Spring 2001

UPDATE

VOLUME 12 • ISSUE 1

The Newsletter of the Council for Accreditation in Occupational Hearing Conservation

Chair's Message

by Peter Weber, MD MBA FACS, Representative of the American Academy of Otolaryngology Head and Neck Surgery

It's Spring!

It is with great pleasure that I inform you that Barbara Lechner has been appointed the Executive Director for CAOHC. Most of you already know Barbara as she has worked many years as the coordinator for CAOHC activities. We are very proud of Barbara's promotion and know that you will join with us in congratulating her. See page 5 for the "official" announcement.

This issue of the UPDATE contains three excellent articles that again will help you in your every day practice.

One of the more difficult aspects of hearing conservation is determining whether or not the hearing protection that is being utilized is actually attenuating the noise workers are exposed to. The article "Hearing Protector Testing – Let's Get Real" by Elliott Berger provides an exploration of the problems in rating hearing protector noise reduction performance. This article is a "must read" for anyone engaged in the use of hearing protection.

Part II in a series on engineering approaches to reducing noise exposure begins on page 4 and is titled "Selecting an Engineered Noise Control Approach: Controlling Noise at the Source, Path or Receiver" by Beth A. Cooper. This second part in the series builds upon the previous article and offers practical ideas for reducing noise in the workplace.

Finally, we have all experienced the difficulty of trying to test workers who are hard to test due to specific hearing loss patterns, tinnitus or malingering. This article offers suggestions for achieving accurate hearing results in these cases. It also gives guidelines for referring some of these more difficult patients for more detailed audiometric testing.

I'm sure that you will find these three articles as useful as I have.

(On behalf of the Council, I would like to thank our former Executive Director, Janet Otten, for her efforts on behalf of CAOHC and to wish her well in her future endeavors.)

Hearing Protector Testing – Let's Get Real

By E. H. Berger, MS Representative of the American Industrial Hygiene Association

Part I of a two-part series

So what's the deal? Here it is at the turn of the millennium and purchasers of hearing protection devices (HPDs) still can't trust the numbers. They still have no easy way to measure the effectiveness of hearing protectors, and the Noise Reduction Rating (NRR) wars continue. There is still disagreement as to the solution of the problem and most manufacturers of HPDs persist in stonewalling any proposal that would lead to lower NRRs. Users are beguiled into focusing most of their attention on high NRRs either because at some gut level they feel this will protect more workers or perhaps because it makes it easier to comply with hearing conservation regulations, or both. What is a hearing conservationist to do? This article[1] will explore the dilemma, providing both a perspective and suggested alternatives, including the application of "Method-B" testing as described in the most recent U. S. standard on measuring HPD attenuation, ANSIS12.6-1997.[2]

Background

A basic question of interest to users and specifiers of hearing protection is the amount of protection that such devices provide. Unfortunately the question has more than one answer. Do you want to know the maximum protection for well-fitted users, the average protection for groups of users in a typical hearing conservation program (HCP), the expected protection for inadequately trained and motivated wearers in many of today's typical programs, the values obtained by a given individual, or some other value? How do you want your data provided: mean attenuation and standard deviation values at

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CAOHC Approved OHC Courses

When you are registering for a recertification course (or if your fellow staff member is registering for the first time at a certification course), please confirm with the registrar that "this is a CAOHC approved" course. Only certified Course Directors, who have received a course approval certificate from the CAOHC Executive office, can conduct an occupational hearing conservation course that leads to CAOHC certification. Course Directors must display this certificate of approval in view of their students. If you don't see it, please ask your Course Director.

If you are uncertain whether the course you are planning to attend is certified by CAOHC, please contact Chris Whiting at the CAOHC office at 414/276-5338 or e-mail info@CAOHC.org

OSHA Releases the Revised Recordkeeping Rule - CFR 1904

The long-awaited OSHA final rule on "Occupational Injury and Illness Recordkeeping and Recording Requirements" was published January 19, 2001 in the Federal Register. For the first time, OSHA has included very specific requirements for recording occupational hearing loss.

Key features as they relate to hearing conservation programs are:

- A change in hearing must be recorded when the average shift at 2000, 3000, and 4000 Hz is 10 dB or greater in either ear (Standard Threshold Shift [STS]).
- Age corrections may be used when calculating STS.
- If the employer chooses to retest an employee showing STS, the retest must be completed within 30 days.
- Recording is required within 7 calendar days of: (1) confirmation of STS by retest, or (2) the end of the 30-day retest period if a retest was not conducted. Recording is not required if the STS is not confirmed by the retest.
- Work relatedness is presumed when occupational noise exposure is 85 dBA TWA or greater, unless a physician or other licensed health professional determines that the case is not work-related or significantly aggravated by workplace noise.
- A five-year retention of the OSHA Log 300 is required.
- **Effective date: January 1, 2002**

For a full copy of the revised regulation, visit the OSHA Web site: http://www.osha-slc.gov/recordkeeping/index.html

Further information will be provided in the next issue of the UPDATE.

