

# CHAPTER 130

## COMMUNITY NOISE ORDINANCES

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### 1 INTRODUCTION

Sound produced by human activities, transportation, machinery, and by nature itself is always present in a community. Such sounds, when unwanted, are perceived as noise. Each person perceives noise by taking into account a vast number of different factors including personal, cultural, economic, and societal. This makes the perception of noise very subjective.

Noise may be understood as an expression of human activity, but it can also be a source of annoyance. People make noise; however, noise is not a problem unless it becomes excessive, thereby hindering the community quality of life. This calls for each community and its government to set up policies for noise management and control and to devise and enforce strategies for noise abatement.

Community noise ordinances have been passed in most countries to address noise issues of all types, from neighborhood to transportation. They deal with noise limits at the receiver as well as with the quality of noise itself. Such ordinances can be qualitative or quantitative; they can be emission or receiver based. As part of the actions of a global noise policy, which includes sustainable development, community noise ordinances can be instrumental tools that ensure a noise-controlled environment.

### 2 COMMUNITY NOISE AS A PROBLEM

Community noise can be described as unwanted sound in a nonoccupational setting. Major sources of community noise are transportation systems, industry, construction, leisure activities, and neighborhood with transportation being the main contributor. Industry can contribute to the overall noise, especially in some suburban or rural areas. Leisure activities may account for a significant part of the noise in some areas of the community. Noise from equipment, either outdoors (construction, air conditioning, ventilation systems) or indoors (lifts, home appliances) is also a part of the overall noise.

Noise in a community must be addressed in terms of quantity and of quality. Once the quantity of noise is reduced, the quality becomes important. People usually have an expectation for the way different noise sources in the environment should sound. In quieter communities or in those where noise has already been reduced, this expected sound quality assumes a higher importance.

The larger and more complex a community is, the higher is the number of noise sources and the more difficult it is to act for noise abatement purposes. In a city, the complexity and intricacy of the human, economical, and social activities make urban noise management and control a difficult issue. Actions must

be devised and applied with the utmost care so as not to affect or disrupt the rhythm of life and the socioeconomic texture of the city.

Noise becomes a problem whenever the noise levels are high or when the number of complaints becomes relevant. The recognition of the noise problem must be followed by firm actions at the different levels of authority.

Noise was recognized as a problem in cities as early as the 1920s, although complaints from noise can be traced back to the Roman Empire due to the noise produced by the cart wheels on the pebble roads. With increasing population density, communities became noisier. In the last decades of the twentieth century, many cities in different parts of the world, namely in the United States, Europe, Japan, and Australia, for example, faced the problem of urban noise very seriously. Noise ordinances were promulgated and noise abatement became a prominent factor in urban planning and development.

### 3 NOISE ABATEMENT RESPONSIBILITIES

Success in the control of noise in a community can only be effectively achieved by a shared responsibility approach. Different levels of responsibilities can be established: local, regional, national, and federal. Community noise is a local problem. However, the solutions are not always necessarily local. Noise levels at a receiver are determined not only by local conditions but also by noise emissions whose limits or parameters are established above local or even national policies.<sup>1,2</sup> Noise from industry, for example, depends on the equipment and machinery noise power but also largely on factory layout and on installed noise control procedures and devices. This is basically a local problem. Road traffic noise depends on the road profile and on the type of pavement but mostly on traffic density and on vehicle emissions. However, limits for noise emissions by road vehicles, as by rail or aircraft, are established at national or federal level.

Noise regulations must then consider all levels of action, sharing the necessary responsibilities for each type of noise source as appropriate. The regulations at different levels must be coordinated and consistent. Provisions must also be made for the allocation of corresponding technical and financial resources for an effective enforcement at all levels.

### 4 COMMUNITY NOISE REGULATIONS

Community noise regulations are a fundamental part of a noise protection policy as they raise the awareness of citizens to noise and to noise effects and reduce

the production of noise in many circumstances. They establish the basic criteria for the acoustical quality of the environment and set the objective noise values that define the noise abatement purposes. These regulations require actions from lower levels of government, from transport authorities, and from other bodies responsible for noise sources and noise emissions. They establish law compliance mechanisms and penalties, making it a platform for the common citizen to be aware of his duties and to demand his rights.

