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## POTENTIAL HEALTH EFFECTS OF NOISE EXPOSURE

Exposure to noise is a potential challenge to individual and community health; sources of excess noise include vehicular traffic, aircraft, industry, and countless sources in the home and/or workplace. The potential health impacts associated with exposure include annoyance, sleep disturbance, interference with communication, decreased school performance, increased levels of stress, and modification of social behavior. Chronic exposure to noise is associated with increased risk of hearing impairment, hypertension, and ischemic heart disease.

Table 1. Examples of Long-term Effects Related to Noise Exposure<sup>§</sup>

Effect	Exposure type	Measure *	dB	Location of assessment
Hearing Impairment	Environmental	$L_{aeq}$ (24 hr avg)	70	Indoors
	Occupational		75	
Hypertension	Environmental	$L_{dn}$ (24 hr avg)	70	Outdoors
	Occupational	$L_{aeq}$ (24 hr avg)	<85	Indoors
Ishchemic Heart Disease	Environmental	$L_{aeq}$ (24 hr avg)	70	Outdoors
Annoyance	Environmental	$L_{dn}$ (24 hr avg)	42 <sup>#</sup>	Outdoors
	Occupational	$L_{aeq}$ (24 hr avg)	Industry <85 Office <55	Indoors
Performance	School	$L_{aeq}$ (avg during school day)	70	Outdoors
	Occupational		70	
Disturbance of Sleep pattern	Sleep	$L_{aeq}$ (overnight avg)	<60	Outdoors
Awakening	Sleep	SEL	55	Indoors
Sleep Quality	Sleep	$L_{aeq}$ (overnight avg)	40	Outdoors
Mood Next Day (sleep disturbance)	Sleep	$L_{aeq}$ (overnight avg)	<60	Outdoors

§ The information contained in Table 1 was derived from Passchier-Vermeer and Passchier (2000).  
\* Noise levels presented in this table are presented as an equivalent sound level ( $L_{aeq}$ ) measured over a period of time and day-night level ( $L_{dn}$ ) which measures sound level over 24 hours with sound levels during the night. A sound exposure level (SEL) is the equivalent sound level of an event measured over 1 second.  
# The dB level causing annoyance is approximately 12 dB lower for impulse noise.

The potential risk of adverse health effects associated with exposure to noise is dependent on the duration of exposure (acute or chronic) and intensity (decibel level).

To protect the community from exposure to excess noise, legislation has been enacted at the Federal, state, and local levels to reduce potentially harmful exposures. These efforts have typically focused on the reduction of harmful occupational and residential exposure to noise. Federal regulations governing occupational exposures are shown in the table below.

Table 2. OSHA Daily Permissible Occupational Noise Level Exposure

Duration per day (hours)	Sound level (dB)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
≤ 0.25	115

Similar to other communities, the City of Madison has established legislation to decrease the potential exposure to excessive noise. In each of these communities, the common theme of these ordinances is to govern acceptable noise standards for exposures generated from vehicles, construction equipment, industrial and agricultural equipment, and other noises generated at unsafe levels that may impact residential environments.

Examples of noise regulations from various communities are shown in the table below (Table 3). In the sample selected, the common approach is to define unacceptable noise levels as levels that lead to annoyance, disturbance of peace, and potential health impacts of residential areas near the source of exposure; the acceptability of these complaints are typically determined by the first responder at the scene (i.e. law enforcement). However, other communities such as the City of Madison, Wisconsin and Minneapolis, MN have standardized this approach by establishing acceptable decibel (dB) levels that can be monitored, evaluated, and reported to determine acceptability. Please note that this sample of community noise regulation is by no means a comprehensive view of potential approaches to regulate excessive noise exposure across the Midwestern United States.

Table 3. Examples of Noise Regulation in Various Communities

Community	Noise Ordinance Regulation*
Dane County, WI	Excessive noise defined as any sound or level that unreasonably disturbs peace, comfort, quiet, or repose of persons in vicinity of sound. Applies to all of Dane County communities without a similar ordinance addressing excessive noise.
Madison, WI	Established time periods and acceptable noise levels in dB. Stationary noise: 65 dB Equipment: 70 – 88 dB
Monona, WI	Similar ordinance to Dane County, no dB level established.
Middleton, WI	Established time periods and acceptable noise levels in dB. Amplified sound cannot exceed 60-65 dB. Other levels of unacceptable noise are defined in a similar manner as Dane County.
Milwaukee, WI	Established time periods and acceptable levels of noise in noise rating (NR) numbers established by the International Standards Organization (ISO/TC 43, Secretariat-139, August 1961, Table 1) <sup>#</sup> . The acceptable noise limits range from NR 55 – 65 during established day time hours and 45 – 60 during night hours; the NR number is dependent upon zoning district.
Minneapolis, MN	Established time periods and acceptable noise levels in dB. The maximum permitted sound along business district boundaries ranges from 32 – 72 dB and along residence district boundaries 39 – 79 dB; both ranges are dependent upon octave band frequency.
Indianapolis, IN	Similar to Dane County ordinance. Acceptable times are established and noise is deemed excessive if sounds are an annoyance, unsafe, and/or disturbing to the peace.

\* The regulatory information was current at the date of writing of this document.  
# Noise rating (NR) is based upon a mathematical calculation that considers the sound pressure of noise (dB) and the frequency of the sound (hertz) to determine safe levels of sound exposure.

The following resources and links provide additional information concerning the potential risk of noise exposure.

City of Madison. (2009). Chapter 24 – offenses against peace and quiet. Retrieved on November 17, 2009 from:

<http://www.municode.com/Resources/gateway.asp?pid=50000&sid=49>

Noise Pollution Clearinghouse (NPC). (n.d.). Law library – noise regulations and ordinances of US cities, counties, and towns. Available at: <http://www.nonoise.org/lawlib/cities/cities.htm>

Passchier-Vermeer, W, and Passchier, WF. (2000). Noise exposure and public health. *Environmental Health Perspectives*, 108 (supplement 1), 123-131. Available at: <http://www.ehponline.org/members/2000/suppl-1/123-131passchier-vermeer/passchier-vermeer-full.html>

United States Department of Labor, Occupational Safety and Health Administration (OSHA). (n.d.). Occupational noise exposure – 1910.95. Available at: [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=standards&p\\_id=9735](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9735)

World Health Organization (WHO). (1999). Guidelines for community noise. Available at:  
<http://www.who.int/docstore/peh/noise/guidelines2.html>

World Health Organization (WHO). (2001). Occupational and community noise. Available at:  
<http://www.who.int/mediacentre/factsheets/fs258/en/>

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