A REVIEW OF NOISE EXPOSURE IN U.K. CALL CENTRES

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1 ABSTRACT

According to ContactBabel, approximately 780,000 people are employed in agent positions in call centres throughout the UK[1]. Our experience of measuring and assessing ambient noise levels and telephone audio levels in a variety of call centres suggests that a substantial number of agents may be exposed to noise exceeding the first or second action level defined in the 2005 Noise at Work Regulations. We have found that high ambient noise levels in densely occupied call centre areas can lead agents to run their headsets at very high levels.

This paper summarises the results of our measurements and examines the range of signal-to-noise ratios favoured by call centre agents when setting their headset audio level and factors affecting this. Based on our findings, we suggest guidance on acceptable occupied ambient noise levels in call centres and consider acoustic design principles to minimise distraction and thus to allow agents to work with telephone audio at safe levels. It is hoped that such guidance will not only help employers comply with legal requirements, but will also provide a higher quality working environment for an ever-growing number of people employed by the call centre industry.

2 INTRODUCTION

In 2015 and 2016 Adrian James Acoustics carried a series of measurements in thirteen call centres across the U.K, resulting in collection over 90 measurements of operator exposure level using a wide variety of phone systems. The purpose of the measurements was, initially, to assess call quality rather than to review compliance with the noise at work regulations. However, it quickly became apparent that employees were willingly increasing the volume of their headsets to levels which could require the employer to take action under The Control of Noise at Work Regulations (2005).

This review is not intended to analyse the reasons why employees may wish to turn their head sets up to dangerous levels, nor is it a review of whether The Control of Noise at Work Regulations (2005) are applicable in this context. From the literature review undertaken for this paper it is clear that there is relatively little work surrounding the noise exposure in call centres and to answer these questions further research would be required, far beyond what is possible with the data collected during this work.

3 REGULATIONS AND GUIDANCE

3.1 Noise at work regulations

For the purposes of this study the noise levels in The Control of Noise at Work Regulations (2005)[4] have been used. The regulations specify “action levels” and “limit values” for personal noise exposure over a working day or week and the maximum noise (peak sound pressure) exposure.

The values are:

Lower exposure action values:

Daily or weekly exposure of 80 dB(A)
Peak sound pressure of 135 dB(C)

Upper exposure action values:
Daily or weekly exposure of 85 dB(A)
Peak sound pressure of 137 dB(C)

Exposure limit values:
Daily or weekly exposure of 87 dB(A)
Peak sound pressure of 140 dB(C)

The exposure action values do not take into account the effect of any hearing protection.

The exposure limit values of 87 dB (daily exposure) and 140 dB (peak noise) take into account the effect of wearing hearing protection and must not be exceeded.

3.2 BS8233-2014

Section 7 of BS8233-2014[5] recommends a design range of 45 – 50 dB $L_{Aeq,T}$ for unoccupied noise levels in open plan offices where privacy is important[5]. There is, however, no specific UK standard for call centres.

4 METHODOLOGY

Between April 2015 and June 2016, we visited 13 call centres across the U.K. As part of a wider scope of work, measurements were taken of noise levels which phone operators were exposed to when using Supra-Aural monaural headsets. Measurements were taken using two headsets attached to a phone system with a headset splitter. The phone operator would use one headset while the second headset was placed on a GRAS 43AG artificial ear, which conforms to Type 3.3 as set out in ITU-T P.57:2009[6]. The headset was secured with a spring-loaded clamp which was adjusted to exert a force of 10N on the headset. The clamping force was verified using a Salter Model 12 spring balance. The phone operators were instructed to adjust the volume controls on their headsets to effectively do their work.

The GRAS 43AG artificial ear was connected to a Norsonic 118 sound level meter which was set to measure L_{eq} in one-third octave bands between 100 Hz and 5,000 Hz over the duration of the call.

A headphone amplifier was attached to the line output of the Norsonic to allow the consultant undertaking the measurements to make notes about the quality and other factors.

