

SYMPOSIUM REPORT

## Current activities of the European Union concerning harmonised noise indicators and prediction and measurement methods

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The European Commission started activities to improve the environmental noise policy. In view of the high exposure of the population the future policy is no more restricted to the limitation of noise emissions but activities relating to the reduction of noise exposure are initiated based on the principle of shared responsibility. For the preparation of a new directive the Commission established several working groups, among others to work out proposals for harmonised European noise indicators (Working Group 1) and prediction and measurement methods (Working Group 3). In this paper the main recommendations of WG 1 are presented and discussed together with the basic concept of WG 3 for the elaboration of the harmonised prediction and measurement methods. Finally, the scope and the main regulations in the currently discussed draft of the new directive concerning the assessment and reduction of noise exposure are reported.

Keywords: Noise indicators, Environmental noise, Harmonisation, Noise prediction, Measurement methods

PACS number: 43.15.+s

### 1. INTRODUCTION

Noise is a problem that affects people world-wide. Therefore, an international co-operation and exchange of information about noise exposure, noise effects, noise assessment, and noise control is very useful to elaborate effective and efficient noise reduction measures. The Japan Day at the DAGA 2000 was an excellent opportunity to present and discuss the current European activities relating to the harmonisation of noise indicators and prediction and measurement methods with experts from Japan.

### 2. GREENPAPER "FUTURE NOISE POLICY" OF THE EUROPEAN COMMISSION — FOLLOW UP

In 1996, the European Commission published the Greenpaper "Future Noise Policy".<sup>1)</sup> A thorough evaluation of the noise situation in the Member

States showed that about 20% of the population in the European Union live in so called "black spots" where the noise exposure exceeds an equivalent noise level of 65 dB(A) at daytime. In these areas a large part of the population is highly annoyed by the noise exposure, and there is some epidemiological evidence that harmful health effects, esp. concerning heart diseases, may occur.

A critical assessment of the European noise policy yielded that the restriction to the limitation of noise emissions — under the principle of reducing barriers to the trade — is not sufficient to create acceptable living conditions in the Member States. Therefore, the Commission proposed to minimize the high exposure to noise with a coherent approach on the European, national, and local level according to the principle of shared responsibility.

The Greenpaper was discussed at several conferences in Europe, and it was widely accepted by the interested parties. There was a general agreement

**Table 1** European Working Groups (Noise perception).

WG 1	European Noise Indicators
WG 2	Dose/Response-Relationships
WG 3	Harmonisation of Prediction and Measurement Methods
WG 4	Noise Mapping
WG 5	Noise Abatement

that noise abatement is a neglected environmental issue, and more efforts to reduce noise were demanded. Therefore, the European Commission started to extend its former policy on the limitation of noise emissions by vehicles, aeroplanes, and machinery and it initiated a new policy relating to noise exposure.<sup>2)</sup> In this context, various Working Groups were established to support the European Commission (overview see Ref. 3), current state of activities see Ref. 4)).

Table 1 shows the Working Groups (WG) which shall contribute to a new directive concerning the description, assessment, and reduction of noise exposure.

As various noise indicators, prediction and measurement methods are in use in the Member States<sup>5,6)</sup> harmonisation is a prerequisite for future common activities. Some results from WG 1 and WG 3 are presented in the following chapters.

### 3. HARMONISED EUROPEAN NOISE INDICATORS

WG 1 already worked out a "Position Paper on EU Noise Indicators" and presented it to the European Commission.<sup>7)</sup> Various indicators which are being in use or in scientific discussion were rated by means of criteria such as validity (relation to noise effects), practicability, consistency with current practice. Two sets of indicators are proposed. The key recommendations are:

#### Indicators for European reporting

- $L_{EU}$  and  $L_{EU,N}$  for each source separately
- long-term averages (calendar year of interest)
- incident sound levels at 4 m above ground
- determined at the most exposed facade

$L_{EU}$  (or  $L_{den}$ ) is a composite indicator for a 24 h-period. The exposures during daytime  $L_{Aeq,12h}$ , evening time  $L_{Aeq,4h}$ , and night-time  $L_{Aeq,8h}$  are added energetically with an adjustment of 5 dB for exposure during evening time, and an adjustment of 10 dB for exposure during nighttime. The Member States shall be free to define the beginning and the end of the time intervals according to national customs.

$L_{EU,N}$  (or  $L_{night}$ ) is the  $L_{Aeq}$  for the 8h night period without any weighting.

#### Indicators for general applications

- $L_{Aeq}$  for each source separately
- determined for a 12 hour day, 4 hour evening, 8 hour night time interval separately
- for representative time periods (e.g. 3 month, 6 month, a year)
- incident sound levels
- at locations being appropriate for the corresponding aim of the assessment.

WG 1 stresses that for special sources and special situations the consideration of additional features may become necessary. Typical examples are noises with tonal or impulsive character, noises with dominant spectral components at low frequencies, or noises which only occur infrequent. WG 1 does not present definite rating procedures which should be applied when assessing these kinds of noises. Additionally, WG 1 does not recommend special procedures to deal with situations where more than one noise source are present.

The Position Paper reflects the international discussions about noise indicators quite well. These discussions — e.g. with the revision of ISO 1996 series "Description, measurement, and assessment of environmental noise" — mainly concern frequency weighting, energy principle, long-term averaging, adjustments for special noise features, and the use of logarithmic quantities. At the moment a majority of experts recommend the use of  $L_{Aeq}$  as the basic noise indicator for the rating of the main environmental noise sources.

