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# UPDATE

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*The Newsletter of the Council for Accreditation in Occupational Hearing Conservation*

## Hearing Conservation in the USA - *A Road Less Traveled*

### Part 1 of a 2-part series

*By Tom Thunder, AuD, FAAA, INCE Bd. Cert.*

US efforts to protect hearing in the workplace now span over three decades. Although sustained interest in hearing conservation began shortly after World War II - with Air Force Regulation 160-3 issued in 1948 and industrial programs appearing by the early 1950s - federal interest did not emerge until the late 1960s (U.S. DOL 1969). It was not until the Noise Exposure Regulation was promulgated in 1971 that the U. S. Occupational Safety and Health Administration (OSHA) began its efforts to protect the hearing of workers in general industry (OSHA 1971). In that regulation, OSHA established a permissible exposure level (PEL) of 90 dBA time-weighted average (TWA).

The ink had hardly dried on the new OSHA regulation when the National Institute of Occupational Safety and Health (NIOSH) published its first criteria document in 1972 for occupational noise exposure (NIOSH 1972). This document represented a call to OSHA to lower its PEL to 85-dB TWA and to make other proactive changes to protect hearing in the workplace.

With mounting pressure to adopt more stringent safeguards, OSHA promulgated an amendment in 1981 which created a new term called the "action level" (OSHA 1981). This exposure was set at a dose of 50% or 85 dBA TWA and, when exceeded, required employers to implement a well-defined hearing conservation program (HCP). But this new amendment immediately became sidetracked during the Reagan administration while the Office of Management and Budget stripped and simplified it. The final, condensed version of the Hearing Conservation Amendment was not released until 1983 (OSHA 1983).

The 1983 amendment was appealing to industry as it allowed employers to use hearing protection, audiometric monitoring, and employee training in lieu of potentially expensive engineering or administrative controls – controls that would have been required if OSHA lowered the PEL to 85-dBA TWA. In any case, with the new amendment finally in place, hearing conservation was back on track – or so we thought.

Now that OSHA has been around for 35 years and its amendment for over 20 years, I am often asked "How effective have the OSHA regulations been in preventing hearing loss in the workplace?" At a special workshop hosted by NIOSH in Chicago in 1998 I had the opportunity to pose this question to a number of "seasoned" audiologists, noise control engineers, and manufacturing representatives (NIOSH 1998). The consensus was that although OSHA's efforts have made a significant impact, we have fallen short of our expectations. So what happened?

### How Did OSHA Lose its Influence?

If we go back to 1971, when the original regulation became effective, we can trace events and policies that have made the practice of hearing conservation a fuzzy notion to many plant managers and a low priority to others. In 1971, OSHA's intention was to remove the hazard (via engineering controls) or remove the worker (via administrative controls) when noise exposures reached a TWA of 90 dBA. Hearing protection was to be used only as an interim measure until feasible engineering or administrative controls could be implemented.

However, during the 1970s, the word "feasible" became the most significant point of controversy in the new regulations and the burden of proof to show technical and economic feasibility (i.e., cost-effectiveness) rested squarely on OSHA's shoulders. This new burden combined with diminishing resources compelled OSHA to change strategies and enforcement policies. This was the beginning of the problem. OSHA still preferred engineering and administrative controls, but by the mid-80s, policies and circumstances evolved that diminished the preference for these controls. Furthermore, these new policies and events diminished the influence of OSHA on building effective hearing conservation practices. Let's discuss these circumstances.

**Demise of the Office of Noise Abatement and Control (ONAC)**

Among its other responsibilities, ONAC (the Office of Noise Abatement and Control within the Environmental Protection Agency), was responsible for developing and enforcing a method for rating and labeling the effectiveness of hearing protection known as the NRR (or Noise Reduction Rating). Unfortunately, under the Reagan Administration,

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## Content

CAOHC UPDATE

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*555 E. Wells Street / Suite 1100*
*Milwaukee, WI 53202-3823*
*Phone (414) 276-5338*
*Fax (414) 276-2146*
*E-mail: info@caohc.org*

- ***Editor and Publications Committee Chair***
  *Elliott Berger, MS, INCE. Bd. Cert.*
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# Chair's Message

*By Beth A. Cooper, PE INCE. Bd. Cert.*

How much math does an occupational hearing conservationist need to know? I struggle with this question every time I teach a Noise Exposure Metrics lecture as part of CAOHC's Professional Supervisor course or serve as a guest lecturer on Noise Exposure Monitoring and Control for a CAOHC-approved OHC certification course. Professional Supervisors and OHCs alike have a difficult time truly comprehending the concepts of Time-Weighted Average (TWA), dose, exposure, and exchange rate to the extent that they are able to use these concepts to understand the relevance of audiometric test results. Although the many elements of a hearing conservation program may seem, at first glance, to be diverse and separate, the interrelatedness of noise exposure metrics and audiometric test results is at the core of every program. An effective program, then, is one where there is an "open-loop" process for feedback and information flow between program elements, which allows the OHC to relate noise exposure to noise-induced-hearing loss in a quantitative manner. This is the mechanism by which program effectiveness is both evaluated and improved.

Unfortunately for OHCs and Professional Supervisors, this process requires the development and comparison of numerical metrics that are based on mathematical formulas, most of which are found in the OSHA Standard on Occupational Noise Exposure (29 CFR 1910.95). It's difficult to get a good feel for these relationships without "doing the math," either manually (by inserting your own numbers into the above equations), or in some automated fashion. Dennis Driscoll's article in this issue of Update, *"Noise Exposure Assessment for Extended Work Shifts – What Are the Options?"* (Page 5), discusses one of the issues associated with properly developing and evaluating numerical metrics: how to extrapolate partial-shift dosimetry measurements to arrive at metrics that represent full-shift exposure. Dennis proposes several options for accomplishing this, but I'm sure you'll note that "doing the math" is at least a small (but necessary) part of whichever of these you choose to pursue.

In the course of teaching OHC and Professional Supervisor courses, I've developed a tool that helps me visually illustrate noise dose and TWA exposures as a function of changes in sound level, duration of exposure, and exchange rate. It's a Microsoft Excel® spreadsheet that automatically calculates TWA and noise dose in response to changes in the other parameters and displays them for easy projection in a classroom environment. This *TWA Calculator* is particularly helpful for evaluating composite exposure scenarios where an employee is exposed to several different sound levels for varying durations over the course of a workshift. The *TWA Calculator* also provides a worksheet for extrapolating exposure metrics for extended workshifts and for extrapolating part-shift dosimetry samples to obtain full-shift exposure metrics. If you'd like an electronic copy of the file, please send me an email to: **Beth.A.Cooper@NASA.gov** and request a copy of the *TWA Calculator*.