Before measurements of call noise levels were taken, an ambient measurement was carried out to allow the measurements to be corrected for the influence of ambient noise from the surrounding space affecting the measurements. This was done through the equipment as described above with the headset attached. The call operator was then instructed to continue to carry out their work as normal. The sound level meter was started at the beginning of each call and stopped at the end of the call. Measurements therefore represent the noise exposure of a call agent during a wide range of calls. For the purposes of this study these results have been averaged to represent the average noise levels a call operative would be exposed to when using a particular phone in a particular department.

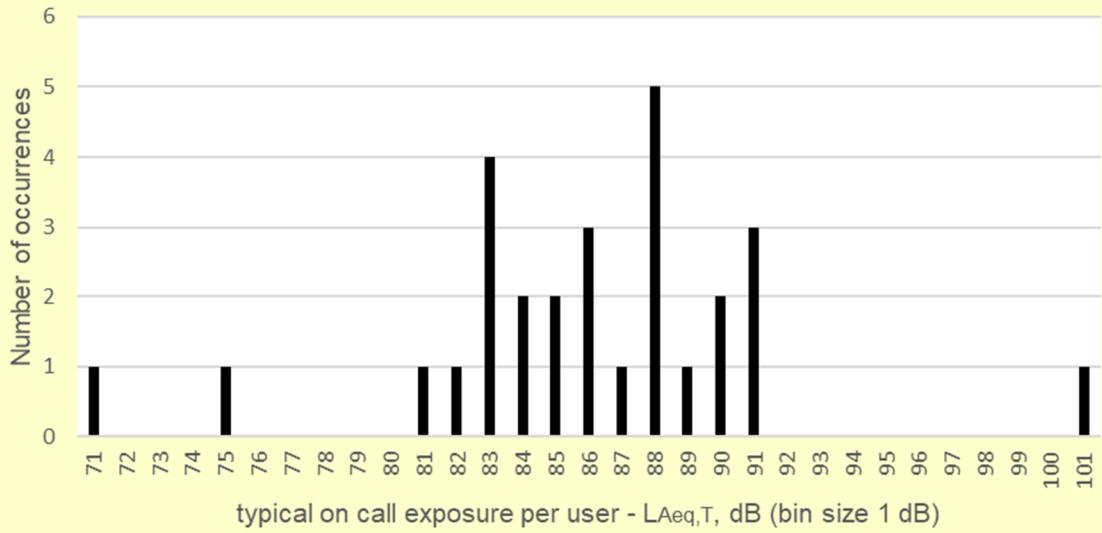
It should be noted that the GRAS 43AG measures an ear-drum reference point level (DRP). In order to compare this to noise at work recommendations this needs to be corrected to an equivalent diffuse-field correction using table 2a from ITU-T P.57[6] and table 2 from ITU-T P.58[7].

A spatial average of ambient noise levels in each call centre was also measured using the Norsonic meter with its associated microphone. This was carried out at approximate head height of the operators and was grouped by department and approximate occupancy.

5 RESULTS

The distribution of corrected equivalent diffuse field noise levels while agents were on calls are shown in as a histogram in Figure 1 in terms of $L_{Aeq,T}$ where T is the duration of the call.

Figure 1 – Histogram of equivalent diffuse field noise level measured during calls

