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**School pilot of the industry / HSE noise
guidance**

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EXECUTIVE SUMMARY

Objectives

The Control of Noise at Work Regulations come into force for the Music and Entertainment sector in April 2008. A school piloted guidance for the music and entertainment sector on these Regulations. The school has purpose built practice and performance facilities for music, designed with consideration for the acoustics and soundproofing. Measurements were made to determine the possible noise exposure of the music tutors, and any controls that could or are already being tried to ensure compliance with the new Regulations.

Main Findings

There were no specific control measures to reduce the noise exposure of the teaching staff.

Only the guitar tutor used hearing protection.

The saxophone tutor is exposed to noise levels sufficient to give a daily personal noise exposure above 90dB(A).

The electric guitar, flute and trombone tutors are exposed to noise levels sufficient to give a daily personal noise exposure above 85dB(A).

String, piano and voice tutors are unlikely to be at risk from their teaching activities alone.

Pupils are exposed to average sound levels up to 98dB(A) during group rehearsals.

Recommendations

The school should assess the noise exposure of music teachers during their activities at the school.

A programme of control measures should be implemented making the staff most at risk a priority. The following simple initial measures are suggested:

- Use the larger practice rooms for tuition on louder instruments
- Increase the spacing between players in group practices
- Balance loud and quiet pieces in a repertoire
- Reduce the amplification of electronic instruments during practice sessions

Hearing protection should be used in conjunction with noise controls where a risk remains. During the visit the following staff were identified as likely to be at risk.

- The saxophone teacher should use hearing protection to ensure compliance with the Noise at Work Regulations.
- Electric guitar, flute and trombone tutors should be provided with hearing protection under the Noise at Work Regulations and should acclimatise to its use before it is mandatory under the Control of Noise at Work Regulations.

1 INTRODUCTION

Until April 2008 the music and entertainment sector remains under the Noise at Work Regulations 1989 [1]. These regulations give first and second daily exposure action levels of 85 and 90dB(A). After April 2008 the Control of Noise at Work Regulations 2005 [2] come into force for the music and entertainment sector. These regulations set new action values for daily exposures at 80 and 85dB(A) and also a limit value of 87dB(A).

Representatives, from the music and entertainment sector, are preparing specific guidance for the Control of Noise at Work Regulations with support from the Health and Safety Executive. Andrew Maxey, (HSE Noise and Vibration Programme) requested the Health and Safety Laboratory (HSL) make measurements supporting piloting of this guidance. A school volunteered to pilot the guidance and in June 2006 Liz Brueck from HSL's Noise and Vibration Section made measurements of the noise exposure of the music department teaching staff present on that day.

The school music department has its own purpose built facilities containing practice rooms and a raked auditorium. These facilities have been designed to provide good acoustics and sound proofing and are in excellent condition. Measurements were made during normal school activities: a lunchtime practice of the Sax group and an after school orchestra practice in the auditorium; and individual music lessons in the practice rooms.

The activities during the measurements were the normal activities for the day. No changes had been made to the way the lessons and practice sessions were conducted. The measurements therefore provide an indication of the noise exposure of school music teachers working with state of the art facilities in terms of the quality of the music and teaching facilities but without noise exposure controls.

2 MEASUREMENTS

Sound level measurements were made with a B&K 2260 sound level meter / analyser by the ear of the tutor. Some additional noise exposure measurements were made during the orchestra practice with CEL logging noise dosimeters. These dosimeters monitored the noise from the shoulder of the staff, recording both overall values for the measurements and how the sound varied in 15s intervals.

The L_{eq} (average A-weighted sound pressure level) and duration of a noise exposure determines how much it contributes to a person's daily noise exposure. Table 1 (below) details the L_{eq} by the teacher's ear while instruments were being played, and the exposure time at this level to reach a daily personal noise exposure ($L_{EP,d}$) of 80, 85 and 90dB(A). Similar values are also given for the pupils playing with the saxophone group and orchestra. These values can be used to estimate the noise exposure of the staff and pupils during school activities in conjunction with information on the possible exposure duration.

This report does not attempt to determine the daily personal noise exposure of the staff. This will depend on the duration of the exposure as well as the levels measured. In addition to work at the school, private practice and performances will also contribute to the daily noise exposure.

2.1 SAXOPHONE GROUP

The Saxophone Group consisted of eight pupils with their tutor. They rehearsed standing in a single row semicircle in the performance area of the auditorium. The tutor also played with the group, standing at one end of the semicircle.

The practice session is normally 30 to 35 minutes long, with the group playing for about 20 to 25 minutes during this period.

Two measurements of the L_{eq} at the tutor's ear while she and the group were playing were 93dB(A) and 95dB(A). For the pupils the L_{eq} varied between 94 and 96dB(A).