Twenty-Five "Most Active" Course Directors for 2000 Announced

The CAOHC Council is pleased to announce the twenty-five most active Course Directors for 2000. These CDs taught 2,532 students who were then certified as Occupational Hearing Conservationists by CAOHC. This represents 57% of all students who certified or recertified in 2000. Congratulations to all!

1. John Elmore (Precision Hearing – Helotes, Texas)
2. Timothy Swisher (Employee Health-Pittsburgh, Pennsylvania)
3. Melette Meloy (Sound Solutions-Dallas, Georgia)
4. Kathryn Deppensmith (OMI- Houston, Texas)
5. Thomas Thunder (Acoustic Associates-Palatine, Illinois)
6. Mary McDaniel (Pacific Hearing- Seattle, Washington)
7. Valerie Newman (HESc – Kansas City, MO)
8. Robert Rhodes (OMI- Houston, Texas)
9. Rodney Atack (Hearing & Speech Health Care- Portland, Oregon)
10. Roger Angelelli (Audiometric Baseline Consulting-Bethel Park, Pennsylvania)
11. William Wolfe (ETC – Atlanta, Georgia)
12. Cynthia Bloyer (HESc – Kansas City, Missouri)
13. A. Gregg Moore (HESc - Marietta, Georgia)
14. Pamela Cronin (Jordan Valley Audiology – West Jordan, Utah)
15. Paul Kurland (Bay Hearing Conservation – Green Bay, Wisconsin)
16. Anne Giroux, (self-employed – Winslow, Maine)
17. Ellen Kelly (Center for Speech & Hearing Sciences, Inc. – E. Brunswick, New Jersey)
18. Melissa Lyon (Gunter Audiological Services – Marion, Indiana)
19. Barbara Garrett (St.Luke's Hearing Conservation Services – Sioux City, Iowa)
20. Charles Fankhauser (MEDI – Benicia,California)
21. Thomas Norris (The Hearing Center – Omaha, Nebraska)
22. Meredy Hase (Hearing Services, Ltd. – Milwaukee, Wisconsin)
23. Thomas Dolan (Speech & Hearing Sciences/Portland State University – Portland, Oregon)
24. Edward Korabic (Marquette University – Milwaukee, Wisconsin)
25. Moreland, Rebecca (Chesapeake Occupational Health Services – Baltimore, Maryland)

OHC Corner

Hard to Test Workers

By Linda Frye, COHN-S/CM MPH RN
Representative of the American Association of Occupational Health Nurses

Illustration provided courtesy of E•A•R Hearing Protection Products

As an OHC I have been challenged by some workers during the audiometric procedure. I am sure many of you have your own stories to share as well. Employees who already suffer from hearing loss such as those with tinnitus or a sensorineural hearing loss such as presbycusis frequently arrive for testing with a heightened level of anxiety. Individuals who have difficulty hearing are often times self-conscious or embarrassed and they may "act out" in order to conceal the truth. Let's take a few minutes to consider the hard to test worker's perspective and alternatives that might help us as OHC's accomplish our objectives.

Hard-to-test workers have often had a negative experience during testing. This might be due to being in the booth for extended periods of time, or frustration because they have difficulty distinguishing the audiometric tones from the sounds they hear in their head. If such an employee presents with an "attitude" and is greeted by an OHC with an "attitude" because of the employee's reputation for being difficult to test, you can imagine the outcome is not going to be the desired one.

Over the years I, and other OHCs I know, have developed a few tricks for getting the best results during audiometric testing, even under difficult circumstances. These tips are not based on research and may not be appropriate in every situation, but I hope you will find them helpful. If you have others that you want to share please contact me through the CAOHC office and we will pass them on to you in future UPDATE newsletters.