As a noise control engineer, I (like my colleague Dennis) find the technical basis of noise exposure metrics to be one of the more fascinating aspects of occupational hearing conservation. I'm continually looking for new and better approaches and tools that can make these complicated and non-intuitive concepts most accessible and understandable for the other members of the hearing conservation team. Regardless of how interesting the mathematical equations seem to YOU, it's important to be able to calculate how noise dose and TWA exposures are affected by changes in sound level, duration of exposure, and exchange rate. So, please read Dennis Driscoll's article *before* you request a copy of the *TWA Calculator*. Then, I'd be interested in hearing about how you convey these concepts in your employee training sessions or other courses and in receiving your feedback on the *TWA Calculator*.

OHC Corner

# Bringing CAOHC to Procter & Gamble, Europe



*By Donald B Kirchner, MD, MPH, Deanna Meinke, MA, Laurie Wells,MS FAAA (pictured here left to right)*

In 1998, Procter & Gamble Company (P&G) embarked on an effort to standardize health services at plants and technical centers globally. As part of that effort, standards and other good practice directives were produced. In terms of hearing conservation, this process resulted in the creation of numerous documents designed to improve the quality of the audiometric testing program. In spite of these written directives, it became clear to medical leadership that audiometric technician training similar to CAOHC was needed to insure quality and consistency in audiometric testing on a global basis. Because such training was not available in the overwhelming majority of countries in which Procter & Gamble had operations, the company decided to inquire whether CAOHC would support international technician training based on the U.S. training model.

Two of the authors, audiologists and CAOHC Course Directors, worked with P&G to bring this training to European, Middle Eastern, and African-based occupational health providers. Wells and Meinke gained CAOHC approval to provide this course with the understanding that the basic course requirements would be maintained and that expansion of the topics would address the diverse needs of the audience and include P&G company-specific guidelines. For example, while OSHA performance standards were covered, all participants were required to research and present to the class their respective country's legal requirements for hearing conservation programs.

Logistics planning was especially important because of the travel distance involved. The initial course was held in Prague, Czech Republic in the winter of 2003. The customized course materials were printed in Europe, incorporating copies of all the pertinent company-specific directives. Audiometers were contracted in Prague or were brought by the participants. Sound level meters and personal dosimeters, commonly used in the participants' countries, were employed for the noise monitoring demonstrations. The 22 participants represented multiple locations within P&G's Fabric and Home Care business unit. These sites were located in 14 countries. The course was taught in English, without official interpreters, since the majority of P&G health professionals have some familiarity with the English language. Nevertheless it was necessary to slow the pace of the course and ask those with better English skills to aid others as needed. Additionally, a pre-test was administered to gauge the language ability and knowledge level of the group. Key learnings were reinforced on a periodic basis. Having two course directors also allowed closer observation of participants to insure comprehension of material as intended. One training advantage was that all participants were physicians or nurses with a basic understanding of the anatomy of the ear and physiology of hearing.

Despite detailed planning, certain surprises did occur. For example, the contracted audiometers were of a design not experienced by the trainers before. Especially in Central and Eastern Europe, audiometers have been manufactured on a small scale and do not conform to a standard, such as ANSI S3.6-1996 "Specifications for Audiometers." Despite the style differences, these audiometers were adapted to conform to commonly-accepted audiometer testing protocols. Variations in country laws were also enlightening. For example, occupational audiometric testing in Poland also requires both air-bone conduction testing down to 125 Hz! In some countries, the practice of periodically monitoring hearing is through perception of whispered speech, not through audiometric

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## OHC Spotlight

### MILITARY OHC TAKES CARE OF TROUPS

The Chief of Hearing Conservation at the Army's Fort Hood in Texas, Lt. Col. Vickie Tuten, describes PFC Cassandra Langstaff as "a shining star in hearing conservation and an example of a team player." PFC Langstaff is dedicated to providing high-quality care in protecting the hearing of the men and women serving in the military.

Langstaff, a native of New York, joined the Army for the opportunity to travel and experience a variety of jobs. Months of medical training included a specialty concentration as an ear, nose and throat technician, which she completed as an honor graduate. Part of her training included CAOHC certification, which she puts to use to raise awareness and help protect the hearing of the approximately 50,000 soldiers that pass through the service center on base. As an audiometric technician, she is the one of the first contacts for soldiers who are in-processing, deploying, or redeploying. In addition to hearing testing and fitting hearing protection, Langstaff understands the critical role of counseling. *Soldiers aren't aware of how important it is to wear their earplugs and how much hearing loss can occur from discharging their weapon, even once, without their earplugs*. The preservation of hearing is important, not only for quality of life but also to effectively function. Good hearing may mean a soldier's life, the lives of a comrade or the life of non-combatant. *The snap of a twig, the click of a rifle bolt or just understanding spoken commands all depends upon good hearing.*

# Audiometric Baseline Revision: Separate or Single?

*By Laurie Wells, MS FAAA – CAOHC Course Director in Colorado*

The best method of revising audiometric baselines after either a persistent decrease or improvement in hearing has been an interesting and often debated topic over the years. Recently, there has been renewed interest in the specific issue of whether both ears should be assigned the same baseline audiogram (single-ear baseline or whole-test baseline) or whether each ear should have a separate baseline reference (separate ear baselines). The author maintains that revising baselines for each ear separately is the preferred approach for three reasons: 1) regulatory compliance requirements, 2) hearing loss prevention purposes, and 3) to recognize the value and necessity of binaural hearing. While baseline revision is the responsibility of the professional supervisor (either an audiologist or a physician), it is important for the occupational hearing conservationist (OHC) and the employer to understand the implications of treating baselines as single or separate ear references.

**Example Employee Hearing Tests**

For this discussion, sample hearing tests of a fictional, noise-exposed employee will be used to compare the single-ear baseline revision approach to the separate-ear baseline revision. The example is presented without age corrections for simplification. As seen in Table 1, the employee has normal hearing in both ears when hired in 2002. On the 2003 annual, the left ear is slightly worse in the STS frequencies, and the right ear shows a persistent STS due to a documented non-work related personal medical condition.The 2004 annual shows additional hearing decrements in the left ear for the STS frequencies and essentially no change in the right ear when compared to the previous 2003 exam.