Noise ordinances may define the excessive noise by its character or nature. They may prohibit certain activities, restrict activities to certain hours of the day, require permits or licenses for noisy activities, or merely define noise zones. These are qualitative ordinances. These ordinances do not include quantitative criteria and may therefore pose some difficulties such as vagueness, as they are generally subjective in nature. Community noise ordinances usually took this form in the past. They can be recommended as a first approach to raise the issues of self-regulation and noise control or for those communities where the noise problems are either not too severe or are caused by locally well-controlled noise sources. Costs associated with the enforcement of qualitative regulations are usually relatively low since the corresponding technical requirements do not have to be too sophisticated.

Quantitative ordinances, on the other hand, establish numerical values as limits for the noise levels produced or received. Criteria are defined and standards are required for measurement or prediction of noise. Maximum permitted noise levels are generally expressed in A-weighted sound pressure levels and may vary for different areas of the community and for different types of noise sources as appropriate. This type of ordinance is recommended for communities where the noise problems are more complex or where a more stringent management of noise must be met. Good results, though, require that technical facilities (know-how, acoustical technicians and engineers, measuring apparatus) either exist or are created, and such costs must be envisaged when the ordinance is being drafted. Qualitative and quantitative ordinances are both valuable, although a composition of both features usually prove to lead to the most effective noise ordinance contents.

Noise ordinances can be of two types: emission laws or receiver-based laws. Emission laws and regulations regulate noise at the source, by establishing limits to the amount of noise emitted by equipment. Maximum permissible noise levels are defined for each type of machinery, vehicle, transportation, or activity. Receiver-based laws regulate the noise levels received at a particular site. Limits are defined for the noise exposure at specific locations. These limits are usually related to the use of the property the sound is entering. These ordinances set zoning performance standards for new noise sources. Noise zoning is then used by local authorities for land-use planning.

In the 1990s, the World Health Organization (WHO) published guideline target values to be adopted for protection against noise.<sup>3,4</sup> The WHO recommended the following: (1) to protect the majority of people

from being moderately annoyed during the daytime, the outdoor A-weighted sound pressure level ( $L_{Aeq}$ ) should not exceed 50 dB, (2) to protect the majority of people from being seriously annoyed during the daytime in outdoor living areas the A-weighted sound pressure level ( $L_{Aeq}$ ) should not exceed 55 dB and (3) at nighttime outside sound pressure level should not exceed 45 dB in residential areas, so that the recommended A-weighted sound pressure level of 30 dB inside bedrooms with the windows open can be met. The WHO also suggests a limit of 60 dB for the maximum outdoor event A-weighted sound pressure level at night to protect people from sleep disruption.

These values were recommended in the European Green Paper on Future Noise Policy<sup>1</sup> as objective noise levels for all European Union (EU) member states. They have also been adopted in noise regulations in other parts of the world.<sup>5</sup> New guidelines for the exposure to noise at night have been prepared recently by the WHO. A final draft was approved in late 2006, and a final publication is expected in 2007.

## 5 COMMUNITY NOISE ORDINANCE COMPONENTS

A community noise ordinance can be a precious instrument for dealing with noise at a local level. The quality and the quantity of the overall noise are addressed, noisy activities are regulated, noise limits are set, and responsible bodies and cost-effective noise abatement policies are defined. It must first be determined, however, whether the local government concerned has enough authority to legislate on the noise matters, since its powers are delegated powers and its legislative authority is only that granted by statutory or constitutional provisions.

A well-written noise ordinance must cover a number of components in a concise, clear, and precise way so as to address the local noise issues in as comprehensive a manner as possible to avoid misinterpretation and litigation. Vagueness, indefiniteness, and uncertainty should be prevented.

A community noise ordinance starts by a declaration of policy, a comprehensive list of definitions of terms and technical references, and by establishing the powers and duties of the municipal agency or department having the lead responsibility for the ordinance (noise control officer).

