realistically a distant sound source such as a car engine or the muffled sound of a fan.

In view of the existence of this category of 'no LF sound', the cause of complaints in the intermediate category ('some LF sound') of cases may indeed be a relatively low level LF sound demonstrated by measurement, but it cannot be excluded that the cause of some of the complaints in this intermediate category is the same as in the 'no LF sound' category.

Acknowledgement

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Show closure threat

"The noise is driving everyone mad," said Eileen White, whose flat at King Edward Mansions reverberates every night with the sound emerging from the Shaftesbury Theatre in London's West End. Although she is used to being disturbed by the sound effects from shows at the theatre, she claimed that Umoja was just too loud. "With Napoleon, there was a huge cannon. But when it went off we knew the show was almost over," she said. "With Umoja, the problem is that all we can hear and feel is the throb of the drums. The noise builds and builds, there is a crescendo, and then it builds again. I used to run a pub nearby, so I am used to sound. But this is just terrible. The people above me hear it even more. The last thing I want is for a show to close - but there must be something they can do to dull the drums." Environmental officers from Camden borough council have already visited the block of flats to "confirm the existence of a statutory noise nuisance."

noise notes

U.S. congress

U.S. congress

1st May 2002,
The Senate (The House of Representatives concurring) resolved that Congress

(1) supports the goals and ideals of National Better Hearing and Speech Month;

(2) commends the 41 States that have implemented routine hearing screenings for every newborn before the newborn leaves the hospital;

(3) supports the efforts of speech and hearing professionals in their efforts to improve the speech and hearing development of children; and

(4) encourages the people of the United States to have their hearing checked regularly and to avoid environmental noise that can lead to hearing loss.

* * *

The Aeronautics Research and Development Revitalisation Act of 2002, introduced in the House in June, places strong emphasis, inter al., on aircraft noise. In section 2, findings, it is stated that "further growth in aviation increasingly will be constrained by concerns related to aircraft noise, emissions, etc, etc.', and 'international competitors have recognised the importance of noise, emissions, fuel consumption and air transportation system congestion in limiting the future growth of aviation and have established aggressive agendas for addressing each of those concerns'. An aggressive initiative by the Federal Government to develop technologies that would significantly reduce aircraft noise, harmful emissions, and fuel consumption would benefit the United States by, among other things improving the quality of life for our citizens by drastically reducing the level of noise due to aircraft operations.