



# INDOOR NOISE AND HIGH SOUND LEVELS—A TRANSCRIPTION OF THE SWEDISH NATIONAL BOARD OF HEALTH AND WELFARE'S GUIDELINES

B. PETTERSSON

*The National Board of Health and Welfare, 106 30 Stockholm, Sweden*

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The National Board of Health and Welfare is together with the National Board of Environment responsible for health protection in Sweden on a national level and issues recommendations or guidelines for environmental factors. The Board of Health and Welfare is responsible for the indoor environment and the Board of Environment is responsible for the outdoor environment. Board guidelines for noise cover indoor noise from different activities in society, except transportation noise. The guidelines for indoor levels are 35–45 dB expressed as  $L_{AP\max}$  for intermittent noise and 30 dBA expressed as  $L_{Aq}$  for continuous noise. Low frequency noise is assessed in one third octave bands with specific dB equivalent pressure levels for each band. The guidelines are intended to be used in situations where the noises come from neighbours, elevators, restaurants and other buildings.

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## 1. INTRODUCTION

Based on paragraph 15 of the Public Health Act (1982:1080), the National Board of Health and Welfare has decided to announce general advice for municipal environmental health committees or the equivalent. The general advice has been prepared in consultation with the National Board of Housing, Building and Planning and the National Environmental Protection Agency.

This general advice is intended to be used as help for municipalities and others engaged in trying to diminish the effects of various types of noise which occur within places of residence, teaching and health-care premises, meeting places, etc. The following presents the legal background and a transcript of the general advice.

## 2. STRUCTURE OF GUIDELINES

The Swedish Parliament has passed Government bill 1993/94:215 for a plan of action against noise. The Government has assigned the National Road Administration, in co-operation with the National Environmental Protection Agency, to draw up a programme including a cost estimate of preventive measures for when road traffic noise exceeds 65 dB in an existing environment. The National Environmental Protection Agency has been assigned to co-ordinate programmes for measures against noise in outdoor environments and, together with the National Rail Administration, to propose guidelines for limiting noise from the railway network, tramway and shunting yards, and to inspect

the handling by county administrative boards of noise-related issues in archipelagic and inland water environments. Together, the National Environmental Protection Agency, the Civil Aviation Administration and the military authorities have been given the assignment, in co-operation with the National Board of Housing, Building and Planning and other authorities concerned, of analysing the possibilities for greater stringency in the standard specifications for levels of aircraft noise. The National Board of Housing, Building and Planning and the National Environmental Protection Agency have also been given the task of developing methods for achieving a good environment as regards sound in physical planning. Consequently, the following general advice should not be applied to noise from air, road or rail traffic.

This general advice contains both guidelines and recommendations. The guidelines should be interpreted with the implication that, if they are exceeded, the noise potentially constitutes a sanitary nuisance. Recommendations reflect a degree of uncertainty regarding the social consequences and levels of disturbance, but they can nevertheless be used as support when making judgements as to whether noise or high sound levels potentially constitute a sanitary nuisance. Recommendations also indicate target levels and should be used in planning.

This general advice is intended to provide instruction as to when noise in the community can constitute a sanitary nuisance according to the Public Health Act. The Act also offers protection to those who are somewhat more noise sensitive than average. This general advice refers to certain categories of people who may be more sensitive or vulnerable to noise than others, e.g., people with impaired hearing. Children are more susceptible to noise-induced hearing damage than adults.

The general advice contains a comprehensive description of what can be classified as noise and at which levels noise becomes a health risk. In certain situations, the general advice can be used as a basis for making a decision to prevent or eliminate sleep disruption or to prevent an experience of disturbance, and in other situations, to encourage a good indoor environment. The general advice provides guidelines above which noise should be regarded as a sanitary nuisance.

The general advice also contains recommendations for maximum sound levels at concerts and discothèques, etc, which should be followed as a precautionary measure against hearing damage and/or tinnitus. The National Board of Health and Welfare has chosen to treat the proposed levels as recommendations and, in that way, to enable municipal environmental health committees to include measures against high sound levels in their planning. Special attention has been given to low-frequency sound.

In some cases, it may not be possible to adjust noise to the levels specified in the general advice. According to the Public Health Act, the legitimacy of demanding that measures be taken should be assessed from case to case. Both economic and technical aspects should be taken into account in this assessment.

When the general advice cannot be followed in an individual case, it can nevertheless provide support for when measures against noise in the community need to be taken.

