

# Proceedings of The Institute of Acoustics

## THE 1988 BEDA DISCOTHEQUE SURVEY PROJECT

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### INTRODUCTION

The project was commissioned by the British Entertainment and Dancing Association with the brief: to provide a representative industry response to the HSE Consultative Document (1) and to provide a basis for future agreement on working practices on up to date knowledge of typical exposure levels and operating practices within the discotheque and nightclub industry. The project was carried out during the first half of 1988 and the project report submitted to the HSE on 1988 June 30 (2).

The object of the exercise was to identify those duties which would be expected to fall within the proposed Regulations, to explore means by which duties which may not at present comply could reasonably be adapted to fall within the requirements, and finally, to identify and seek special provision for certain employments which by their very nature are not likely to comply with the requirements as they stand.

### THE BEDA RESPONSE

The proposed Regulations are concerned with exposure to "noise at work". The Shorter Oxford Dictionary gives the following modern day definition of "noise":

"Loud outcry, clamour or shouting, din or disturbance....loud or harsh sound of any kind...."

And for "music":

"Art of combining sounds with a view to beauty or form and expression of emotion...pleasant sound..."

These two definitions are clearly mutually exclusive. Yet it seems that the music industry in all its many forms is to be included within the scope of legislation based on research carried out in the late 1960s at a government armaments factory (3). There is a fundamental difference between a "noise" which is produced as the undesirable by-product of some other process and "music" which is the painstaking and dedicated end product of a highly developed art form and technological process and concern is expressed that in the absence of substantive evidence to show how the two may be related (4) the scope of the "noise at work" legislation is seen by the authorities as including the music industry.

Thus it is at the express wish of the client that for the purposes of this paper the term "sound" will be substituted for "noise" whenever the reference is to the music produced by this industry in the course of its business.

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### THE SIZE OF THE PROBLEM

In an attempt to give some perspective to the foregoing, the number of professionally operated discotheques in the UK has recently been estimated at 1500 (5). Further, those employers participating in this study estimate the average level of staffing in a discotheque operation at 35/40. Thus, between 52,500 and 60,000 staff are directly engaged in the operation of such venues.

### THE MOTIVES FOR REALISTIC REGULATION

Notwithstanding the foregoing discussion, the sociological benefits of reducing the noise exposure of the population to a minimum practicable level on a broad front is fully appreciated. Further, there are good commercial reasons for encouraging regulation in the level of sound used in discotheque and similar operations as follows:-

Whilst there is a volume threshold below which modern dance music is not effective - typically 94/96dB(A) SPL, the laws of physics dictate that in order to achieve a 3dB increase in sound pressure level from a given amplifier/loudspeaker combination it is necessary to double the amplifier power and provide twice as many loudspeakers. Thus, each 3dB increment in volume level is an expensive commodity adding thousands of pounds expenditure to the build cost of a venue. This clearly represents a considerable disincentive to over provision and it is usual to design a sound system to be capable of providing a maximum undistorted sound pressure level of approximately 104/106dB(A) at the centre of the dance floor, thus allowing 10dB headroom or a doubling of the perceived volume as an operating range.

In order to allow intelligible conversation and order taking at the bars and restaurant areas, it is desirable that a club interior should be designed so that volume levels in these areas are considerably below those obtaining at the dance floor. Levels in the region of 85dB(A) are regularly targeted and mainly achieved.

The exposure of staff to unnecessarily high sound pressure levels is likely to lead to inefficiency through fatigue and due to inability to comprehend management instructions.

### STUDY PROGRAMME

Whereas for many industries there exists a knowledge of noise exposure levels, often accumulated over many years, because the entertainment industry has not previously been subject to the requirements of the existing enforcement based on the 1974 Code of Practice, there is virtually no employee exposure data available.

Thus the survey was initiated to provide up to date knowledge of discotheque working environments as follows:-

- i) Typical dance floor volume levels and spectra.
- ii) Typical workstation volume levels and spectra.