Testing Tips For the Hard-To-Test Employee:

1. When a worker becomes difficult to deal with, try to pause before responding and look at things from their perspective. Perhaps they have had a bad day at work or they are concerned about the job while they are away for the testing.
2. Remember that not everyone will test well with a microprocessor. I suggest that you test an occasional employee using the manual mode to maintain your skills. If you have an agitated worker who does not test well in the microprocessor mode and you as the OHC are not comfortable and efficient in switching to the manual mode, the testing process will not go smoothly. It is essential for all OHCs to remain very familiar with the manual testing procedure. Unfortunately, some employers believe that when they purchase a microprocessor that they don't need a trained OHC such as those who attend a CAOHC approved course and become CAOHC certified.
3. If an employee has a chronic problem such as tinnitus and needs to be tested manually, mark their audiogram "test manually" to avoid wasted time and frustration next time they come in for testing.
4. If a listener has tinnitus, it's often helpful to use a "pulsed" tone rather than a continuous tone for testing (listeners often report that there is less tendency for the pulsed tone to "blend in" with the tinnitus).
5. When you have a known difficult employee to test and you have more than one OHC in your department, match the employee with the OHC who has the best rapport right from the start.
6. Keep in mind that management has the ultimate responsibility for the hearing conservation program. Should you encounter a worker who is disrespectful or non-compliant in spite of your best efforts to accommodate them, stop the testing process and call the appropriate management contact for further assistance.
7. Avoid leaving a worker in the testing booth for extended periods of time during the manual testing procedure. After a reasonable time period (e.g. 10 minutes) allow the worker to come out of the booth to rest, have a drink of water, etc. before proceeding. For those of us who have been tested ourselves, you know that after awhile you begin to hear your own heart beat and are afraid you will miss a tone if you swallow, etc.
8. Those who wear hearing aids must remove them before testing. For those of us dependent on reading glasses, it can be frustrating to be told to read without them. Now imagine being told to hear without your hearing device. Be sure to explain what, why, and when to win support for the testing procedure. Point out beforehand that the test will not be valid with the hearing aid in place because of possible acoustic feedback for example; remind them that the purpose of the test is to find out about their hearing, not their hearing aid. Then, share the results in a positive way with the worker after they have put the hearing device back on.
9. If the only reason for your interaction is to "get the test done" you may be missing the big picture. Inspiring workers to be proactive managers of their own health and well being will have far reaching benefits.

I remember a saying that goes something like, "Isn't it great to love what you're doing and doing what you love." Sometimes it takes a difficult worker to remind us what and why we are doing what we do. Being an OHC is a privilege I value and I hope you feel the same way, too.

Do you have experience with hard-to-test workers? Send your advice to CAOHC, and we'll share it with other OHCs.

Selecting an Engineered Noise Control Approach: Controlling Noise at the Source, Path or Receiver

By Beth A. Cooper, PE INCE.Bd.Cert.
Representative of the Institute of Noise Control Engineering
(Part 2 in a series on engineering approaches to reducing noise exposure.)

Ideally, the selection of an engineered solution to a noise exposure problem is the product of a collaborative planning process that involves, at a minimum, the OHC, the exposed employees and their management, and a noise control engineer. The OHC plays a very important role in this process by bringing the members of the team together to develop a solution to the problem in a participative but very organized and systematic manner. Although the development of the technical specifics of the solution is clearly the responsibility of the noise control engineer, the *selection* of the *approach* should be based on a variety of factors that are best identified and documented by the OHC during field visits and employee interviews prior to bringing the noise control engineer into the discussions. The first installment in this series, "Considering an engineered noise control solution," (Winter 2000/2001 issue of *UPDATE*) presented two checklists that OHCs may use to identify and clarify the objectives as well as the relevant parameters and physical restrictions that will govern the operation of the installed solution. Only when that information is well documented and agreed to by the members of the in-house team, will the involvement of an outside noise control engineer be both helpful and cost effective.

Although not nearly as important as an understanding of the noise exposure problem itself, a familiarity with the basic approaches to engineered noise control will help the OHC and the other decision-making members of the team better understand the noise control engineer's recommendations. In turn, the OHC will be in a stronger position to advocate for funds to implement the recommended solution and to ensure that any equipment installed as part of the solution will be used and maintained by the exposed employees in a manner that preserves its intended (noise control) function. This article will discuss the basic approaches to engineered noise control and some of the factors that influence their selection and implementation.

Illustration provided courtesy of E•A•R Hearing Protection Products

Since noise exposure is a function of both the noise level *and* the duration of time over which employees are exposed, exposure may be controlled by reducing either, or both, of these elements. Reducing the duration of exposure is the basis of what is referred to as "administrative controls," which typically does not involve any engineered reduction in the noise level (although certain engineered solutions actually do accomplish their goals by reducing the duration of exposure). Since we are concerned here with *engineered* approaches to reducing noise exposure, let's concentrate on how we might control noise exposure by reducing the *level* of the noise to which employees are exposed. There are three general approaches, two of which are discussed below, along with examples of typical applications. The third approach will be the focus of the next installment in this series.