The rating index and its assessment method must be very clearly defined. The metrics most widely used is the long-term A-weighted continuous equivalent sound pressure level,  $L_{Aeq}$ , since it yields a good correlation with noise effects.<sup>6</sup> The day–night average noise level,  $L_{dn}$ , is a 24-h A-weighted noise index used in the United States. It is calculated from the values of  $L_{Aeq}$  during daytime and during nighttime where a 10-dB penalty is applied to sound occurring between 10 p.m. and 7 a.m. The European Directive 2002/49/EC introduced the 24-h day–evening–night level,  $L_{den}$ , also calculated from the values of  $L_{Aeq}$  during the day period, during the evening period with a penalty of 5 dB and during the night period with a penalty of 10 dB, to be used by all EU member states in strategic noise mapping and action plans.<sup>7</sup> Other

indicators are used for the rating of road traffic noise or of aircraft noise in different countries. The ordinance must also refer to impulsive, narrow-band, or other relevant acoustical characteristics and establish any corresponding corrections to the rating index.

Measurement and calculation procedures are required to follow the applying standards. The recommendations and provisions set out in the International Organization for Standardization (ISO) 1996 standard<sup>8</sup> or equivalent [e.g., American National Standards Institute (ANSI)] are usual requisites. Noise assessment location (by measurement or calculation) and other relevant conditions (time intervals, emission or received noises) not covered by applying standards should be included in the text of the ordinance.

Reference time periods are defined, with their start and end hours clearly established, if not set at national level. Some countries consider only two reference periods, daytime and nighttime, whereas others consider a third one, a rest or evening period.

The noise ordinance usually defines noise zones according to the land uses and noise-sensitive activities. Corresponding noise limit values are stipulated for each reference time interval. The most stringent limits apply to residential, school, hospital, or leisure areas. It is recommended that different noise zones are created with noise limits in steps of 5 dB. Experiences with courser grades, with 10-dB steps, for example, have proved less practical and less effective.

Restrictions on noisy activities, musical instruments, and public address systems, construction, machine operation, traffic (e.g., heavy goods vehicles and aircraft) should be defined for the different noise-sensitive zones, together with criteria regarding the maximum permitted noise levels and the applicable hours. All such activities have to be clearly defined so as to avoid alternative interpretations and future litigation.

Restrictions are set for construction of some types of buildings (residence, school, hospital, or similar structure) and for land-use planning purposes so that the noise limits for each noise zone can be ensured. Similar types of restrictions are set for new outdoor or indoor recreational and leisure areas for the same reason. Plans for construction of new transportation systems or expansion of the capacity of existing ones in or near noise-sensitive zones may also be restricted, unless the necessary noise abatement measures are included to ensure that the noise levels in the zone will be within the prescribed limits.

The noise limits usually apply to the overall noise levels, but they may refer to noise from the different primary noise sources (industry, road traffic, railway traffic, and air traffic). Limits on noise emissions from machinery, construction work, and industry can be set since they can be well controlled at local level. These noisy activities are usually licensed by the municipalities. Limits on noise from transportation are usually set at the receiver. This is an area where coordination with transport authorities and with regulations at national level will prove most fruitful, given the limitations of the local legislative powers regarding

nationwide transport systems (e.g., airports, highways, and national railways).

Some restrictions (access traffic, activities) may have economic and societal prices, and the community should decide what level of cost-benefit is most appropriate. A number of experiences with severe traffic restrictions in some European cities have met with the opposition of residents who abandoned the area allegedly due to a decrease in economic activity and to the fear of a drop in real estate values.

Responsibilities for the measurement and assessment of noise should be set. Duties of the noise control agency or officer are defined to review the projects that may result in the production of sound, to inspect any place or situation suspected of violating any provision of the ordinance, and to investigate and pursue possible violations of the ordinance. Public education and information programs should be required or suggested. Participation of public-interest groups is mandatory in some countries and recommended in others. Noise mapping and noise action planning are usually required to integrate the land-use plans and long-term urban development plans where these instruments are operative.