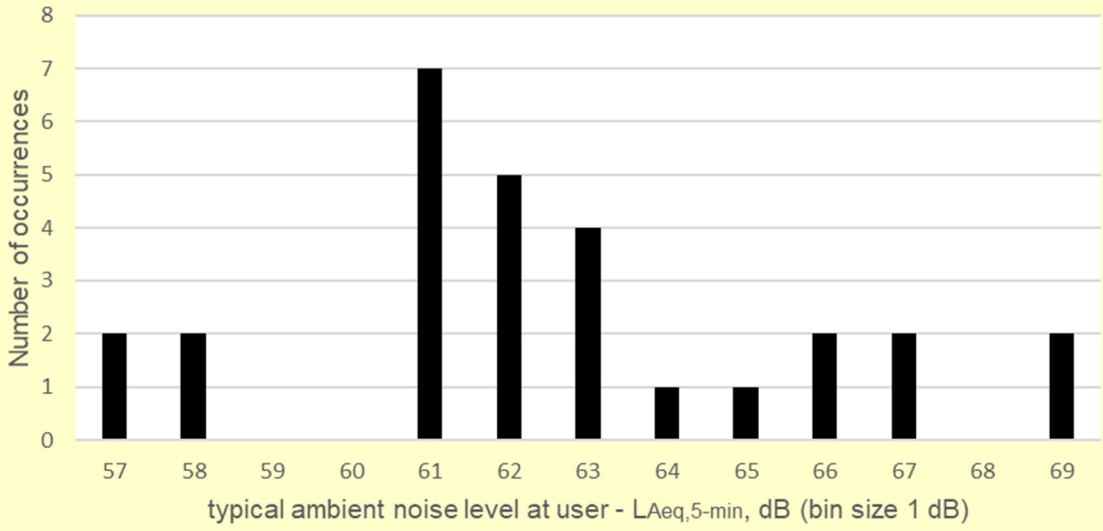


It can be seen from the histogram that the majority of operators were exposed to average noise levels between 81 and 91 dB(A) when on the phone.

The peak sound level did not exceed 135 dB(C) and therefore the peak action levels are not considered excessive when assessed against The Control of Noise at Work Regulations (2005).

Figure 2 shows the distribution of measured ambient noise levels in the relevant areas of the call centres.

Figure 2 – Histogram of equivalent diffuse field noise level measured during calls



6 DISCUSSION

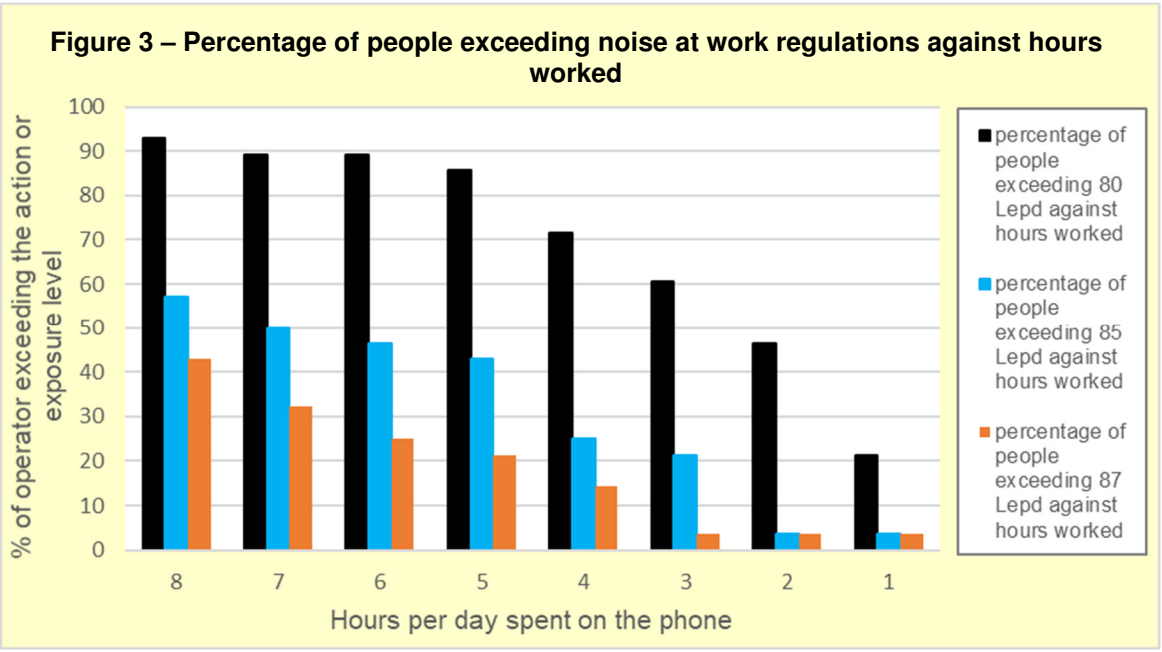
6.1 Exposure levels

For the purposes of the Control of Noise at Work Regulations (2005) the noise levels must be adjusted for the time for which an employee is exposed to them over a typical working day or week. This is known as the $L_{EP,d}$. A full noise at work assessment was not carried out and therefore employees were not asked how many hours per day they were on the telephone on average, but from discussions with employers we understand that this varies significantly depending on the nature of the work.