Source noise control. Noise control at the source is accomplished by changing the noise-generating equipment or process, which results in a reduction in the amount of noise that is produced by that particular source. Accordingly, the noise level associated with the treated source(s) is lowered in the entire surrounding area, and the noise exposure of all persons who happen to be in the area is reduced. If there are multiple noise sources that contribute substantially to employee noise exposure, each of these sources must be treated in order to realize a measurable reduction in the sound level in the work area. Examples of source noise control include, but are not limited to, the examples presented below.

- Changing or eliminating the basic mechanism of sound generation in a way that accomplishes the same task with less noise output. This is often the most ambitious type of noise control project and one that requires specialized expertise beyond a general understanding of noise control engineering. The potential benefits make it an option worth considering, however.
- Replacing noisy equipment by intentionally purchasing or designing newer, quieter equipment. Needless to say, implementation of a corporate "Buy Quiet" policy can prevent today's purchases from becoming tomorrow's noise control projects.
- Retrofitting the noise-generating machinery with parts that are expected to lower the noise emission, such as a different motor or fan.

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Another Successful CD Workshop

Congratulations to the three new Course Directors who certified at the recent Course Director Workshop in Salt Lake City, Utah on March 9, 2001 at the Embassy Suites Hotel. This 8-hour workshop is a requirement for new Course Directors and instructs the CD on how to conduct an OHC 20-hour certification and 8-hour recertification course. In addition, nine Course Directors chose the workshop method for recertification.

The Council would like to congratulate these Course Directors and wish them well in their hearing conservation work.

Alicia Alexander, MA CCC-A
Great Lakes, IL

Patricia A. Carlisle, CIH
Harrison, AR

Debra C. Roby, RN COHN
Gonzalez, FL

Kathryn M. Deppensmith, MS CCC-A
Houston, TX

Dianne Stewart, RN COHN-S
Salt Lake City, UT

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Logan, UT

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Michael Robinson, MS CCC-A
Upland, CA

J.Stephen Sinclair, PhD
Altadena, CA

Walter J. Smoski, PhD CCC-A
Bloomington, IL

Richard L. Stepkin, MS CCC-A
Lindenwold, NJ

Lechner Appointed Executive Director

Barbara Lechner was recently appointed as CAOHC's Executive Director. Lechner has served as the Associate Executive Director for the past two years, originally joining the CAOHC staff in 1995.

As Executive Director, she will manage the daily activities of CAOHC. In addition she will coordinate projects and programs being develop by the Council. Lechner will remain in her role as liaison to CAOHC Course Directors.

WEB SITE UPGRADE

Click on www.caohc.org and review the new upgrades to our Web site! We think the site is easier to navigate.

Check under the heading Newsletter – *Update* for a new glossary of articles – some of these articles are available for your downloading.

The 3rd Edition, *Hearing Conservation Manual by Alice Suter* is now available as an on-line order form. Along with this form, you can also notify CAOHC via e-mail of changes to your address.

If you have any suggestions for improvement of CAOHC's Web site, please contact us at info@caohc.org

Letter to the Editor

Dear Editor: I recently heard that OHC's need to be licensed as audiometric technicians in their state. Is this true?

Dear OHC: The answer to this question depends on your state. There are a number of various state government agencies which may claim jurisdiction over your actions as an Occupational Hearing Conservationist (OHC). For example, state Departments of Labor in Oregon and Washington require CAOHC certification for OHCs. The Department of Health in Texas requires registration of all audiometric technicians, including OHCs.

More commonly, state medical and/or audiology licensure boards may have special requirements for your professional supervisor in regard to "support personnel." That is, your state's audiology board may require that licensed audiologists register OHCs as "audiology aides." Likewise, OHCs operating under the supervision of a physician are typically subject to your state's medical practice laws.

To find out more about your state's licensure requirements, contact your hearing conservation program manager or your supervising audiologist or physician.

WORKSHOP FALL 2001

Fall 2001 Course Director Workshop

The Council will conduct the fall Course Director workshop on Monday, October 1, 2001 in Baltimore, Maryland at the Embassy Suites Hotel BWI. This workshop is a requirement for Course Director certification upon application approval by the CAOHC Screening Committee.

Course Directors may also choose the workshop method for recertification. All questions may be directed to Barbara Lechner, Executive Director, at 414/276-5338.

ANNOUNCES NEW ADVERTISING OPPORTUNITY!