**Table 1: Raw hearing thresholds**

| | LEFT EAR | | | | | | | | RIGHT EAR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kHz | .5 | 1 | 2 | 3 | 4 | 6 | 8 | STS avg | .5 | 1 | 2 | 3 | 4 | 6 | 8 | STS avg |
| 2002 | 10 | 10 | 05 | 00 | 05 | 10 | 05 | | 15 | 10 | 10 | 05 | 05 | 00 | 05 | |
| 2003 | 10 | 10 | 05 | 10 | 15 | 10 | 05 | 6.7 | 35 | 35 | 30 | 30 | 20 | 25 | 25 | 20 |
| 2004 | 10 | 10 | 15 | 15 | 25 | 05 | 00 | | 40 | 35 | 35 | 25 | 20 | 25 | 20 | |

Using a single-ear baseline revision approach in Table 2, the baseline is revised to the 2003 test for both left and right ears, due to the persistent STS in the right ear. The 2004 test shows no STS in either ear when the 2003 revised baseline is used for comparison.

**Table 2: Single-ear baseline revision (highlighted test is revised baseline)**

| | LEFT EAR | | | | | | | | RIGHT EAR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kHz | .5 | 1 | 2 | 3 | 4 | 6 | 8 | STS avg | .5 | 1 | 2 | 3 | 4 | 6 | 8 | STS avg |
| 2002 | 10 | 10 | 05 | 00 | 05 | 10 | 05 | | 15 | 10 | 10 | 05 | 05 | 00 | 05 | |
| 2003 | 10 | 10 | 05 | 10 | 15 | 10 | 05 | 6.7 | 35 | 35 | 30 | 30 | 20 | 25 | 25 | 20 |
| 2004 | 10 | 10 | 15 | 15 | 25 | 05 | 00 | 8.3 | 40 | 35 | 35 | 25 | 20 | 25 | 20 | 0 |

In contrast, the separate-ear baseline approach is shown in Table 3. The baseline for only the right ear is revised to 2003, and the left ear baseline stays at the original 2002 test. Here, the 2004 annual test shows an STS in the left ear, because it is compared to the original 2002 baseline.

**Table 3: Separate-ear baseline revision (highlighted tests are revised baselines)**

| | LEFT EAR | | | | | | | | RIGHT EAR | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kHz | .5 | 1 | 2 | 3 | 4 | 6 | 8 | STS avg | .5 | 1 | 2 | 3 | 4 | 6 | 8 | STS avg |
| 2002 | 10 | 10 | 05 | 00 | 05 | 10 | 05 | | 15 | 10 | 10 | 05 | 05 | 00 | 05 | |
| 2003 | 10 | 10 | 05 | 10 | 15 | 10 | 05 | 6.7 | 35 | 35 | 30 | 30 | 20 | 25 | 25 | 20 |
| 2004 | 10 | 10 | 15 | 15 | 25 | 05 | 00 | 15 | 40 | 35 | 35 | 25 | 20 | 25 | 20 | 0 |

The difference between the two approaches is in the identification of the STS on the 2004 annual test for the left ear: there is no left STS (8.3 dB shift) evident when using the 2003 baseline reference (single-ear baseline), however there is an STS (15-dB shift) evident when using the original 2002 baseline reference (separate-ear baseline).

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# Noise Exposure Assessment for Extended Work Shifts – What Are the Options?

*By Dennis P. Driscoll, PE*
*Associates in Acoustics, Inc.*

Determining employee time-weighted average (TWA) noise exposures and program-inclusion criteria for employees with 8-hour work shifts can be a fairly straightforward procedure. However, confusion often reigns when extended work shifts (i.e., 10-hour, 12-hour days) exist. Often, it is difficult to conduct dosimetry for a full shift to directly obtain full-shift exposure metrics. There are at least three approaches that utilize partial-shift dosimetry results to determine these metrics for workdays longer than 8 hours, providing that noise exposure conditions are expected to remain constant over the remainder of the workshift. The data may be normalized to an 8-hour day for direct comparison to the applicable regulation criteria, the average sound level may be compared to a sliding-scale criteria, or the full-shift projected dose may be utilized. Each option is described herein to help sound surveyors decide which approach may be best suited for their specific needs or management preferences.

Example: A pipe fitter works 12-hour days in a chemical plant. A personal noise dosimeter is used to measure the pipe fitter's daily noise exposure. The dosimeter is pre-set with an 80-dBA threshold level, a 90-dBA criterion level, and a 5-dBA exchange rate. Note: these criteria are set forth in both the Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) occupational noise exposure regulations. The dosimeter sample duration is 10 hours and 41 minutes, which is equal to 10.7 hours. The measured dose is 44.6%, and the average sound level ($L_{AVG}$) is 82.1 dBA. Based on the regulatory requirements, does this job activity warrant inclusion in a hearing conservation program (HCP)?

Note: for demonstration purposes only, data measured with the low-threshold (80 dBA) setting are used. (For an explanation of the differences between low-and high-threshold (90 dBA) data, please refer to the author's article entitled, *A Common Misunderstanding About Noise Exposure Assessment and the Regulations*, which appeared in the CAOHC Update Winter/Spring 2004 issue). In addition, this example assumes sufficient sampling time is used to make certain an adequate number of full-duty work cycles are captured during the partial-shift monitoring to ensure the results are representative of the full 12-hour workday.

**Option 1 – Normalize the data to an 8-hour TWA:**
From the author's experience, the most common approach to handling exposure data for extended work shifts is to normalize the results to an 8-hour average or TWA. This option permits direct comparison to the action level (85 dBA) for HCP inclusion. In fact, the MSHA regulation mandates this procedure and even designates the result as $TWA_8$. However, it is worth noting the subscript "8" is redundant as TWA used by itself is synonymous with an 8-hour average sound level. *In other words, it is technically incorrect to refer to a 10-hour or 12-hour average sound level as $TWA_{10}$ or $TWA_{12}$. These 10-hour and 12-hour results should instead be referred to as $L_{AVG}$ values.*

Both the OSHA and MSHA regulations use the following expression to calculate TWA:

$$TWA = 16.61 Log_{10} (D/100) + 90 \text{ dBA} \quad (1)$$

Where,
D = percent (%) dose for the whole shift.

Using the example results above, to find the TWA we first convert the measured dose for the partial-shift sample into a full-shift dose. Since the workday is 12-hours, and the pipe fitter is expected to continue the same activity for the balance of the day, we may extrapolate the measured dose to find the projected dose as follows:

$$\text{Projected Dose} = \text{Measured Dose} \times [(\text{Shift Length} / \text{Sample Time})] \ \% \quad (2)$$

Where,
Projected Dose and Measured Dose are in units of %, and Shift Length and Sample Time are both in units of Hours or Minutes.

