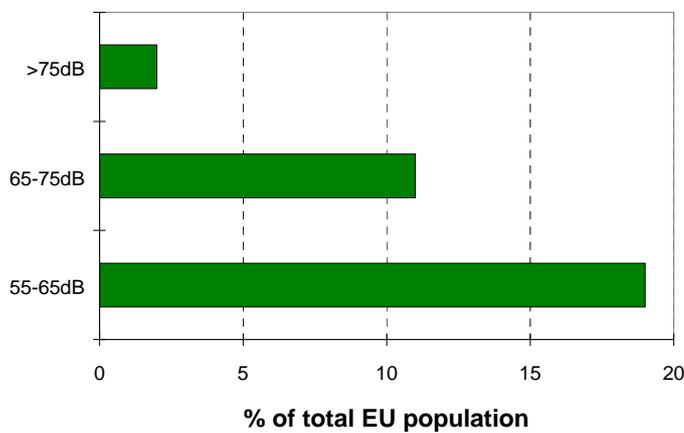


Traffic noise: exposure and annoyance

About 120 million people in the EU (more than 30 % of the total population) are exposed to road traffic noise levels above 55 L_{dn} dB. More than 50 million people are exposed to noise levels above 65 L_{dn} dB.

It is estimated that 10 % of the EU population are exposed to rail noise above 55 L_{Aeq} dB. The data on noise nuisance by aircraft are the most uncertain, but studies indicate that 10 % of the total EU population may be highly annoyed by air transport noise.

Figure 1: Share of population exposed to different road traffic noise levels (EU)



Source: EEA, 1999

Note: the category 45<55 dB is not included because of lack of data.

No update has been made of the noise indicators since TERM-2000; further work on this indicator awaits the adoption of the proposed noise Directive.

Objective

- Reduce number of people exposed to and annoyed by high traffic noise levels (i.e. noise levels which endanger health and quality of life).

Definition

- percentage of population exposed to four transport noise exposure levels (in L_{dn})¹: 45< 55 dB, 55-65 dB, 65-75 dB and > 75 dB.
- percentage of population highly annoyed by traffic noise from various modes.

¹ L_{dn} i.e. a day/night level, is a descriptor of noise level based on the energy-equivalent noise level (L_{eq}) over the whole day with a penalty of 10 dB(A) for night time noise (22.00-07.00 hrs).

Policy and targets

Noise affects people physiologically and psychologically: noise levels above 40 dB L_{Aeq}^2 can influence well-being, with most people being moderately annoyed at 50 dB L_{Aeq} and seriously annoyed at 55 dB L_{Aeq} . Levels above 65 dB L_{Aeq} are detrimental to health (WHO, 2000). Overall, the external costs of road and rail traffic noise have been estimated at some 0.4 % of GDP (ECMT, 1998).

Community noise emission limits have been considerably tightened since 1972 and legislation now sets maximum sound levels for motor vehicles, motorcycles and aircraft. However, methodological inconsistencies (non-harmonised indices and inadequate testing procedures for vehicles) have hampered progress on urban acoustic quality standards and severely limit the accuracy of noise assessments. The Green Paper on Future Noise Policy (European Commission, 1996) was the first step in the development of a Community noise policy.

The European Commission is currently preparing the future Community noise policy, assisted by a number of working groups. The policy will focus on indicators, exposure/impact relationships, computation and measurement, mapping, exchange of experience on abatement action, research and development, and the measurement of costs and benefits. In July 2000, the Commission issued a proposal for a European Directive on the assessment and management of environmental noise (European Commission, 2000a). The proposed noise Directive would harmonise EU noise assessment methodology (using L_{den} as an indicator³). It requires countries to make noise maps for agglomerations, major roads, major railways and airports, by 2004. These maps should be made available to the public and should form the basis for the development of action plans and strategies at local, national and EU levels to combat noise pollution. The proposal also includes measures such as noise control in the rural environment and the protection of relatively quiet areas. It does not propose any new noise limits, nor does it foresee any immediate development of daughter Directives to do this.

Noise from aircraft, particularly at night, arouses strong feelings among those living near airports and under flight paths. Regulation to reduce the effect of noise includes internationally agreed limits on noise from aircraft and local regulation to control impacts around airports. The Communication on Air Transport and Environment (European Commission, 1999) contains recommendations for the harmonisation of noise indicators and assessment methods for aircraft noise and for the forthcoming framework Directive on environmental noise.