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- iii) Employee exposure levels in those occupations likely to be at or above the 1st Action Level.
- iv) Typical working patterns, working hours and length of service data.

### SCOPE OF SURVEY

Twelve venues were selected, all professionally operated purpose built premises having their own payroll and ranging in size from 200 to 2000 capacity. The staff sample was 72.

Some venues include, as a separate operation, "designer" public houses open only during normal licensing hours in which discotheque or dance music is provided as part of the attraction. These are popularly known as "fun pubs" and have only been included in the survey if a special hours license was in operation.

Some were discotheques only and some full night club venues where stage shows as well as live and recorded music is presented. Some included restaurant facilities. All the discotheques and nightclub premises had the benefit of special hours licenses and were open to the public between 2100 Hrs and 0200 Hrs the following morning.

The geographical locations included north-east Scotland, north-west and north-east England, the east and west Midlands, south-east England, London and the Home Counties.

### THE VENUES

A number of the larger venues were housed in converted cinemas, theatres, dance halls, or similar buildings. One had been built into a dis-used warehouse building and others were new-build projects within recent property development schemes. The quality of fitting out, level of patron comfort and visual appeal was of a very high order and in all instances an admission charge was made.

Although very different in individual arrangement and in ambience, a common layout theme applied to all but one venue. Typically, the dance floor is a central feature with bar serveries, lounge seating areas, standing/drinking areas, etc. arranged around the perimeter. In many instances the accommodation was arranged in a multi-level format with the dance floor at ground level and the bars and lounge seating areas built up in split level terracing, thus creating a variety and choice of smaller, more intimate areas within the overall space. Restaurants are usually screened off.

It is usual to find acoustically absorbent suspended ceiling systems over large sections of the club interior, especially over the bar serveries, restaurants and lounge areas, and for the floors to be extensively carpeted. This in conjunction with the widespread use of upholstered fitted seating generally results in a high level of perimeter absorption and attendant low reverberation time, typically less than 0.5 seconds at 1KHz when empty.

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It is usual to find the loudspeaker system either arranged around or else directed onto the dance floor from one end, so that the sound is concentrated where much of the energy is absorbed by patrons dancing. Because of the high level of perimeter absorption provided in most venues this results in significantly reduced sound levels over the more remote bar serveries, restaurants and lounge areas thus providing the patron with a choice of aural environment. In some venues the perimeter absorption has proved so effective that it has been necessary to introduce a separate distributed system to provide controlled coverage of the perimeter areas.

In the majority of venues visited a quiet staff room is provided well away from the scene of activity.

### STAFFING & WORK PATTERNS

From a sound exposure viewpoint staffing at these venues can be divided into three categories:-

- i) Staff who remain outside the entertainment area at all times. These include door security personnel, office staff, cashiers, cloakroom attendants, kitchen staff. These employees are not considered to be at risk under the provisions of the draft regulations.
- ii) Staff who move around the premises and are therefore subject to varying levels of sound exposure. These include management, security personnel, floor staff, waitresses, bar and catering supervisors.
- iii) Staff whose principal duties are in and around the dance floor area and are therefore, apart from break periods, exposed to sound at continuous levels. These include bar staff, DJs and lighting operators.

Some staff also work at the venue on a daytime basis, engaged on preparatory catering or in the administrative or promotional activities. These are typically bar and catering staff, the DJ and management. Typical hours are 1000Hrs - 1700Hrs. For the purposes of the survey these have been treated as "2nd jobs" and the hours involved have not been included in the LAeq calculations.

Typical opening time is 2100Hrs. In most venues staff will report for duty at 2030Hrs or shortly after, using the 30 minute interval to change into uniform, prepare tills, set up bars and food serveries, unlock emergency exit doors, set lighting, set up any special promotion, etc. so as to be ready for doors-open at 2100Hrs. During this period it was unusual for music to be played.

At 2100Hrs music is played at relatively low volume levels, typically below 85dB(A). By 2200Hrs there is some level of activity and by 2300Hrs the club is usually well underway with sound levels approaching their normal working levels and the dance floor packed.