Therefore, substituting the measured and known data into Equation 2:

$$\text{Projected Dose} = 44.6 (\%) \times [12 (\text{Hrs}) / 10.7 (\text{Hrs})] = 50.0 \%$$

The TWA is now calculated using Equation 1:

$$TWA = 16.61 Log_{10} (50.0/100) + 90 = 85.0 \text{ dBA}$$

The resultant TWA represents the full-shift exposure normalized to 8 hours. Since the TWA equals the 85.0 dBA action level, this job activity must be included in an HCP.

A word of caution is warranted when using personal dosimeters. Most, if not all, noise dosimeters will provide a projected dose; however, the resultant value is based on an 8-hour work shift. In addition, dosimeters provide a TWA result, which typically is calculated using the measured dose and not the projected dose. Users need to review the dosimeter owner's manual or check with the manufacturer to ascertain how their particular instrument performs these internal calculations. For extended work shifts, to avoid potential misinterpretation or misuse of dosimetry data, users should take the dosimetry data for measured dose and sample run time, and then manually calculate the extended-shift projected dose using Equation 2, and the normalized TWA using Equation 1.

Courtesy Quest Technologies

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the funding for this office was cut even though the office was not legislatively eliminated. In effect, "the lights are on, but nobody's home." As a result, the labeling regulations have not been enforced, auditing of manufacturers' labeling has been virtually nonexistent, and federal efforts to update the NRR to include real-world factors have been feeble. Although the EPA recently took a step to rectify this situation by hosting a "Workshop on Hearing Protector Devices" in March of 2003 (Berger, 2003), as of yet, there have been no formal proposals to revise the labeling regulation (40 CFR Part 211).

### Confusion over the Hazard Level

OSHA's 1983 amendment effectively lowered the criterion level to 85-dBA TWA by creating a new term called the action level. But because the PEL itself remained at 90-dBA TWA, a great deal of confusion exists as to exactly what action is required at which level (Driscoll, 2004). And where there is confusion, there is misdirected action or, worse yet, procrastination. Such procrastination can be a costly workers compensation liability. If an HCP is not implemented during the first 10 years of a worker's employment, even having a stellar program during the last 10-15 years can be all for naught.

### Lack of Incentives to Design Quieter Equipment

Acoustical engineers know well that designing noise control into equipment on the drawing board is almost always more effective and less costly than retrofit. Yet manufacturers are quick to say that it's OSHA's or the employer's job, not theirs, to protect hearing in the workplace. This attitude stems from the lack of a national policy providing direction, coordination, and funding. As a result, OSHA, as well as other agencies, continues its program without oversight or a united advancement in noise control (von Gierke, 1996). Interestingly, that incentive may soon come, but under a system of adversity rather than in the spirit of cooperation. Driven by hearing-impaired workers who have collected awards insufficient to pay for the advanced digital hearing instruments their audiologists have recommended, lawyers are beginning to circumvent worker compensation plans by suing machine manufacturers. Will litigation provide the needed incentive? Time will tell.

### Reduced Inspections

Under the former Clinton Administration, there were fewer OSHA inspections than any other administration. In fact, two years under the Clinton Administration showed the lowest OSHA citations since 1972 - the first full year OSHA was in force. It's hard to imagine that under the current Republican administration inspections would have increased. Although OSHA has implemented a strategic partnership program to create a more cooperative relationship with industry, companies hesitate to participate for fear of exactly what liability this "partnership" may impose. The bottom line is that fewer inspections mean a reduced inclination for companies to implement or maintain effective hearing conservation measures.

### The 100-dB Criterion

Not long after its amendment became effective, OSHA issued a memo that instructed its officers not to cite companies for lack of engineering controls for exposures *under 100-dB TWA as long as hearing protection was utilized and no significant threshold shifts were detected* (OSHA 1984). Of course, every enforcement agency, including the state police, issue policy directives - but how many directives are so at odds with the regulations to which they pertain? Imagine the state police issuing a press release stating it would not issue speeding tickets in a 65-mph zone *to those traveling under 80 mph as long a seat belt was used and you had no prior convictions*. There is no doubt a lot of drivers would be traveling faster than the speed limit. Public knowledge of this enforcement memo effectively created a defacto PEL of 100-dBA. Many plants choose not even to study the feasibility of engineering controls as long as they know their exposures are less than 100-dBA TWA and they have issued hearing protectors.

### Over Reliance on Hearing Protection Devices

Certainly hearing protection devices (HPDs) have improved greatly over the last 30 years. But management has relied upon HPDs to the extent of assuming that if hearing protection is issued, the noise problem is solved. OSHA never intended for HPDs to replace engineering or administrative controls in the hierarchy of reducing noise in the workplace. But OSHA opened the door wide for HPDs and that's the road companies often take. What's worse is that well-intentioned plant representatives have relied on the protectors with the highest NRR without giving much consideration to other equally important aspects of hearing protection such as fit, utilization, compatibility, wearing time, care, etc. In its most recent "Criteria for a Recommended Standard: Occupational Noise Exposure," NIOSH cites data showing that protection afforded by HPDs in the field is substantially less than that reported by the laboratory (NIOSH 1998). To be fair, hearing protection can work, but only when combined with other components of an effective hearing conservation program. As discussed below, it is questionable whether all of these components are present in company programs.

### STS Recordability

Although the original 1983 Amendment indicated that work-related injuries were to be recorded, there was no real guidance provided. A form of "guidance" came when OSHA issued two memos in 1991 instructing its officers not to cite companies for failing to record STSs on the OSHA log *unless the total change from the original baseline exceeded 25 dB* (OSHA 1991a and OSHA 1991b). Public knowledge of these orders created a situation where companies were simply not recording STSs until they observed a full 25-dB shift. Worse yet, many companies were figuring the 25-dB change relative to the revised baseline, not the original baseline. This misunderstanding, combined with the fact that age corrections could be used, meant that a worker could loose a substantial amount of hearing before someone - maybe even OSHA - caught the error. After a decade of pressure, OSHA finally rescinded this enforcement operative and changed its recording rules. As of 2003, OSHA now requires that any STS in combination with a hearing loss be logged. Here, a hearing loss is defined as a pure-tone average greater than 25 dB over 2000, 3000, and 4000 Hz.