2.2 ORCHESTRA

The orchestra consisted of 29 players, playing brass, woodwind, and percussion. They were seated in the performance area of the auditorium facing the tutor conducting the orchestra. In addition to the pupils, one member of the staff, seated at the edge of the back row, played the tuba.

The practice lasted around 40 minutes. The conductor and the tuba player wore dosimeters with the microphones fitted on the shoulder. The dosimeters show the actual playing time during the rehearsal was 26 minutes.

The L_{eq} recorded by the dosimeters during the 26 minutes of playing time was 94dB(A) for the conductor and 92dB(A) for the tuba player. Spot measurements of the pupils' L_{eq} varied from 91dB(A) for a saxophone player in the back row to 98dB(A) for a front row flute player.

2.3 INDIVIDUAL MUSIC LESSONS

Individual music lessons were provided in the music practice rooms. Although several practice rooms were being used at the same time there was little disturbance from adjacent rooms. The windows of the music practice rooms were open during the measurements (it was a hot day). Slightly higher sound levels may occur within the rooms when the windows are closed.

The lowest L_{eq} was 76dB(A), recorded during a violin lesson in a large practice room where the pupil was standing at least 3m from the tutor at the piano. A tutor was exposed to levels 6dB(A) higher during a similar violin lesson in a small practice room.

The highest L_{eq} recorded in a lesson was 95dB(A) during a saxophone lesson in a small practice room. Sound levels reached 98dB(A) within the orchestra during the after school practice.

Table 1 Measured L_{eq} values while playing and exposure time to reach daily exposures of 80, 85, and 90dB(A)

<i>Activity/ location</i>	<i>Measured L_{eq} dB(A)</i>	<i>Exposure time to 80dB(A) $L_{EP,d}$</i>	<i>Exposure time to 85dB(A) $L_{EP,d}$</i>	<i>Exposure time to 90dB(A) $L_{EP,d}$</i>
<i>Saxophone group practice (estimated playing time 20 to 25 minutes)</i>				
Tutor	93 to 95	15 to 24 minutes	48 to 76 minutes	2.5 to 4 hours
Students	94 to 96	12 to 19 minutes	38 to 60 minutes	2 to 3 hours
<i>Orchestra practice (actual playing time 26 minutes)</i>				
Tutor conducting	94	19 minutes	60 minutes	3 hours
Student trombones back row	94	19 minutes	60 minutes	3 hours
Student percussion	92	30 minutes	1.5 hours	5 hours
Student trumpet soloist with orchestra	96	12 minutes	38 minutes	2 hours
Student saxophone back row	91	38 minutes	2 hours	6 hours
Student clarinet front row	95	15 minutes	48 minutes	2.5 hours
Student flute front row	98	8 minutes	24 minutes	75 minutes
Staff tuba	92	30 minutes	1.5 hours	5 hours
<i>Individual music lessons (tutor exposure only)</i>				
Trombone	90	48 minutes	2.5 hours	8 hours
Violin and piano accompaniment (small practice room)	82	5 hours	Not exceeded	Not exceeded
Violin and piano accompaniment (large practice room)	76	Not exceeded	Not exceeded	Not exceeded
Violin	84	3 hours	>8 hours	Not exceeded
Electric guitar	88	75 minutes	4 hours	> 8 hours
Singing (piano accompaniment)	85	2.5 hours	8 hours	Not exceeded
Flute	89	1 hour	3 hours	>8 hours
Saxophone	95	15 minutes	48 minutes	2.5 hours
Piano	82	5 hours	Not exceeded	Not exceeded

3 NOISE CONTROL AND HEARING PROTECTION

Under both the Noise at Work Regulations 1989 and Control of Noise at Work Regulations 2005 there is a requirement to reduce noise exposure. A noise control programme must be implemented under the 1989 Regulations where daily noise exposure is likely to reach or exceed 90dB(A). Under the 2005 Regulations the noise control programme is required when exposure reaches or exceeds 85dB(A).

The tutors most at risk should be the priority for noise control measures.

Reduction of the noise is the first priority, with hearing protection being used only as a last resort where a risk remains. Under the 1989 Regulations hearing protection must be worn if the daily exposure is likely to exceed 90dB(A), and must be available when the daily exposure exceeds 85dB(A). Under the 2005 Regulations hearing protection must be used at 85dB(A) and provided at 80dB(A).

3.1 NOISE CONTROL

Some simple noise controls that can be implemented immediately are suggested below.

3.1.1 Group rehearsals in the auditorium

During group rehearsals increase the spacing between players. Consider staging to raise the players in the back rows above those in front and increasing the spacing between the rows and within rows. Avoiding seating players directly in front of loud instruments. Increased spacing reduces the noise heard by the players from the rest of the orchestra and allows them to play more quietly because it is easier for them to hear their own playing.

Playing more quietly and planning quieter pieces into the repertoire will be a benefit.