For the first time in it's history, the CAOHC Council and Publications Committee announces the availability of advertising in the UPDATE newsletter.

We are making half-page and quarter-page space available to anyone wishing to inform our readership of their products, services or programs. We will not inundate you with ads and plan to keep ad space limited initially to no more than one page in this 12-page format. All advertising material submitted must be relevant to the interests and needs of our constituency and subject to editorial review. Space will be sold on a first-come/first served basis.

About the UPDATE newsletter

Our readership of Certified Occupational Hearing Conservationists consists of:

- 56% registered nurses
- 25% medical assistants/technicians
- 19% other
- Certified course directors are 85% audiologist;15% engineers, certified occupational health nurses, and others representative of CAOHC's CPO organizations.
- 42% of OHCs conduct 100-499 audiometric tests annually, and
- Course Directors conducted 542 CAOHC courses in 2000 with 7,000 students in attendance.
- 94% of our readership rated the UPDATE newsletter with high regard for informational content.

We mail to over 22,000 Certified OHCs; Course Directors; and others such as scientific writers and CPOs on a quarterly basis.

2001 Rate Card

1/2 Page (7 ½" x 5" horizontal) or (10" x 3 3/4 " vertical) $1,100.00 per issue
1/4 Page (3 6/8" X 5") $750.00 per issue

4% discount available on multiple issue ad placement (to qualify for multiple issue rate, ads do not have to be consecutive, but must fall within 4 consecutive issues).

Closing Dates

Spring Issue:	February 27, 2001
Summer Issue:	May 28, 2001
Fall Issue:	August 20, 2001
Winter Issue:	November 30, 2001

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•Phone: 414/276-5338 •Fax: 414/276-2146 •E-mail: info@caohc.org

Noise Control Approaches

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- Performing maintenance and repairs to reduce noise generated by problems like worn parts (e.g., bearings), unbalanced rotating machinery and equipment that is being operated at an off-design condition. A good noise control engineer will be able to diagnose this type of problem by identifying characteristic symptoms in the noise signature of a particular piece of equipment.

Ideally, noise is best controlled at the source, since reducing the generation of noise usually has more widespread benefit than approaches that treat only specific locations in the work area or specific receivers (employees). But, source noise control solutions are typically expensive and may require modifications to the source that are not technically feasible. Additionally, in areas where there are multiple sources contributing to the noise level, treating all of the sources (which is required to achieve an appreciable reduction in noise level) is often simply impractical.

Illustration provided courtesy of E•A•RHearing Protection Products

Path noise control. This approach to reducing noise exposure acts along the path between the source and the intended receiver (the exposed employees) without interfering with the source itself. By inserting a noise control device in the path, the transmission of sound to the receiver is prevented or greatly reduced. This approach does not change the amount of noise that is produced, but it reduces the sound level due to the source(s) located upstream of the device and, thus, the exposure of employees who happen to be in the area *downstream of the noise control device*. Some examples of path noise control follow.

- Installing a noise control "device" such as a silencer (muffler) in the flow stream of gas or fluid flow systems to reduce the noise produced by venting, exhaust flow or turbomachinery located upstream of the silencer.
- Enclosing a noisy machine with a complete or partial enclosure to prevent or reduce the transmission of sound to the surrounding area. One example that might not come to mind immediately is acoustical pipe lagging, which prevents noise in the piping from radiating through the pipe wall to the surrounding environment.
- Repairing existing equipment enclosures and replacing missing parts. Noise "leaks" into or out of a structure that encloses either the source (or the receiver, for that matter) may be reduced by identifying and repairing gaps and openings in the enclosure. Often, these leaks can be easily identified and repaired without any specific knowledge of noise control engineering. Some guidance for "do it yourself" noise control will be the subject of a future installment in this series.
- Adding absorption to the surrounding space to reduce the buildup of reverberant sound in the work area. Although this will not reduce the noise level near the source (nor the noise exposure of employees in the vicinity of the source, such as at the "operator" position of a piece of machinery), it *will* prevent noise generated in one area of the plant from reverberating throughout the space and *causing* a problem in areas remote from the original noise source.

