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Controlling of noise exposure at the workplace

**Kontrola izloženosti bučave na
radnom mestu**



Waste management curricula
development in partnership with
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Structure

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Introduction

- Approximately 12–15% of the workforce is exposed to noise levels defined as hazardous by World Health Organisation.
- According to the WHO, although noise is associated with almost every work activity, some activities are associated with particularly high levels of noise.
- Occupations at highest risk:

- Manufacturing
- Transportation
- Mining

- Construction
- Agriculture and
- The military



Introduction

- Noise at work can cause hearing damage that is permanent and disabling
 - hearing loss that is gradual because of exposure to noise over time,
 - damage caused by sudden, extremely loud noises.
- Implementation of EU regulation in the control of noise at work in the developing countries in relation to:
 - the harm that noise can cause;
 - identifying if there is a problem with noise at the workplace;
 - controlling noise and preventing harm



The noise exposure limit values

- The daily personal noise exposure level, $L_{EP,d}$ which corresponds to $L_{EX,8h}$ defined in international standard ISO 1999: 1990 clause 3.6 is expressed in decibels and is ascertained using the formula:

$$L_{EP,d} = L_{Aeq,T_e} + 10 \log_{10} \frac{T_e}{T_o}$$

- T_e is the duration of the person's working day, in seconds;
- T_o is 28,800 seconds (8 hours); and
- $L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, as defined in ISO 1999, 1990 clause 3.5, in decibels, that represents the sound the person is exposed to during the working day.



The noise exposure limit values

- The weekly personal noise exposure, $L_{EP,w}$, which corresponds to $L_{EX,8h}$ defined in international standard ISO 1999: 1990 clause 3.6 (note 2) for a nominal week of five working days, is expressed in decibels and is ascertained using the formula:

$$L_{EP,w} = 10 \log_{10} \left(\frac{1}{5} \sum_{i=1}^m 10^{0.1 (L_{EP,d})_i} \right)$$

- m is the number of working days on which the person is exposed to noise a week; and
($L_{EP,d}$) is the $L_{EP,d}$ for working day i .



The noise exposure limit values

- Peak sound pressure is the maximum value of the noise pressure and is expressed as peak dB (C). Peak sound pressure level (L_{Cpeak}), is expressed in decibels and is ascertained using the formula:

$$L_{Cpeak} = 20 \log_{10} \left[\frac{p_{Cpeak}}{p_o} \right]$$

p_{Cpeak} is the maximum value of the C-weighted sound pressure, in Pascals (Pa), to which a person is exposed during the working day;

and

$$p_o = \mu\text{Pa}$$



The noise exposure limit values

Sound pressure level table



The noise exposure limit values

- exposure limit values $LEX_{8h} = 87$ dB(A) and $p_{peak} = 200$ Pa , above which no worker may be exposed; the noise reaching the ear should, in fact, be kept below these exposure limit values;
- upper exposure action values: $LEX_{8h} 85$ dB(A) and $p_{peak} = 140$ Pa respectively;
- lower exposure action values: $LEX_{8h} = 80$ dB(A) and $p_{peak} = 112$ Pa respectively which determine when preventive measures are necessary to reduce the risks to workers.



Noise exposure points

Worked example

Table



Instruments

- sound level meter (SLM)
- dosimeter (personal sound exposure meter) worn by the employee
- Dual-purpose instruments (can operate as both a sound level meter and a dosimeter)
- calibrator to check the meter each day before and after making any measurements
- windshield to protect the microphone against air movement and dirt



Sound level meter (SLM)



Dosimeter (SLM)

Instruments

Other, more sophisticated, equipment

- data recorders,
- frequency analyzers, and
- sound intensity analyzers can be used for a more detailed assessment.

Where a person is highly mobile or working in places where access for the measurement is difficult, a dosimeter is an alternative means of measuring a person's noise exposure.