### 4. HARMONISATION OF NOISE PREDICTION AND MEASUREMENT MEASURES

WG 3 shall elaborate common calculation and measurements methods for road, rail, and air traffic, industrial, and machinery noise. The calculation

methods shall be suited for the calculation of the noise exposure in terms of  $L_{EU}$  and  $L_{EU,N}$  as proposed by WG 1. Additionally, prediction of single events for air and rail traffic and for impulsive industrial noise shall be possible. The calculation methods shall be developed for a variety of topographical and meteorological conditions occurring in the Member States.

At the moment WG 3 is working on the following activities:

- preparation of an inventory of existing methods
- elaboration of specifications for the EU computation methods for road and rail traffic noise
- elaboration of research needs
- elaboration of a proposal for measurement methods

#### Preparation of an inventory of existing methods

The WG is preparing an inventory of existing methods to predict noise from road, railway, and aircraft noise in the Member States. The inventory shall include both procedures and limit values for various purposes. It can partly be based on existing evaluations which have been carried out in some European countries. For aircraft noise the inventory is nearly complete, and it will be made available soon. For the other sources information from some Member States is still lacking, and it will be collected in a research project.

#### Elaboration of specifications for the EU computation methods for road and rail traffic noise

As many of the prediction methods are based on research results from the 70 s and 80 s WG 3 decided that the common calculation methods should not be a compromise among existing methods. The methods should be a "step ahead" making use of the scientific knowledge of the last decades and the potential of modern computers. By this, a more precise prediction of the exposure can be achieved resulting in a fairer use of the restricted financial means for noise reduction measures.

In the model to be developed

- source emission data shall be clearly separated from sound transmission data
- the same sound transmission model shall be applied for all sources
- the presentation and categorisation of noise sources shall be improved so that future techni-

cal developments can be easier integrated into noise prediction schemes.

#### Elaboration of research needs

For the elaboration of the common calculation methods extensive research is still necessary. WG 3 has outlined the indispensable projects:

Sound emission (road)

The aim of the project is to deliver a source characterisation for road traffic noise which complies with the requirements given above. Working packages of the project are:

- definition of the main sources of noise from vehicles under all reasonable operating conditions. The data shall comprise source positions, sound power levels, frequency characteristics, directivity
- categorisation of road vehicles, vehicle/road interaction, operating conditions of roads, and weather conditions to be considered
- evaluation of number of categories depending on the necessary accuracy
- definition of methods how data for a European data bank can be got from existing information and/or new measurements

Sound emission (railway)

A project similar to the one described above has to be performed for railway noise. Special attention has to be given to aerodynamic noise at high speeds of the trains.

Propagation Modelling

The aim of the project is to provide sound propagation models that are suitable for use with the source models being developed in the projects described above. Models with different degrees of complexity shall be developed which meet the needs for different fields of applications. These models should be derived from a comprehensive reference model with a given accuracy which should be validated.

Factors to be taken into account are:

- geometrical spreading of noise,
- air absorption,
- meteorological effects,
- ground effects, height of propagation,
- topography,
- the presence and effects of barriers, berms and other forms of screens and
- reflections from buildings and other surfaces.

In the project, the possibilities of advanced model-

ling technique such as Finite Element and Boundary Element Methods, Wave Field Extrapolation (particularly Parabolic Equations) should be evaluated to improve the physical representation of some of the factors given above.

Measurement methods

Concerning measurement methods WG 3 is in close contact to the WG 45 of ISO Technical Committee 43/Sub-Committee 1. At the moment this WG is revising ISO 1996. Information about the progress will be available by the end of 2000.

**5. DIRECTIVE CONCERNING THE DESCRIPTION, ASSESSMENT, AND REDUCTION OF NOISE EXPOSURE**

The European Commission is preparing a directive on the assessment and reduction of environmental noise. The aim of the directive is

- the assessment of environmental noise in the member states based on common methods
- ensuring that information on environmental noise and its effects is made available to the public
- ensuring that actions are taken to reduce noise where it is necessary and to maintain noise quality where it is good.

Among others the following actions shall be carried out :

Member States

- introduction of the European noise indicators  $L_{den}$  and  $L_{night}$  in regulations for noise mapping (acoustical planning or noise zoning)
- definition of noise limits in terms of  $L_{den}$  and  $L_{night}$  for the road, rail, aircraft and industrial noise
- declaration about the consequences of a violation of the limits
- establishment of noise maps and action plans for all agglomeration with more than a given number of inhabitants and for all main roads, railways and airport, firstly based on national methods, later based on common methods
- information of the public and the Commission about the noise maps and action plans
- regular updating of maps and action plans

European Commission

- elaboration of common methods for the predic-

tion and measurement of noise as well as noise mapping

- elaboration of long-term and medium-term goals for the reduction of affected citizens
- elaboration of a strategy for the protection of quiet areas

At the moment the draft of the new directive is circulated within the European Commission for approval. A decision is expected in the course of the summer 2000. Probably, controversial discussions about the best approach for the assessment and reduction noise will go on among all interested parties. But it is very important that everybody is aware that a political falling through of this directive would be a considerable set-back for noise abatement, not only on the European level. Therefore, it is necessary that especially the scientific community supports the efforts to improve the noise situation in Europe by means of this directive.

**6. FINAL REMARKS**

At the moment, politics is willing to tackle the noise problem, not only on the European level. Therefore, current political activities on noise abatement must come to a successful end very soon. The noise experts have to underline that reasonable solutions are already available now and can be put into practice.

NOTE

In the meantime, the draft of the directive relating to the Assessment and Management of Environmental Noise was published by the European Commission : Document COM (2000) 468 final, 2000/0194 (COD) of July 26th, 2000 (internet address : [http://europa.eu.int/eur-lex/en/com/pdf/2000/en\\_500\\_PC\\_048.pdf](http://europa.eu.int/eur-lex/en/com/pdf/2000/en_500_PC_048.pdf)).

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