### Lack of the Proper Professional Supervision

Since its 1983 amendment, OSHA has required that either an audiologist or physician supervise the audiometric testing program. However, there is some question in today's

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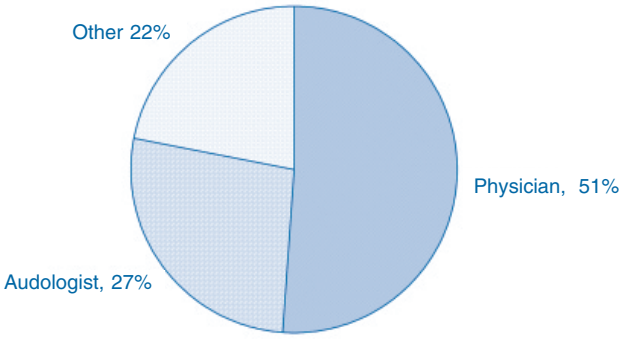
programs about who actually is the professional supervisor. According to a survey by the Council for Accreditation in Occupational Hearing Conservation (CAOHC) (see Figure 1), the person who is identified by 51% of Certified Occupational Hearing Conservationists (COHC) as the professional overseeing their programs is a physician, with audiologist cited as the apparent supervisor 27% of the time (Panhorst-Lassiter, 1998). So who are the other 22%? The answers included head nurse, industrial hygienist, safety director, human resource manager, and even the business owner! According to OSHA, none of these are eligible to serve as a professional supervisor. Two other curious findings resulted from this study: first, half of the "supervised" COHCs felt their supervisor would benefit from additional training; second, 16% of the respondent COHCs interacted with their supervisor only once a year or less! Without proper supervision, truly effective programs are questionable. In an effort to improve this situation, CAOHC has been sponsoring seminars on hearing conservation at the annual conventions of the American Academy of Audiology and the American College of Occupational and Environmental Medicine.

**Figure 1** – Occupations identified as "professional supervisors" by occupational hearing conservationists (Panhorst-Lassiter (1998).




### Failure to Openly Endorse the Use of Insert Earphones

When foam insert earphones for audiometric testing were introduced, pediatric, hospital, and home care audiologists were quick to embrace them because they increased noise reduction, enhanced comfort, and eliminated collapsed canals. However, OSHA blocked the use of these devices and indicated their use would be subject to a *de minimus* (hand slap) violation. This was understandable at the time because ANSI had not yet standardized these devices. But eventually, ANSI did standardize them and, in fact, today's easier-to-use insert earphones are in their second generation. Based on my online courses in hearing conservation, it appears that more than 75% of audiologists regularly or exclusively use insert earphones. Despite this, OSHA has only partially embraced this new technology. With the additional benefits of increased interaural attenuation, reduced disease transmission, improved test/retest reliability, and increased resistance to shock and mishandling, OSHA should actively endorse them. It is time for the 1940's technology of the conventional headphone in modern audiometric testing to go the way of the monochromatic displays in personal computing.

**. . .To be continued in the Summer 2005 Update**

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*Dr. Tom Thunder is an audiologist and board certified noise control engineer. On staff at Rush University, Tom has taught courses in acoustics, psychoacoustics, and hearing conservation. You may contact him at: 847-359-1068 Voice, 847-359-1207 Fax, or Email:* ***tthunder@comcast.net***

## Professional Supervisor Courses Scheduled for Spring 2005

Audiologists and physicians who take on supervision of audiometric testing in hearing conservation programs should be competent in "best practices" of hearing conservation. The CAOHC Council will present a course titled: "The Professional Supervisor of the Audiometric Monitoring Component of Hearing Conservation Programs" prior to the American Academy of Audiology (AAA) convention on Wednesday, March 30, 2005 in Washington, DC. This course is directed to audiologists.

A similar course for physicians will be conducted by CAOHC and sponsored through the American College of Occupational & Environmental Medicine (ACOEM) at the American Occupational Health Conference (AOHC) on Wednesday May 4, 2005 in Washington, DC. The faculty for these courses include: Paul Brownson, MD, Beth Cooper, PE, Richard Danielson PhD, and Peter Rabinowitz, MD MPH. You'll find registration links at:

**www.caohc.org/professional.html**

Attendees will receive continuing education credits, a copy of the *Hearing Conservation Manual 4th Edition*, and unique training materials.

## Noise Exposure Assessment for Extended Work Shifts... – continued from page 5

**Option 2 – Using $L_{AVG}$ and the sliding-scale criteria:**
As an alternative to using the dose and TWA results, $L_{AVG}$ may be used to determine regulatory compliance. Herein, this option is referred to as the sliding-scale criteria. Under this option the user must identify the appropriate action level and permissible exposure limit (PEL)[1], based on the work-shift length. Table G16a in the OSHA regulation and Table 62-1 in the MSHA regulation present the allowable reference duration of exposure per sound level, or $L_{AVG}$ under this option. Following the table, the regulation includes an equation that provides the permitted duration for a given average level. In our case we need the permitted average level, given a specified duration. That relationship is given as Equation 3.

$$L_{AVG} = 16.61 Log_{10} (T_c / T_p) + 90 \text{ dBA} \quad (3)$$

Where,

$T_c$ is the criterion sound duration. $T_c$ = 8 hours for OSHA/MSHA purpose.

$T_p$ is the permissible time of exposure at a stated A-weighted sound level that accumulates 100% noise dose (i.e., $T_p$ = 12 hours for 12-hour shifts)

As an example, with 12-hour workdays, the allowable $L_{AVG}$ is 87.1 dBA (calculated from Equation 3). This value now becomes the PEL for 12-hour work shifts. The HCP action level will always be 50% of the PEL, which is 5 dBA less using a 5-dBA exchange rate. So for 12-hour workdays the action level is 87.1 – 5 = 82.1 dBA under this option. Given the fact that the measured $L_{AVG}$ is 82.1 dBA, which equals the action level for a 12-hour shift, the pipe fitter must be included in the HCP. [Note: This option only determines program inclusion requirements but does not yield an equivalent dose or TWA, which may be required for regulatory compliance purposes.]

It is important to keep in mind an average is an average is an average; irrespective of shift length. Assuming the $L_{AVG}$ is representative of the full-shift exposure, the user may simply decide to apply the sliding-scale criteria to determine HCP inclusion. An additional feature of the sliding-scale $L_{AVG}$ approach is that it explicitly demonstrates that average sound levels lower than the specific action level or PEL, are not necessarily in compliance, when exposures exceed 8 hours.

**Option 3 – Using the Projected Dose**:
The final and third option is a shorter version of Option 1, as it only requires use of Equation 2 to calculate the full-shift projected dose. Instead of following the second step in Option 1 of converting the dose to a TWA, the percent dose is simply compared to the applicable regulatory criteria. Recall both the OSHA and MSHA occupational noise exposure regulations set the HCP inclusion at or above a TWA of 85 dBA, or equivalently, a dose of fifty percent. Because in the pipe fitter example the projected dose is 50.0% (see calculation under Option 1), this mandates HCP inclusion.