Instruments



Making measurements
with a hand-held sound
level meter



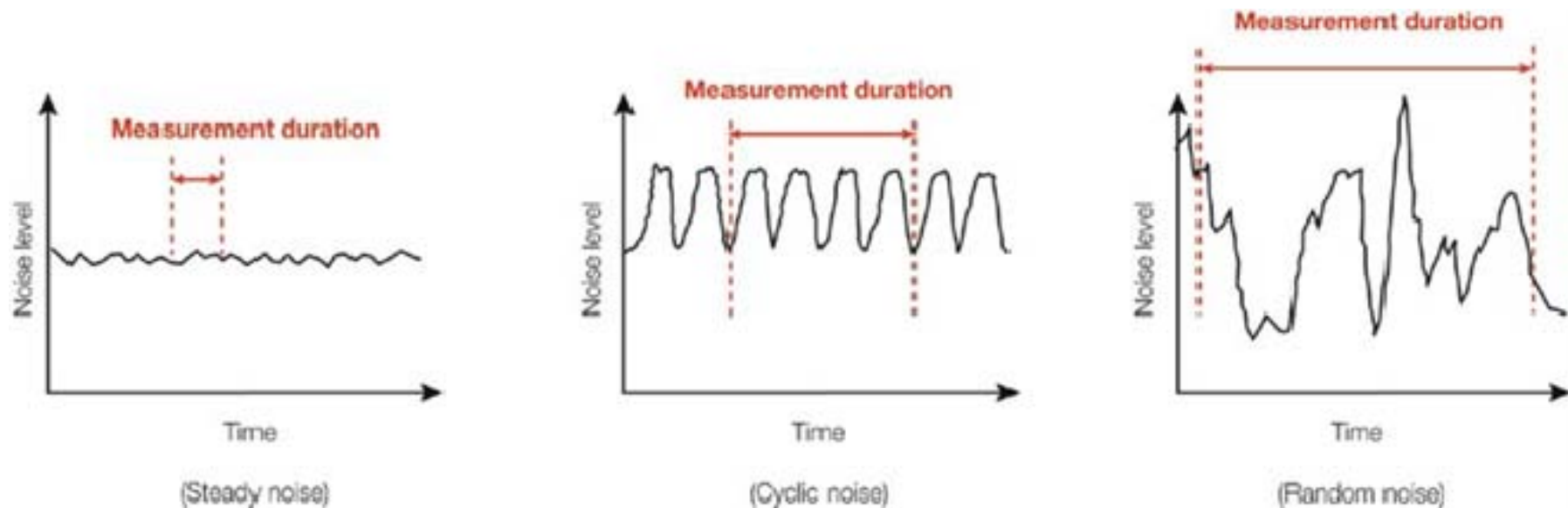
Recommended position for a
dosimeter microphone



Duration of measurement

- How long to measure

With a sound level meter, the measurement at each position or during each job or task, should be long enough to obtain a representative measurement of the level the person is exposed to. Representative measurement durations for different types of noise are shown below.



