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UPDATE

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The Newsletter of the Council for Accreditation in Occupational Hearing Conservation

Hearing Aids + Earmuffs: Counter-Intuitive Hearing Conservation

By Babette Verbsky

Introduction

At first glance, the thought of wearing hearing aids underneath earmuffs may seem counter-intuitive, crazy or contrary to OSHA or MSHA regulations. After all, the reason for wearing hearing protection devices (HPDs) is to reduce the sound level in the ear sufficiently so that the worker will not sustain a noise-induced hearing loss (NIHL). What justification could there be for increasing the sound level under the HPD? Furthermore, even if such a justification did exist, would not the increased sound level put the worker at increased risk for NIHL?

The Problem

Many workers do not wear HPDs or do not wear them consistently. One of the primary reasons given by workers for not consistently wearing HPDs is that they interfere with speech communication (Morata et al., 2001). Other barriers to HPD use include beliefs that HPDs reduce job safety and the ability to hear warning signals (Verbsky, 2004).

Workers who have hearing loss continue to be employed in the same hazardous noise conditions in which they acquired their NIHLs. For listeners with hearing loss, HPDs could reduce the audibility of speech to such low sensation levels that speech intelligibility is reduced, or worse, speech is rendered completely inaudible (Verbsky, 2002). Since HPDs may impede communication for workers with hearing loss, these workers may be less likely to wear HPDs than their normal-hearing coworkers thus potentially putting them at increased risk for additional NIHL.

All Things Considered

It would seem that the simplest solution to the problem would be to penalize employees for non-compliance with policies requiring HPD use. An employer has the right to enforce safety regulations. The problem with this solution is that the hearing-impaired employee is left with a communication problem. Unfortunately, there is no law that says workers in general must be able to communicate in noise.

If the worker has a communication problem when wearing his or her HPD, what are the typical strategies for accommodation? Off the job, a person who has a hearing loss will either attempt to increase the level or speech-to-noise ratio (SNR) of the speech through various strategies (hearing aids, getting closer to the speaker, etc.) or pretend to understand what was said.

In a high noise environment, increasing the level of the speech often is accomplished by removing the HPD (Morata, 2002). At first consideration, this may seem like a fairly safe method of accommodation. However, it is easy for minutes of unprotected noise exposure to add up over the course of an eight-hour work shift. For example if one is working in relatively continuous noise, it only takes a total of 30 minutes of unprotected exposure to reduce the effective HPD attenuation by more than 50 percent. Thus, an HPD which might have provided 30 decibels of protection when worn 100% of the time would provide only 12 decibels of "effective protection" when worn for 7 ½ hours out of an 8-hour day.

The second method of accommodation, pretending to understand, better protects the hearing. However, miscommunication may result in costly mistakes or workplace injuries to others. Additionally, while the link between miscommunication and physical injury or death has not been substantiated in the epidemiological literature to date, there have been case reports of death due to impaired communication by fire fighters and railroad workers. Neither method of accommodation is without its potentially unfavorable consequences. In light of this evidence, perhaps it would be better not to ignore the communication component in attempting to prevent NIHL in hearing-impaired workers.

The technology to solve the communication-in-noise problem exists in the form of an FM transmitter and receiver incorporated in the HPD. However, in the real world cost is an important factor. Therefore, state-of-the-art communication headsets are not always available for noise-exposed workers.

The Solution for Some

Some hearing-impaired workers wear hearing aids off the job to enable them to communicate better with their family and friends. Audiologists counsel their patients to avoid wearing their hearing aids in high noise environments and to use HPDs instead. This advice promotes good hearing conservation, but not good communication. Is it possible to provide better audibility for speech without putting the worker at risk for increased NIHL?

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UPDATE

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Chair's Message

By Beth A. Cooper, PE INCE Bd. Cert.
Representative of the Institute of Noise Control Engineering

Wow! What a busy spring! I've just returned from a whirlwind tour of hearing conservation education events that took me from my home in Cleveland to Seattle, then Philadelphia, Salt Lake City, and finally, Kansas City. In each of these places, I had the pleasure of serving with my fellow CAOHC Council members on the faculty of a hearing conservation workshop. We thoroughly enjoyed sharing our knowledge and enthusiasm with a broad range of audiences across these venues, and, in every case, we were gratified to find attendees brimming with enthusiasm and knowledge that helped us prepare for our next workshop.