Enforcement provisions must be clearly set out. The noise control officer or agency must rely on a well-trained team of municipal or county engineers who must be technically prepared and equipped to review relevant acoustical projects, to proceed with inspections, and to issue notices of violation and abatement orders (these are more effective if such orders include advice or recommendations on types of possible solutions or remedies). Although they do not need to be experts or even hold a college degree, some training on basic acoustics, sound radiation and propagation, and acoustical measurements should be provided to the technical staff. They must have a good knowledge of the existing measurement and calculation standards and of the measuring apparatus. The higher the quantitative nature of the ordinance, the higher is the technical requirement and the associated cost.

Fines and penalty actions must be well defined. The ordinance must state the explicit time criteria and goals for the full compliance of the regulations: hours of restrictions and periods of time to correct the violation or to implement the necessary remedies or abatement measures. Exceptions (e.g., emergencies) and variances (time to comply in specific conditions) should also be included.

The document *Model Community Noise Control Ordinance* issued by the U.S. Environmental Protection Agency (EPA) in the 1970s, describes a generic layout of a community noise ordinance to be adopted in U.S. communities.<sup>9</sup> Model noise ordinances were thereafter drafted in various U.S. states (e.g., Alaska, California, and New Jersey) aimed at their municipalities.

The community may publish, as a support to the noise ordinance, technical and information guides on community noise with more detailed definitions, basic explanations on noise production, noise sources, and effects of noise on practical measures and procedures to reduce it and on how the citizens can seek abatement orders. This has been followed in many cities of various countries with great success. Information regarding

noise and noise effects is never too much but should be provided at a level that can be fully understood by the target population, meaning that different brochures or documents, technical and nontechnical, may be required. Community noise ordinances have been instruments for the management and control of noise in local communities of many countries worldwide.

## 6 THE U.S. NOISE POLICY

The need for a noise policy in the United States was first recognized in 1967. In 1969, the National Environmental Policy Act (NEPA) was approved.<sup>10</sup> The NEPA is a basic national charter for protection of the environment in the United States. NEPA mandated the environmental impact assessment process, and noise is one of the many environmental attributes that must be considered.

In 1972, the Noise Control Act (NCA 72) was approved by the U.S. Congress.<sup>11</sup> The NCA 72 was passed specifically to address environmental noise. The NCA 72 stated that it is “the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare.” In the act, the U.S. Congress recognized that the “primary responsibility for the control of noise rests with state and local governments” while “federal action is essential to deal with major noise sources.”

The responsibility for implementing NCA 72 was assigned to the EPA.<sup>12</sup> This was to be the leading federal agency in charge of coordinating the programs of all federal agencies dealing with noise control. However, in the early 1980s EPA was no longer involved with noise control regulations.<sup>12,13</sup> About a dozen federal agencies have since been responsible for the development, formulation and implementation of the U.S. noise policies together with the corresponding bodies of state and local authorities. The policies of these agencies have not always been coordinated, leading to some lack of consistency in noise requirements, which usually apply separately to different noise source emissions.<sup>14</sup>

The aircraft noise policy of the Federal Aviation Administration (FAA), applicable to civilian-operated airports, has been very effective. The Aircraft Noise Abatement Act of 1968 (later modified by the NCA 72) directed the FAA to establish standards and regulations for aircraft noise.<sup>15</sup> Aircraft noise certification by FAA was required by the 1969 Federal Aviation Regulations.<sup>16</sup> This was followed by the 1976 Aviation Noise Abatement Policy<sup>17</sup> and by the Aviation Safety and Noise Abatement Act of 1979.<sup>18</sup> In 2000, the Aviation Noise Abatement Policy was revised and various issues from aviation noise assessment to promotion of compatible uses of impacted land were outlined. The FAA and the Department of Defense adopted the annual A-weighted day–night average sound pressure level of 65 dB as the level for action regarding aircraft noise abatement in residential areas near an airport.<sup>19</sup>