### 3. LEGISLATION

The Public Health Act contains regulations for the measures which the owner or occupier of a property can be required to take to prevent or eliminate a sanitary nuisance. Sanitary nuisance means a disturbance which can constitute a health risk and which is not of an insignificant or temporary nature. The municipal committee responsible for supervision according to the Public Health Act, usually the environmental health committee, is to assess whether measures are to be taken against a source of sanitary nuisance.

The environmental health committee should try to ensure that the law is abided by without employing coercive measures, e.g., by providing advice on how the sanitary nuisance can be remedied. An injunction or a ban should be issued only upon failure to observe the committee's advice. In such a case, the committee must also assess whether the measures are legitimate and stand in proportion to the degree of nuisance. The financial position of the disturber should not be a deciding factor.

Both owners and occupiers of a property can be required to take measures. The demands should be combined with the penalty of a fine. Sometimes, it may be appropriate to address the demands both to the owner and the occupier since they may both be able to reduce the source of the nuisance.

The committee also has supervisory responsibility according to the Environment Protection Act (1969:387). The Public Health Act and the Environment Protection Act are both fully valid alongside one another and the committee may apply the Act it deems most appropriate. The Environment Protection Act should however be chosen in the case of activities for which the disturbances can be tried under the Environment Protection Act since, as a rule, the Public Health Act cannot be applied against activities which are permitted under the Environment Protection Act.

The Public Health Act permits demands for measures which are not directly connected to the source of disturbance, e.g., a demand to fit triple-glazed windows as a more cost-efficient alternative to measures against the actual source of the noise. In cases of disturbance between neighbours, the landlord also has special responsibility according to housing legislation.

The Planning and Building Act (1987:10) states that, among other things, new buildings must be situated and constructed so that they, or the activities they are to be used for, will not cause significant nuisance to the surrounding environment. The Building Ordinance (94:1215) states that a building must have sound absorption and soundproofing, well-adapted for its purpose, both against sound generated within the building and against noise from activities in the surrounding environment or from traffic. The building contractor is responsible for ensuring that the technical properties specified in the Building Ordinance are observed. After completion, the owner of the property is responsible for ensuring that the properties of the building which existed when it was constructed or after reconstruction are, in substance, maintained.

According to penalty legislation and practice within environmental health legislation, the demands which are made on a disturber must be clear and unambiguous. The demands in an injunction must therefore be defined in such terms that the aim of the noise-reducing measures is entirely clear. What it is that causes the disturbance should also be clearly expressed in the decision.

A guideline for what constitutes a sanitary nuisance should protect against the major effects of a source of disturbance. Only a small number of the exposed population should experience disturbance at this recommended maximum level.

#### 4. GUIDELINES AND RECOMMENDATIONS

The guidelines for noise are based on the assumption that the effects of the noise are primarily determined by its acoustic properties. The guidelines are specified for maximum (intermittent) noise and for equivalent (continuous) noise. The recommendations for low-frequency noise are given only for equivalent noise. The recommendations for precautionary measures against hearing damage are given for both maximum and equivalent levels (see Table 1).

TABLE 1

*Guidelines for assessment of noise as an indoor public nuisance*

Type of noise	Sound level (dB)
Maximum	$L_{AFmax} = 35-45$
Equivalent	$L_{Aeq,T} = 30$

The guideline for maximum noise levels, 45 dB(A), is intended as a protection against sleep disturbance, waking up, after-effects of disturbed sleep and repeated disturbance to speech intelligibility among especially vulnerable categories of people. To be regarded as a sanitary nuisance it is sufficient for the disturbance to exceed the guideline a few times, for example during one night.

The guideline for maximum noise levels, 35 dB(A), should be used in assessing whether an experienced, or subjective disturbance in some cases, can constitute a sanitary nuisance. To be regarded as a sanitary nuisance, the disturbance should be of a recurrent nature.

The guideline for equivalent noise levels, 30 dB(A), concerns the duration (T) of the disturbing activity and is intended as a protection against sleep disturbance, speech-masking and perceived individual disturbance.

Measurements of noise should be undertaken in accordance with the Swedish standard 02 52 63, measurement of sound levels in rooms—field tests.

TABLE 2

*Recommendations for assessment of low frequency, equivalent noise as an indoor public nuisance*

One-third octave band (Hz)	Equivalent acoustic pressure level (dB)
31.5	56
40	49
50	43
63	41.5
80	40
100	38
125	36
160	34
200	32

The recommendations can provide support when assessing whether a perceived disturbance from equivalent low-frequency noise can constitute a sanitary nuisance. Measurement of low frequency noise should be undertaken in accordance with the National Testing and Research Institute, SP-INFO 1996:17 (see Tables 2 and 3).