This noise exposure assessment option works the same regardless of the shift length. Keep in mind noise dose is a cumulative quantity. So once a fifty percent dose is reached or projected, it is clear that the employee must be included in an HCP. Frankly, using the projected dose is the simplest option for handling extended work-shift data. The principal difficulty with this option is often worker and/or management perception. Over the past few decades we have simply been conditioned to think of, and work with, dBA values. As a result, most end users have difficultly conceptually relating to projected dose. To effectively apply this data assessment option, it will likely require reconditioning (re-training) of workers and management to think of noise exposure in terms of percent dose.

In conclusion, noise exposure assessment for extended work shifts needs to be managed with care. The most common evaluation procedure is to normalize all data to an 8-hour TWA. This approach requires the user to perform two fairly basic calculations. For assistance, use of a spreadsheet is recommended. The sliding-scale criteria option provides a simple data assessment procedure. However, this method can potentially lead to confusion and/or inadvertent misinterpretation of data when facilities have both 8-hour and extended workdays for different work groups, job activities, and/or departments. Therefore, the sliding-scale criteria option is only recommended for facilities with one shift length. The final option of using the projected dose is the simplest procedure, provided users can relate to percent dose. Hearing conservationists should review the details of all three options and consider the practical applications of each method before deciding which procedure is most suitable for their particular needs.[2]

(Footnotes)

[1] Note: the OSHA regulation uses the term Permissible Exposure Limit, while the MSHA regulation uses Permissible Exposure Level. Both quantities represent the same maximum allowable TWA of 90 dBA or equivalently a dose of 100%.

[2] For a more detailed discussion of the issues covered in this article see "Noise Surveys and Data Analysis," by L. H. Royster, E. H. Berger, and J. D. Royster in the *AIHA Noise Manual* 5th edition available at <https://www.aiha.org/webapps/commerce/product.aspx?id=ENOM03-619&cat=Books&subcat=>

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*Dennis Driscoll, is the Principal Consultant, Associates in Acoustics, Inc. located in Evergreen, Colorado. Website: www.esion.com You may contact Mr. Driscoll at: Teamaia@cs.com*

# A CAOHC COURSE ON THE ISLAND OF ST. CROIX

*By Charles Fankhauser, PhD – CAOHC Course Director in California*

Early last year, a colleague asked me if I could present a CAOHC-certified course on the island of St. Croix in the U.S. Virgin Islands. That offer seemed like an attractive adventure, and I thought it should not be significantly different from a comparable presentation in my customary surroundings in Northern California.

The client, an oil refinery, is the world's sixth largest. Company operations included employees who are permanent island residents and temporary contract employees. A separate occupational medical team monitored each employee group. Both teams had personnel requiring either CAOHC certification or re-certification.

Once we established how many would be attending the course and finalized the location, materials, and equipment necessary to meet CAOHC course requirements, we were ready to go.

When we arrived at the refinery we were required to view a company video on local safety requirements. This brief but superb presentation established that this company placed a high priority on matters of occupational safety and health. We were greeted with conference facilities that would be comparable to the best anywhere, accompanied by excellent technical support.

Course participants were equally impressive and the participating faculty was a pleasure to work with. It was apparent that they all genuinely enjoyed each other, and this camaraderie certainly contributed to a productive training atmosphere. All participants satisfactorily completed the training program and were later CAOHC-certified or re-certified.

After the course was completed, we were able to find a little time for island exploration. High points of our island tour included a visit to a premium rum distillery, a former sugar plantation that is now a museum, and to Point Udall, the easternmost land mass of the United States. However, much of the island population is economically depressed due to the decreased tourism on the island. We also had time for a snorkeling adventure on a barrier reef that provided spectacular views of sea life and coral formations.

Such a deal! Meeting and working with people anxious to establish and maintain the highest standards of health and safety, and having an opportunity to visit an interesting place with a rich and varied history. We would do it again!.

*Charles Fankhauser, PhD has been a CAOHC Course Director since 1975. He is Director of Audiology Services, MEDI in Benica, CA. You may reach him at:* ***charleyf@ix.netcom.com***

## Bringing CAOHC to Procter & Gamble, Europe – *continued from page 3*

testing. Additionally, whereas many countries in the region require accommodations for hearing-impaired individuals, similar to the Americans with Disabilities Act, certain other countries prohibit the hiring of these hearing-impaired individuals into noisy jobs.

The P&G medical leader established expectations that the material learned would be used to improve the hearing conservation programs at participant sites. A P&G follow-up survey indicated high grades were given to the training experience. All respondents noted they had improved some aspect of their site hearing conservation program, particularly managing problem audiogram follow-up and obtaining more consistent and accurate results. They reported frequently using the course notebook as a reference, and stated that the training helped them in their job duties. Additionally, participants believed that the course facilitated better compliance with company hearing conservation guidelines. Respondents also talked of the value of receiving the CAOHC *Update* newsletter. One participant noted that the improvements she implemented resulted in her recognition by local plant leadership (and a salary increase!).

The success of this course convinced medical leadership to extend the training to other P&G business units operating in the same region. An additional course was conducted in the spring of 2003 in Budapest, Hungary. Additionally, P&G expects recertification to be conducted according to CAOHC's five year schedule.

The provision of a well-organized and relevant hearing conservation training experience can benefit health care providers with limited access to training, particularly those from developing countries, by providing highly prized education that companies are willing to sponsor for the professional growth and recognition of employees in their communities. The international experiences were equally valuable to the American instructors. Learning through teaching is always rewarding, especially when the learning goes beyond the content of hearing conservation programs to include exchanges and new understandings of cultures and people.

*Donald B Kirchner, MD, MPH, Procter & Gamble Company, Cincinnati, OH.*
*Deanna Meinke, MA, is a CAOHC Course Director and employed at the University of Northern Colorado, Greeley, CO.*
*Laurie Wells,MS FAA, is a CAOHC Course Director employed by Associates in Acoustics, Inc., Evergreen, CO*

## Spring 2005 Council Meeting

The CAOHC Council will hold their semi-annual meeting prior to the spring Course Director Workshop on Thursday, March 17, 2005 in Denver, CO at the Embassy Suites Hotel DIA. The Council meets to report on the status of committee projects, discuss tactics for carrying out future tasks, and to review the fiscal activities of CAOHC.

