

ANSI S12.9-2000/Part 6

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AMERICAN NATIONAL STANDARD

**QUANTITIES AND PROCEDURES FOR
DESCRIPTION AND MEASUREMENT
OF ENVIRONMENTAL SOUND —
PART 6: METHODS FOR ESTIMATION
OF AWAKENINGS ASSOCIATED WITH
AIRCRAFT NOISE EVENTS HEARD IN
HOMES**

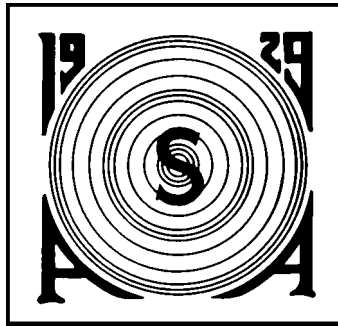
ANSI S12.9-2000/Part 6

Accredited Standards Committee S12, Noise

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ANSI S12.9-2000/Part 6

American National Standard
**Quantities and Procedures for Description
and Measurement of Environmental Sound—
Part 6: Methods for Estimation of
Awakenings Associated with
Aircraft Noise Events Heard in Homes**

Secretariat
Acoustical Society of America (ASA)

Approved 15 November 2000
American National Standards Institute, Inc. (ANSI)

Abstract

This Standard provides a method to predict sleep disturbance in terms of percent awakenings associated with the noise level of events in terms of sound exposure level (SEL). The Standard was developed using field studies of behavioral awakening primarily in homes near areas of routine aircraft takeoff and landing operations. The database used in derivation of the dose-response relationship consists of more than 5,000 subject-nights of observations in a variety of communities in the United States.

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Foreword

[This foreword is for information only and is not an integral part of ANSI S12.9-2000/Part 6, *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound—Part 6: Methods for Estimation of Awakenings Associated with Aircraft Noise Events Heard in Homes.*]

This Standard was developed under the jurisdiction of Accredited Standards Committee S12, Noise, which has the following scope:

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.

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

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Suggestions for improvement will be welcomed. They should be made in writing to Accredited Standards Committee S12, Noise, in care of the Standards Secretariat, Acoustical Society of America, 35 Pinelawn, Rd., Suite 114E, Melville, New York, 11747, USA.

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American National Standard

Quantities and Procedures for Description and Measurement of Environmental Sound— Part 6: Methods for Estimation of Awakenings Associated with Aircraft Noise Events Heard in Homes

1 Scope

This Standard defines noise levels that are associated with sleep disturbance in home settings in which people are familiar with the neighborhood noise environment. Sleep “disturbance” is defined as a behaviorally-confirmed awakening, as demonstrated by pressing a button upon awakening. Noise levels are quantified as indoor sound exposure levels of events occurring less than 5 minutes prior to the awakening. The Standard further assumes a population of normal hearing individuals with no sleep disorders.

The Standard does not address other aspects of sleep disturbance such as gross body movements, sleep stage changes, sleep latency or self report of sleep quality. The Standard does not apply to children or individuals in poor health.

2 Definitions

2.1 behavioral awakening. Awakening from sleep as confirmed by a specific motor action such as a button push.

2.2 noise event. A transient elevation of noise level. For aircraft noise events, the duration usually ranges from 5 to 60 seconds. Operationally defined as a level exceeding a threshold for a selected duration.

Common thresholds and durations of aircraft noise vary across studies from 60-70 dB and 2-10 seconds, depending on the range of maximum aircraft noise and ambient noise levels.

2.3 percent of awakenings. One hundred times the number of indicated behavioral awakenings divided by the total number of events or potential awakenings. $(100 \cdot n(\text{awakenings}))/n(\text{events})$

3 Relation of sleep disturbance (awakening) to noise of single events

Percent of people awakened is related to the indoor noise level of a preceding noise event occurring within 5 minutes by the following formula:

$$\text{Percent of awakenings} = -7.02 + 0.14L_{AE} \quad (1)$$

with a 95% confidence interval of $\pm 7.3\%$, where L_{AE} (from 50-100 dB) represents the indoor sound exposure level of a single event determined from estimates of single events or measurements of the single events of interest, made over a minimum of 9 hours encompassing the period from 10 PM to 7 AM. Measurements should be made with a single microphone located 3-5 feet above floor level and no closer than 3 feet from any wall within the sleeping quarters. Note should be made as to how the noise event sound exposure level was obtained.

Data from all of the studies used to derive this relationship (field studies only) are presented in figure 3 of annex A.

4 References

4.1 Informative references

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