Receiver noise control. Control of noise at the receiver prevents or reduces the *reception* of noise by enclosing the affected employee(s) in a sound-attenuating structure. Receiver noise control treatments do not reduce the amount of noise produced by high-noise equipment, nor do they lower the sound level in any part of the work area (other than inside the sound-attenuating structure). This particular type of engineered solution works by reducing the *duration* of the affected employees' exposure to the noise produced by high-noise equipment in the work area. Protecting the receiver is typically the least elegant approach to retrofit engineered noise controls and one that may impose cumbersome operational restrictions. Receiver noise

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Noise Control Approaches

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control has its place, however, and is often the easiest, most affordable and most accessible option, particularly in environments where multiple pieces of high-noise equipment contribute to the overall sound level. Here, source or path noise control approaches are likely to be unreasonably expensive, whereas enclosing noise-exposed employees in a sound-attenuating structure (when they are not specifically required to be working in the equipment area) effectively reduces the employees' exposure to *all* noise sources. Below are a few examples of this kind of approach.

- Constructing a "quiet" room (e.g., office, breakroom, control room, lunchroom) within the high-noise work area, where employees may spend time between operations, maintenance or monitoring tasks that require them to work on and around the high-noise equipment. Often, sound-attenuating structures are custom-designed by a noise control engineer and are constructed in the field from standard materials, much like any other building. There are also high-quality prefabricated units that may be purchased directly from a reputable vendor; these should be selected to provide the required amount of noise reduction. Although it sounds deceptively simple, the design of noise-attenuating structures is a fairly technical matter that requires the involvement of a noise control professional to ensure the acoustical integrity of the structure. A future installment in this series will explore the characteristics of properly designed noise-attenuating structures, both traditional and prefabricated.
- Smaller versions of the above "quiet" rooms, communication booths are prefabricated sound-attenuating structures placed strategically around high-noise work areas in locations where there are no other quiet spaces. These booths are sized to accommodate one or two employees, who may safely remove personal hearing protectors and communicate with each other or, via telephone or radio, with remote dispatch or control stations.
- Wearing personal hearing protectors, including communication headsets is a form of receiver noise control that is mentioned here for completeness.

The effectiveness of a receiver noise control approach depends on the willingness of the receiver to intentionally take advantage of the availability of the controls at every opportunity. An appreciation of the advantages and disadvantages of the three approaches will provide the OHC with a basis for evaluating the tradeoffs between the goals of the project and the potential effectiveness of each approach being considered. The next installment in this series will illustrate some examples of simple noise control techniques that may be easily implemented by the OHC to solve minor noise problems *without* the need for formal engineering. To assist the OHC with the solution of more complicated projects, the last installment of the series will describe resources and suggested procedures for obtaining and benefiting from professional noise control engineering support.

To be continued in the Summer 2001 Update.

Hearing Protector Testing...

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octave-band center frequencies, the NRR[3], the NRR(SF) [Noise Reduction Rating (Subject Fit)],[4] the HML,[5] a Class rating,[6,7] or some other value? And would you like it de-rated with a one-size-fits-all value or perhaps a device-type specific value, and should the de-rating be included in the number as provided, or incorporated by the user after the fact?

Prior to 1979, attenuation data for HPDs were commonly available from manufacturers, but only in the form of octave-band values mentioned above, and indeed, U. S. occupational hearing conservationists almost exclusively utilized the octave-band method of computing protection (also called the "long" method or NIOSH Method #1). In fact, in most instances HPD attenuation values were simply ignored because of the difficulty of acquiring octave-band workplace noise measurements with the instrumentation of that era, combined with the difficulty in the pre-calculator and pre-PC age of performing multiple tabular computations.

The advent of the NRR, and the accuracy and simplicity that it seemed to provide, substantially changed the picture. Much attention was then focused on HPD attenuation values. In many instances, either purchasing specifications or HCP policies were based upon the NRR. As a result, manufacturers highlighted the NRR to a greater extent in their literature, and a battle of numbers arose as more attention was directed at this ostensibly critical parameter. In many cases, purchasing decisions came to be predicated upon differences in NRRs of as little as 1 dB.

Use of the NRR became even more entrenched in the 1980s when OSHA included it as the preferred method for assessing HPD adequacy for compliance with the Hearing Conservation Amendment.[8] One result has been that in many instances additional key parameters of performance such as comfort, compatibility, communication needs and hearing ability are neglected or overlooked in favor of choosing the HPD with the highest possible NRR. This can lead to wearer dissatisfaction and consequent misuse or even non-use, resulting in inadequate protection or none at all. At the other extreme, correct use of products with too much noise reduction can create communication and safety problems, especially for workers with preexisting hearing losses.[9]