During the progress of the evening the sound level was found to vary as special features were presented. A stage act or a 60s Special would generally be at a

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lower volume level than current Dance, Hip-hop or House favorites and by 0145Hrs it is usual to find the tempo and volume levels winding down towards the 0200Hrs finishing time.

Typically, it was found to take up to 20 minutes before the last patron was out of the premises and approximately 30 minutes for clearing up. In many venues staff taxis were ordered for 0230Hrs and most staff were found to leave the premises at this time.

Thus, the typical working hours are 2030Hrs to 0230Hrs, or 6 hours in all, of which only five hours are spent in a noisy environment. Thus, the 1st Action Level proposed under the Draft Regulations becomes in effect 87.25dB and the 2nd Action Level 92.25dB, LAeq.

### SOUND EXPOSURE STUDY

Each venue was visited by prior arrangement at 2030Hrs as staff were reporting for work. Following a familiarisation survey of the premises, and under guidance from the unit manager, 6No responsible staff in jobs considered to be at risk were selected on the spot as subjects for dosimetry. The actual numbers in each job description varied between venues according to circumstances but included the Duty Manager, Resident Disc Jockey, Bar Servery Staff, Floor Staff, Waitresses and Security Personnel.

The selected staff were then assembled for briefing. Most were unaware that a survey was being undertaken until this time, although some had an inkling "that someone was coming to check the sound". Staff were informed of the object and purpose of the survey, that the success of the project was in their own long term interests, and asked to go about their normal jobs in the normal way as if nothing unusual was happening.

Up to 6No dosimeters were used at each venue. Each was calibrated on the spot at the time of issue and in front of the participating staff. Lapel microphones were clipped to collars as close as practicable to the ear - sometimes left, sometimes right, according to the dictates of wearing apparel. The instrument was carried either in a jacket or trouser pocket, or, in the case of scantily clad female staff, in a belt pouch. Microphone cables were concealed under wearing apparel to avoid risk of tanglement in tills, glass washing machines, bar dispense fittings and sound and lighting equipment, and the apparatus generally arranged so as to maintain a minimum profile to the operation. The dosimeters were started as near to 2100Hrs as individual circumstances permitted.

Dosimeters were collected in as near to 0200Hrs as circumstances allowed and each participating member of staff asked to help with a simple questionnaire designed to provide an indication of the likely noise history of the participant, hours of work and typical lengths of service in the industry. The questions were put verbally and the questionnaire used is reproduced in Appendix #1.

SPL measurements and 1/3rd octave spectra were recorded at or about 2330Hrs, 0030Hrs, and 0230Hrs at the centre of the dance floor, in the DJ Console,

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behind bar serveries, in lounge areas and in the Restaurant as appropriate.

### BLIND STUDIES

Because of the very strict admissions policy operated at all the venues visited and the level of security used to enforce that policy at the door, selective "blind" studies to verify the results obtained were not considered feasible. However, every diligence was used to assess the likely volume capability of the installed sound system in relation to the SPL values being recorded and in most instances it was found that the "clip" or "limit" indicators on the power amplifiers were activated, suggesting that the sound system was being operated close to its maximum capability.

### EQUIPMENT USED

The dosimetry programme was carried out using Metrosonics data logging noise dosimeters type DT-301A. These were set for an operating range of 60-123dB(A) and for a short Leq integration of 1 minute. At the end of each session each logger was downloaded into the Metroreader type DT-390 collector unit for subsequent print-out and for permanent storage on floppy disc thus facilitating future processing and interrogation. Each Metrologger was calibrated on site using a Cirrus Research CRL 5:11 calibrator. A typical time history plot from this apparatus is shown in Appendix #2.

SPL measurements and real time spectrum analysis was performed using a Cetec-Ivie IE-30A precision grade SPL/RTA on the basis of visually estimated L10 values. Hard copy plots were obtained by downloading the internal memories of the IE-30A into a Cetec-Ivie IE-17A processor communicating with a Hewlett Packard type 7010B XY plotter. A typical 1/3rd octave plot is shown in Appendix #3.