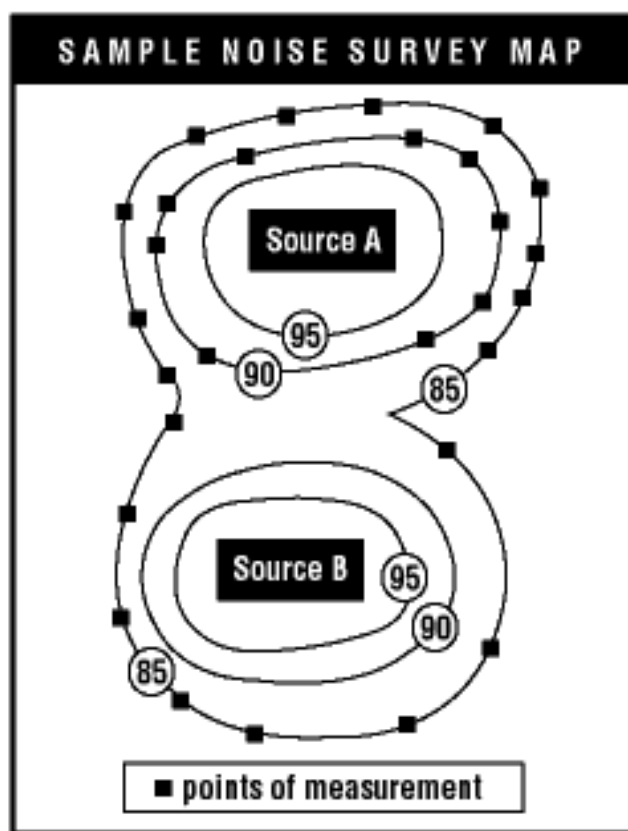
Control of noise at work

A noise survey takes noise measurements throughout an entire plant or section to identify noisy areas. Noise surveys provide very useful information which enables to identify:

- Areas where employees are likely to be exposed to harmful levels of noise and personal dosimetry may be needed.
- Machines and equipment which generate harmful levels of noise.
- Employees who might be exposed to unacceptable noise levels.
- Noise control options to reduce noise exposure.



Control of noise at work

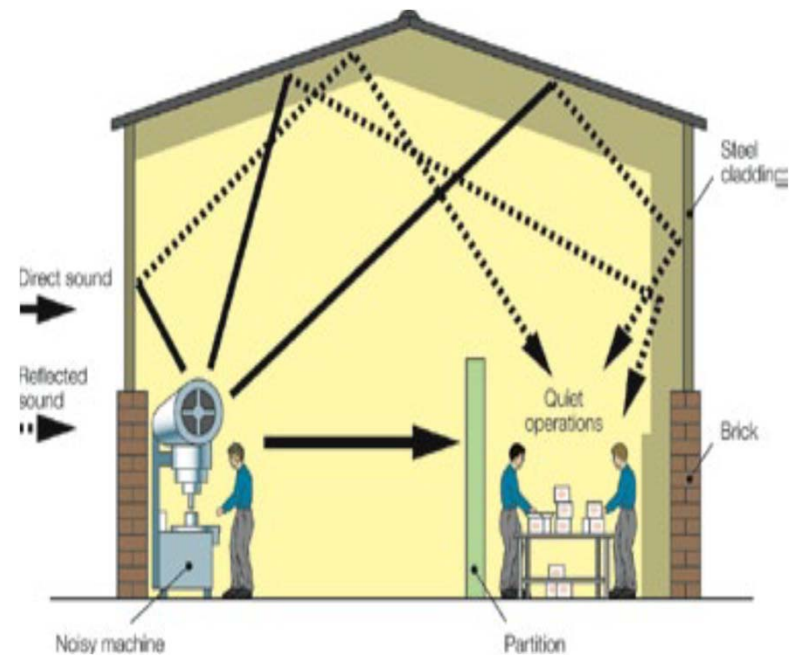


- A noise map can be produced by drawing lines on the sketch between points of equal sound level. Noise survey maps, like that in figure, provide very useful information by clearly identifying areas where there are noise hazards.