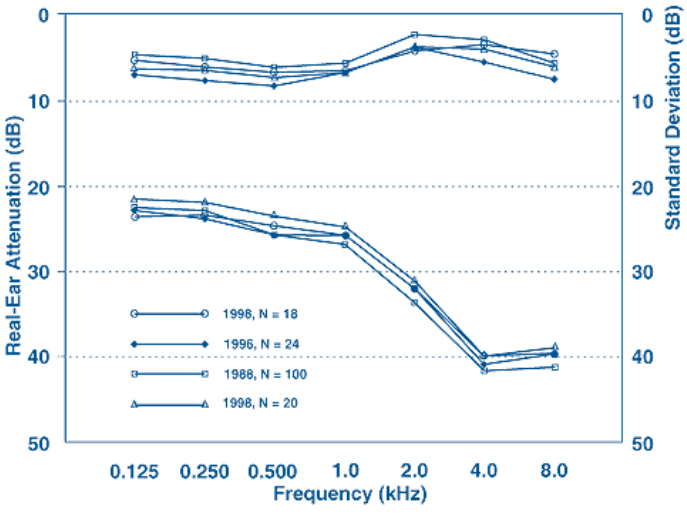

Figure 1 - Four subject-fit estimates of attenuation for a foam earplug.

Even more fundamental than grappling with the issues mentioned above is the complexity of answering the natural and seemingly straightforward question - How much noise reduction can hearing protectors provide? In fact, the accurate estimation of the attenuation that wearers of HPDs receive under conditions of actual use (also called "real-world" attenuation), has been a topic of substantial research. The facts are presented by Berger[1] along with commentary about the dangers of high-labeled NRRs. Although the technicalities of the measurement problem are well understood and documented, the methods of modeling the behavioral aspects of real-world users in a laboratory setting have only been recently standardized.[2,10]

One Solution – Individual Fit Testing

Arguably the best approach to assigning HPDs with the proper attenuation is to individually fit test each wearer. This is time-consuming, but well worth the effort. Not only does it provide the most accurate assessment for an individual user (presuming they wear the device in the same manner in actual use as they did during the test), but it affords an excellent opportunity to train and motivate the employee as well. A number of methods are available, but the most practical is to use large circumaural cups with built-in speakers to conduct a real-ear attenuation at threshold evaluation.[11] Today, off-the-shelf devices are available for such testing,[12] but few companies can find the time to implement such a procedure. In the future American National Standards Institute (ANSI) Accredited Standards Working Group, S12/WG11 (Hearing Protector Attenuation and Performance), will look at standardizing such an approach.

An Alternative Solution – Improved Laboratory Testing

A new approach to resolving the above dilemma is now available. In 1997 a national standard that describes how to measure, in the laboratory, the real-ear attenuation of HPDs, was approved by the American National Standards Institute (ANSI). The standard, entitled *Methods for Measuring the Real-Ear Attenuation of Hearing Protectors* (S12.6-1997)[2] was the culmination of nearly a decade of research by S12/WG11.[10] The most exciting aspect of this standard is that it includes a procedure, designated *Method B, Subject Fit*, which provides data that approximate the protection that can be attained by *groups* of informed users in workplaces with representative well-managed and well-supervised occupational HCPs. The 1997 standard also includes a Method A, Experimenter-Supervised Fit, which retains practices from the 1984-version of the same standard that are designed to describe the capabilities of HPDs under ideal conditions.

The new standard was developed after years of research and a four-facility interlaboratory study.[13] It specifies laboratory-based procedures for measuring, analyzing, and reporting the noise-reducing capabilities of conventional HPDs using tests conducted on human subjects. The standard is not a method of approval of products, nor a quality assurance procedure. It simply provides noise-reduction data. However, the existence of the Method-B procedure is quite valuable since leaders in the field have pointed out for over a decade that labeled NRRs computed from existing data, as specified by the Environmental Protection

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Hearing Protector Testing...

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Agency (EPA), overestimate work-place protection for groups of users by as much as 25 dB, depending upon the hearing protector, as shown in Figure 1 of EARLog 20.[1]

The keys to Method B are the subjects and how the experimenter works with them. In the EPA-specified procedure the subjects behave as test fixtures while the experimenter optimally fits the product (often for earplugs in an unrealistic and uncomfortable manner). In Method B, the subjects, although trained and experienced in audiometric test taking, are naïve with respect to use of hearing protection and are simply told to fit the device to the best of their ability. They work from the manufacturers' printed instructions with no assistance whatsoever from the experimenter.

That the new standard exists is the good news. The bad news is that the regulation which specifies the labeling of hearing protectors,[3] not only does not recognize the new 1997 standard, but still requires testing by the government's interpretation of a 27-year old standard that is no longer supported by ANSI (S3.19-1974[14]). Because there is no one home at the EPA's noise office, the agency responsible for the promulgation and maintenance of the regulation, nothing is being done to revise the existing rule. In short, the current hearing protector NRRs, based upon testing to the old ANSI standard are of even less accuracy and value than the original much-maligned EPA fuel-economy ratings. The procedures behind the fuel-economy ratings were improved; those behind the hearing protector ratings have not been.

