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Draft Final Report of I-INCE TSG#3 –

Noise Polices and Regulations

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Abstract At the General Assembly of the International Institute of Noise Control Engineering (I-INCE) held in Ft. Lauderdale, Florida USA in December 1999, it was decided to start a long-term, internationally coordinated program to assess the effectiveness of noise control and exposure policies, guidelines, and regulations around the world and TSG #3 “Noise Policies and Regulations ” was initiated. A work plan was then established to assemble and catalogue the noise policy regulations and standards of the participating countries as the first phase of the study. The first questionnaire survey was carried out in 2001 and a second survey was held in 2002 to supplement the contents of the initial survey. The results were arranged in tables including the category/nature of the laws/ordinances (regulations or guidelines, “emission” or “immission”), the subject of the noise policy (noise sources), the noise assessment method (noise index and measurement position), the specified exposure criteria levels and other information. The resulting database was deemed to be the appropriate starting point for an eventual project to assess the effectiveness of noise policies in reducing noise exposure. This information is also useful as the foundation for discussions of global noise policy and for the possible harmonization and standardization of legislative systems regarding environmental noise problems. The TSG #3 Final Report documents the results of the international survey and provides recommendations for possible follow-on projects to collect additional noise policy information and to estimate national noise exposures in the I-INCE participating member countries, as a next step towards the long-term goal of assessing the effectiveness of environmental noise policies. This paper describes the general outline and conclusions of the draft Final Report, which is currently being reviewed for publication by I-INCE.

1. INTRODUCTION

During the second half of the 20th century, virtually all of the major countries of the world have recognized that environmental and occupational noise are public health problems

requiring effective and affordable noise control practices. These practices include promulgation of local, national and international noise exposure policies, such as guidelines, regulations and Standards, as well as development and implementation of a variety of noise control technologies. Although considerable progress has been made over the past few decades in the development of both noise exposure policies and noise control technologies, there has been very little effort to determine the actual effectiveness of these measures. National governments, professional scientific and engineering societies, and the general public, however, are appropriately quite interested in knowing the impacts of efforts to control noise exposure. Politicians need to know whether the benefits of noise control measures are worth the financial expenditures they are requested to provide. The general public wants to know if the efforts of their governments are effective in reducing noise exposure in cities, occupational environments, and in their local communities. To fill these needs, it is proposed that a methodology for performing such periodic assessments be developed for use both by individual countries and, potentially, for making cross-national comparisons.

If it can be shown that noise control policies actually reduce noise exposure over time, this would be the best argument for convincing government policy-makers to continue to improve noise exposure policies, adequately fund required noise control efforts, and monitor noise exposure over time. Alternatively, data collection efforts may show less than anticipated benefits of current noise control policies, in which case these data would provide a strong impetus for additional, but necessary, improvements in noise exposure policies and regulations. Assessing the effectiveness of various noise control efforts is also necessary because of the economic impacts of *not* funding adequate noise control programs. In the United States, for example, corporate expenditures for compensation of occupational hearing loss are the second highest cost of doing business in many industries. Indirect costs such as this are incurred by societies when adequate noise control measures are not implemented, but are often overlooked in the decision-making process concerning whether or not to implement specific noise exposure policies and regulations. Typically, only the direct costs of developing and using adequate noise control technologies are considered. Informed governmental decisions would consider both types of costs, as well as the benefits expected from various noise control/noise mitigation options.

2. METHODOLOGY FOR ASSESSING THE EFFECTIVENESS OF NOISE POLICIES

The data obtained from implementation of the survey methodology described below would be compiled and analyzed to determine what effects are observed from changes in noise policies and from improvements in noise control technologies. Collectively, they would provide the data required to accurately describe and compare various home, occupational, recreational, and community noise environments in different countries over time. Figure 1, below, provides an overview of the various components of the recommended methodology.