Road traffic noise has been regulated by the Federal Highway Administration (FHWA) since it was mandated by the Highway Federal Act of 1970 to develop noise standards for mitigating highway traffic

noise and by the NCA 72 to enforce the noise emission standards for vehicles that were to be defined by the EPA. A number of documents were published since the 1970s. The Procedures for Abatement of Highway Traffic Noise and Construction Noise set limits for levels of noise along highways and defined criteria and the responsible bodies for noise abatement procedures.<sup>20</sup> The FHWA criterion for action to protect residents near a federally funded highway project is the noise action level of 67 dB corresponding to the peak traffic hour  $L_{Aeq1h}$ . Land-use planning near highways is, however, left to state and local governments.

The U.S. EPA recommended in 1974 that the outdoor A-weighted day–night sound pressure level should be kept below 55 dB in residential areas. This value has also been adopted by the Federal Energy Regulatory Commission (FERC) to protect residents near some industrial installations.

The policy for noise protection is now basically defined at state or local level since it was recognized as a more efficient approach. Nevertheless, for communities impacted by a combination of different sources, the issue is a difficult one since a variety of limits and metrics apply. A large number of U.S. cities and towns have their own community noise ordinances.<sup>21</sup> The first known local noise ordinance regarding noise limits was adopted by Chicago around 1955. These were zoning regulations aimed primarily at industry and targeted at 61 dB for sound entering other business areas and 54 dB for sound entering residential areas during day or night. The New York City noise ordinance is currently undergoing a major revision. Most community noise ordinances in the United States now apply the general strategy set out in the EPA’s Framework for Community-Based Environmental Protection.<sup>22</sup>

The need to revise the U. S. national noise policy is now being considered seriously.<sup>13,14,23,24</sup> There is a need to unify noise protection criteria at the national level and to reactivate a lead agency responsible for noise policy and control. A reformulation of the U.S. noise policy can be expected in the near future.<sup>21</sup>

## 7 THE EUROPEAN CHALLENGE

Noise regulations were passed in many European countries and cities since the late 1970s. They dealt with different aspects of noise from transportation, equipment, neighborhood, or leisure activities. Most defined noise-sensitive zones, depending on the different land uses, defined associated noise limits for day and for night periods, and established restrictions on traffic and on noise-producing activities.

Environmental noise is addressed at the European level through a wide range of instruments.<sup>25</sup> Various directives regarding noise emissions from different sources, such as motor vehicles, railway systems, aircraft, household appliances, and outdoor machinery, have been approved since the early 1970s.

Directive 86/594/EEC was passed in 1986 regarding noise labeling of household appliances.<sup>26</sup> Directive 2000/14/EC lays down noise provisions to reduce the noise emitted by outdoor equipment and requirements for harmonization of noise emission limits and standards,

of conformity assessment procedures, and of noise level marking.<sup>27</sup> Directive 2003/44/EC, which amends the previous recreational craft Directive 94/25/EC and took effect progressively from 2005, establishes requirements regarding noise emission limit values for recreational craft.<sup>28</sup>

The directives on noise emission from new motor vehicles have been a success story. The first European harmonized noise requirements for road vehicles were introduced in 1970 by Directive 70/157/EEC relating to the permissible noise level and the exhaust system of four-wheel motor vehicles.<sup>29</sup> Noise limits for new cars first defined in Directive 77/212/EEC were made increasingly more stringent until the most recent one, 92/97/EEC.<sup>29</sup> The decrease in the prescribed maximum allowed noise levels ranged from 6 dB for passenger cars to 10 dB for heavy trucks. Directive 97/24/EC<sup>30</sup> sets permissible noise levels for two- and three-wheel vehicles and their exhaust systems, and Directive 2001/43/EC<sup>31</sup> deals with tire rolling noise.

European legislation has addressed railway noise at source through directives on railway interoperability for high-speed rail (Directive 96/48/EC<sup>32</sup>) and for conventional rail (Directive 2001/16/EC<sup>33</sup>). Technical specifications were approved in 2002, setting out noise emission limits for high-speed trains at different speeds.

