Compendium of WHO and other UN guidance on health and environment

2022 update

Chapter 11. Environmental noise



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11. Environmental noise

This section addresses exposure of the general population to environmental noise, such as noise from various forms of traffic or industry. It includes amplified music in the framework of leisure activities as well. It does not specifically include occupational noise exposure. Occupational risks, including noise exposure, are covered in section 11.3 on workplaces.

Overview

In 2011, an estimated one million healthy life years were lost from traffic-related noise in the western part of Europe only *(1)*. Important sources for environmental noise exposure are road, railway and air traffic, or building sites. Noise exposure can also occur through other sources such as wind turbines, and leisure activities such as listening to loud music or other audio content including participation in e-sports (video and computer game competitions). Excessive noise can cause annoyance; in addition research shows it increases the risk for IHD and hypertension, sleep disturbance, hearing impairment, tinnitus and cognitive impairment, with increasing evidence for other health impacts such as adverse birth outcomes and mental health problems *(2)*.

What is the proportion of people impacted by environmental noise in my country?

The noise indicators below are taken from guidelines that were developed for the WHO European Region. In terms of their health implications, the recommended exposure levels can be considered applicable in other regions and suitable for a global audience *(2)*.

Noise indicators are based on the European Union Directive 2002/49/EC *(3)* in the European Region.

- L_{den} is an average sound pressure level over all days, evenings and nights in a year.
- L_{night} is the equivalent continuous sound pressure level when the reference time interval is the night.
- $L_{Aeq,T}$ is the A-weighted (a frequency weighting to better reflect the human ear), equivalent continuous sound pressure level during a stated time interval starting at t_1 and ending at t_2, expressed in decibels (dB), at a given point in space.

The first two indicators are used particularly for noise monitoring and exposure assessment. The third is used for measuring leisure noise exposure. For more information on these and other noise indicators consult the *Environmental noise guidelines for the European Region (2)*. These noise indicators can be converted to other indicators used in other settings *(4)*.

What is the proportion of people impacted by environmental noise in my country?

Several countries use surveys to assess the perception of noise in the general population. The last European Quality of Life survey, carried out 2016–2017, found that 32% of more than 30 000 participants across Europe reported problems with noise in the immediate neighbourhood of their home *(5)*.

What are the levels of noise exposure we want to achieve?

Based on the systematic review of evidence available at the time of the development of the environmental noise guidelines *(2)*, the following recommended levels for specific noise sources can be defined.

For average noise exposure, the following sound pressure levels are recommended *(2, 6)*:

- < 53 dB L_{den} for road traffic noise
- < 54 dB L_{den} for railway noise
- < 45 dB L_{den} for aircraft noise
- < 45 dB L_{den} for wind turbine noise
- yearly average from all leisure source noises combined to ≤ 70 dB $L_{Aeq, 24h}$
- weekly average from leisure sources (such as personal listening devices [1]) ≤ 80 dB(A) or 1.6 Pa^2h
- short-term average from occasional exposure to leisure source noise ≤ 100 dB $L_{Aeq, 15min}$.

For **night noise exposure**, the following sound pressure levels are recommended *(2)*:

- < 45 dB L_{night} for road traffic noise
- < 44 dB L_{night} for railway noise
- < 40 dB L_{night} for aircraft noise.

Different categories of noise mitigation interventions along a continuum from source reduction to behaviour change can be defined. Interventions in the guidance section below are marked with A–E as defined hereafter *(2)*.

A. Source intervention:
   - change in emission levels of sources
   - time restrictions on source operators.

B. Path intervention:
   - change in the path between source and receiver
   - path control through insulation of receiver/receiver's dwelling

C. New/closed infrastructure:
   - opening of a new infrastructure noise source
   - closure of an existing one
   - planning controls between (new) receivers and sources.

D. Other physical intervention:
   - change in other physical dimensions of dwelling/neighbourhood.

E. Behaviour change intervention:
   - change in individual behaviour to reduce exposure
   - avoidance of exposure or reduced duration of exposure
   - community education and communication.

[1] A personal listening or audio device is a portable device designed to be worn on the body or in a pocket. It is designed to allow the user to listen to various forms of media.