Several countries have national targets for the reduction of noise nuisance. For example the Netherlands aims at ensuring that by 2000 the percentages of the population that are exposed to different noise levels should return to what they were in 1985, and that by 2010 no-one should be "seriously annoyed" by noise (these targets are currently being revised). The Norwegian Pollution Control Authority has outlined measures for reducing "noise nuisance" by at least a quarter from current levels by 2010. Some Member States are already monitoring noise and setting limits to noise pollution in sensitive areas.

Findings

Exposure to traffic noise

Traffic noise remains a major environmental problem as transport demand continues to grow. The magnitude of exposure varies according to the sources (i.e. transport mode):

² L_{Aeq} is equivalent sound pressure level in dB(A)

³ L_{den} is day/evening/night level, a descriptor such as L_{dn} but with a penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00)

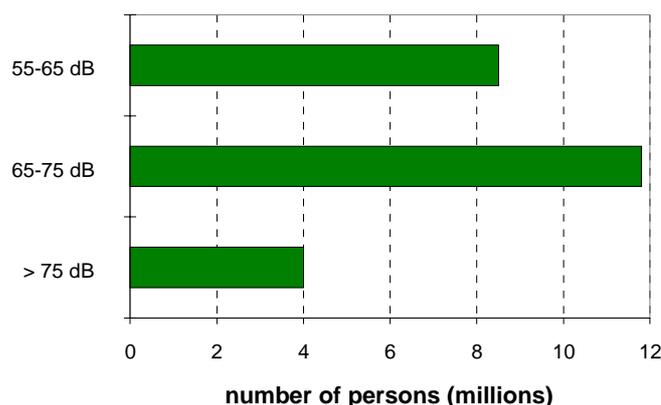
<i>Road traffic</i>	It is estimated that approximately 32 % of the EU population is exposed to road noise levels above 55 L_{dn} dB at the front of their houses (Figure 1).
<i>Rail traffic</i>	Some 37 million people (10 % of the EU population), are exposed to rail noise above 55 L_{Aeq} dB, according to an estimate based on data from France, Germany and the Netherlands (Lambert <i>et al.</i> , 1998).
<i>Aviation</i>	EU-wide data on exposure to aircraft noise is currently the least reliable, but an estimate of the number of people exposed to more than 55 L_{dn} dB around selected airports gives an indication of the scale of the problem (Table 1). These airports differ considerably in magnitude of traffic, fleet mix and lay-out in respect to noise-sensitive areas, and can therefore provide a representative basis for this analyses.

Table 1: Number of people exposed to noise levels over 55 L_{dn} dB around selected airports

Airport	Number of people
Heathrow; London	440 000
Fuhlsbüttel, Hamburg	123 000
Charles de Gaulle, France	120 000
Schiphol, Amsterdam	69 000
Kastrup, Copenhagen	54 000
Barajas, Madrid	33 000

Source: M+P, 1999

Figure 2: Number of people highly annoyed by road transport noise – preliminary estimate (EU)