Noise emission limitations from civil aircraft have been in force since 1980 (Directive 80/51/EEC.<sup>34</sup>) Directive 92/14/EEC of 1992, based on standards of the International Civil Aviation Organization (ICAO), banned the noisiest aircraft (Chapter 2 of Annex 16 of ICAO) from European airports.<sup>35</sup> In 2002, Directive 2002/30/EC established rules and procedures with respect to the introduction of noise-related operating restrictions at EU airports.<sup>36</sup> It further required that results of the implementation of this directive be reported no later than 2007.

In the mid-1990s various studies were conducted as a starting point of a new directive on environmental noise. It was found<sup>37</sup> that about 20% of the European population was exposed to A-weighted sound pressure levels of 65 dB or above, mainly from transportation. In 1996, the European Commission produced the Green Paper on Future Noise Policy.<sup>1</sup> Following the publication of this document, a new framework for noise policy, based on shared responsibility between the European Union, national, and local authorities was defined.

The Environmental Noise Directive (END) 2002/49/EC was published in 2002 on the basis of the Green Paper recommendations to address noise issues and to define a "common approach for all European countries in order to avoid, prevent or reduce on a prioritized basis the harmful effects, including annoyance, due to exposure to environmental noise".<sup>7</sup> The END defines the basic principles of a harmonized European noise policy. It requires the assessment of the environmental noise, both overall and from major noise sources, such as transportation and industry, the number of people exposed to different noise levels, action plans for reduction of noise

exposure, communication with the public, and communication between the European Commission and the member states. No noise limits were included as this is left to each country or local community.

A noise expert network was set up in order to assist and provide advice to the European Commission prior to and after the publication of the END. Different working groups of experts from different member states were created to deal with emissions from noise sources and with noise effects and perception. Two working groups still meet regularly: Assessment of Exposure to Noise (WG-AEN) and Health and Socio-Economic Aspects (WG-HSEA).

The European Directive 2002/49/EC requires the competent authorities to draw strategic noise maps for the assessment of noise from major transport infrastructures and in communities with more than 100,000 inhabitants.<sup>7</sup> Action plans are required and should be designed to manage noise issues and effects, including noise reduction, if necessary. Two stages are defined. In the first stage, strategic noise maps for all agglomerations with more than 250,000 inhabitants, major airports with more than 50,000 movements per year, major roads with more than 6,000,000 vehicles per year, and railways with more than 60,000 passages per year must be completed by June 2007. The corresponding action plans must be finished by July 2008. The second stage corresponds to other agglomerations with more than 100,000 inhabitants, major roads with more than 3,000,000 vehicles per year, and railways with more than 30,000 passages per year. Strategic noise maps must be completed by June 2012 and action plans by July 2013. Noise maps and action plans are to be reviewed every 5 years.

All EU directives are transposed into national legislations of the European member states. Their own noise ordinances at national, regional, or municipal levels that address noise zoning, noise limits, and noise abatement<sup>38</sup> incorporate the growing harmonized noise criteria and procedures.

## 8 THE EXPERIENCE IN JAPAN

Environmental noise policies in Japan started in 1967, and in 1968 the first Noise Regulation Law was approved and later amended in 1995 and in 2000.<sup>39</sup> The Environmental Quality Standards for Noise<sup>40</sup> were first defined in May 1971, based on Article 9 of the Basic Law for Environmental Pollution Control. Limit noise values were stipulated for two types of areas: general areas and roadside areas. General limits for the A-weighted sound pressure level were established at 35 dB during nighttime for quiet neighborhoods and at 60 dB during daytime for areas with a considerable number of dwellings but which included commerce and industrial uses. Limits for roadside areas were 5 to 10 dB higher depending on various factors such as the number of road lanes. In accordance with the provisions of Article 16 of the Basic Environment Law (Law No. 91) of 1993, the noise limits were reviewed in 1998 and enforced in 1999.<sup>41</sup> Outdoor noise limits of 55 dB during daytime and of 45 dB during nighttime for residential areas

were then recommended. For areas with particularly noise-sensitive uses, the limits are 5 dB lower, whereas for areas with commerce and industry they are 5 dB higher. In areas facing roads with two or more lanes, another 5 dB were allowed.

