Bills Committee on
Occupational Deafness (Compensation)(Amendment) Bill 2002

The Administration's Response -

Measurement of the daily personal noise exposure of mahjong parlour workers conducted by the Labour Department

Introduction

At the meeting held on 11 March 2003, the Administration was asked to provide detailed explanation on how the daily personal noise exposure of mahjong parlour workers (namely, substitute players, attendants and cashiers) were measured, and figures showing the distribution of different noise levels which these workers were exposed to during their entire shift of duty in a day. The Administration responded that it did not possess data for the entire shift of the surveyed workers in a working day.

2. The Administration proposed to explain how the mean daily personal noise exposure of these workers was arrived at from the available data captured by a noise dosimeter. The Administration's response is provided below.

Daily Personal Noise Exposure ($L_{EP,d}$) measured by a noise dosimeter

3. The daily personal noise exposure ($L_{EP,d}$) of workers is evaluated by taking into consideration the noise levels and exposure patterns measured by a noise dosimeter. A noise dosimeter (simply known as a personal sound exposure meter) is a small and light device that can be clipped to a person's belt to measure noise exposure. With a small microphone fastened to the person's collar near the ear, the dosimeter stores data on the changing noise level which the person is exposed to.

4. From the data collected, the dosimeter carries out an averaging process and a measurement of the average level of exposure during the measurement period is given at the end of the time period. This reading will be shown by the dosimeter. Since the dosimeter is worn by the worker, it gives an

accurate picture of how much noise, from all sources, the worker is actually exposed to at work. This procedure is generally referred to as "personal" noise monitoring.

5. The mathematical definition of $L_{EP,d}$, expressed in dB(A), is :

$$L_{EP,\,d} = 10 \log_{10}\left\{\frac{1}{To}\int_{o}^{Te}\left[\frac{P_A(t)}{Po}\right]^2\right\} dt$$

where To = 8 hours

Te = the duration of the person's personal exposure to sound

Po = 20 μPa

$P_A(t)$ = the time-varying value of A-weighted instantaneous sound pressure in pascals in the undisturbed field in air at the atmospheric pressure to which the person is exposed (in the locations occupied during the work day), or the pressure of the disturbed field adjacent to the person's head adjusted to provide a notional equivalent undisturbed field pressure.

Frequency A-weighting network is used as it corresponds to the frequency response of the human ear and also has a good correlation to the risk of noise-induced hearing loss.

6. With a built-in programme to work out and give a single reading on the daily personal noise exposure throughout the period when the dosimeter is worn, a worker's $L_{EP,d}$ during the period when he is on duty can be read from the dosimeter after each assessment if he wears the device throughout the whole shift.

Measurement by representative periods

7. Where it is known that a worker is exposed to representative noise pattern during the busy hours and the non-busy hours in a working day, it is an international practice in noise surveys to capture the readings of noise exposure at representative periods in the busy hours and non-busy hours.

8. According to this measurement, the daily personal noise exposure can be established from the measured equivalent continuous sound level during a

sample time interval T, and the duration of exposure at work. The $L_{EP,d}$ can be calculated by the following formula :

$$L_{EP,d} = 10 \log \frac{1}{8} \left[\sum_{i=1}^{n} ti \times 10^{\frac{L_{PAi}}{10}} \right]$$

where ti = exposure duration in hour of the i th measurement

L_{PAi} = noise level in dB(A) of the i th measurement

9. To illustrate, if the employee states that his busy hours on a typical working day last for 3 hours whereas the non-busy hours last for 5 hours and the noise pattern during these respective periods is rather steady, then the value of 'ti' in the $\mathbf{L_{EP,d}}$ formula will be 3 and 5 respectively. Assuming that the noise dosimeter is switched on for 30 minutes each during the periods of busy hours and non-busy hours, and the dosimeter readings are 88 dB(A) and 81 dB(A) respectively, then the daily personal noise exposure of the worker according to the formula will be 85 dB(A).

Assessment of daily personal noise exposure in mahjong parlours

10. The Occupational Hygiene Division of the Labour Department conducted noise assessments in 10 mahjong parlours to measure the daily personal noise exposure of substitute players, attendants and cashiers. Measurement by representative periods was used in the assessments.

11. The results in each mahjong parlour showed that the $L_{EP,d}$ of substitute players was between 88 dB(A) and 93 dB(A), the $L_{EP,d}$ of attendants was between 85dB(A) and 89 dB(A) while the $L_{EP,d}$ of cashiers was between 80dB(A) and 89 dB(A). A breakdown of the survey results is at the Annex.

12. Basing on the $L_{EP,d}$ of each noise assessment for substitute players, attendants and cashiers in all the mahjong parlours surveyed, the mean $L_{EP,d}$ for each of the three posts is then calculated by using the following formula :

$$\text{Mean } L_{EP,d} = 10 \log \frac{1}{n}\left[\sum_{i=1}^{n} 10^{\frac{L_{EP,di}}{10}}\right]$$

where $L_{EP,di}$ = $L_{EP,d}$ of the i th measurement in dB(A)

n = total number of $L_{EP,d}$ measurements.

13. Accordingly, the mean $L_{EP,d}$ for substitute players, attendants and cashiers is 91 dB(A), 88 dB(A) and 86 dB(A) respectively.

14. It should be noted that the intensity of sound is measured in decibel by a logarithmic scale. A 3dB reduction of noise level is equivalent to a 50% reduction of sound intensity. As revealed from this “3-dB rule”, though the difference in the mean daily personal noise exposure between attendants and substitute players in mahjong parlours is only 3dB(A) in absolute terms, attendants are subject to only half the sound intensity than that of substitute players. On the other hand, the difference in the mean daily personal noise exposure between cashiers and substitute players is 5dB(A). Therefore, cashiers are exposed to sound intensity which is less than half of that of substitute players.

Labour Department
March 2003

Annex

Noise survey for employees in Mahjong Parlour

Mahjong Parlour	**Substitute Player** $L_{EP,d}$ (dB(A))	**Attendant** $L_{EP,d}$ (dB(A))	**Cashier** $L_{EP,d}$ (dB(A))
1		88.8	86.9
2	93.0	85.0	86.4
3	90.2		
4	88.0		
5		87.6	87.5
6		87.7	89.0
7		87.8	82.7
8	90.3	88.0	80.0
9		87.4	85.6
10		88.2	
Range (dB(A))	88 - 93	85 - 89	80 - 89
Mean (dB(A))	**91**	**88**	**86**