Most recently, Dr. Dick Danielson and Dr. Peter Rabinowitz and I taught an 8-hour course for Professional Supervisors at the American Occupational Health Conference (see Dick's note on page 9). This "physician version" of the course followed one that Dick and I taught with Dr. Bob Goldenberg for the American Academy of Audiology (AAA) in late March. Of course, we also held our semi-annual Course Director Certification workshop in mid-March, in conjunction with our spring Council meeting. This came on the heels of the National Hearing Conservation Association conference in February, where Dick and I taught two workshops on multimedia hearing conservation training (using a fun new game that we developed for the conference – visit **http://www.grc.nasa.gov/WWW/AcousticalTest/HearingConservation/JeopEARdy.htm** to request a free copy). We repeated this unique workshop at AAA for a diverse group of audiologists, some of whom were very new to hearing conservation. From audiologists to physicians to OHCs . . . from experienced and seasoned pros to hearing conservation neophytes, there is always something to be learned and shared both ways in a hearing conservation-teaching environment. I hope you feel this way when you provide training for your noise-exposed workforce.

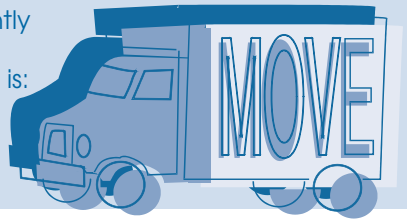
Luckily, for those of us on Council who consider teaching to be an important and satisfying part of our professional lives, we will be even busier next spring, as CAOHC launches a new half-day recertification workshop for active Course Directors. We'll offer those at each of the venues we visited this spring (along with the Professional Supervisor workshops again) as well as for the American-Speech-Language-Hearing Association (ASHA) in the fall of 2005.

Whew! I don't know about you, but I need a summer vacation after all of this traveling and teaching (and thinking about more for the future). The good news for OHCs is that your Professional Supervisor and the Course Director whose recertification class you will attend will be all the more educated for all of this. Better yet, they will hopefully have brought home to YOU some of the enthusiasm, current thinking, regulatory updates, hot topics, and nifty training tools that are a part of all CAOHC workshops.

In my view, there is nothing quite as exciting as teaching and providing resources for hearing conservationists, and the relatively relaxed summer season is no exception. Please have a great one, but don't miss two of the most important hearing conservation holidays of the year: July 4th and Labor Day (when loud outdoor concerts and car races abound with opportunities for evangelism). I wish you the best of luck in finding your own ways to share the message with your workforce this summer. I'd be pleased if you'd share those ideas with me via email at **Beth.A.Cooper@nasa.gov**.

CAOHC has a new office location

The administrative office for CAOHC recently moved to a new location across the street from our former location. Our new address is: CAOHC, 555 East Wells Street/Suite 1100, Milwaukee, WI 53202-3823. There was no change to phone or fax numbers.



OHC Corner

External Otitis and Hearing Protector Hygiene

By Elliott Berger, MS INCE. Bd.Cert.
Representative for the American Industrial Hygiene Association
(with abstracting and editing by Paul Brownson, MD FACOEM FAAFP, Representative for the American College of Occupational and Environmental Medicine)

Basic Anatomy

The external ear consists of the auricle (pinna), the external auditory meatus (earcanal), and the tympanic membrane (eardrum) as illustrated in Figure 1. The pinna is a cartilaginous shell-shaped structure attached to the skull by muscles and ligaments that are covered by skin. The earcanal is a generally elliptical S-shaped tube, approximately 25-mm (1 inch) long, with an average diameter of 8 mm at its entrance. It is directed inward, upward, and slightly forward. The eardrum, which terminates the earcanal, forms an airtight and watertight barrier separating the middle ear from the external ear.

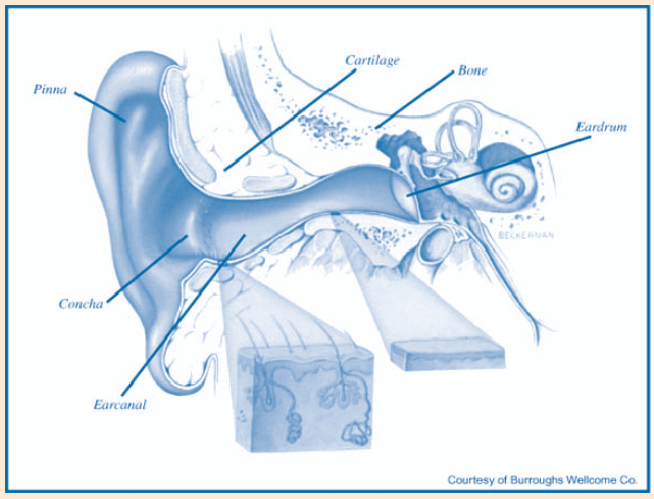


Figure 1 – Cross section of the earcanal with expanded views of the skin of the outer (cartilaginous) and inner (bony) portions of the earcanal.

The outer half of the earcanal is cartilaginous, with an epithelial layer (skin) possessing numerous hair follicles and associated ceruminous and sebaceous glands. By contrast, the inner or medial half of the canal is osseous (bony), with skin that is only about 1/5 as thick (0.2 mm) and nearly devoid of hair follicles and glands. The differences between the outer and inner portions of the earcanal in terms of pore structure and hairiness are similar to those found between the back of the hand and the palm.