3. PROJECT OVERVIEW

The I-INCE Initiative: At the INTER-NOISE 99 conference in Fort Lauderdale, Florida USA, the International Institute of Noise Control Engineering (I-INCE) decided to undertake a study with the objective of determining if it is possible to make an assessment of the effectiveness of noise policies on noise exposure internationally. It was decided that the first

Technical Approach for Assessing the Effectiveness of Noise Policies

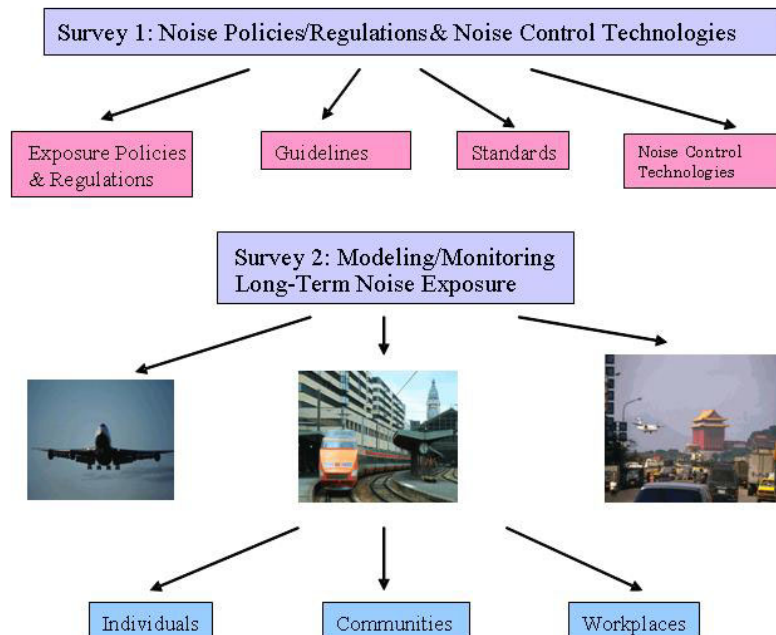


Figure 1. Assessing the effectiveness of noise policies [1, 2]

step would consist of collecting and organizing descriptions of noise policies (regulations, laws, guidelines, etc.) from the various I-INCE member countries. As a result, Technical Study Group #3: Noise Policies and Regulations was established. According to I-INCE, “This I-INCE technical initiative deals with the effectiveness of noise policies and regulations around the world and involves a study of existing noise exposure policies and regulations in all countries which have recognized noise as a problem involving public health and welfare”.

4. TSG#3 MEETINGS

At the first meeting held in Nice, France during INTER-NOISE 2000 it was decided to assemble and catalogue the noise regulations/standards of each of the participating countries as the first phase of the study. After the meeting, a questionnaire survey including the following points was carried out: (1) the legislative and administrative structures for the enactment and enforcement of noise policies and regulations/standards, (2) enumeration of the major laws and/or ordinances relevant to environmental noise problems, (3) the nature of these laws and ordinance, (4) the subject which these laws and ordinances are applied to, (5) the regulation/standard values specified in these laws and ordinances, and (6) effectiveness of the noise laws/ordinances in the reduction of environmental noise. 10 countries replied to this questionnaire survey and an effort was started to obtain additional noise policy information from published articles and reports. The results were arranged in tables including

category/nature (regulations or guidelines, “emission” or “immission”) of the laws/ordinances, the subject (noise sources), noise assessment method (noise index and measurement position), the specified sound levels and other information.

At the second meeting held in Den Haag on 2001 August 28, the results of the first questionnaire survey was reviewed and it was decided to make an additional survey to obtain further information about the characteristics of the laws/ordinances, building codes regarding sound insulation and noise criteria/standards in buildings, and laws/standards/regulations for occupational noise and noise labeling of consumer products. In this meeting, the relationships between TSG#3, TSG#5 (Noise as a Global Policy Issue) and TSG#6 (Community noise) was also discussed. It was agreed that for the discussion on environmental noise problems, such terms related to noise policies as “noise policy”, “regulations”, “standards”, “guidelines”, etc. should be clearly defined. Based on the conclusions at this meeting, the second questionnaire survey was carried out and 5 countries replied.

