ASA S12.13 TR–2002

Reaffirmed by ANSI May 29, 2020

AMERICAN NATIONAL STANDARD

Evaluating the Effectiveness of Hearing Conservation Programs through Audiometric Data Base Analysis

Secretariat:

Acoustical Society of America

ASA Technical Report Registered: 26 August 2002

American National Standards Institute, Inc.

Abstract

This ASA Technical Report describes methods for evaluating the effectiveness of hearing conservation programs in preventing occupational noise-induced hearing loss by using techniques for audiometric data base analysis. The rationale is given for using the variability of threshold measurements in annual monitoring audiograms as the basis for judging effectiveness. Guidelines are discussed concerning how to select a restricted data base to which the analysis procedures will be applied. Specific procedures for data analysis are defined, and criterion ranges are given for classifying program effectiveness as acceptable, marginal, or unacceptable. Sample results for industrial audiometric data bases contributed to Working Group S12/WG12 are included as an annex for reference and illustration.

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ASA TECHNICAL REPORT

Evaluating the Effectiveness of Hearing Conservation Programs through Audiometric Data Base Analysis

ASA S12.13 TR–2002

Accredited Standards Committee S12, Noise

Acoustical Society of America
Standards Secretariat
1305 Walt Whitman Road, Suite 300
Melville, New York 11747

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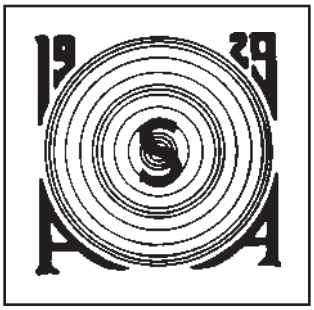

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ABSTRACT

This ASA Technical Report describes methods for evaluating the effectiveness of hearing conservation programs in preventing occupational noise-induced hearing loss by using techniques for audiometric data base analysis. The rationale is given for using the variability of threshold measurements in annual monitoring audiograms as the basis for judging effectiveness. Guidelines are discussed concerning how to select a restricted data base to which the analysis procedures will be applied. Specific procedures for data analysis are defined, and criterion ranges are given for classifying program effectiveness as acceptable, marginal, or unacceptable. Sample results for industrial audiometric data bases contributed to Working Group S12/WG12 are included as an annex for reference and illustration.

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Contents

Annexes

Tables

Figures

FOREWORD

[This foreword is for information only and is not an integral part of ASA S12.13 TR - 2002 *ASA Technical Report Evaluating the Effectiveness of Hearing Conservation Programs through Audiometric Data Base Analysis*]

This ASA Technical Report is a revision of Draft American National Standard S12.13-1991, which was published for a period of trial use and comment regarding the validity and usefulness of the recommended procedures for evaluating the effectiveness of hearing conservation programs (HCPs) through audiometric data base analysis (ADBA), and later unsuccessfully balloted for approval as a full standard. The ADBA procedures described are those recommended by the members of S12 Working Group 12 (S12/WG12) based on the results from their original research in applying suggested procedures to actual audiometric data bases (see Annex C), as well as the additional experience and feedback obtained from S12/WG12 members and other interested users following publication of the draft standard.

In spite of the unsuccessful ballot to convert the draft standard to a full standard, S12 deemed the contents of the document of substantial value for the hearing conservation community, and hence decided to publish them for guidance as an ASA Technical Report. The substantive negative comments during the balloting involved the following issues:

a) the possibility that gradual hearing loss in excess of that due to aging may occur in subgroups of the population evaluated in spite of acceptable ADBA criteria results on a year-to-year basis,
b) objections to the year-to-year nature of ADBA evaluations, which intentionally provide a set of indicators with values that vary annually to reflect current HCP status changes to alert personnel to incipient problems (in contrast to a single overall indicator across a long period of time),
c) concern that an inadequate selection of restricted groups for analysis by the evaluator might lead to failure to detect that different subgroups of the HCP population may show lesser degrees of protection from noise than the group selected for analysis,
d) the derivation of the numerical ranges for the criteria,
e) the fact that this results-oriented method does not address failures of omission by the HCP (such as failure to identify and include all noise-exposed individuals in the program) or failures of implementation by the HCP (such as failure to provide annual educational programs).

The Working Group chair did not elect to pursue reversal of the negative votes because the scope of changes desired by negative voters would have fundamentally altered the nature of the document. The ADBA method was developed as a tool for evaluating HCP effectiveness in terms of audiometric data variability from year to year. Other types of methods that reflect cumulative hearing loss over time are briefly described in Annexes A and B, but the intent of this document was to describe only the ADBA method.

Publication of this ASA Technical Report has been approved by the Acoustical Society of America. This document is registered as a Technical Report in a series of publications according to the Procedures for the Registration of ANSI Technical Reports. This document is not an American National Standard and the material contained herein is not normative in nature. Comments on the content of this document should be sent to the following address:

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This ASA Technical Report 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 ASA Technical Report was submitted to Accredited Standards Committee S12, Noise, for final approval, the membership was as follows:

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S. Blaeser, *Secretary*

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U.S. Naval Surface Warfare Center (NSWC) . . . . . .S.A. Fisher, J. Niemiec (Alt.)

