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New trends in noise abatement

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ABSTRACT

The classic noise abatement approach consisted of evaluating the problem by establishing noise maps, evaluating noise abatement measures in form of action plans and keeping the public informed of the progress with a regular monitoring. At least this has been the procedure utilized in Switzerland over the last forty years and the EU follows basically the same procedure. This approach is driven by the belief that there are some efficient technical or constructive measures available to reduce noise emissions. Moreover, it was expected that low-noise innovations would inevitably solve the problem and noise as an environmental burden would eventually disappear from the agenda.

However, new trends and developments have made noise abatement aiming at moving targets and facing new battlefields of conflicts. These changes can be attributed to evolution of attitude of human beings, social-demographic changes and progresses in the techno-economical environment. In answer to these developments, the strategy of noise abatement has to be adapted in order to cope with the new challenges. This adaptation should ensure that the type of noise abatement measures are less "end-of-pipe" such as noise barriers or protection windows, but measures at source based on holistic concepts that integrate all relevant aspects of modern life.

Keywords: noise abatement, developments, social-demographic changes, techno-economic progress

1. INTRODUCTION

Noise as a public health issue has become of growing concern in the European Union and it has been recognize as one of the most dominant environmental nuisance. There are more than 100 million people affected by road traffic noise in western Europe (1). Every year noise causes the loss of more then 1.6 million healthy years of life. Estimates (2) of the social costs of environmental noise are valued in the range of EUR 40 billion every year. It is also proved that traffic noise is especially harmful to vulnerable groups, such as children, the elderly and the poor. Although noise abatement strategies with regulations, monitoring procedures and action plans have been introduced, noise exposure is still growing.

2. NOISE ABATEMENT STRATEGIES

The European response to the growing problem of noise exposure started with the Green Paper of noise abatement (3)) in the mid-nineties. Since then, the EU has undertaken remarkable efforts for developing regulations, such as Environmental Noise Directive 2002/49/EC (END) (4), the Outdoor Noise Directive 2000/14/EC (OND) (5) and the Balanced Approach Regulation 598/2014 (6). Moreover, there are various national regulations that control noise management on a local basis. In parallel with the consolidation of EU-regulations, WHO issued a number of important publications on scientific evidence of the impact of noise exposure on the population. Among them are the Night noise guidelines for Europe (7), the Burden of disease from environmental noise (8) and the Environmental Noise Guidelines for the European Region (1).

The fundamental noise abatement policy is stipulated in the END, focusing on the most dominant

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traffic noise sources such as roads, railway lines and airports as well as industrial sites. Monitoring of noise exposure is carried out by means of the indicators L_{den} and L_{night} and action plans have to be established in order to reverse the tendency of growing community noise and to protect the population's health. Noise reducing measures have to be taken at source or at the sound propagation path as priority and sound insulation at the dwellings of noise exposed people is only second choice. Further important abatement rules are laid down in the Balanced Approach Regulation to protect the population from aircraft noise. Apart from promoting technical reductions of aircraft noise, this regulation specifies the principle of land-use planning and management and noise abatement operational procedures, including operating restrictions such as night flight ban. It is recommended to apply cost-benefit analysis to evaluate the total economic welfare effects of noise abatement measures.

There are no pan-European noise exposure limit values that trigger remediation measures, because the EU has left this task to the member states, knowing that a general agreement would be very difficult to achieve. Also the type of measures in the action plan to reduce noise is left to the member states, as it is supposed that the local players (noise polluters, people exposed and authorities) can better manage these problems than any detailed European regulation.

Further regulations regard noise emission values for type approval of cars, trucks and motorbikes, as well as other outdoor equipment. The emission limit values, however, are not very ambitious in that they only reflect the lower end of the technological development. This is because the principal driver behind these regulations is the aim of eliminating technical obstacles in trade. The emission limit values are therefore adapted to the weakest or - regarding car technologies - the strongest and loudest categories.

The effort of Europe in tackling the noise problem is remarkable and to great extend efficient and effective, as was proved in the regulatory fitness check (9) of the END. The analysis revealed that the directive led to a common approach to noise management and a positive contribution to reducing noise, while the overall cost-benefit ratio is in the outstanding range of 1:29. However, what is a good measure today, does not have to be so in the future and it seems fair enough to ask the question, whether the present noise abatement strategy is appropriate for new trends and developments.

3. Mega-trends for the acoustic future

As a first step to determine the most important future changes we looked at the so-called megatrends, among the various trends and movements of all fields in life. The term "megatrends" refers to a long-term social, economic, political and technological change that structurally influence society, the economy, politics and technology over several decades. These megatrends are then the basis for developing hypothesis for the future, which in turn can be used to define needs and actions for the upcoming noise abatement strategy (figure 1).

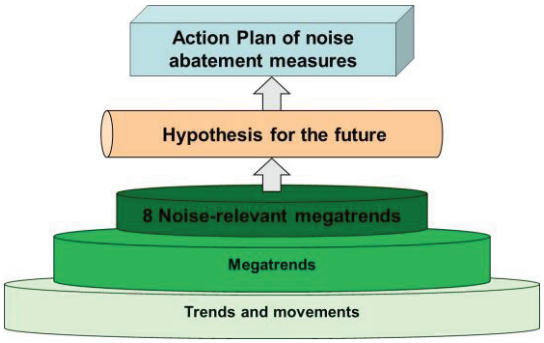

Figure 1 – Development of action plans of noise abatement measures in the future.