### SURVEY RESULTS

The survey results comprise a separate time history print out for each employee monitored, separate SPL measurements in the principle workstations and public areas of the venue and representative 1/3rd octave real-time frequency analysis plots. It is not proposed to present the entire data file here, but Appendix #4 gives a simple analysis, by job description, of the results obtained.

The survey also revealed that of 49No staff sampled 21No had second jobs and 28No did not. Of those with a second job most were students, office staff, conventional barstaff, or were in similar occupations where noise exposure is not likely to exceed the 1st Action Level. Only two were subject to noise in their second job, both in the construction industry.

It can be seen from Table #2 that with the exception of waitresses, all staff participating in the survey are shown to be exposed above the adjusted 1st Action Level. With the exception of Disc Jockies, all other staff are exposed at or around the 5 hour adjusted 2nd Action Level. Only DJs are shown to be exposed significantly above the adjusted 2nd Action Level.

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Given the restricted dynamic range of a sound system installation it is considered impossible for the Peak Action Level to be reached in a discotheque environment and this aspect of the Regulations has not therefore been addressed.

### PROPOSALS FOR COMPLIANCE

Given that all those jobs expected to be at risk are shown in Table #2 to be exposed at above the 1st Action Level it has been accepted that employers will implement the requirements of Sections 4, 5, 6 and the applicable clauses of Section 10 of the Draft Regulations as a matter of course.

Having regard to the high level of staff turnover within the industry, as shown in Table #4 the keeping of records in the form required under the provisions of Section 5 of the Draft Regulations will not be practicable. It is therefore suggested that such records should relate to the particular workstation or job description to be applied to any employee doing that job.

Having regard to the extent of borderline exposure at or around the hours adjusted 2nd Action Level, it is proposed that Section 7 will be implemented at the same time.

### MEANS OF COMPLIANCE

It is expected that the requirements of Sections 6 and 7 can be met by a combination of volume regulation (6), by alterations to staff working patterns and rostering and in the longer term by changes to the internal layout and design of the venues. The provision of guidance on these aspects is included within the BEDA brief.

It is expected that this action will reduce the exposure associated with most jobs to below the adjusted 2nd Action Level, but others, particularly DJs and other performers, and possibly some floor staff, may remain above the adjusted 2nd Action Level.

Clearly, it is not acceptable or practicable for a DJ or other performer, or for scantily clad girls serving over bar counters or taking drink orders or money, to wear ear defenders. The externally worn type are not aesthetically acceptable in what is in effect a theatre environment, and in any event, these or the worn-in-the-ear type would hinder, and in some cases prevent, the performance of the duty. The Weekly Averaging Exemption will therefore be sought.

### THE CASE FOR WEEKLY AVERAGING EXEMPTION

Table #3 shows that employees in this industry are working only a small fraction of the standard 40 hour working week and it is considered that a case is thus made for the weekly averaging provision of Section 12(b)(i) of the Draft Regulations to be allowed as an exemption of the duty required under Section 8.

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It is considered that the case is further strengthened by the results of Table #4 showing an average length of service of just eleven months.

The survey has further shown that less than half of the 49No employees questioned have another job, and of these only two may be exposed to noise in that employment.

### SUMMARY

It has been suggested that the statistical evidence upon which the various action levels are based has been derived from sources that bear no relationship to the nature of the "noise" produced by the entertainment industry. It has been shown elsewhere (4) that there is contradictory evidence to show that exposure to music played at volume levels well above the proposed 2nd Action Level may not necessarily lead to hearing impairment.

Given the measures being proposed for compliance with the requirements of Sections 4, 5, 6, 7, 9 and 10 of the Draft Regulations, the 5-hour adjusted exposure level and agreement by the Health and Safety Commission to an exemption from the requirements of Section 8 under the provisions of Section 12(b)(i), the survey suggests that most discotheque venues would nevertheless be able to operate broadly within the proposed Regulations.

