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AMERICAN NATIONAL STANDARD

Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response

ANSI S12.9-2005/Part 4

Accredited Standards Committee S12, Noise

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ANSI S12.9-2005/Part 4
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AMERICAN NATIONAL STANDARD

QUANTITIES AND PROCEDURES FOR DESCRIPTION AND MEASUREMENT OF ENVIRONMENTAL SOUND — PART 4: NOISE ASSESSMENT AND PREDICTION OF LONG-TERM COMMUNITY RESPONSE

Secretariat:

Acoustical Society of America

Approved by:

American National Standards Institute, Inc.

Abstract

This Standard specifies methods to assess environmental sounds and to predict the annoyance response of communities to long-term noise from any and all types of environmental sounds produced by one or more distinct or distributed sound sources. The sound sources may be separate or in various combinations. Application of the method of the Standard is limited to areas where people reside and related long-term land uses. This Standard does not address the effects of intrusive sound on people in areas of short-term use such as parks and wilderness areas, nor does it address other effects of noise such as sleep disturbance or health effects. This Standard does not provide a method to predict the community response to short-term, infrequent, non-repetitive sources of sound.

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Contents

Figures

Tables

Foreword

[*This Foreword is for information only, and is not a part of the American National Standard ANSI S12.9 - 2005/Part 4 American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound - Part 4: Noise Assessment and Prediction of Long-Term Community Response.*]

This standard comprises a part of a group of definitions, standards, and specifications for use in noise. It was developed and approved by Accredited Standards Committee S12 Noise, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S12 is as follows:

> *Standards, specifications, and terminology in the field of acoustical noise pertaining to methods of measurement, evaluation, and control; including biological safety, tolerance, and comfort, and physical acoustics as related to environmental and occupational noise.*

This standard is a revision of ANSI S12.9-1996/Part 4, which has been technically revised. The changes in this edition harmonize with the new material added to ISO 1996-1:2003. This includes a minor change to high-energy impulse noise assessment (less than 1 dB) so that it is totally in sync with ISO. Second, as appropriate, ISO assessment adjustments have been included. Also, some new cautionary notes from ISO are added to the estimation of "highly annoyed" as notes to the informative annex. A new Annex G addresses complaints in the limited situation of high-energy impulsive noise.

The current edition of ISO 1996-1:2003 actually began as the text of ANSI S12.9 - 1996/Part 4. However, the ISO standard was substantially revised during the WG and committee deliberations. For example, ISO recognizes the more general Day-Evening-Night Sound Level in contrast to S12's Day-Night Sound Level. Nighttime hours are not given in ISO because they vary from country to country. The terms "background" sound and "ambient" sound are NOT used in ISO because they have diametrically opposed meanings in different countries and regions. There are many other differences of this nature. ISO uses "rating" sound level; ANSI uses "adjusted" sound level, etc.

At the time this Standard was submitted to Accredited Standards Committee S12, Noise for approval, the membership was as follows:

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Suggestions for improvements of this standard will be welcomed. They should be sent to Accredited Standards Committee S12, Noise, in care of the Standards Secretariat of the Acoustical Society of America, 35 Pinelawn Road, Suite 114E, Melville, New York 11747-3177. Telephone: 631-390-0215; FAX: 631-390-0217; E-mail: asastds@aip.org

Introduction

0.1 Part 1 of ANSI S12.9 defines day-night average sound level and other descriptors of community noise. Part 2 of ANSI S12.9 describes measurement procedures. ANSI S12.9/Part 5 provides a recommended relation between long-term usages of land and day-night average sound level for purposes of long-term land-use planning. Since the early 1970s, many agencies within the United States of America have used day-night average sound level as the fundamental descriptor to predict the community response to environmental sounds.

0.2 The 1978 seminal paper by T.J. Schultz demonstrated the efficacy of day-night average sound level for predicting the annoyance response of a community as a result of noise from highway traffic, railroad, aircraft, and some industrial sites. Implementation of the concept of day-night average sound level for prediction of community response often combined the sound exposures from such sources.

0.3 Day-night average sound level has been used to predict the annoyance response of communities to types of noises that were not included in the Schultz database for the relation between the percentage of a population expressing high annoyance and the corresponding day-night average sound level. These additional types of noises include sounds with special characteristics, such as impulsiveness, dominant pure tones, rapid onset, and strong low-frequency content.

0.4 Technical reports and articles published in refereed engineering and scientific journals demonstrated that the community response to these sounds may be predicted, provided suitable adjustments are applied. A practical procedure to apply these adjustments is provided by this Standard.

0.5 For situations where activity interference is the major concern, use of adjusted day-night average sound level or adjusted total day-night sound exposure may not be appropriate. For example, day-night average sound level without adjustments may be a better predictor of speech interference than adjusted day-night average sound level. Descriptors such as maximum A-weighted sound level, time-above, or speech interference level may be even more appropriate for predicting speech interference.

American National Standard

QUANTITIES AND PROCEDURES FOR DESCRIPTION AND MEASUREMENT OF ENVIRONMENTAL SOUND — PART 4: NOISE ASSESSMENT AND PREDICTION OF LONG-TERM COMMUNITY RESPONSE

1 Scope

1.1 This Standard specifies methods to assess environmental sounds and to predict the potential annoyance response of a community to outdoor long-term noise from any and all types of environmental sounds from one or more discrete or distributed sound sources. The sound sources may be separate or in various combinations. Application of the prediction method is limited to areas where people reside and to related long-term land uses.

NOTE The long-term period is typically one year. However, the user of this Standard can employ these methods for shorter periods of time, but they should report this change and not attempt to predict percent highly annoyed using Clause 8.3 or Annex F, since the Annex F data all represent long-term situations.

1.2 This Standard describes adjustments for sounds that have special characteristics so that the long-term community response to such sounds can be predicted by a method that is based on day-night average sound level or total day-night sound exposure. Sounds, such as from highway traffic, are evaluated directly by sound exposure or sound level without adjustment. The prediction method is directly analogous to the use of day-night average sound level to predict the response of a community to general environmental sounds.

1.3 This Standard does not address the effects of short-term exposure of people to intrusive sounds in locations such as parks and wilderness areas. The Standard also does not address other effects of noise such as sleep disturbance or health effects. This Standard does not provide a method to predict the response of a community to short-term, infrequent, non-repetitive sources of sound.

1.4 This Standard introduces the application of new descriptors: adjusted sound exposure and adjusted sound exposure level. The new descriptors are closely related to sound exposure and sound exposure level, respectively. The new descriptors are introduced to facilitate the prediction of the response of communities to the wide range of outdoor sounds covered by the scope of the Standard.

1.5 The sounds are assessed either singly or in combination, allowing for consideration, when necessary, of the special characteristics of impulsiveness, tonality, onset rate, and low-frequency content. In the same manner as sound exposure and sound exposure level are used to generate total day-night sound exposure or total day-night average sound level, adjusted sound exposure or adjusted sound exposure level are used to generate adjusted total day-night sound exposure or adjusted day-night average sound level.

1.6 Annoyance is not the only possible measure of community response. One frequently cited measure is numbers of complaints, sometimes normalized to numbers of inhabitants. Complaints can be particularly relevant near factories and plants, by airports and military installations, etc. Complaints do not correlate well with long-term average metrics such as DNL (see Refs. 7 and 8 for