Source: EEA, 1999

Annoyance caused by traffic noise	Assessing the impact of noise requires exposure data to be transposed into annoyance estimates. A 'noise annoyance' assessment at the EU level has been hindered by gaps in data and knowledge, but recent research (Miedema <i>et al.</i> , 1998) allows estimates of annoyance to be inferred from exposure data.
<i>Road traffic</i>	A first try-out of this new calculation method at the EU level suggests that around 24 million people are highly annoyed (HA) by road traffic noise higher than 55 dB (Figure 2). This estimate excludes the category 45-55 dB because of lack of information. However, this is a category where annoyance can also result.
<i>Rail traffic</i>	Applying a similar methodology to recent rail noise data (Lambert <i>et al.</i> , 1998) suggests that about 3 million people are highly annoyed by rail traffic noise.
<i>Aviation</i>	<p>Aircraft noise, which has low frequency components or is accompanied by vibration, is often perceived as more annoying than other noise (WHO, 1999). However, the number of people highly annoyed by aircraft noise in the EU cannot be estimated accurately, because much annoyance is caused by noise levels of 45-55 L_{dn} dB for which there is a lack of information. An earlier assessment (INRETS, 1994) suggest that some 10 % of the total EU population may be highly annoyed by air transport noise.</p> <p>Noise levels around several large airports in the EU have dropped over recent years, mainly because of the phasing out of noisier 'Chapter 2' aircraft in Europe. This will be completed by 2002. For example at Heathrow Airport the number of people living within the daytime 57Leq contour, which is taken to mark the "onset of significant community annoyance", fell from 1.5 million in 1979 to about 331,600 in 1999, in spite of growth in aircraft movements and average aircraft size (DETR, 2000). Compared to 1990, and using L_{DEN} as an indicator, the noise nuisance around Schiphol has been reduced by 20 % (in the immediate vicinity of Schiphol) and by 50 % in the wider surroundings. However, noise annoyance by aviation in the Netherlands has been increasing again since 1998, as the growth in aircraft movements is no longer compensated by the use of quieter aircraft (RIVM, 2000a).</p>
<i>Projections</i>	<p>The RIVM estimates that exposure to high noise levels will only decrease slightly by 2010 (RIVM, 2000b).</p> <p>Noise annoyance along the main European road transport corridors will increase due to the growth in freight traffic. The effect of the reduction of engine noise will be offset by the dominance of tyre noise (EEA, 1999).</p> <p>The increase in noise nuisance around major airports is expected to be smaller than the expected growth in aircraft movements, due to the introduction of quieter aircraft and optimisation of flight routes.</p>

Box 1: Noise threats to animals

One noise-related issue which is not addressed by the current indicators is the impact on animals. There is increasing evidence that the high noise levels, such as found around motorways, disturb breeding birds. There could be a number of effects of noise on free-ranging marine mammals. Loud and sudden bursts of noise, such as underwater explosions during seismic exploration, can deafen animals (e.g. whales), or disturb them and scare them away from their natural habitats and feeding areas. Another important impact may be the interference of noise with marine mammal communication. Marine mammals possess a complex communication system serving a large variety of functions. Masking these communication signals to the point of incomprehensibility could have fatal results. Whales could be severely affected by loud underwater noise from sources such as ship propellers and underwater drilling, losing their ability to hear and therefore to escape from approaching ships. Whales have been observed to change their normal pattern of behaviour to avoid underwater noise. The extent of the long-term repercussions of this, for example changing migration routes and moving animals away from their preferred feeding and breeding grounds, need to be further investigated.

Future work

This indicator will be updated when the Noise Directive has been adopted. This proposes two indicators:

- the day-evening-night level L_{den} in decibel, which is an indicator for “annoyance”. This measure is similar to L_{dn} , but with an additional penalty of 5 dB(A) for evening noise.
- the “overall night-time noise indicator” L_{night} .

L_{den} and L_{night} indicators, combined with the associated dose-effect relationships, enable predictions to be made of the average response of a population subject to long-term noise exposure in terms of annoyance and ‘self-reported sleep disturbance’.

Additional or alternative indicators that could be considered are:

- budget allocations to noise abatement measures (with particular indication for spending on noise control at source), indicating levels of awareness and concern in the Member States;
- the ratio of the number of people annoyed by transport noise to the number of passengers for air traffic or passenger-km for road and rail traffic. Such indicators would link noise annoyance with personal mobility for different transport modes;
- similar indicators linking noise annoyance with freight tonnage for air traffic or tonne-km for road/rail traffic.

Another possibility for a national noise indicator, which could be introduced rapidly but may be rather expensive, is through direct random-field social surveys; this is already being done in the Netherlands on a national basis every five years. A similar type of questionnaire for use by all Member States would provide comparative results for the EU.

Data

At present, differences in methodologies preclude comparisons between Member States. Table 1.4 gives some data for Finland and Germany.

Table 1.4: Transport noise in selected Member States

Methodology	Finland	Germany	The Netherlands
Indicator	Exposure ($L_{Aeq} > 55$ dB)	Annoyance (seriously affected)	Annoyance
Year	1992-1996	1994	1999
Assessment (% of population)			
Road	17 %	22 %	28 %
Aviation	1.3 %	9 %	18 %
Rail	0.7 %	3 %	6 %

Source: Finnish Environment Institute and German Federal Environmental Protection Agency, RIVM, 2000a

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