# UPCOMING OHC CERTIFICATION AND RECERTIFICATION COURSES* 2005

*The listed dates indicate day one of the scheduled classes; certification courses are 20 hours in length; recertification classes are 8 hours.

**Current as of January 2005 (for a complete list of courses visit our website at www.caohc.org); for the most current list of courses contact the CAOHC office at 414/276-5338.**

| Begin Date | State | City | Course Director | Phone |
|---|---|---|---|---|
| 3/14/05 | FL | Tampa | Harvey B. Abrams | 727-398-9395 |
| 3/14/05 | CO | Denver | John H. Elmore | 800-357-5759 |
| 3/16/05 | ID | Boise | Brek D. Stoker | 208-376-3591 |
| 3/16/05 | TX | Houston | Robert C. Rhodes | 281-492-8250 |
| 3/16/05 | IL | Hillside | Sue Zurales | 708-449-5470 |
| 3/16/05 | OR | Portland | Thomas G. Dolan | 503-725-3264 |
| 3/16/05 | NC | Morrisville | Thomas H. Cameron | 919-657-7500 |
| 3/16/05 | OH | Cincinnati | Timothy A. Swisher | 412-367-8690 |
| 3/17/05 | PA | Pittsburgh | Roger M. Angelelli | 412-831-0430 |
| 3/28/05 | CA | Anaheim | Charles E. Fankhauser | 707-746-6334 |
| 3/30/05 | CA | Los Angeles | Kathryn M. Deppensmith | 281-492-8250 |
| 4/6/05 | WI | Madison | James J. Jerome | 317-841-9829 |
| 4/6/05 | FL | Orlando | John H. Elmore | 800-357-5759 |
| 4/6/05 | IL | Chicago | Robert C. Rhodes | 281-492-8250 |
| 4/6/05 | PA | Pittsburgh | Timothy A. Swisher | 412-367-8690 |
| 4/12/05 | ME | Waterville | Anne Louise P. Giroux | 207-872-0320 |
| 4/13/05 | DC | Washington | Diane M. Brewer | 202-994-7167 |
| 4/13/05 | TX | San Antonio | John H. Elmore | 800-357-5759 |
| 4/18/05 | WI | Milwaukee | John H. Elmore | 800-357-5759 |
| 4/19/05 | CA | Ontario | Kirsten R. McCall | 425-254-3833 |
| 4/20/05 | AL | Birmingham | Georgia W. Holmes | 205-934-7184 |
| 4/20/05 | FL | W. Palm Beach | Herbert J. Greenberg | 678-352-0312 |
| 4/20/05 | TN | Nashville | Melette L. Meloy | 678-363-9897 |
| 4/20/05 | LA | New Orleans | Robert C. Rhodes | 281-492-8250 |
| 4/20/05 | VA | Richmond | Thomas H. Cameron | 919-657-7500 |
| 4/21/05 | IL | Chicago | John H. Elmore | 800-357-5759 |
| 4/26/05 | ME | Waterville | Anne Louise P. Giroux | 207-872-0320 |
| 4/27/05 | WI | Brookfield | Edward W. Korabic | 262-547-2227 |
| 4/27/05 | IL | Chicago/Schaumburg | Thomas D. Thunder | 847-359-1068 |
| 5/2/05 | OR | Aloha | Michael Fairchild | 503-259-2686 |
| 5/3/05 | PA | Erie | James W. Nutter | 814-453-4716 |
| 5/4/05 | KY | Louisville | James J. Jerome | 317-841-9829 |
| 5/4/05 | AZ | Phoenix | Kathryn M. Deppensmith | 281-492-8250 |
| 5/4/05 | GA | Atlanta | William K. Wolfe | 770-475-2055 |
| 5/10/05 | MO | North Kansas City | Linda Kay Ratliff-Hober | 913-268-0928 |
| 5/11/05 | AL | Birmingham | Georgia W. Holmes | 205-934-7184 |
| 5/11/05 | CO | Denver | John H. Elmore | 800-357-5759 |
| 5/11/05 | DE | Dover | Timothy A. Swisher | 412-367-8690 |
| 5/16/05 | NJ | Piscataway | Ellen J. Kelly | 732-238-1664 |
| 5/16/05 | IL | Normal | Gail L. Pollock | 309-266-9949 |
| 5/16/05 | GA | Altanta | Herbert J. Greenberg | 678-352-0312 |
| 5/16/05 | NM | Albuquerque | John H. Elmore | 800-357-5759 |
| 5/17/05 | KS | Overland Park | Cynthia J. Bloyer | 913-748-2000 |
| 5/18/05 | TX | Houston | Robert C. Rhodes | 281-492-8250 |
| 5/18/05 | IL | Hillside | Sue Zurales | 708-449-5470 |
| 5/18/05 | NC | Morrisville | Thomas H. Cameron | 919-657-7500 |
| 5/19/05 | ME | Waterville | Anne Louise P. Giroux | 207-872-0320 |
| 5/23/05 | OH | Cleveland | Carol J. Snyderwine | 216-491-6104 |
| 5/25/05 | PA | Harrisburg | John H. Elmore | 800-357-5759 |
| 6/1/05 | OH | Columbus | James J. Jerome | 317-841-9829 |
| 6/1/05 | NC | Charlotte | John H. Elmore | 800-357-5759 |
| 6/1/05 | WA | Bellevue | Mary M. McDaniel | 206-706-7352 |
| 6/6/05 | OR | Portland | Rodney M. Atack | 503-614-8465 |
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| 6/8/05 | MI | Detroit | Kathryn M. Deppensmith | 281-492-8250 |
| 6/8/05 | IA | Des Moines | Laura Kauth | 563-355-7712 |
| 6/8/05 | NC | Morrisville | Thomas H. Cameron | 919-657-7500 |
| 6/9/05 | PA | Pittsburgh | Roger M. Angelelli | 412-831-0430 |
| 6/13/05 | TX | Dallas/Ft Worth | John H. Elmore | 800-357-5759 |
| 6/13/05 | OR | Portland | Thomas G. Dolan | 503-725-3264 |
| 6/14/05 | IL | Chicago/Schaumburg | Thomas D. Thunder | 847-359-1068 |
| 6/15/05 | AL | Birmingham | Georgia W. Holmes | 205-934-7184 |
| 6/15/05 | FL | W. Palm Beach | Herbert J. Greenberg | 678-352-0312 |
| 6/15/05 | SC | Columbia | Melette L. Meloy | 678-363-9897 |
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| 6/15/05 | PA | Harrisburg | Timothy A. Swisher | 412-367-8690 |
| 6/16/05 | TN | Memphis | John H. Elmore | 800-357-5759 |

## INTERNATIONAL NOISE AWARENESS DAY,

*Wednesday, April 20, 2005*

**Hear for the Future**

"It is time to address the threat that noise poses to hearing, health, learning and behavior," says Amy Boyle, Director of the Noise Center of the League for the Hard of Hearing. This year the League is once again spearheading a special effort to inform the public of the necessity of creating a quiet home, school, and recreational environment. Continuous exposure to noise above 85 decibels can be harmful to hearing, and documented research has found that noise does not have to be that loud to lead to physiological changes in blood pressure, sleep, digestion and other stress-related disorders. Studies exist documenting the harmful effects of noise on children's learning and behavior. "It is time," Boyle says, "that we take responsibility to quiet our surroundings and create a healthy environment for us and our children."