The secretions of the ceruminous and sebaceous glands, together with dead skin cells which are regularly cast off and replaced, combine to form cerumen (ear wax), a water-repellent substance that coats and impregnates the skin of the earcanal. This coating is one of the most important protective mechanisms of the ear. It acts as a mechanical barrier that shields the skin from exposure to excessive moisture, and its acidity provides an antibacterial "acid cloak" that some believe inhibits the development of many of the bacteria responsible for earcanal infections.

Since the skin that lines the inner portion of the canal is continuous with the external layer of the eardrum, the earcanal can be thought of as a skin-lined tube. This "lining" migrates outwards from the center of the eardrum towards the entrance of the earcanal at the rate of about 1.5 mm/month. Skin migration, combined with jaw movement work to keep the canal clear of excess cerumen and other debris.

What is an External Ear Infection?

The medical term that describes an inflammatory condition of any portion of the skin of the earcanal is otitis externa. This need not necessarily be an infectious process, i.e. one involving an invasion of the body by microorganisms. The inflammation may be caused by mechanical means (scratching) or chemical (caustic or allergenic) substances, or by biologic (bacterial and fungal) agents. Once the skin has been abraded or inflamed it is easier for microorganisms to become implanted in the follicles and glands of the earcanal and for an infection to develop. Since the hair follicles and glands are almost exclusively found in the outer third of the earcanal, infections are also primarily limited to that region.

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OHC Spotlight

The "OHC Spotlight" focuses attention on Janet Weaver, an occupational health nurse at a major technology center in Texas.

Janet has been in occupational nursing for about 30 years and has been CAOHC certified and working in occupational hearing conservation for the past 20 years. She enjoys her work in the occupational setting because she is able to impact the health, quality of life, and hearing of workers by ensuring that they wear the correct hearing protection and that they wear it properly both at work and at home. By speaking periodically with employees, Janet is able to understand their noise exposure and work cooperatively with the industrial hygiene function at her facility to ensure that all noise sources are properly evaluated. She likes cooking and spending time with her family on the weekends.

Time-Weighted Averages and Fire Fighter Hearing-Loss

By Randy L. Tubbs, PhD
National Institute for Occupational Safety and Health

Fire fighting in the United States has many scenarios that involve high levels of noise exposure including sirens, diesel engines, air horns, power saws, and power ventilators. While these noises are intermittent and often unpredictable, it seems intuitive that personal exposure monitoring using noise dosimeters should indicate exposures that are quite high. However, most noise evaluations at fire departments (Tubbs 1995) report 8-hr time-weighted averages (TWAs) much less than the Occupational Safety and Health Administration's (OSHA) permissible exposure limit (PEL) of 90 dBA (CFR 2003). For many evaluations, once noise has been measured at levels that do not exceed OSHA regulations, then nothing further is done. If city government decision makers had used only the noise data, then hearing conservation programs for fire fighters would never have happened. Thankfully, they did wait for the other set of data on fire fighter hearing loss before making these decisions and, today, hearing conservation programs are found in many departments.

The National Institute for Occupational Safety and Health (NIOSH) has conducted several investigations of noise exposure and hearing loss at fire departments across the U.S. (Flesch & Tubbs 1985; Tubbs & Flesch, 1982; Tubbs, et al., 1988; Tubbs 1985, 1990, 1991, 1994, 1995). Most of the surveys used recordings of individual events for spectral analysis in the laboratory as well as noise dosimetry of fire fighters during their work shift. The findings have been fairly consistent; individual events are short in duration but exposures can range up to 120 dBA, while the dosimeter displays noise readings that are consistently less than the PEL, even for fire fighters working 24-hr shifts. Six of these eight investigations also measured the hearing levels of fire fighters with pure-tone audiometry, four of them at individual city fire departments and two of them at International Association of Fire Fighters' annual conventions. In all but one of the investigations conducted at a convention, a statistical relationship between high-frequency hearing loss and years of fire department service was reported. This occupational loss of hearing is about 1-2 dB for each year of fire service.

The reason for the lack of association between fire fighters' measured noise exposures and their hearing ability is unknown. It can be argued that the hearing loss is not occupational in origin but rather the result of fire fighters' other occupations or recreational activities. The NIOSH investigations have surveyed large and small departments with varying work schedules in eastern and southern cities. They have also tested fire fighters from cities throughout the United States and Canada who were at the union's conventions. It is difficult to believe that each of these hundreds of fire fighters all have second jobs and noisy recreational activities which would result in the statistical association found between their employment tenure and their rate of high-frequency hearing loss. A similar argument can be made to dispel the idea that the hearing losses are the result of a unique event in which a fire fighter was exposed to a short duration, very intense noise resulting in high-frequency hearing loss. It is more than coincidental that every fire fighter would have this type of noise event in their career to explain a finding of gradual loss of high-frequency hearing over time. There may be other explanations for the hearing loss, including combined chemical and noise effects on hearing or the number of narrow frequency band noise exposures that are found in the fire service.