Individual Experts of Accredited Standards Committee S12, Noise, were:

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R.W. Benson	R.K. Hillquist	J.P. Seiler
L. Beranek	D.L. Johnson	L.C. Sutherland
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W.J. Galloway	L.H. Royster	R.W. Young

Working Group S12/WG12, Evaluation of Hearing Conservation Programs, which assisted Accredited Standards Committee S12, Noise, in the preparation of this ASA Technical Report, had the following membership:

J.D. Royster, *Chair*
E.H. Berger, *Vice-Chair*

A. Behar	M.M. McDaniel	T.Y. Schulz
C. Dixon-Ernst	S.C. Megerson	A.P. Stewart
J.R. Franks	W. Melnick	A. Suter
J.W. Jabara	M. Roberts	E. Toothman
D.L. Johnson	L.H. Royster	

When preparation of this ASA Technical Report was begun, Larry H. Royster was WG chair.

Suggestions for improvement will be welcomed. Send suggestions for improvement to Accredited Standards Committee S12, Noise, in care of the ASA Standards Secretariat, 35 Pinelawn Road, Suite 114E, Melville, New York 11747-3177.
Telephone: +1 631-390-0215; FAX: +1 631-390-0217.

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0 INTRODUCTION

0.1 Need

Hearing conservation programs (HCPs) have been implemented in occupational, military, and other settings to protect noise-exposed populations from developing occupational hearing loss, which negatively affects individuals' quality of life. For industry in the U.S.A., the Occupational Safety and Health Administration (OSHA) has promulgated regulations defining minimum standards which the employer must follow in implementing an HCP. Similar requirements also exist for the mining industry (regulated by the Mine Safety and Health Administration) and HCPs in the military. However, these regulations currently give no guidance for determining program effectiveness.

Without evaluation procedures based on objective data, it is difficult for the personnel responsible for administering the HCP to determine whether the program is actually preventing occupational noise-induced hearing loss. Several authors [5–13] have discussed the need for systematic procedures to assess whether noise-exposed populations are being adequately protected and to identify any inadequacies in the HCP. The goal of standardizing procedures for audiometric data base analysis (ADBA) is to give objective data concerning HCP effectiveness to management, to the key individual responsible for the entire HCP, and to other personnel involved in implementing the program (safety professionals, industrial hygienists, noise control engineers, audiometric technicians, fitters of hearing protectors, audiologists, medical directors, and departmental supervisors who enforce hearing protector utilization). HCP personnel need information about the program's performance to make decisions about HCP policies, to achieve and maintain adequate employee protection, to justify resource allocations, and to motivate supervisors and employees [11,12]. In addition, a method for using audiometric data to judge HCP effectiveness could be useful to regulatory compliance officers.

0.2 Rationale

Because the purpose of HCPs is to prevent occupational hearing loss, the results of monitoring audiometry for noise-exposed personnel provide the obvious test of whether the HCP has been successful. However, audiogram results cannot alert the audiologist or physician reviewer to incipient hearing loss if the threshold measurements are so variable that beginning hearing shifts cannot be identified. Likewise, unreliable data invalidate attempts to assess long-term population hearing level trends. Even if the noise-exposed population is not developing occupational hearing loss, poor quality audiometric monitoring data render the HCP ineffective because professional audiogram reviewers cannot discriminate spurious threshold shifts from real hearing changes. The employer is penalized by having to deal with follow-up actions for shift rates which are inflated by poor quality data.

This report provides procedures for evaluating HCP effectiveness based on the variability in serial monitoring audiometry for the noise-exposed population. Year-to-year audiometric variability is selected as the basis for the ADBA procedures specified in this report because it provides an immediate indication of data problems. The evaluator is alerted by the high variability to investigate whether it results from inadequate protection from occupational noise, or from poor control of audiometric testing factors. Either way, corrective actions can be taken before many individual employees develop significant threshold shifts.

0.3 Alternative Approaches

Other valid approaches using population audiometric data to judge HCP effectiveness exist, but they are not amenable to standardization because their use requires the evaluator to make case-by-case judgments rather than applying a fixed set of criterion ranges to the results. For the reader's convenience, some of these techniques are summarized in Annex A.

Annual rates of OSHA standard threshold shifts (STSs) are frequently used as a measure of HCP effectiveness, but these rates cannot be interpreted in a meaningful way without knowing relevant characteristics of both the noise-exposed population and the audiometric data. Therefore, OSHA STS rates do not provide an indicator which is amenable to standardization. Further details are provided for the reader in Annex B.

Checklist or audit approaches to evaluating HCPs are also in common use, but these approaches usually merely tally the observed completeness of a program, or its nominal regulatory compliance, without assessing the quality of the program elements that are present. Sample checklists are available which attempt to address qualitative factors [14,15]. However, the usefulness of such audits depends on the expertise of the evaluator in recognizing the difference between cursory lip service to program requirements versus meaningful implementation.

Task-based statistics regarding HCP implementation (such as the percentage of audiograms administered on time, the percentage of retests obtained promptly, the percentage of employees observed to be wearing hearing