Whilst this industry is responding positively to the requirements of the new Regulations and is conscious of its responsibilities to regulate employee exposure to high sound levels, the Health and Safety Executive have been requested to allow a reasonable period of time for full compliance. For example, much can be done to reduce the average daily exposure levels by the design and layout of buildings, but given the very high costs of carrying out such alterations, and that this type of premises are typically refurbished on a 5 year cycle anyway, it could take that period before all venues can be adapted in the way envisaged.

It has been stated that the entertainment industry is unique among employers in that the "noise" is its actual product. Thus without the "noise" there is no industry. It has been shown that were the industry to disappear tens of thousands of jobs, mainly employing young people, would be lost. There would be major repercussions in the building industry, in the many high-tech supporting industries such as lighting, video, lasers and sound system engineering, and would lead to a significant downturn in the brewing and catering industries.

The data recorded and the interviews carried out suggest that the majority of employees work in this industry because they want to - because the exposure to music is part of the enjoyment of the job. Most are young, active, fashionable and attractive people to whom music is an integral part of life. Once the age is reached where this form of music ceases to be attractive, they move on to other types of employment. Thus the accumulative effect over the working life will be minimal in terms of the statistics upon which the exposure limits have been set.



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### References:

- 1) Health & Safety Commission, "Prevention of Damage to Hearing from Noise at Work - Draft Proposals for Regulations and Guidance", HMSO, 1987 November.
- 2) Dibble K, "BEDA Response to HSC Consultative Document on Proposed Noise at Work Regulations arising from EEC Directive 86/188". BEDA/The Sound Practice, 1988. Restricted circulation report not yet published.
- 3) Burns W and Robinson D W, "Hearing and Noise in Industry", HMSO, 1970.
- 4) Dibble K, "Disco Deafness - the Myth?" Reproduced Sound 4 conference, Windermere, 1988. Proc IoA Vol 10.
- 5) Estimate by Phonographic Performance Ltd, 1988.
- 6) Dibble K, "Sound Level Limiting - An Overview of the Means for Effective Control", Reproduced Sound 4 conference, Windermere 1988. Proc IoA Vol 10.