At the third meeting held in Dearborn, Michigan the results of the second questionnaire survey were reviewed. Beside, discussions were made on the tasks/aims of TSGs (#3, #5 and #6) and the problems when comparing the values of noise indices specified in regulation/guidelines in respective countries. In conclusion, it was decided to arrange the results of the survey works and present the interim report at INTER-NOISE 2003 in Korea. Additional meetings were held during INTER-NOISE 2003 (Jeju Island, Korea) and INTER-NOISE 2004 (Prague, Czech Republic) to review the progress on developing the TSG #3 database and preparing the draft Final Report. During the course of this project, periodic progress updates were presented at various conferences [3 – 6].

5. THE RESULTS OF THE QUESTIONNAIRE SURVEYS

As the result of this questionnaire survey, 10 countries replied and, in total, information about the following 21 countries was obtained, also using secondary sources when these were available [7-12]:

- Australia (West Australia, New South Wales, Queensland), Austria, Belgium (Flanders, Wallonie, Brussels), Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Norway, Portugal, Slovenia, Spain, Sweden, The Netherlands, Turkey, UK, USA.

The results were arranged in tables including the category/nature (regulations or guidelines, “emission” or “immission”) of the laws/ordinances, the subjects (noise sources), noise assessment method (noise index and measurement position), the specified exposure criteria levels and other information. These tables are provided in the Annexes to the Final Report in MS Word format. The sortable EXCEL database will be made available from I-INCE.

Regarding noise indices, equivalent continuous A-weighted sound pressure level (LA_{eq}) is the most commonly used metric worldwide, but the specification of the assessment time period, the measurement point, and the way of considering the reflection by acoustic obstacles like building facades are different in respective regulations/guidelines. These points should be discussed in I-INCE TSGs #3, #5 and #6 for the future discussion of the possibility of global policy for standardization and harmonization of legislative system regarding environmental noise problems.

The information about building codes regarding housing sound insulation, noise criteria in buildings, regulations/guidelines for occupational noise and requirements for noise labeling of consumer products is not sufficient at present and a systematic survey on these noise policy topics should be performed in the future. Also, additional information is needed on emission-oriented product and machinery noise policies that might be related to the control of environmental noise.

6. SUMMARY OF RESULTS AND DISCUSSION:

In addition to collecting and organizing the noise policy database which was the focus of the current effort, it was desired that a summary of the data collected be developed as an input to the development of a future Global Noise Policy, such as the current effort of I-INCE Technical Study Group #5: Global Noise Policy. However, as concluded by Lang and Tachibana [3], "It is difficult to compare the policies from one country to another because major differences exist between them. Complicating factors include the following:

- Differences in noise indicators and noise exposure metrics;
- Differences in assessment methods: measurement or calculation;
 - If by calculation, what computation method should be used
- Differences in duration of assessment times;
- Character of each legislative document: "Law," "Act," "Regulation," "Guideline," or "Standard"
- Control of emission from noise sources(s) or immission at receiver(s);
- Intention of specified noise levels: mandatory limits or targets;
- Requirements for existing situations or new installations, or both;
- Differences in measurement methods;
- Differences in location of measurement points:
 - Outdoors or indoors
 - Free-field (How to deal with façade reflection)
 - Measurement height above ground and location relative to nearby structures." ([3], p.

2)

In spite of these limitations, a review of the noise policy descriptive information provided by the questionnaire respondents made it possible to make the following general conclusions regarding the status of international environmental noise policies, at least for the countries participating in the survey:

- There are many different types of noise policies and many different societal influences which dictate what types of noise policies are adopted in a country. It is important to recognize the importance of societal influences, such as the attitude of the public towards the environment, their expectations concerning the role of the government, the type of legal system which exists in a country, and the financial and technical resources available to address environmental noise problems. These societal influences explain much of the differences in noise policies observed in the countries which were surveyed, indicating that these are topics need possibly might be considered in the development of any Global Noise Policy (one example is that the most stringent criteria for exposure to environmental noise occurs in the more developed countries).