The HPD rating situation is even more egregious, since the advice of the professional community has been ignored. Their consensus recommendations, developed in 1995 by the National Hearing Conservation Association's (NHCA) *Task Force on Hearing Protector Effectiveness*, called for testing and labeling according to the new Method-B procedure.[4] The recently revised NIOSH *Criteria for a Recommended Standard: Occupational Noise Exposure*[15] also specifies Method-B testing, although in the absence of such data NIOSH provides a variable derating based upon the work of Berger et al.[11] Furthermore professional organizations such as the Acoustical Society of America (ASA), the American Speech-Language Hearing Association (ASHA), the American Academy of Otolaryngology / Head and Neck Surgery (AAO/HNS), the Council for Accreditation in Occupational Hearing Conservation (CAOHC), NHCA, and others, have all written directly to the EPA petitioning them to revise the regulation. Yet nothing has happened.

Curiously, the only participant in the NHCA Task Force that has been steadfastly opposed to the new test data is the Industrial Safety Equipment Association's (ISEA) Hearing Protector Group, composed of representatives of the manufacturers of HPDs. Exactly why some members of this group do not see the benefits of representative and useful ratings is a confusing and contentious issue; it will be up to the readers of this article to contact manufacturers with whom they do business, or the ISEA itself, to further explore their concerns.

Representative Method-B Data

Laboratories are currently involved in implementing the new Method-B testing. One laboratory is examining various aspects of the protocol as well as acquiring data on a large range of available products.[16] A concern regarding Method-B testing has been the repeatability (variability within a lab) and the reproducibility (variability between different labs) of such data. S12/WG11 addressed Method-B interlaboratory variability and found it as good or better than other laboratory protocols.[10] Figure 1 provides illustrative data from one laboratory.[16] Four sets of results for the E·A·R® Classic foam earplug are compared, as collected by three different experimenters over a 10-year period. The values closely compare across the four studies with the computed overall NRR-type values falling within a range of 3 dB.

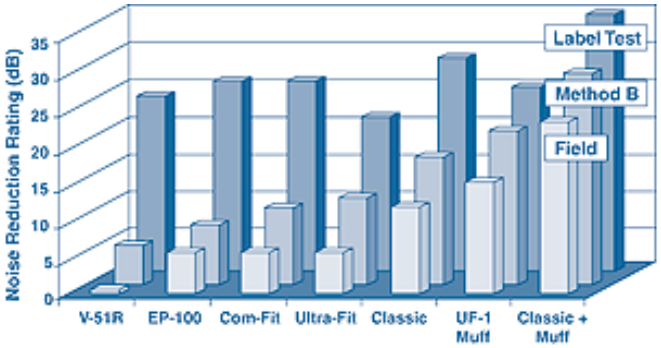

Figure 2 - Comparison of labeled data (ANSI S3.19) to field performance,[11] and to Method B (ANSI S 12.6). Labeled NRRs computed with a 2-SD correction; field and Method-B data are NRR(SF)s computed with a 1-SD correction to represent 84% of the users.

More to the point, however, Method-B data have been shown to provide a much better indication of "achievable" results than do existing labeled values.[13] "Achievable," means values that are among the higher levels of attenuation attained by *groups* of informed users in well-managed industrial and military HCPs. Recent Method-B data are presented in Figure 2.[16] In this chart field data are plotted using the NRR(SF) instead of the NRR (see rating discussion later in this article). The Method-B values [also using the NRR(SF)] are included as well. Note that the Method-B values properly rank order the field data (which the labeled values do not) and they also provide a reasonable estimate of absolute performance, albeit still somewhat of an overestimate, as was intended by the writers of the standard. Thus, Method-B values are a goal to shoot for, an achievable goal, but still not one that will generally be realized by groups of users in occupational settings.

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[1]Berger (1979-1999), [2]S12.6-1997, [3]epa labeling document, [4]berger/royster at nhca, [5]iso part2 standard, [6]csa Z94.2, [7]as/nz 1270, [8]osga 1983, [9]casali berger, [10]part I, [11]berger, franks, lindgren, [12]kevin michaels spectrum paper, [13]part III, [14]ANSI S3.19-1974, [15]niosh criteria document, [1]berger, kieper, peyton asa april 1999 E•A•R 98-27

(Part II continues in the 2001 Summer Update)

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