



Council of the  
European Union

**Brussels, 6 August 2019**  
**(OR. en)**

**11626/19**  
**ADD 1**

**ENV 725**

**COVER NOTE**

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From:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	6 August 2019
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	D063276/01 - Annex
Subject:	ANNEX to the COMMISSION DIRECTIVE (EU) .../... of amending Annex III to Directive 2002/49/EC as regards the establishment of assessment methods for harmful effects of environmental noise

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Delegations will find attached document D063276/01 - Annex.

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Encl.: D063276/01 - Annex



EUROPEAN  
COMMISSION

Brussels, **XXX**  
D063276/01  
**[...]**(2019) **XXX** draft

ANNEX

**ANNEX**

**to the**

**COMMISSION DIRECTIVE (EU) .../... of**

**amending Annex III to Directive 2002/49/EC as regards the establishment of assessment  
methods for harmful effects of environmental noise**

**Annex III**  
**ASSESSMENT METHODS FOR HARMFUL EFFECTS**  
**Referred to in Article 6(3)**

## **1. Set of harmful effects**

For the purposes of the assessment of harmful effects the following shall be considered:

- ischaemic heart disease (IHD) corresponding to codes BA40 to BA6Z of the international classification ICD-11 established by the World Health Organisation;
- high annoyance (HA);
- high sleep disturbance (HSD).

## **2. Calculation of harmful effects**

The harmful effects shall be calculated by either of the following:

- the relative risk (RR) of a harmful effect defined as

$$RR = \left( \frac{\text{Probability of occurrence of the harmful effect in a population exposed to a specific level of environmental noise}}{\text{Probability of occurrence of the harmful effect in a population **non** exposed to environmental noise}} \right) \quad (\text{Formula 1})$$

- the absolute risk (AR) of a harmful effect defined as

$$AR = \left( \begin{array}{c} \text{Occurrence of the harmful effect} \\ \text{in a population exposed} \\ \text{to a specific level of environmental noise} \end{array} \right) \quad (\text{Formula 2})$$

### **2.1 IHD**

For the calculation of the RR, with respect to the harmful effect of IHD and concerning the incidence rate (*i*), the following dose-effect relations shall be used:

$$RR_{IHD,i,road} = \begin{cases} e^{[(\ln(1.08)/10) * (L_{den} - 53)]} & \text{for } L_{den} \text{ greater than } 53 \text{ dB} \\ 1 & \text{for } L_{den} \text{ equal or smaller than } 53 \text{ dB} \end{cases}$$

(Formula 3)

for road noise.

## 2.2 HA

For the calculation of the AR, with respect to the harmful effect of HA the following dose-effect relations shall be used:

$$AR_{HA,road} = (78.9270 - 3.1162 * L_{den} + 0.0342 * L_{den}^2) / 100 \quad \text{(Formula 4)}$$

for road noise;

$$AR_{HA,rail} = (38.1596 - 2.05538 * L_{den} + 0.0285 * L_{den}^2) / 100 \quad \text{(Formula 5)}$$

for railway noise;

$$AR_{HA,air} = (-50.9693 + 1.0168 * L_{den} + 0.0072 * L_{den}^2) / 100 \quad \text{(Formula 6)}$$

for aircraft noise.

## 2.3 HSD

For the calculation of the AR, with respect to the harmful effect of HSD the following dose-effect relations shall be used:

$$AR_{HSD,road} = (19.4312 - 0.9336 * L_{night} + 0.0126 * L_{night}^2) / 100 \quad \text{(Formula 7)}$$

for road noise;

$$AR_{HSD,rail} = (67.5406 - 3.1852 * L_{night} + 0.0391 * L_{night}^2) / 100 \quad \text{(Formula 8)}$$

for railway noise;

$$AR_{HSD,air} = \frac{(16.7885 - 0.9293 * L_{night} + 0.0198 * L_{night}^2)}{100} \text{ (Formula 9)}$$

for aircraft noise.