The Noise Regulation Law required the local governments to proceed with noise zoning and classification. By the mid-1990s, more than 600 large cities and more than 850 small municipalities had their own noise ordinances.<sup>42</sup> That law also demanded the Environment Agency to establish the maximum permissible levels of noise produced by the operation of motor vehicles. Since they were first implemented in 1971, controls of running noise on new vehicles have been strengthened several times, namely in 1979, in 1986, and in 1992 when the document *The Future Policy for Motor Vehicle Noise Reduction* was approved.

The Environmental Quality Standards for Aircraft Noise were initially defined in 1973 and later revised and updated in 1993 to prevent aircraft noise pollution.<sup>43</sup> Maximum levels of the A-weighted equivalent continuous perceived noise level (WECPNL) (calculated from  $WECPNL = L_{Apeak} + 10 \log N - 27$  where  $L_{Apeak}$  is the mean level of all peaks that exceed the background noise by at least 10 dB in one day, and  $N$  is a time-weighted total number of aircraft) are prescribed as 70 dB for residential areas and 75 dB for other areas where normal living conditions should be preserved. A certification system banning the operation of aircraft whose noise exceeds prescribed levels has been in effect since 1975 and later strengthened in 1978, leading to the phasing out of the noisier aircraft at major airports as from 1988. In order to implement further aircraft noise countermeasures, a portion of the Civil Aeronautics Law was revised in 1994 pointing to the gradual restriction of operation of the noisier aircraft in Japan from 1995 and to their prohibition as from 2002.

Noise from the Shinkansen railway line is the subject of the Environmental Quality Standards for Shinkansen Superexpress Railway Noise, as originally issued in 1975 and revised and updated in 1993.<sup>44</sup> Noise limits are 70 dB for residential areas and 75 dB for areas with commerce and industry where normal living conditions should be preserved, measured as A-weighted peak sound pressure levels. These limits actually relate to noise emissions but not to the exposure of the population to noise since the number of trains is not accounted for. For conventional railway trains, noise standards have been under study.

Based on the noise standards, countermeasures have been implemented against all types of noise sources. Local government actions deriving from local community noise ordinances have been reportedly very effective. However, it has been recognized that the whole noise policy needs to be reconsidered and this seems to be underway.

## 9 THE AUSTRALIAN EXPERIENCE

In Australia, excessive noise is regulated in each state by environment protection acts and by environment protection policies. The environment protection policies set maximum permissible noise levels for certain types

of machines during specified times as well as for motor vehicles and control the maximum levels of noise exposure in areas with residential uses. Local governments, as regulatory authorities, are demanded to enforce the noise limit values.

In South Australia, for example, the Environment Protection (Industrial Noise) Policy 1994 established maximum permissible noise levels for both day and night in six different land zones.<sup>45</sup> Daytime A-weighted sound pressure level limits are 47 dB for a rural area or 52 to 58 dB for urban residential areas, depending on other existing uses. The corresponding limits for nighttime are 40 dB and 45 to 50 dB. Maximum noise levels are also defined for premises adjoining roadways carrying more than 100 vehicles/hour ranging from 54 to 76 dB with corrections for the distances to the road.

In New South Wales, local environmental noise issues are managed by the Protection of the Environment Operations Act 1997<sup>46</sup> and by the Protection of the Environment Operations (Noise Control) Regulation 2000. This document prescribes maximum noise levels for different classes of motor vehicles with specifications for testing procedures. The Environmental Noise Criteria for Road Traffic Noise set out criteria to be applied to residential areas with maximum A-weighted sound pressure levels of 55 dB to 60 dB during the day or 50 dB to 55 dB during the night, depending on the type of road and on new or redevelopment area.<sup>47</sup>

In Queensland, the Environmental Protection (Noise) Policy 1997, amended in 2003, prescribes rules for noise labeling of various products, for noise assessment to be used by the local authorities, and recommendations to get the communities involved in the protection of environmental noise.<sup>48</sup> Planning levels are defined. The A-weighted equivalent sound pressure levels in front of the most exposed facades of noise-sensitive buildings must not exceed 65 dB (87 dB maximum single event) near railways or 60 dB (80 dB maximum single event) near public roads. Near an airport,  $L_{max}$  must not exceed 70 dB.