For this purpose a study (10) was carried out in order to evaluate the trends, the megatrends and the relevance of these megatrends with regard to the future acoustic landscape. The framework for the long-term analysis was set to 2050, which represents a horizon that extends beyond the normal

political and official planning and decision-making cycles. As a result there were identified eight noise-relevant megatrends that have an impact to the acoustic world in the future. These megatrends are:

- *Demographic development* will lead to more people and more activities and eventually to more noise.
- *Technological progress* will lead to more vehicles and devices and eventually to more noise, but might also lead to less noisy technologies.
- *Globalisation* will lead to less local solutions with a loss of autonomy in influencing one's life conditions, leading to a 24-hours society with other sleep, rest and recreation habits.
- *Deterioration of ecological situation* will overload the system and put other priorities before a quiet environment.
- *Urbanisation* leads to higher population densities with more traffic and noise and more stress.
- *Shift of economic structure to information society* leads to less conventional noise problems, but also to changes in the needs of working and resting times.
- *Increasing complexity, interconnection and mobility* leads to overloading the classic transportation and communication channels with the need for more time slots (24-hours society).
- *Growing importance of the health and sustainability lifestyle* leads to increased importance of health and environmental topics, and quietness is part of them.

Social and political studies are always based on numerous assumptions and implicit models concerning trends and interconnectedness. These megatrends and their possible consequences are therefore not necessarily deduced in a strictly logical manner and one could also come to other conclusions than those shown above. Nevertheless, the outcome is worth developing the hypothesis somewhat further, including possible actions in order to be prepared for the future challenges in noise abatement.

4. Quo Vadis noise abatement?

In view of the upcoming development indicated by the above depicted noise relevant megatrends, a number of hypotheses of challenges (Figure 2) in four domains have been formulated: noise sources, recreation areas, settlements and people. On the basis of theses hypothesis there have been proposed a number of possible responses or action plans in order to tackle these challenges. These measures are not complete, but intended to serve as basis for discussion and provoke responses and new ideas. Many of them are already known and have been proposed. e.g. in the final report (11) of the EPA-network's Interest Group on Noise Abatement (IGNA).

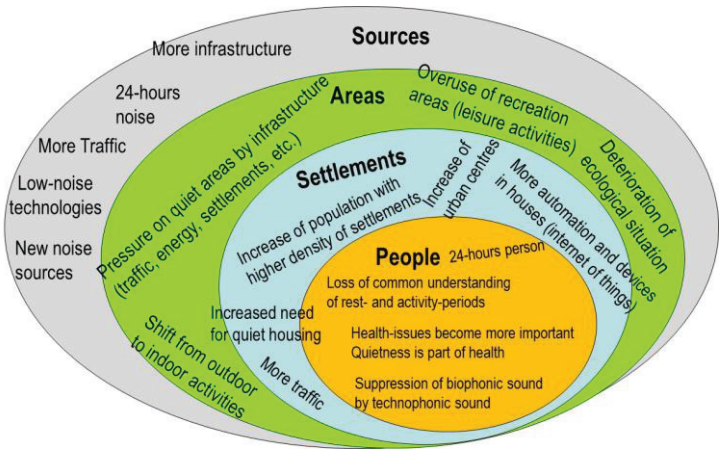

Figure 2 – Hypothesis of future challenges in four domains

"Sources", "Areas", "Settlements" and "People".

Sources: Mobility and automation continue to increase and noise will increase. New technologies

might lead to a reduction of technical noise at source, but this progress has to be demanded and promoted. *Action plans* should aim at taming mobility by making use of optimizing measure such as smaller and less noisy cars and introducing driving guidance systems. What's more, substitution measures should be encouraged such as promoting telecommunication and Home-office solutions instead of physical presence in offices and meeting places. A key technology for low-noise traffic is electro-mobility (but without AVAS) as well as low-noise tyres and road surface. Buying quiet vehicles and devices should be facilitated by introducing noise labels for vehicles and devices, but also by stimulating research in low-noise technologies. Classic noise abatement measures such as noise barriers, speed limits and other operational optimisations will still be needed.

Areas: Quiet areas will be under pressure because of the increase of population, infrastructure and settlements, but also because of overuse. Shift from outdoor to indoor activities might make natural recreation areas less valuable for some part of the population. *Action plans* should aim at preserving recreation areas and maintaining them quiet, especially in the vicinity of settlements. What's more, citizens should be made aware of the positive effects of natural and quiet areas on health and aspects of noise and quietness should be integrated from the very beginning into spatial and settlement planning.

Settlements: Housing will become denser, especially in urban centres, and noise from traffic, house automation and devices will increase. Everyday noise and noise from recreation will gain in importance, and noise-related conflicts among neighbours will become more frequent. *Action plans* should complement good sound insulation of housing (external and internal) with energy and climate aspects. In addition, there should be implemented automatic regulations of house-insulation and ventilation based on customs of inhabitants (internal) and linked with external noise. Close to settlements there should be made available easy accessible quiet outdoor spaces for recreation and compensation. Moreover, mediation processes should be introduced into planning and execution of noisy installation close to settlements.

People: Technological, demographic and social changes endanger the common understanding of rest and activity periods, favouring a 24-hours society, where biophonic sound is more and more suppressed by technophonic sound. But quietness as part of health will become more important. *Action plans* should sensitize the population of the importance of quietness and its positive effects on health. Noise abatement should be anchored deeper into public health strategies and political discussions should be promoted in order to reach consensus regarding time and space for activities and/or recovery.

5. Conclusions

New trends and developments have made noise abatement aiming at moving targets. In answer to these developments, the strategy of noise abatement has to be adapted in order to cope with the new challenges. Classic noise abatement measures will still be necessary in the future, but there are needed new holistic concepts that integrate all relevant aspects of life. The EPA-Network’s Interest Group of Noise Abatement (IGNA) is working on that.

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