Community Noise Management and Control: Some Successes and Some Challenges

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ABSTRACT

Over recent decades there have been some clear achievements in the acknowledgement of the importance of addressing noise in the community. The focus has been on the major noise sources associated with transportation and industry that globally affect the larger number of people. The publication of guidelines for noise level limits and for establishing noise control policies and approaches to noise management provides a good basis for further applications. This paper discusses some of the successes and also some of the remaining challenges in developing and adopting the most appropriate noise management and control policies.

INTRODUCTION

Noise in human settlement, whether it be called community noise or environmental noise, is acknowledged as being a major problem around the world. It is not unreasonable to say that at some time everyone who lives in or interacts within a community has been exposed to noise generated by others and to some extent has been annoyed or disturbed by that noise. While those who live in cities and towns are exposed more frequently to such noise, even those who seek a quiet rural life will still experience some noise generated by the activities of others. Community noise is not a new problem, as Juvenal the poet and writer in ancient Rome complained about the development of the city and that "*the movement of heavy wagons through narrow streets, the oaths of cattle-drovers would break the sleep of a deaf man....*" The noise from horse drawn vehicles on the cobblestones caused sleep disturbance in Medieval Europe. The control measures implemented then were similar to what we would do today: either the wagons were banned from the city streets at night or straw or dirt was added to the road in an attempt to achieve a quieter road surface.

Since the days of Ancient Rome and Medieval Europe there has been an increase in the types of noise, the levels of noise and the number of people annoyed and disturbed by the noise. This paper will consider some aspects of community noise management and control over recent decades and discuss some of the successes and challenges that still need attention.

ACKNOWLEDGEMENT OF THE PROBLEM

In part because the number of people affected has increased with the increasing population density in towns and cities, community noise can no longer be ignored. International and national organizations have acknowledged the importance of identifying, reducing and managing environmental noise to reduce the negative impacts. One example is that the very first paragraph of DIRECTIVE 2002/49/EC from the European Union[1] which states:

> *It is part of Community policy to achieve a high level of health and environmental protection, and one of the objectives to be pursued is protection against noise. In the Green Paper on Future Noise Policy, the Commission addressed noise in the environment as one of the main environmental problems in Europe.*

And for assessment of the effects, when there is insufficient protection against such noise, the outcomes of the study by the World Health Organization (WHO) on the Burden of Disease from Environmental Noise[2] concluded that the estimate of the disability-adjusted life years (DALYs):

> *.... lost from environmental noise in the western European countries are 61,000 years for ischaemic heart disease, 45,000 years for cognitive impairment of children, 903,000 years for sleep disturbance, 22,000 years for tinnitus and 654,000 years for annoyance. If all of these are considered together, the range of burden would be 1.0–1.6 million DALYs. This means that at least 1 million healthy life years are lost every year from traffic-related noise in the western European countries, including the EU Member States.*

With statistics like that it is not easy for national bodies responsible for the well-being of the community to ignore the extent of the problem. And indeed

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the WHO itself has undertaken work in recent years on setting goals guidelines for noise exposure. The document on Community Noise Guidelines was produced in 1999[3] and in 2009 has been followed up with Night Noise Guidelines For Europe[4], and further reports are being prepared.

Another influential body that has been active in seeking ways to reduce environmental noise is the International Council of Academies of Engineering and Technological Sciences (CAETS). This council considered noise as part of their study on Environment and Sustainable Growth[5] and stated that while much improvement had been achieved globally in relation to other environmental pollution, *environmental noise is a constraining factor for sustainable development.*

As Lang and Khilman summarized in their paper at Internoise 2011[6], there are various ongoing activities within CAETS in order to work towards dealing with this issue. These include a CAETS Noise Control Technology Committee (NCTC) which has been given the mission to provide *an active, science-based support for noise policymakers on technological options for a quieter world.*

The International Institute of Noise Control Engineering (I-INCE) has a memorandum of agreement with CAETS and the Chair and Secretary of the NCTC are Khilman and Lang[7]. This committee arranges for participation in international meetings dealing broadly with environmental issues as well as organizing symposia specifically on noise – for example, the forum on "Lessening the Severe Health Effects of Traffic Noise in Cities by Reducing Emissions" is to be held following the Internoise 2013.

While international bodies can identify the problem and even suggest guidelines to reduce the extent of the effects, it is only when each country or region adopts policies that require compliance with limiting levels of noise that there will be an overall improvement in the environment. In their summary of the findings of the Team 9 of the International Commission on the Biological Effects of Noise (ICBEN), on progress in noise policies Finegold at al[8] reported that *as*

before, much of this progress was made in the European Union, although other areas of the world demonstrated a continuing commitment to improvement on these issues, especially in Asia and North America while in developing countries with their higher noise levels the problem of noise exposure has been hardly recognized.