Control of noise at work



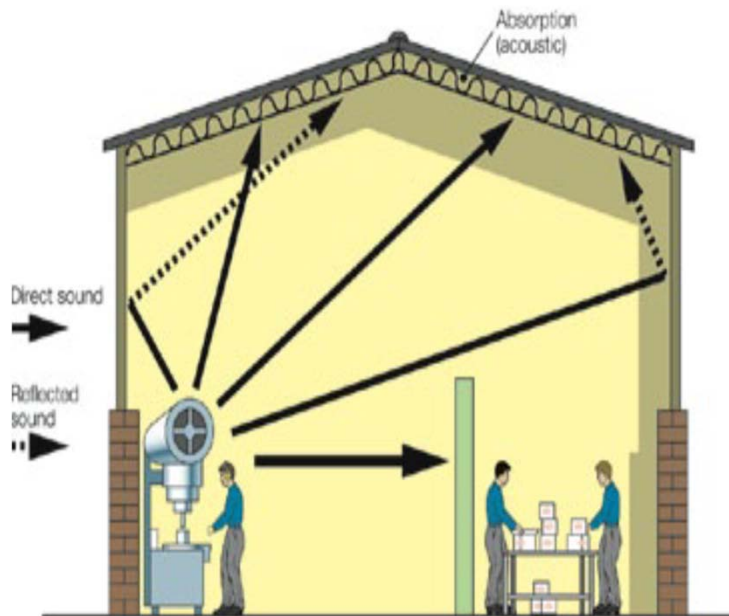
Hearing protection zone sign



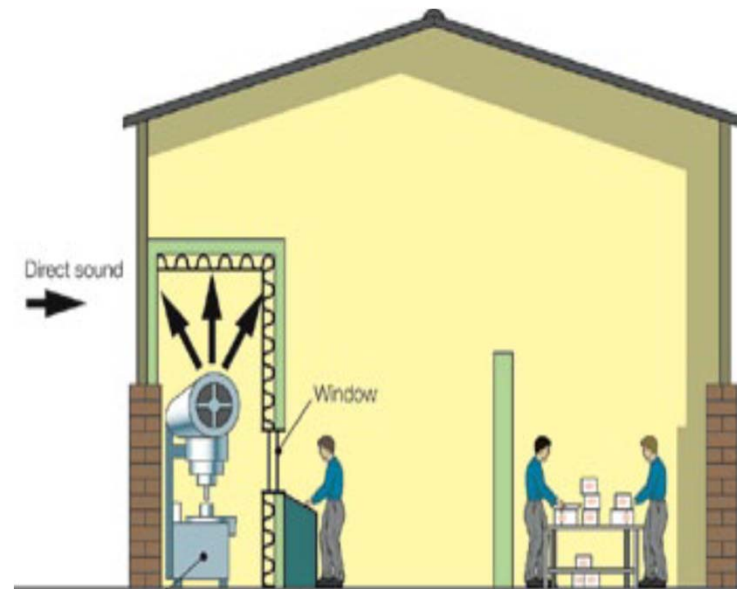
Noise paths found in a workplace. The quiet area is subjected to reflected noise from a machine somewhere else in the building



Control of noise at work



The correct use of absorption in the roof will reduce the reflected noise reaching the quiet area



