WHO 1999 Guidelines

Extract

For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB LAmax more than 10–15 times per night (Vallet & Vernet 1991), and most studies show an increase in the percentage of awakenings at SEL values of 55–60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10–30 s, SEL values of 55–60 dBA correspond to a LAmax value of 45 dB. Ten to 15 of these events during an eight-hour night-time implies an LAeq,8h of 20–25 dB. This is 5–10 dB below the LAeq,8h of 30 dB for continuous night-time noise exposure, and shows that the intermittent character of noise has to be taken into account when setting night-time limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background level of these events.

If negative effects on sleep are to be avoided the equivalent sound pressure level should not exceed 30 dBA indoors for continuous noise. If the noise is not continuous, sleep disturbance correlates best with LAmax and effects have been observed at 45 dB or less. This is particularly true if the background level is low. Noise events exceeding 45 dBA should therefore be limited if possible. For sensitive people an even lower limit would be preferred. It should be noted that it should be possible to sleep with a bedroom window slightly (

Table 4.1: Guideline values for community noise in specific environments.

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax, fast [dB]
Outdoor living area	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwelling, indoors Inside bedrooms	Speech intelligibility and moderate annoyance, daytime and evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
School class rooms and pre-schools, indoors	Speech intelligibility, disturbance of information extraction, message communication	35	during class	-
Pre-school bedrooms, indoors	Sleep disturbance	30	sleeping -time	45
School, playground outdoor	Annoyance (external source)	55	during play	-
Hospital, ward rooms, indoors	Sleep disturbance, night-time Sleep disturbance, daytime and evenings	30 30	8 16	40 -
Hospitals, treatment rooms, indoors	Interference with rest and recovery	#1		
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Ceremonies, festivals and entertainment events	Hearing impairment (patrons:<5 times/year)	100	4	110
Public addresses, indoors and outdoors	Hearing impairment	85	1	110
Music through headphones/ earphones	Hearing impairment (free-field value)	85 #4	1	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment (adults) Hearing impairment (children)	- -	- -	140 #2 120 #2
Outdoors in parkland and conservation areas	Disruption of tranquillity	#3		

#1: as low as possible;
#2: peak sound pressure (not LAmax, fast), measured 100 mm from the ear;
#3: existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low;
#4: under headphones, adapted to free-field values

Table 5.1
Summary of effects and threshold levels for effects where sufficient evidence is available

Effect		Indicator	Threshold, dB	Reference (chapter, section)
Biological effects	Change in cardiovascular activity	*	*	3.1.5
	EEG awakening	$L_{Amax, inside}$	35	4.10
	Motility, onset of motility	$L_{Amax, inside}$	32	3.1.8, dose–effect relation for aircraft
	Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep	$L_{Amax, inside}$	35	3.1
Sleep quality	Waking up in the night and/or too early in the morning	$L_{Amax, inside}$	42	3.1.7, dose–effect relation for aircraft
	Prolongation of the sleep inception period, difficulty getting to sleep	*	*	3.1
	Sleep fragmentation, reduced sleeping time	*	*	3.1
	Increased average motility when sleeping	$L_{night, outside}$	42	3.2, dose–effect relation for aircraft
Well-being	Self-reported sleep disturbance	$L_{night, outside}$	42	4.2, dose–effect relation for aircraft/road/rail
	Use of somnifacient drugs and sedatives	$L_{night, outside}$	40	4.5.8
Medical conditions	Environmental insomnia**	$L_{night, outside}$	42	3.1; 4.1; 4.2

* *Although the effect has been shown to occur or a plausible biological pathway could be constructed, indicators or threshold levels could not be determined.*

** *Note that "environmental insomnia" is the result of diagnosis by a medical professional whilst "self-reported sleep disturbance" is essentially the same, but reported in the context of a social survey. Number of questions and exact wording may differ.*

Table 5.2
Summary of effects and threshold levels for effects where limited evidence is available+

Effect		Indicator	Estimated, threshold dB	Reference (chapter, section)
Biological effects	Changes in (stress) hormone levels	*	*	2.5
Well-being	Drowsiness/tiredness during the day and evening	*	*	2.2.3
	Increased daytime irritability	*	*	2.2.3
	Impaired social contacts	*	*	2.2.3
	Complaints	$L_{night,outside}$	35	4.3
	Impaired cognitive performance	*	*	2.2.3
	Insomnia	*	*	4.6
	Hypertension	$L_{night,outside}$	50	2.2.3; 4.5.6
	Obesity	*	*	2.2.3
	Depression (in women)	*	*	4.8
	Myocardial infarction	$L_{night,outside}$	50	4.5.15
	Reduction in life expectancy (premature mortality)	*	*	2.2.3; 2.5
	Psychiatric disorders	$L_{night,outside}$	60	4.8.15
	(Occupational) accidents	*	*	2.2.3; 2.4

+ *Note that as the evidence for the effects in this table is limited, the threshold levels also have a limited weight. In general they are based on expert judgement of the evidence.*

* *Although the effect has been shown to occur or a plausible biological pathway could be constructed, indicators or threshold levels could not be determined.*

The calculation for the total number of effects from reaction data on events (arousals, body movements and awakenings) needs a number of assumptions. The first that needs to be made is independence: although there is evidence (Brink, Müller and Schierz, 2006) that the order of events of different loudness strongly influences the reactions, the calculation is nearly impossible to carry out if this is taken into consideration.