- All countries surveyed reported having both noise emission and noise immission noise policies. Emission noise policies generally contain noise limits for controlling product noise at the source (at some specified distance) and for noise certification purposes. These are virtually always embodied in noise *regulations* (laws). Immission noise policies, on the other hand, concern the limits which are acceptable at a receiver's location, typically near the façade of a residence, and the majority of these are embodied in noise *guidelines*, rather than in *regulations*. The latter approach is typical for transportation noise sources, although many industrial noise and construction noise immission policies are embodied in regulations. Land use planning is often closely associated with the use of community noise immission policies. Some policies are applied only to existing and future developments, while others are applied retroactively to existing developments such as residential areas, especially for applications such as widening a highway or lengthening a runway at an airport. There were several areas where additional work is needed on the level of specification and applicability of various types of noise policies. This is an area where a coordinated international discussion and consensus-building effort could be quite beneficial.

- For the three common types of transportation noise sources (vehicles, aircraft and train), virtually all governments regulate noise emission from these sources because they are generally considered as national level (e.g., inter-state) products, and most operate under the International Civil Aviation Organization (ICAO) Chapter/Stage noise emission criteria for aircraft certification purposes. However, virtually all countries surveyed also use the environmental noise impact assessment and mitigation process, as defined in various noise policy guidelines documents, to allow flexibility in determining noise immission exposure levels in the community. Generally speaking, product noise criteria are typically based on sound power level or similar bases, while noise immission criteria use the family of metrics based on sound pressure level, such as LEQ.

- Road Traffic Noise: Virtually all surveyed countries have a combination of individual vehicle noise emission limits, embodied in national regulations, as well as national road traffic immission policies. The road traffic immission noise policies are typically embodied in guidelines, although some countries have now adopted immission regulations for road traffic noise. As expected, the noise limits vary considerably between various countries, based on the economic and technical considerations relevant to each country, the "will of the people", etc.. There is more variability in the metrics used to control road traffic noise than for other transportation noise sources. Although the majority of countries use a time-based LEQ metric, such as an LEQ for the busiest hour of the day, it is also not uncommon to see road traffic noise metrics such as L_{10} .

- Aircraft Noise: Most countries are required to follow the ICAO regulations for aircraft noise emissions (noise certification requirements), but most also have noise immission guidelines concerning aircraft noise intrusion into overflowed communities. ICAO regulations do not differ by country, but the flexible noise immission national guidelines reflect economic and technical considerations relevant to the circumstances of each country, the same as for road traffic noise. For aircraft noise immission policies, the most common noise metric is LEQ(24) or some variant of this, such as the Day-Night Average Sound Level (DNL), or perhaps Day-Evening-Night Average Sound Level (DENL). The use of WECPNL seems to be declining around the world, although many countries have still been using their own aircraft noise metrics, such as NNI, NEF, and Kosten units. However, in the future, all

European Union countries will be required to use the Day-Evening-Night Average Sound Level (DENL), as described in the new European Commission Environmental Noise Directive, although they will also be allowed to also maintain their own separate noise indices/metrics if they choose.

- Railway Noise: Most countries have a combination of railway noise emission regulations and community noise intrusion guidelines. Again, the guidelines allow flexibility for local conditions, but most countries use LEQ or one of its variants.

- Since immission noise policies are typically, but not always, implemented in noise guidelines, rather than in regulations, they allow for flexibility in determining acceptable levels of exposure (within limits). Most of the surveyed countries reported that they have guidelines describing a process to guide government bodies and local communities in conducting an environmental noise impact assessment and making final noise limit decisions on an individual development project basis. I-INCE Technical Study Group #6: Community Noise: Environmental Noise Impact Assessment and Mitigation is currently collecting additional information on these particular policies. This additional noise policy data will supplement the data collected by TSG #3 and will be made available through TSG #6.