3.1.2 Individual lessons

The noise exposure in the large practice rooms is likely to be lower than in the smaller practice rooms. The noise exposure of a tutor providing piano accompaniment during a violin lesson was 6dB lower in the large practice room than a similar lesson in a small practice room. In a larger practice room the tutor's exposure is reduced because of the room acoustics and because they can be further away from the pupil. The tutors teaching the loudest instruments would benefit the most from using the larger practice rooms.

Using less amplification will reduce the sound level during electric guitar lessons. The risk of excessive noise exposure can be eliminated during practice sessions by selection of a low level amplifier, muffling or moving speakers further away.

3.2 HEARING PROTECTION

The electric guitar teacher was providing his own hearing protection. No other staff were using hearing protection.

The saxophone tutor is likely to be receiving a daily exposure above 90dB(A) if exposed to playing for more than 2.5 hours a day. On the day of the visit the tutor gave lessons and lead the saxophone group. If their daily personal noise exposure is confirmed as likely to reach or exceed 90dB(A) hearing protection must be used until the noise exposure is reduced sufficiently by other means.

The flute, trombone, and electric guitar teachers are possibly at risk of exceeding a daily exposure of 85dB(A). If this is the case hearing protection should currently be provided and will be mandatory under the Control of Noise at Work Regulations.

Under the Control of Noise at Work Regulations only the tutors of the quieter instruments (such as strings, piano, and singing) are likely to be able to continue with only voluntary use of hearing protection.

Flat response hearing protectors for musicians provide protection while minimising the distortion of the sound. These are likely to be the most acceptable. Although the pupils are not covered by the above Regulations those playing the louder instruments would also benefit from using hearing protection.

4 RECOMMENDATIONS

The school should assess the exposure of all the music teachers to determine those at risk from their activities while working at the school. In addition staff should consider the additional risk from their exposure from work activities outside the school.

Staff should be informed of the results of the assessment and given training on the noise hazards and noise control measures necessary. Consider extending this training to pupils.

The school should use the assessment to implement a programme of noise controls. The following simple initial actions are suggested to reduce the noise exposure of both staff and pupils:

- Increase the spacing between players during group rehearsals and performances. Avoid seating those playing quieter instruments immediately in front of those playing loud instruments.
- The sound levels in the larger practice rooms can be lower than in the smaller rooms. Use the larger practice rooms for the lessons on the loudest instruments to maximise the benefit.
- Plan a repertoire of both loud and quiet pieces to avoid playing loudly all the time.
- The amplification of electric guitars should be limited during lessons to prevent daily exposures above 80dB(A).

Hearing protection should be used in conjunction with noise controls where a risk remains. During the visit the following staff were identified as at risk depending on the duration of their noise exposure.

- The saxophone tutor's daily personal noise exposure is likely to exceed 90dB(A) after 2.5 hours of noise exposure during lessons and group practice. Use of hearing protection is an immediate requirement under the Noise at Work Regulations 1989 if this daily exposure is reached or exceeded.
- Tutors of the louder instruments (trombone, flute and electric guitar) are at risk of exceeding a daily personal noise exposure of 85dB(A) during a working day at the school and are advised to acclimatise to hearing protection before the Control of Noise at Work Regulations 2005 come into force. The provision of hearing protection is already a requirement under the Noise at Work Regulations 1989 for exposures above 85dB(A), and its use will be mandatory when the Control of Noise at Work Regulations 2005 come into force.

The piano, voice, and violin tutors are unlikely to receive a daily personal noise exposure over 85dB(A) from activities at the school.

CE marked flat frequency response protectors designed for musicians are likely to be most suitable. Consider a range of different types so staff can choose for themselves what they find most comfortable.

5 REFERENCES

- 1. Noise at Work Regulations 1989** Statutory Instrument 1989 No 1790 – Health and Safety Regulations 1989
- 2. Control of Noise at Work Regulations 2005** Statutory Instrument 2005 No. 1643 Health and Safety

6 APPENDIX A

Measurement and analysis equipment

- B&K 2260 sound level meter/ analyser serial number 2305154 with B&K 4189 microphone serial number 2294166 and B&K 4231 sound calibrator serial number 2309005

UKAS calibration May 2005

Meter conformance to IEC 60804, and IEC 60651 Type 1 and calibrator to IEC 942:1988 Class 1

- CEL 360 logging noise dosimeter serial number 3/026938 with CEL 110 acoustic calibrator serial number 026392

Manufacturer's calibration March 2006

Meter conformance to IEC 60804 Type 2, IEC 60651 Type 2, and IEC 1252. CEL sound calibrator conformance to IEC 60942 Class 2C

- CEL 460 logging noise dosimeter serial numbers 0691603 used with CEL 110 acoustic calibrator serial number 026392 (as above).

Calibration by Health and Safety Laboratory Noise and Vibration Section March 2006

Meter conformance to IEC 60804 Type 2, IEC 60651 Type 2, and IEC 1252.