TORONTO

Briefing Note

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Update on the health effects of noise (Draft)

Issue / Background:

In March 2015, Municipal Licensing and Standards (ML&S) launched the Chapter 591, Noise Bylaw review. ML&S has asked for Public Health input.

At its meeting of April 3, 2000, the Board of Health adopted the report from the Medical Officer of Health that summarised the literature on health effects of noise. Toronto Public Health has not yet updated this review.

Noise is a concern for residents in the City of Toronto. The large majority (82.5%) of respondents to the initial round of consultation (April 2015) indicated that there is a problem with noise in their ward. Construction, amplified sound and motorcycle noise were the types of noise most complained about. Respondents indicated that the most common effects of noise in addition to general disturbance were loss of sleep/insomnia and stress.

Definitions:

Sound levels are reported in decibels (dB) or A-weighted decibels (dBA) which take into account the way in which the human ear responds to different frequencies. The loudness of sound (L) may be expressed in different ways:

Leq: The equivalent continuous level, which is the average level of sound over a period of time (for example hour, day, or year)

Ldn: the average equivalent sound level over a 24 hour period with a penalty added for noise during the nighttime hours

Lden: the average equivalent sound level over a 24 hour period with a penalty added for noise during the evening and nighttime hours

Lmax: the maximum level of sound that occurs in a period of time

Lnight: average level during the night (usually 8-hours, for example 11pm to 7 am)

Plane of door or of window: the centre of an exterior window or door opening in a building

SEL: the sound exposure level measured over one second

Key Points:

There is sufficient evidence to indicate that environmental noise is not just a cause of nuisance but also a concern for health. The World Health Organisation has estimated that in Europe the burden of illness from exposure to noise is similar to the burden of illness from exposure to environmental tobacco smoke (WHO 2011).

Level of annoyance is influenced by the characteristic of the noise. For example, noise from aircraft is more annoying than noise from traffic; noise from trains is less annoying than traffic, though vibrations

and frequency of trains will increase annoyance. Short bursts of noise are more annoying than more even sounds. Night-time noise is more annoying than daytime noise.

Health Effects

Sleep is essential for health. Sleep disturbance has an impact on metabolic and endocrine function and contributes to the risk of cardiovascular disease. Sleep loss is associated with weight gain, risk of diabetes, and susceptibility to viral illness (WHO 2009). Preventing sleep disturbance due to excessive noise will contribute to improved health. The risk of myocardial infarctions and hypertension have been found to increase at night-time noise levels above 50 dBA (WHO 2009). Table 1 outlines effects for which there is sufficient evidence and the levels at which these have been found to occur.

Table 1: Effects of noise on health and wellbeing with sufficient evidence (source: European Environmental Protection Agency, 2010)

Effect	Exposure Measure *	Threshold ** (dBA)	Effect type
Annoyance disturbance	L_{den}	42	Chronic
Self-reported sleep disturbance	L_{night}	42	Chronic
Learning, memory	L_{eq}	50	Acute, chronic
Stress hormones	$L_{max\ Leq}$	NA	Acute, chronic
Sleep	$L_{max,\ indoors}$	32	Acute chronic
Reported awakening	$SEL_{indoors}$	53	Acute
Reported health	L_{den}	50	Chronic
Hypertension	L_{den}	50	Chronic
Ischaemic heart diseases	L_{den}	60	Chronic

Note:

* Lden and Lnight are defined as outside exposure levels. Lmax may be either internal or external as indicated.

** Level above which effects start to occur or start to rise above background. NA – not available.

Environmental Exposures

There is insufficient data to estimate the extent of exposure to noise in Toronto. Hammer and colleagues (2014) estimated that about 1/3 of the US population is exposed to levels above 70 dBA (as cited in ICBEN 2015).

The World Health Organisation (WHO 1999; 2011) has determined that noise-induced hearing loss is unlikely when average daily exposure to noise is below 70 dBA and sound levels do not exceed 110 dBA. The equivalent 8-hour exposure is 75 dBA.

Health Canada does not have any exposure guidelines for noise. The 8-hour workplace permissible exposure limit in Ontario is 85 dBA. To maintain total average exposure to 70 dBA, a worker who is

exposed to an average of 85 dBA for eight hours would need to ensure the average exposure for the other 16 hours is kept to 62.5 dBA or less.

The WHO (2009) has established a night noise guideline of 40 dBA (outdoors 8-hour average) to maintain an average level of 30 dBA indoors. In the event that this is not possible to achieve this, WHO identified a maximum allowable night-time level of 55 dBA (outdoors); it notes that the night-time level of 55 dBA is not a health-based limit as it will not protect the most vulnerable (children, chronically ill, or elderly) from the adverse health effects of night noise.

To protect health and welfare of people, the US Environmental Protection Agency (1981) identified an average of 45 dBA as desirable levels of noise indoors in residences, hospitals and schools. In areas of human activity outdoors, a level of 55 dBA is desirable. Other outdoor levels should be maintained to an average of 70 dBA or less to prevent hearing loss (US EPA 1981).

The Ontario Environmental Noise Guideline for stationary and transportation sources (NPC-300) identifies various limits depending on area, source of noise, time of day, and type of noise. Noise sensitive land uses include residential properties, hotels, schools, hospitals, and community centres.

For example, for road-related noise, control measures (such as sound proofing and ensuring adequate ventilation so that windows or doors can be kept closed) may not be required if the sound level in the plane of a bedroom or living/dining room window is less than or equal to 55 dBA (daytime) or 50 dBA (night-time). If the sound level in the plane of a bedroom or living/dining room window is greater than 65 dBA (daytime) or 60 dBA (night-time), installation of central air conditioning is required, to ensure that sound levels indoors remain at acceptable levels. Indoor noise levels are to be maintained below an average of 45 dBA in living areas, with a provision of night-time average levels of 40 dBA in sleeping quarters due to road-related noise; the corresponding values for rail-related noise are 40 and 35 dBA.

NPC-300 also includes a graduated scale for impulse noise (short burst of loud noise) depending on number of impulses per hour ranging from 80-50 dBA(impulse, outdoor), with a provision for higher allowable noise levels in Class 4 areas (areas which are currently impacted by less sensitive land uses such as industrial facilities, where new sensitive land uses may be built).

Conclusion:

While noise has typically been controlled to address quality of life issues and noise-induced hearing loss, there is evidence that exposure to noise also has impacts on health at levels below which impacts on hearing acuity occur. These adverse health effects could occur at levels below 50 dBA.

A quality outdoor environment can support more active living (more walking or cycling, or active recreation). Limiting average outdoor noise levels to below 55 dBA (daytime) is therefore desirable for health.

Keeping levels of noise below the provincial Environmental Noise Guideline (NPC-300) is desirable as sleep disturbance has been shown to occur at levels as low as 32 dBA.

References:

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