In developing countries not only is there very limited attention to environmental noise, there is concern that the noise policies adopted in other countries may not be the most applicable. As discussed by Finegold et al[8], an international consortium has been set up to work in a coordinated international effort to explore this issue and facilitate discussions necessary on noise research and noise policy within developing and emerging countries. This consortium has already organized and sponsored workshops and special technical sessions at relevant conferences – a recent being the special session during Acoustics 2012 in Hong Kong.

So in recent decades there is a clear message from International organizations that environmental noise is a problem, that it affects persons in the community, and that steps should be taken to reduce this impact. While most western countries have clearly defined noise policies which attempt to reduce excessive noise exposure, there is still a great challenge in the developing countries to acknowledge the importance of the problem and to encourage the adoption of appropriate noise control policy for the health and well-being of the community.

SETTING THE NOISE LIMITS

For any noise policy there needs to be goals and a mechanism for ensuring compliance with those goals. The most practical way to achieve this is to define criteria or noise limits — either emission or immission limits. Such limits not only provide a clear statement to those who are responsible for the noise source and the community that may be affected, but also allow for quantitative assessment of the noise. When selecting these limits, the findings from investigations of health effects and dose-response relationships and other studies provide the basis for guidance on limits to noise. Surveys to establish these relationships require large sample sizes and hence most of this work has been directed to the effects of those noises that affect large communities — i.e. primarily transportation noise sources.

Yano et al[9] in their paper on Community Response to Noise summarized the recent activities of the ICBEN noise team 9 in this area. While there have been a number of separate studies since the 1980's aimed to develop and refine dose response relationships there is "*an enormous spread in the data from different surveys*." The establishment by Fields et al[10,11] of some standard questions to be used in surveys has helped to allow for more effective and accurate comparison of data obtained. However Yano et al[9] identified that the "railway bonus" is an example of the diversity of reactions to noise and the challenge this places in attempts to establish international noise dose relationships. This 'bonus' arose from analysis of many surveys that indicated that at equal exposure, railway noise leads to a lower percentage of annoyed people than road traffic noise. In their final report on noise annoyance correction factors, the International Union of Railways[12] questioned this bonus particularly in the light of new and extended railway lines. Yano et al[9] further questioned the applicability of the 'bonus' as studies in Asia have not revealed lesser annoyance to railway noise.

While noise from transportation clearly affects the greatest number of persons across the globe, there are other sources that lead to annoyance reactions in the community. These range from industry and infrastructure such as wind turbine farms or gas fired power stations to more local issues such as outdoor concerts, festivals and sporting activities and, of course, noisy neighbors. In developing noise policy to deal with this range of noise sources, the regulators frequently refer to the precedents of guidelines and limits set in other countries for a similar types of noise. In 2009 I-INCE published the report from the Technical Study group led by Tachibana and Lang on "Survey of Legislation, Regulations, and Guidelines for Control of Community Noise"[13]. This committee sought to document "*legislation, regulations, and guidelines related to the control of community noise*" from around the world and provides a series of tables. These tables are a valuable comparison guide between countries, and while approximately 60% of the policies relate to transportation noise, the remainder provide some indication of the approaches to control all other noise sources. However there is clearly some way to go to provide rigorous evidence for appropriate guidelines for the wide range of noise sources that exist in modern communities.

ASSESSING THE NOISE

Once a policy and the noise limits have been established, it is important to have an assessment process in place to ensure that there is compliance with the limits. The technical aspects of noise measurement have shown great advances in recent decades. Even a basic sound level meter now has the processing and storage capacity to provide the noise level in a range of metrics. With more sophisticated noise logging it is no longer necessary for personnel to be present at the noise — the audio signal can be sent to a remote location or it can be stored for listening to at a later time. It may not be long before the need to have processing and some buffer storage at the monitoring location may be replaced with only the bare essentials of a transducer at a sensor node with the storage and data analysis moved to a centralized computer. Botteldooren

et al[14] recently explained their "internet of sound observatories" and the early implementation of such a system.

When the noise source under investigation is clearly the main source of noise in the area, as is the case for those areas near busy roads, airports and industry, the monitoring and assessment of the noise is reasonably straight forward. However when the compliance levels for the new activity are above the background, but still within the ambient noise in the area, the assessment becomes more challenging. Take for example the case of noise from a mine in a rural area. The background noise levels are very low as it is a rural area, however the ambient level with the day to day rural activities can be much higher. The compliance noise limits are typically set in accord with the usual guideline of 5 dB above background over a 10 or 15 min time period. When measuring noise which is so close to a low background noise, any other noise in the area can affect the results so that it is extremely difficult to assess if the mine is actually in compliance. The other consideration is that even when the noise from the mine is well below compliance, due to the nature of the noise being different to the usual 'rural' activity noise, the characteristics of the mine noise can be clearly noted and this leads to the expression of annoyance by the residents.