Regardless of the lack of data surrounding working hours, the basic principle is that employees who work longer hours on the phones will have a higher $L_{EP,d}$ when compared to an employee who spends less time on the phone, when exposed to the same levels. Similarly, employees who are exposed to higher noise levels will have a higher $L_{EP,d}$ then those exposed to lower levels over the same hours of work.

It was therefore decided to review the data as a percentage of people who may exceed the noise at work regulations for different average working hours. This is shown in Figure 3 for 80 $L_{EP,d}$, 85 $L_{EP,d}$ and 87 $L_{EP,d}$ respectively.

Figure 3 – Percentage of people exceeding noise at work regulations against hours worked



It is clear that the data is skewed by some outliers. For example, one call operator was exposed to equivalent diffuse field levels exceeding 95 dB(A) in all four calls that we monitored, with the highest sound level being 103 dB L_{Aeq}, over the generation of the call.

The fact that the phone system allowed the user to set such a high level is surprising given that just 15 minutes of exposure at this level would cause that operator to exceed the upper limit for noise at work exposure.

Ignoring the impact of this outlier it can be seen that the minimum working period for 10% of employees to exceed the noise at each action level is as follows:

HSE action value	Time required on the phone to exceed HSE action value
Lower exposure action values: Daily or weekly exposure of 80 dB(A)	1 hour a day
Upper exposure action values: Daily or weekly exposure of 85 dB(A)	3 hours a day
Exposure limit values: Daily or weekly exposure of 87 dB(A)	4 hours a day

6.2 Signal to noise level

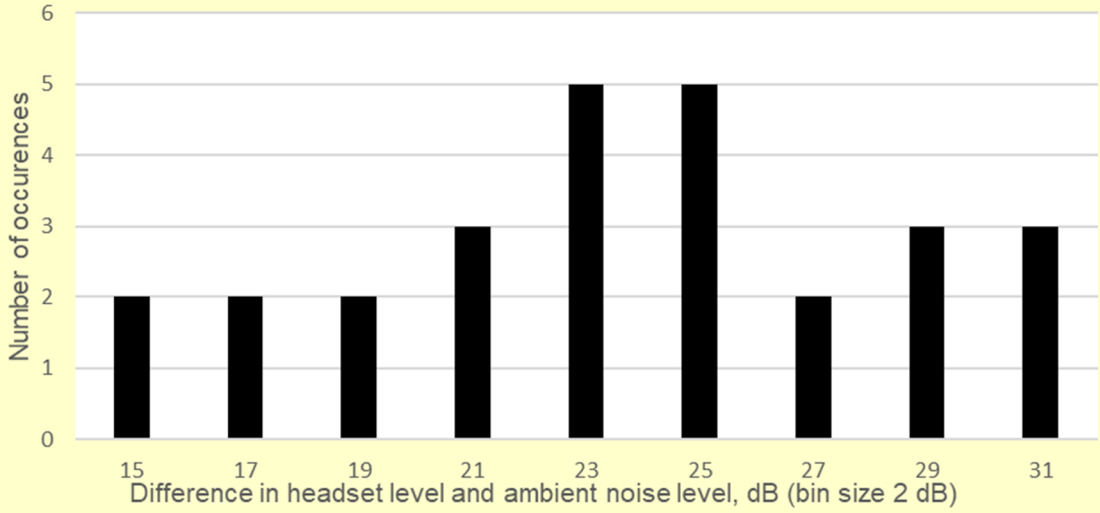
It was expected that the ambient noise level would be one of the factors affecting the call agent's headset level, our measurements showed a statistically low correlation between the surrounding ambient noise levels and the levels at which agents set their headset level.

This may be a product of the limited amount of data collected, of the surveys being carried out in environments with a relatively narrow range of noise levels, and of other variables which could not be quantified, such as the audiology of individuals and volume limitations of phone systems.