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments
Road traffic noise: policies and actions			
Recommended actions are available for specific noise sources and do not cover all potentially important noise exposures.			
1. Improve the choice of appropriate tyres and road surface (A) *(2)*.	Transport Land use planning	National; community	Regulation; infrastructure, technology and built environment
2. Reduce traffic flow and restrict truck traffic (A) *(2)*.	Transport Land use planning	National; community	Regulation; taxes and subsidies; infrastructure, technology and built environment
3. Insulate dwellings, construct barriers (B) *(2)*.	Housing Land use planning	National; community	Regulation; taxes and subsidies; infrastructure, technology and built environment
4. Construct road tunnels (C) *(2)*.	Transport Land use planning	National; community	Infrastructure, technology and built environment
5. Design/make available a “quiet side” in the dwelling; create nearby green space (D) *(2)*.	Housing Land use planning	National; community	Infrastructure, technology and built environment
Railway noise: policies and actions			
6. Apply rail grinding procedures to remove deformations and corrosions on railway tracks (A) *(2)*.	Transport	National; community	Infrastructure, technology and built environment
Railway noise: awareness raising and capacity building			
7. Inform the community about interventions being implemented to potentially reduce noise annoyance (E) *(2)*.	Health Environment Transport	Community Universal health coverage	Information, education and communication
Aircraft noise: policies and action			
8. Adapt opening and closing of runways (C) *(2)*.	Transport	National; community	Regulation; other management and control

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments
9. Rearrange flight paths (C) *(2)*.	Transport	National; community	Regulation; other management and control
Leisure noise: policies and actions			
10. Implement sound exposure monitoring (volume level and time spent listening) in all personal listening devices to allow for self-control with reference to a standard. In every listening device, the user should be allowed to select two different operational modes of reference exposure *(6)*, and track the percentage of exposure used vs the reference exposure for every seven days. The two operational modes include the following. • Mode 1: WHO standard level for adults • Mode 2: WHO standard level for sensitive users (e.g. children).	Health Sports and leisure	National	Regulation; infrastructure, technology and built environment
11. Implement options for volume limitation and parental volume control in every device *(6)*.	Sports and leisure	National	Regulation; infrastructure, technology and built environment
12. Enact and enforce legislation/regulations/policies for limiting sound levels and exposure in entertainment venues and events such as clubs, bars, fitness centres, concerts, etc.*(3, 7)*. Legislation should focus on: • limiting sounds to 100 dB(A) averaged over 15 minutes; • conducting regular sound monitoring to ensure and document compliance; • optimizing venue acoustics and sound system design to ascertain optimal listening conditions for all audience members in the venue/event; • create quiet zones allowing audience members to rest; • ensuring provision of hearing protection (earplugs); • ensuring provision of training on noise reduction strategies and information about noise.	Sports and leisure	National	Regulation
Leisure noise: awareness raising and capacity building			
13. Provide information on personal sound exposure to the user of personal listening devices through the device interface or other means *(6)*.	Health Sports and leisure	National	Information, education and communication
14. Provide personalized recommendations and cues for action for safe listening through personal listening devices, customized to a user's listening profile through the device interface or other means *(6)*.	Health Sports and leisure	National	Information, education and communication
15. Provide instructions on how to use safe listening features on the specific device through the device interface or other means *(6)*.	Health Sports and leisure	National	Information, education and communication

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments
16. Provide general information on safe listening and ways to practise it through the device interface or other means *(6)*.	Health Sports and leisure	National	Information, education and communication

Selected tools
WHO 2021: WHO is developing a global standard for safe listening entertainment venues *(7)* This guidance will promote safe listening among attendees of entertainment venues to mitigate their risk of hearing loss.
WHO Regional Office for Europe 2018: *Environmental noise guidelines for the European Region (2)* Results of the noise guidelines are also available as an executive summary in different languages.
WHO/ITU 2019: *Safe listening devices and systems – a WHO-ITU standard (6)* This document outlines the key features and requirements that personal audio systems must have in order to facilitate safe listening practices among users.
WHO 2015: *Make listening safe (8)* This webpage provides access to advocacy material around safe listening such as infographic, poster, banner and brochure.
WHO/ITU 2019: *Toolkit for safe listening devices and systems (9)* This toolkit provides practical guidance to support countries, industry partners and civil society groups in the use and implementation of the global standard on safe listening devices and systems (ITU-T H.870) *(10)*.
WHO Regional Office for Europe 2012: *Methodological guidance for estimating the burden of disease from environmental noise (11)*
WHO Regional Office for Europe 2011: *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe (1)*
WHO Regional Office for Europe 2009: *Night noise guidelines for Europe (12)*

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