Segregation of the noisy operation will benefit the whole workplace

Hearing protection

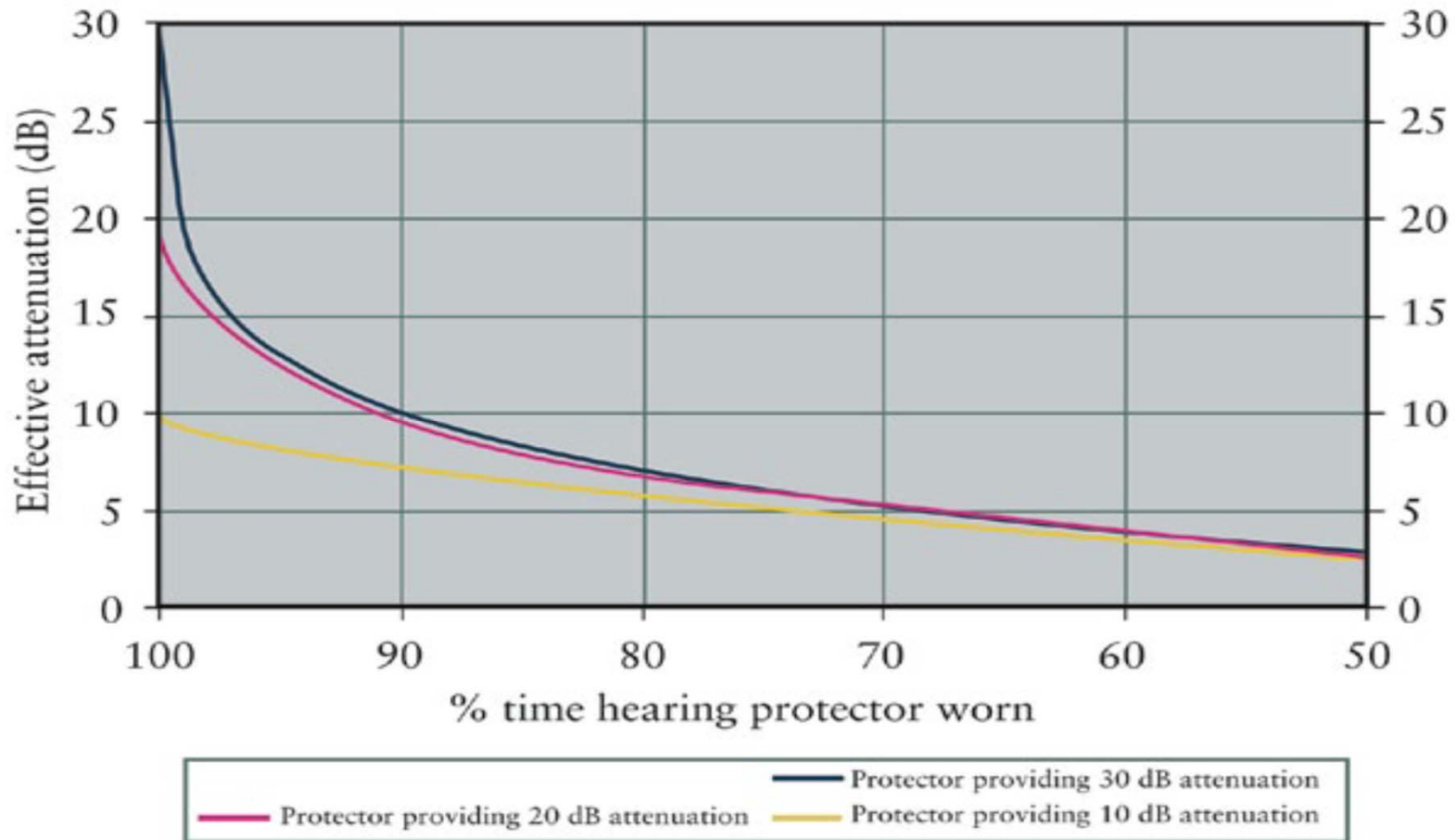


Maximising performance of protectors through full use

The effectiveness of a hearing protector is reduced if it is not worn all the time it should be. It shows the effective protection offered by three different hearing protectors against the percentage of time worn. When the protectors are worn for 100% of the time that the user is exposed to the noise, they give the expected protection. As wear time is decreased the effective protection offered decreases. A significant reduction in protection is found even if the wear time is 90%. If the protectors are worn for 50% of the time they should be, the protection offered is only about 3 dB.



Maximising performance of protectors through full use



Preventing harm and managing noise risks

Assess the risks

- Identify noise hazards
- Estimate likely exposure to noise
- Identify measures required to eliminate or reduce risks, control exposures and protect employees

Worker information and training

- Consult workers and allow their participation
- Give employees information, instruction and training about the risks, control measures, hearing protection and safe working practices



Preventing harm and managing noise risks

Protect employees

Eliminate or control noise risks

- Eliminate or reduce risks using good practice and known control and management solutions
- For the higher-risk cases, plan and put in place technical and organizational noise-control measures
- Make sure the legal limits on noise exposure are not exceeded.

And provide hearing protection

- Protect employees with hearing protection
- Make its use mandatory for the high-risk cases
- Manage the use of hearing protection within zones, instruction and supervision



Preventing harm and managing noise risks

Health surveillance

Eliminate or control noise risks

- Provide health surveillance (hearing checks) for those at risk
- Use the results to review controls and further protect individuals
- Employees co-operate and attend for hearing checks

Maintain and use the equipment

- Maintain any noise-control equipment and hearing protection
- Ensure that anything supplied is fully and properly used
- Employees use the controls provided and report any defects
- Employees use hearing protection where its use is mandatory



Preventing harm and managing noise risks

Review as things change

- Changes in work practices
- Changes in noise exposures
- New ways to reduce risks



Conclusion

Implementation of EU regulation in the control of noise at work in the developing countries in relation to:

- Take measures and activities to avoid, prevent or noise reduction,
- Take noise protection measures imposed by the nearby environment that causes discomfort and disturbance,
- Removal or reducing the harmful effects that result from exposure to noise in the media and areas of the environment and secure and developing measures to reduce the noise emitted by the major sources, in particular the road, railway and water transportation and infrastructure, aircraft, equipment used in open spaces and in industry, and mobile mechanical means of operation.
- Creation healthy living conditions and protection of people environment from noise



Thank you for your attention

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Orijentaciona šema izvora buke, njene jačine i efekti koje prouzrokuje

Zvuci u okruženju	NIVO BUKE (u dB)	Efekt
Lansiranje rakete	180	
Neposredna blizina mlaznog motora	140	
Paljba iz vatrenog oružja	130	Prag bola
Pucanj groma, buka u diskoteci	120	Prag osetljivosti
Rad pneumatskog kompresora Glasni rok koncert	115 -120	Izloženost veća od 1 minuta -rizik od nepovratnog oštećenja sluha
Neposredna blizina rada teških kamiona	100	Izloženost bez zaštite nije preporučljiva više od 15 min.
Rad kosilice za travu Podzemna železnica Kamionski saobraćaj Rad motocikla	90	Stvara izuzetnu neprijatnost i uznemirenost
Rad električnog brijača Mnoga radna mesta u industriji	85	Nivo na kome počinje oštećenje sluha
Prosečna buka u gradskom saobraćaju	80	Izaziva neprijatnost i uzmenirenost. Otežava konverzaciju
Rad usisivača Rad fena za sušenje kose Unutrašnjost automobila	70	Ometajući nivo. Otežava komunikaciju telefonom
Normalna konverzacija Rad šivaće mašine Rad mašine za kucanje	60	
Mirna kancelarija Rad rashladnog uređaja	50	Ugodnost
Rad frižidera	40	
Šapat Tišina u biblioteci	30	Vrlo tiho
Šum normalnog disanja	10	Jedva čujno
	0	Najtiši zvuk koji može da detektuje ljudsko uvo

Sound pressure level, L_{Aeq} (dB)	Duration of exposure (hours)								Total exposure points	Noise exposure $L_{EP,d}$ (dB)
	1/4	1/2	1	2	4	8	10	12		
95	32	65	125	250	500	1000			800	94
94	25	50	100	200	400	800			630	93
93	20	40	80	160	320	630			500	92
92	16	32	65	125	250	500	625		400	91
91	12	25	50	100	200	400	500	600	320	90
90	10	20	40	80	160	320	400	470	250	89
89	8	16	32	65	130	250	310	380	200	88
88	6	12	25	50	100	200	250	300	160	87
87	5	10	20	40	80	160	200	240	130	86
86	4	8	16	32	65	130	160	190	100	85
85		6	12	25	50	100	125	150	80	84
84		5	10	20	40	80	100	120	65	83
83		4	8	16	32	65	80	95	50	82
82			6	12	25	50	65	75	40	81
81			5	10	20	40	50	60	32	80
80			4	8	16	32	40	48	25	79
79				6	13	25	32	38	20	78
78				5	10	20	25	30	16	77
75					5	10	13	15		

Table 3 Worked example of noise exposure ready-reckoner

This pattern of noise exposures gives an $L_{EP,d}$ of between 86 and 87 dB. The priority for noise control or risk reduction is the task involving exposure to 95 dB for 45 minutes, since this gives the highest individual noise exposure points.

Weekly noise exposure ready-reckoner

159 In the circumstances outlined in Part 1 (see paragraphs 27-29) the weekly noise exposure level rather than a daily exposure level can be used as an indicator of risk.

160 The weekly noise exposure level ($L_{EP,w}$) takes account of the daily personal noise exposures for the number of days worked in a week (up to a maximum of seven days). It may be calculated using the formula given in Schedule 1 Part 2 of the Regulations. A ready-reckoner for calculating weekly exposure from the daily exposures for up to seven days is given in Table 4. An electronic spreadsheet for calculating weekly exposure can be found on the HSE website (www.hse.gov.uk/noise).