### 3. Assessment of harmful effects

**3.1** The exposure of the population shall be assessed independently for each noise source and harmful effect. Where the same people are simultaneously exposed to different noise sources, the harmful effects may -in general- not be cumulated. However, those effects may be compared to assess the relative importance of each noise.

#### 3.2 Assessment for IHD

**3.2.1. For IHD in the case of railway and aircraft noise**, the population exposed above adequate  $L_{den}$  levels is estimated as subject to an increased risk of IHD, while the exact number  $N$  of cases of IHD cannot be calculated.

**3.2.2. For IHD in the case of road noise**, the proportion of cases of the specific harmful effect in the population exposed to a RR that is calculated to be caused by environmental noise is derived, for the noise source  $x$  (road), harmful effect  $y$  (IHD) and for the incidence  $i$  by:

$$PAF_{x,y} = \left( \frac{\sum_j [p_j \cdot (RR_{j,x,y} - 1)]}{\sum_j [p_j \cdot (RR_{j,x,y} - 1) + 1]} \right) \text{ (Formula 10)}$$

Where:

-  $PAF_{x,y}$  is the population attributable fraction,

- the set of  $j$  noise bands is made up of single bands spanning over a maximum of 5 dB (e.g.: 50-51 dB, 51-52 dB, 52-53 dB, etc. or 50-54 dB, 55-59 dB, 60-64 dB, etc.),

-  $p_j$  is the proportion of the overall population  $P$  in the area assessed that is exposed to the  $j$ -th exposure band, which is associated with a given RR of a specific harmful effect  $RR_{j,x,y}$ . The  $RR_{j,x,y}$  is calculated using the formulas described in point 2 of this Annex, calculated at the central value of each noise band (e.g.: depending on availability of data, at 50.5 dB for the noise band defined between 50-51 dB, or 52 dB for the noise band 50-54 dB).

**3.2.3. For IHD in the case of road noise, the total number  $N$  of cases of IHD** (people affected by the harmful effect  $y$ ; number of attributable cases) due to the source  $x$  is then:

$$N_{x,y} = PAF_{x,y,i} * I_y * P \text{ for road (Formula 11)}$$

Where:

-  $PAF_{x,y,i}$  is calculated for the incidence  $i$ ,

-  $I_y$  is the incidence rate of IHD in the area under assessment, that can be obtained from statistics on health for the region or country where the area is,

-  $P$  is the total population of the area under assessment (the sum of the population in the different noise bands).

**3.3. For HA and HSD in the case of road, railway and aircraft noise, the total number  $N$  of people affected by the harmful effect  $y$**  (number of attributable cases) due to the source  $x$ , for each combination of noise source  $x$  (road, railway or aircraft source) and harmful effect  $y$  (HA, HSD), is then:

$$N_{x,y} = \sum_j [n_j * AR_{j,x,y}] \text{ (Formula 12)}$$

Where:

-  $AR_{x,y}$  is the AR of the relevant harmful effect (HA, HSD), and is calculated using the formulas set out in point 2 of this Annex, calculated at the central value of each noise band (e.g.: depending on availability of data, at 50.5 dB for the noise band defined between 50-51 dB, or 52 dB for the noise band 50-54 dB),

-  $n_j$  is the number of people that is exposed to the  $j$ -th exposure band.

#### 4. Future revisions

The dose-effect relations introduced by future revisions of this Annex will concern in particular:

- the relation between annoyance and  $L_{den}$  for industrial noise,
- the relation between sleep disturbance and  $L_{night}$  for industrial noise.

If necessary, specific dose-effect relations could be presented for:

- dwellings with special insulation against noise as defined in Annex VI,
- dwellings with a quiet façade as defined in Annex VI,
- different climates/different cultures,
- vulnerable groups of the population,

- tonal industrial noise,
- impulsive industrial noise and other special cases.