

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

Dieter Gottlob, Federal Environmental Agency, Bismarckplatz 1, 14193 Berlin, Germany

1. Introduction

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

2. Greenpaper „Future Noise Policy“ of the European Commission - Follow up

In 1996, the European Commission published the Greenpaper „Future Noise Policy“ [1]. Based on an evaluation of the noise situation in the Member States and its former noise policy it proposed to reduce the high exposure to noise with a coherent approach on the European, national, and local level according to the principle of shared responsibility. The reactions by the interested parties were very positive. They agreed that noise abatement is a neglected environmental issue and demanded more efforts to reduce noise. Therefore, the European Commission started to extend its former policy on the limitation of noise emissions by vehicles, aeroplanes, and machinery and initiated a new policy relating to noise exposure [2]. In this context, various Working Groups (WGs) were established to support the European Commission (overview [3], current state of activities [4]). Some WGs (s. Table 1) 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 [5][6] harmonisation is a prerequisite for future common activities. Some results from WG 1 and WG 3 are presented in the following chapters.

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

3. Harmonised European Noise Indicators

WG 1 already worked out a „Position Paper on EU Noise Indicators“ and presented it to the European Commission [7]. 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} (also called 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.

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

Indicators for general applications

- L_{Aeq}
- determined for a 12 hour day, 4 hour evening, 8 hour night time interval separately
- for each source separately
- for representative time periods
- incident sound levels
- at locations being appropriate for the corresponding aim of the assessment

WG 1 stresses that for special sources and situations the consideration of additional features may become necessary, e. g. when tones, impulses, low frequencies are present or the noise is infrequent, but no definite rating procedures are given.

The proposals well reflect the international discussions about noise indicators, e. g. with the revision of ISO 1996 series. Nevertheless the discussions about „perfect“ noise indicators continue among experts e. g. concerning the reference time intervals (long-term average) and additional indicators for special applications.

4. Harmonisation of noise prediction and measurement methods

WG 3 shall elaborate common calculation and measurement methods for transportation, industrial, and machinery noise. The methods shall be suited for the prediction 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). Prediction 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
- measurement methods

Preparation of an inventory of existing methods

The WG is preparing an inventory of existing methods to predict road, railway, and aircraft noise in the Member States. The inventory shall include both procedures and limiting 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 70s and 80s WG 3 decided that the common calculation methods should not be a compromise among existing methods.

The new methods should be a „step ahead“ making use of the scientific knowledge of the last decade and the potential of modern computers. By this, more precise predictions 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 applicable for all sources
- the presentation and categorisation of noise sources shall be improved so that future technical 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 modelling 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 an ISO working group (ISO TC 43/SC1/WG45) which is revising ISO 1996 „Description, measurement, and assessment of environmental noise“. 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 description, 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.

At the moment, drafts of the directive are circulated for comments. The introduction of the following actions are discussed:

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 prediction 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

It is expected that the Commission will decide on the draft of the directive in the summer 2000. Afterwards the European Council will deal with it. It can be foreseen that controversial discussions will go on about the question whether the directive represents the best approach for the assessment and reduction noise. But everybody should be 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, everybody who wants to improve the noise situation in Europe should support the efforts of the Commission.

6. Final remarks

At the moment politics it seems that politics is willing to tackle the noise problem. 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.

7. References

- [1] European Commission (1996). Greenpaper „Future Noise Policy“. KOM(96) 540, Brussels
- [2] Irmer, V.K.P. (1999). Harmonisierung der Lärmschutzpolitik in Europa (Harmonisation of the European noise policy). Z. f. Lärmbekämpfung 46, 195-202
- [3] ten Wolde, T. (1998). European Commission Future Noise Policy, Proceedings Internoise 98. ISBN 0 473 05443 4, Christchurch
- [4] European Environmental Agency (2000). EIONET Noise Newsletter, No. 3 January, Copenhagen (<http://themes.eea.eu.int/theme.php/issues/noise>)
- [5] Lambert, J. , Vallet, M. (1994). Study related to the preparation of a communication on a future EC noise policy. INRETS Report LEN No. 9420, Lyon
- [6] Gottlob, D. (1995). Regulations for community noise. Noise News International 223-236
- [7] EU-Working Group 1 (1999). Position Paper on European Noise Indicators. EC , Brussels (<http://www.xs4all.nl/~rigolett/ENGELS/>)