TABLE 3

*Recommendations for assessment of high sound levels as a public nuisance*

Type of sound	Sound level (dB)
Maximum	$L_{AFmax} = 115$
Equivalent	$L_{Aeq,T} = 100$

The recommendations for limits above which high sound-levels potentially constitute a sanitary nuisance should be applied at discothèques, concerts etc., both indoors and outdoors.

## 5. APPLICATION

The guidelines and recommendations for assessment of noise as a sanitary nuisance in Tables 1 and 2 are intended for application in “rooms for habitation” in places of residence. Rooms for habitation include bedrooms and living rooms. Kitchens, bathrooms, etc., do not come under this category unless the room, for example a diningroom, is obviously used for habitation in a small flat. These levels are also intended to be applied in premises for teaching, health-care or other welfare services. They can also be applied in hotels, boarding-houses and similar buildings. Measurements should be undertaken with closed windows.

The general advice does not provide closer directions regarding the number of occurrences of noise in the case of intermittent noise. Here, levels from 35 dB(A) may constitute a sanitary nuisance in cases of frequent occurrence or 45 dB(A) in the case of a single or limited number of occurrences. Whether occurrences of noise in the interval 35–45 dB(A) constitute a potential sanitary nuisance should be assessed locally from case to case.

The higher value, 45 dB(A), is intended as a precautionary measure against sleep disturbance or disturbance during the period of falling asleep. This value should be applied as a recommended maximum value for when noise can constitute a potential sanitary nuisance at any time of the day. Limits for how many times the recommended values may be exceeded should be decided with regard to local circumstances.

Music transmitted in structure is often perceived as more disturbing when low frequency sound is predominant. The guidelines for when noise can constitute a potential sanitary nuisance should therefore be interpreted more strictly for this type of noise. Levels as low as 25 dB(A), equivalent level, can be perceived as disturbing. However, assessments of levels at which noise from music can constitute a potential sanitary nuisance should be made with regard to local circumstances.

The guidelines for when noise potentially constitutes a sanitary nuisance should be applied more strictly to sound with audible tone components. Levels as low as 25 dB(A), equivalent level, can be perceived as disturbing. Assessments of levels at which sounds with audible tone components can constitute a sanitary nuisance should be made with regard to local circumstances.

Occurrence of sound with audible tone components can be assessed in different ways. The noise should preferably be assessed where it occurs, by the person conducting measurements. Due to interference factors, sound levels may vary a great deal upon relatively small shifts in listening position. To assess the occurrence of tone, a position where the tone sounds loudest should be chosen.

In order to achieve good conditions for speech intelligibility in schools, it may sometimes be necessary to ensure the noise levels are kept below 30 dB(A), equivalent level. For pupils with impaired hearing or with a different native language from the speaker, background noise levels as low as 25 dB(A), equivalent level may be necessary, in order to achieve good conditions for speech intelligibility. Decisions regarding maximum background noise levels in schools and similar premises should be made with regard to local circumstances.

Continuous sound should be measured until a mean value has been obtained. If a disturbing, continuous sound is perceived as fluctuating, the measurement should be repeated several times. In order to assess whether a continuous noise constitutes a potential sanitary nuisance, it may be necessary to analyse the noise of the low frequency region. To assess whether a sound has a low frequency, it can be weighted with an A-filter or a C-filter as described in the guidelines above. This method can give a superficial and inconclusive indication of whether the noise has a low frequency. Often, an experienced person can assess whether a noise contains a large proportion of low frequency

sound just by listening to it. If the noise is perceived as having a low frequency, a one-third octave band analysis should be undertaken. This type of analysis should only be undertaken if there is considerable reason to believe that the noise has a low frequency. If the analysis shows that the requirement curve is exceeded in any of the bands, the noise can be deemed to be a potential sanitary nuisance.

The values as listed in Table 3 are given as recommendations for when high sound-levels can constitute a potential sanitary nuisance that should be applied at discothèques, concerts and similar premises/events. These recommendations may also be applied at open-air concerts. At discos for children and similar events, noise-levels may need to be limited to 90 dB(A), equivalent level.

Sound levels at discothèques and similar premises should be measured in the area accessible to the public at the spot where the noise is probably the loudest. Measurements of equivalent sound levels should be undertaken for as long as it takes to establish the level across the entire exposure time. Silent periods between records/songs should be included in the measurement.