Significantly more research would be required to investigate any link between headset level and ambient noise level.

A histogram of signal to noise ratios used over the majority of the data is shown below, excluding one outlier where the user increased headset levels to 40 dB over the ambient noise levels. It should be noted that there was no specific correlation to the high phone levels used by this operator and the ambient noise levels.

Figure 4 – Difference between diffuse field headset levels and ambient noise levels



Review of the data shows that most call operators set headset levels approximately 20 - 25 dB above the ambient noise levels.

Hence ambient noise levels approximately 25 dB below the operator's phone level would allow most call operators to work without exceeding the lower exposure action level when working an 8-hour day.

Considered another way, occupied ambient noise levels of 55 dB L_{Aeq} at the operatives' head position would allow most operators to work without exceeding the lower exposure action level.

This is on average 5 dB lower than the ambient noise levels that we measured during our study. However, other studies show that call centres can achieve occupied ambient noise levels below 55 dB L_{Aeq}[2].

The higher ambient noise levels that we measures are thought to be a product of the proximity of agents to one another, the lack of acoustic screening and in some cases relatively large room volumes with acoustic finishes located principally at high level.

7 CONCLUSIONS AND RECOMMENDATIONS

The findings from this work indicate that when using monoaural headsets call operatives will typically set headset sound levels approximately 25 dB above the ambient noise levels. In order to accommodate this safely, the ambient noise level should therefore not exceed 55 dB L_{Aeq}.

This study shows that in the ambient noise levels that were measured, without hard noise limit restrictions on the phone systems workers are likely to adjust their headset level so that 60% of call operators exceed the lower action level and 20% will exceed the upper action level as set out in the noise at work regulations with just 3 hours of phone use per day.

Good acoustic design to mitigate noise is important in allowing people to work effectively while keeping exposures down. Good design should include reducing reverberant noise levels using acoustically absorbent finishes, as well as controlling direct sound using acoustically absorbent screens between operatives.

Of course, other methods of decreasing the signal to noise level at ear may be available, such as the use of closed-backed binaural headsets, although from anecdotal accounts from our work suggest that this solution is not liked by all users.

Further research is obviously required in order to refine recommendations for ideal noise levels both in the working environment and on the headsets used by call agents. Any such research would ideally be undertaken in a controlled environment, with participants undertaking audiology tests to identify any outliers which may affect the results; or to at least group the results in groups of individuals with similar hearing.

One question of interest to the author is whether the vocal effort of the talker plays more of a role in lower ambient noise environments. If this is the case it would be reasonable to assume that below a certain ambient noise level there is no change in head-set levels.

Other questions of interest are whether it is indeed reasonable to look at an A-weighted level for the speech spectrum, and whether headset levels are related to the clarity or intelligibility of the person on the other end of the line. A study looking into this would presumably need to look at the quality with which the phone systems reproduce frequencies associated with sibilance, as this may show correlation with the noise level reaching the uncovered ear over an otherwise noisy or poorly reproduced phone signal.

8 REFERENCES

1. ContactBabel, 'UK Contact Centres: 2016-2020, The State of the industry and Technology Penetration (13th Editions)', Last accessed 28/02/2020 at http://www.contactbabel.com/pdfs/dec2015/UK-SOITP-2016-Marketing-v2.pdf
2. Planeau, 'Noise Hazards associated with the call centre industry', N.D.
3. Pawlaczyk-Luszczynska, et.al., 'Noise Exposure and Hearing Status Among Call Center Operators', (2018).
4. HSE, 'The Control of Noise at Work Regulations 2005', 2005.
5. BSI Standards Publication, 'Guidance on sound insulation and noise reduction for buildings, BS8233:2014', 2014.
6. International Telecommunication Union, 'Series P: Terminal and subjective and objective assessment methods: Objective measuring apparatus: Artificial Ears, P.57', (04/2009).
7. International Telecommunication Union, 'Series P: Telephone Transmission Quality: Objective measuring apparatus: Head and torso simulator for telephonometry, P.58', (08/1996).