- Implications for the development of a Global Noise Policy: It is apparent that a combination of noise emission and noise immission policies are used in virtually all countries to manage environmental noise at the national level. Hopefully, noise emission policies will continue to be implemented using both national and local regulations, while it is unclear whether noise immission policies should be embodied in noise “regulations” or continue to be implemented predominantly through noise “guidelines”. Standardization of noise measurement procedures needs considerable attention, as these differ considerably among countries. Hopefully the International Organization for Standardization (ISO) will fulfill this need in the future. Basically, there was more similarity across the countries participating in the present questionnaire survey in their overall approaches to implementing environmental noise policies than was originally expected. It is hoped that this level of consensus, at least at the noise policy concept level, will provide a substantive foundation for the future development of a Global Noise Policy.

7. CONCLUSIONS AND RECOMMENDATIONS

The results of the international questionnaire surveys conducted by TSG #3 showed that a wide variety of approaches have been used in different countries for developing their national noise policies. Thus, a direct comparison of noise policy structures and mechanisms across countries is not advisable because of these wide differences, although it does seem feasible to develop some useful generalizations on issues such as noise policy concepts, noise exposure criteria, etc. Compilation of the noise policy background material for TSG #3 provides a database of international noise policy documents and exposure criteria for additional uses in the future. Thus, the database, itself, is the primary product resulting from the current TSG #3 efforts.

The present project provided a wealth of information concerning the current status of environmental noise policies in many countries around the world. The databases provided in the Appendices to this report can be quite useful in a variety of efforts in the future and could be quite useful as an international baseline as one component of developing a Global Noise

Policy. It was originally proposed that the long-term goal would be to eventually develop a methodology to assess the effectiveness of environmental, and perhaps occupational, noise policies (including regulations, guidelines and Standards) in controlling individual and community noise exposure. ***The next step towards this goal is development and implementation of a modeling approach to describe national level noise exposures.*** This step is both necessary and feasible in the near future. The data which such a methodology would provide will be invaluable to politicians, the general public, and the engineering and scientific communities in planning strategies for managing, controlling and mitigating environmental noise exposure in the future. Use of this modeling/data collection methodology internationally would facilitate comparisons of environmental noise exposures across countries and would function as an international database of noise exposure, similar to efforts underway in other environmental areas such Air Quality.

A *second* possible project involves collecting new information in addition to that collected during the present project to better understand the similarities and differences between the noise policies of various countries. It was learned during the current project that a lot of detailed information can be obtained to describe existing noise policies, but it is more difficult to understand the conceptual and legal bases for these policies from these data. Thus, the Final Report recommends that a follow-on to the present project be implemented to obtain additional inputs from the participating countries on the history of their national noise policies and why particular choices were made. Relatively short “white papers” could be requested to provide a better understanding of the historical development of noise policies in various countries and the conceptual bases for these policies. This information could potentially be quite useful in later efforts to compare noise policies around the world and to the development of a “Global Noise Policy”. This second project would also solicit more data on specific topics that were underrepresented in the present project; most notably the following:

- A wider range of emission noise policies related to the general topic of “Environmental Noise”
- More information on policies related to the Environmental Noise Impact Assessment and Mitigation Process
- More data on construction and industrial noise policies
- More information on national and international Standards
- More information on occupational noise policies

In order for these proposed projects to succeed, they will strongly benefit from the existing close working relationships between I-INCE and other international organizations and professional societies, such as the World Health Organization, the United Nations, ICBEN, OECD, etc. Thus, the Final Report recommends that I-INCE initiate a follow-on project to the current TSG #3 effort to (1) collect additional international noise policy information, (2) finalize the sorting capabilities for the TSG #3 EXCEL database, and (3) develop an initial version of a national-level noise exposure model, and (4) prepare an initial plan for developing an interactive map of worldwide noise exposure, based on Geographic Information System (GIS) technology and noise exposure estimates, predominantly through a noise modeling approach. The Final Report recommends that this work be accomplished in coordination with the European Commission efforts to map noise exposure throughout

Europe, and possibly with the active support and involvement of representatives of the United Nations Environment Programme (UNEP).

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