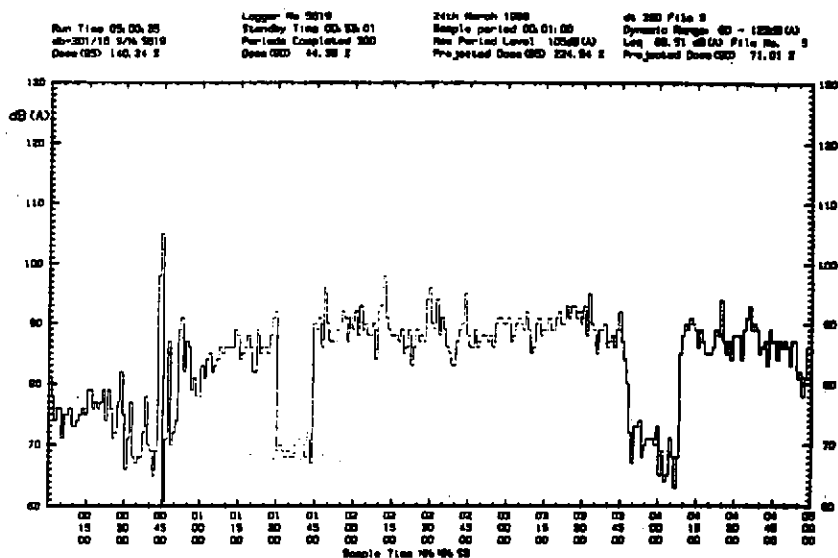
### Appendix 1

BEDA SURVEY MARCH/APRIL 1988	
PARTICIPATING STAFF QUESTIONNAIRE	
VENUE: .....	DATE: .....
NAME: .....	LOGGER: .....
JOB TITLE: .....	AGE: .....
PERIOD IN THIS JOB: .....	
HOURS WORKED: .....	
IS THIS YOUR FULL TIME OCCUPATION? YES/NO	
IF NOT, WHAT OTHER JOBS DO YOU HAVE? .....	
IMMEDIATE PREVIOUS JOB: .....	
HOURS WORKED: .....	
PREVIOUS JOBS: .....	
DO YOU ATTEND DISCOS OUTSIDE WORK? YES/NO HOW OFTEN? .....	
DO YOU ATTEND ROCK CONCERTS? YES/NO HOW OFTEN? .....	
DO YOU ENGAGE IN OTHER NOISY PURSUITS? YES NO	
DETAILS (1) .....	
DETAILS (2) .....	
OTHER COMMENTS .....	
INTERVIEWED BY: .....	

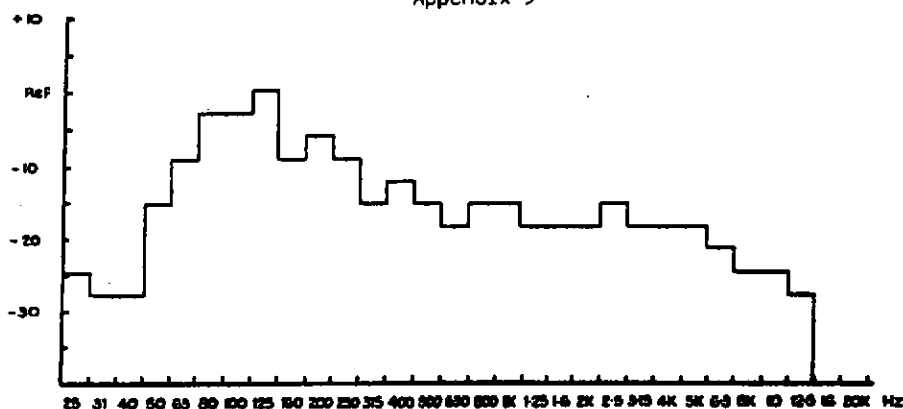
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### Appendix 2



### Appendix 3



Data: Dance Floor SPL & Spectra @ 24.00hrs Date: 03/03/88 Ref: 075001  
Client: BEDA Location: Example  
Ref Lvl: 100 dB Sens: 2.5dB SPL: 105dB Wtg: A Resp: Slow 88g

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### APPENDIX 4

TABLE 1: Venue Volume Levels

Measurement Location	Mean SPL	Mean Devn	Max SPL	Min SPL	No Smpls
Dance Floor:	103dB(A)	1.5	107	99	12
DJ Console:	98dB(A)	1.6	104	98	12
Bar Serveries:	90dB(A)	4.2	100	73	36
Lounges:	90dB(A)	4.5	98	75	32
Restaurants:	84dB(A)	6.1	89	70	10

TABLE 2: Personal Noise Exposure

Job Title	Mean Lep,d	Mean Devn	Max Lep,d	Min Lep,d	No Smpls
Disc Jockey:	99.4dB	1.6	103	96	9
Duty Manager:	92.1dB	3.3	97.5	88	7
Bar Staff:	92.2dB	2.7	98.6	86.4	24
Floor Staff:	93.3dB	2.3	97	88	10
Int. Security:	93.6dB	2.3	99.2	91	5

TABLE 3: Averaged Working Hours in Noisy Environment

Job Title	Avg period per Session	Avg Sessions per week	Avg Hours per week	No Smpls
Disc Jockey:	5Hrs	4.0	20	8
Duty Manager:	5Hrs	4.5	22.5	6
Bar Staff:	5Hrs	3.5	17.5	21
Floor Staff:	5Hrs	3.5	17.5	9
Security:	5Hrs	4.0	20	5

TABLE 4: Averaged Length of Service and Employee Age

Title	Avg Length of Service	Avg Age of Employee	No Smpls
Disc Jockey:	14.5mths	26yrs	8
Duty Manager:	15mths	28yrs	6
Bar Staff:	9.5mths	21yrs	21
Floor Staff:	6mths	21yrs	9
Security:	8.5mths	25yrs	5