## 10 OTHER EXPERIENCES

In Canada, provincial governments set their own noise policies. Ottawa's regulations are based on the Noise Control Guidelines of 1995.<sup>49</sup> The city new environmental plan prescribes maximum A-weighted sound pressure levels of 58 dB during the day and 53 dB during the night from roads, railways, or transitways. Criteria are established for the compatibility of land uses in the vicinity of airports. The Noise Control By-Law of the City of Vancouver of 1989, last amended in 2004, establishes noise limits for noise emissions in different noise zones. For a quiet zone, for example, the A-weighted sound pressure level limits vary between 55 dB and 60 dB during daytime and between 45 dB and 55 dB during nighttime, depending on from where the noise is emitted.<sup>50</sup>

In China, the first act concerned with noise was the National Environment Protection Act of 1979.<sup>51</sup> The Regulations on Prevention and Control of Environmental Noise were approved in 1989 and updated in 1996. Local governments were made responsible for the implementation of noise requirements. Maximum

noise emission levels for motor vehicles were approved in 1979. Other criteria and standards were defined together with noise zoning where noise limits were established for day and for night in 1993. Residential area A-weighted sound pressure level limits are 55 dB during daytime and 45 dB during the night. For quiet residential areas, the limits are 5 dB lower, and for mixed areas they are 5 dB higher. The criteria are implemented by national and local authorities.

In Hong Kong, the Noise Control Ordinance 1988 (with later amendments) is the basic regulation.<sup>52</sup> The Road Traffic Ordinance and the Civil Aviation (Aircraft Noise) Ordinance requires compliance with noise emission standards. New more stringent regulations have been under study.

In Brazil, the state of Rio de Janeiro approved in 2004 an ordinance on urban noise.<sup>53</sup> Of a qualitative nature, it demands the municipalities to implement noise assessment and noise abatement actions and sets the basis for a future environmental noise policy.

## 11 FINAL DISCUSSION

Community noise ordinances of different types have been promulgated in many cities and counties all over the world. They need to be coordinated and consistent with regulations at all other levels, namely regional and national, if an effective improvement in the quality of the sound environment is to be achieved. In a global policy, community noise ordinances act as self-regulation measures that are able to address noise at a local level in a way that citizens can be drawn closer to the actions and get more involved with their results.

Since much of the noise in a community is a local issue, local policies and actions can produce measurable results if a straightforward, practical, and economical approach is set up. Simply enacting a new noise ordinance, either of qualitative or quantitative nature, is not enough, though. The noise ordinance must address the noise problems in a clear and realistic way and must be reasonable. All technical issues such as metrics, standards, assessment, and inspection procedures must be well defined. Responsible bodies must be established together with their obligations and powers, ensuring a capable supervision and enforcement. Efficient enforcement measures and the allocation of adequate financial and technical resources are key issues for successful results. The provision of guides to help on the technical issues and of rules for dissemination of information has generally proved to be an advisable feature.

The maximum permitted noise levels defined in noise zoning for daytime and for nighttime in recent years are generally very close to those recommended by the WHO, in most cases referred to the A-weighted continuous equivalent sound pressure level.

Community noise ordinances and national noise policies are currently being revised in many parts of the world, generally incorporating more stringent noise limits and criteria. Although a reduction in noise emissions from road vehicles and aircraft has been achieved due to successful policies in the United States, Europe and Japan, for example, a corresponding reduction in receiver noise values has not been so

apparent given the rise in traffic.<sup>54</sup> The trend in the increase of population density in urban areas must be met with the growing citizen's requirements for a better quality of life. Community noise criteria and goals must be used as tools in land-use and transport planning.<sup>55</sup> Experience has shown that noise ordinances play a primary role in the community noise management and control policy.

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