Additional information on International Noise Awareness Day and how you can participate is available at the Noise Center website at **www.lhh.org/noise** or by contacting Amy Boyle via phone at 917-305-7809 or email at **aboyle@lhh.org**.

**LEAGUE FOR THE HARD OF HEARING**
50 Broadway, 6th Floor
New York, NY 10004

## Website Revision at www.caohc.org

We've recently revised the website to include: "Upcoming Courses for Technicians" look-up system. You may search for courses using a selection of any one of the following choices: state; country; month; year or course director name. Note: You can leave any field blank. You can select non-US countries from the state list by scrolling to the bottom of the state selection menu. You can also easily view all courses. Go to the CAOHC homepage and click on the box in the lower right titled "OHC Course Listings."

We've also added a shortcut on the homepage to selected articles from current issues of the UPDATE newsletter and full copies of past issues. You'll find the box on the lower-right homepage under hearing conservation manual box.

## Audiometric Baseline Revision: Separate or Single? – continued from page 4

### Regulatory Compliance

The OSHA Occupational Noise Standard, CFR 1910.95 (g)(10)(i), and the MSHA Health Standards for Occupational Noise Exposure in Coal, Metal, and Nonmetal Mines, 30 CFR Part 62.101, state: a standard threshold shift is a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000 Hz, 3000 Hz, and 4000 Hz, *in either ear*. In the above example, the single-ear baseline approach does not comply with the OSHA and MSHA requirement to identify STS *in either ear,* because the 2004 STS in the left ear is missed. In order to identify the 2004 STS, there must be a separate baseline reference for the left ear so that the 2004 test is compared to the original 2002 baseline.

To clarify its position on baseline revision, OSHA issued a letter of interpretation on May 8, 2003. The letter states: "When the professional evaluating the audiogram determines that a baseline revision is appropriate, whether due to a persistent STS or improved thresholds, the baseline must be revised for each ear separately." The entire letter is posted on the CAOHC website (caohc.org) under the section on "OSHA Recordability – Current Issues" or may be accessed directly at **http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=24565**

### Hearing Loss Prevention

The purpose of audiometric testing for noise-exposed employees is to allow early identification of temporary threshold shift resulting from over exposure to noise. Timely intervention of employee notification, retraining, and hearing protection fitting will ideally stop the decrease of hearing and prevent a permanent hearing loss. In the example above, the left ear shows a pattern of hearing change consistent with noise exposure between 2002 and 2004. If the STS in 2004 is not identified, because it is compared to the revised 2003 baseline, then intervention will not occur until additional hearing loss is accrued. Late identification leads to hearing conservation programs that *document* hearing loss instead of *preventing* hearing loss.

This position was reinforced by professionals of the National Hearing Conservation Association (NHCA) during the development of the NHCA Professional Guide for Audiometric Baseline Revision in 1996, which stated that "The two ears are examined separately and independently. If one ear meets the criteria for revision of baseline, then the baseline is revised for that ear only. Therefore, if the two ears show different hearing trends, the baseline for the left ear may be from one test date, while the baseline for the right ear may be from a different test date." The full text of the NHCA document is available at **http://www.hearingconservation.org/rs_pos_AudiometricRevision.html**

### Value of Hearing

Imagine the frustration of an avid bird watcher, who finally hears the long awaited song of a Vermillion Flycatcher, yet is deprived of the pleasure of spotting the colorful bird. It is gone before its location can be identified. Probably everyone, at one time or another, has heard a sound, but couldn't tell where it was coming from. For someone with hearing in only one ear, or with hearing loss greater in one ear than the other, localizing sound is very difficult if not impossible. Our ability to localize sound depends on having two functioning ears. Another significant benefit of binaural hearing is the ability to better hear and understand speech, particularly in a noisy environment. Just as having vision in two eyes provides depth perception and increases our range of sight, having hearing in both ears facilitates effective communication, enhanced sound quality, and provides protection by permitting early detection and localization of sound sources.

Revising baselines for both ears simultaneously ignores the fact that we have two sensory organs that are affected differently by illness and injury. All animals depend on more than one normal hearing mechanism for their communication and survival. Having two ears gives added function just like having two hands, two feet, two eyes, etc. When monitoring occupational injuries and illnesses for other parts of the body, each part is treated and monitored independently from its counterpart. For example, if an employee loses a finger on the left hand at work, there is a recordable injury to the left hand only. The status of the right hand is not affected by injury to the left hand. Furthermore one can justifiably argue that the undamaged ear (or finger) is even more important to auditory (hand) function creating a greater need to closely monitor the "better" ear (hand) due to the greater dependence on its normal function. If hearing professionals do not treat each ear as separate, independent and vital sensory organs, then the misconception that "one ear is enough" will continue to be perpetuated.

### Considerations of Single vs. Separate-Ear Baselines

Some audiometric management software programs have been designed to analyze data using *either* single- or separate-ear baselines. The option is typically chosen during the set-up procedure, determined when the database is established. In some programs, the "default" setting is for single-ear baselines and the user must select separate-ear baselines for each new database. Some programs allow the user to change from single-ear to separate-ear baseline references in an existing database; however the software will move and revise baselines automatically. Re-analysis may create differences in STS identifications and rates. It is critical that baseline references be approved by the professional supervisor and not simply reset by a software program; therefore any change in baseline analysis must be done under the supervision of the physician or audiologist overseeing the audiometric testing program.Baseline references must be documented before and after the change in analysis and historical records maintained.

The use of separate-ear baseline references is the preferred method for providing accurate identification of occupational hearing loss and provides the most protection to the employee. Recognizing each ear as a separate and valuable sensory organ, promotes better awareness and hearing health care. After all, two ears are better than one.

*Laurie Wells, MS FAA, Associates in Acoustics, Inc., Evergreen, CO*

# CAOHC Council Members and The Organizations They Represent

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