Another example when the usual method for assessing noise has limitations is for recreation activity noise such as from motor sports venues. When it is a major race through the main streets, or when residential areas are close to a facility, the noise may be dominant and clearly be heard and measured for comparison with the guideline noise limits. However at greater distances the noise from the vehicles on the track may be well within the 'background' but can be clearly identified. In part this may be due to the frequency characteristics of the vehicle noise, in part it may be due to the short term rise and fall time for the sound from each vehicle and in part it may be due to the repetition as the vehicles take generally much the same time to go around the track. The outcome is that there is a genuine concern by the residents to the noise but it is challenging to measure and assess such noise.

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ESTABLISHING THE POLICY

Establishing noise policy essentially requires a decision on the appropriate noise limits and a mechanism to ensure that those noise limits are complied with. From the regulator viewpoint, a successful noise policy is one that after implementation there are a minimal number of complaints from the community. From the proponents' viewpoint, a successful policy is one for which there is a cost effective reasonable and feasible solution to the control of the noise output. From the community's viewpoint, a successful policy is one that provides them satisfaction with their acoustic environment, a mechanism for complaints should they be annoyed and some evidence that there is consideration given to their concerns. I-INCE Technical Study Group 6 under the leadership of Larry Finegold investigated this and the final report[15] provides guidance on guidelines on environmental noise impact assessment and mitigation. This publication provides a flow chart to demonstrate the various elements of the process that work together to establish an appropriate policy.

One of the recommendations from this study was that effective policy needs to allow for a flexible approach as long as it meets with the community expectations. A negotiated agreement could be an outcome when the noise control solutions required to meet the compliance noise levels that would normally apply for other industries or undertakings are not reasonable or feasible for the proponent. If the community is involved with the discussion, then they may be willing to accept a little higher than the usual noise limit as long as there are some benefits, such as limits to hours of work or even a financial contribution to community activities.

As discussed above, much effort has been applied to providing guidelines for those noise sources that affect large numbers of the population. For other noise sources in the community there is less guidance

internationally and a flexible approach is particularly important when there are community benefits from the activity. The noise from recreation activities is one example where some of the community benefits from the opportunities provided by the activity yet other parts of the community could be adversely affected. Live music from venues, particularly amplified music, is one recreation activity which has become an increasing problem for the regulators seeking to establish a suitable policy. In some situations it may be appropriate to apply noise limits that require the venue to install extensive noise control measures to keep the noise within the venue. In other situations it may be more appropriate to consider the culture of the area, the fact that the area has a tradition of being an area or a street where the community goes to enjoy to music. Internationally recognized for Jazz music is Bourbon Street in New Orleans, Louisiana. Woolworth[16] has discussed the complexity of establishing a policy to deal with the music/noise that is part of the culture and tradition of the area. However many cities have such areas and less well known may be Fortitude Valley in Brisbane, Australia[17]. A pragmatic approach for these situations is to clearly identify the area as a special area and not subject to the usual regional noise policy. Having provided the message that this area is different to the rest of the city, the next step is to negotiate and reach a compromise on reasonable limits applicable within that area. The policy may involve a number of elements that include a limit to the noise at the source, a limit to the hours of operation and perhaps more stringent limits for new facilities.

A subject that is particularly controversial in many countries relates to policies that deal with noise from wind turbines. One example is the Australian Government Senate Select Committee investigating the community concerns after they received over 1,000 submissions. Their report[18] identified that there was a "*lack of adequately resourced epidemiological and laboratory studies of the possible effects of wind farms on human health*" and while the Government response did not specifically allocate funding to such investigations, there is encouragement for support for such studies via existing funding agencies. In contrast, Health Canada in July 2012 has specifically supported a "Wind Turbine Noise and Health Study"[19] with the results expected in 2014. Until the outcome of such studies really provide reliable guidelines for limiting noise from wind farms, the approaches will be similar to those for other types of general noises, namely comparison with the background noise level; for example, the guidelines[20] and the accompanying best practice guide recently released in the UK[21].

CONCLUSION

Over recent decades there have been some clear achievements in the acknowledgement of the importance of addressing noise in the community. The focus has been on the major noise sources associated with transportation and industry that globally affect a large number of people. The publication of guidelines for noise level limits and for establishing noise control policies and approaches to noise management provides a good basis for further improvements. However, there are still some challenges to increase the awareness of such guidance and encourage appropriate policies in developing countries. There are also still a number of noise sources for which there are challenges in developing and adopting the most appropriate noise management policies.

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