The dosimeter technology available at the time of the NIOSH investigations dictated the type of noise data that could be collected. Today's dosimeters that simultaneously calculate doses according to three or four different evaluation criteria were not on the market. Most of the dosimeters of the time also were only able to sample for a limited duration because of memory constraints in the meters. One sample stored each minute for an eight-hour period was about the best one could obtain. Because of these limitations, the dosimeters were set at the OSHA 5-dB exchange rate and collected data for 8 hours in the NIOSH studies. For the fire departments with 24-hr work shifts, dosimeters were replaced every 8 hours, three times per day, which meant that twice the number of meters needed to adequately cover a fire station were taken into the field to replace dosimeters that had been filled to capacity. This rapidly increases the cost of a survey.

The real-time readouts from these dosimeters revealed a daily noise dose usually less than 50% of the allowable dose, but they were characterized as being variable or intermittent in nature with periods of fairly intense exposures followed by quieter periods. The recordings of many of the individual events also verified the high-intensity exposures that occurred for short periods of time. It is known that the NIOSH 3-dB exchange rate (NIOSH 1998) will produce higher daily doses under these circumstances but the revised criteria document was not published at the time of these fire department surveys. The more conservative 3-dB exchange rate was proposed by NIOSH to better predict the hearing loss from varying noise exposures. Perhaps, if the NIOSH investigations were repeated using the newer NIOSH criterion, then higher noise exposures may be documented which would explain the hearing losses found in fire fighters.

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External Otitis . . . – continued from page 3

It is important to distinguish soreness or irritation from the above conditions. For example, irritation may develop when a new user begins wearing hearing protection devices (HPDs) for extended periods of time. (For this reason new users should gradually increase their wearing time over a period of a couple of weeks). This type of irritation is similar to the discomfort many people experience on the bridge of the nose when they initially begin wearing glasses. The irritation will subside without treatment when either the irritant is removed, or the skin has adapted to its presence. In contrast, the resolution of earcanal infections generally requires medical treatment.

Signs and Symptoms of Otitis Externa

Observable signs of infectious otitis externa include swelling and reddening of the earcanal, a greenish-tinted discharge, and sometimes a foul odor to the ear. Symptoms include itching, pain, tenderness upon manipulation of the pinna, a feeling of "fullness to the ear," and hearing loss in those cases in which the swelling and/or discharge is severe enough to have fully obstructed the earcanal. However, otitis externa may often be present in the absence of one or more of these signs and symptoms. A common example of the latter is eczematous or seborrheic otitis, which is characterized by itching, excess scaling, thickening and cracking of the outer canal, and often secondary infection due to scratching with fingernails or instruments such as cotton-tipped applicators.

The Development of Otitis Externa

The incidence of otitis externa in the general population is related to environmental or seasonal conditions, being more prevalent when temperature and humidity are elevated and/or when recreational water sports are common. It has been hypothesized that prolonged exposure to water removes the protective ceruminous layer, allowing the skin to soften and absorb moisture. This leads to swelling and obstruction of the sebaceous and ceruminous glands, thus preventing replacement of the cerumen. Itching results, which may give rise to scratching and more itching, and the situation worsens. Water-sports enthusiasts may prevent this condition by regular use of acidic alcohol drops (available over the counter) in each external canal after swimming.

Another common cause of otitis externa is excessive cleansing and scratching/digging at the earcanal. This not only removes the protective ceruminous layer and creates itching, but may result in trauma or abrasion that further breaches the skin's protective barriers. This may result from regular aggressive cleaning of the earcanal with cotton-tipped applicators; if such applicators are used, they should be applied gently only to the outermost portion of the earcanal. Studies of patients with otitis externa have found a large majority reported cleaning their earcanals with cotton swabs, matches, fingernails, or the like. A recent study of causes of otitis externa in children also concluded that use of a cotton-tipped applicator to clean the ear seems to be the leading cause of otitis externa in children.

Recommendations for HPD hygiene

As with all clothing and equipment that comes in repeated and intimate contact with the body and the work environment, the cleanliness of HPDs must be considered. HPDs should be cleaned regularly in accordance with manufacturers' instructions, and extra care is warranted in environments in which employees handle potentially irritating substances. Normally, warm water and soap are recommended as cleansing agents. Solvents and disinfectants should generally be avoided.

Earplugs should be washed in their entirety with mild non-abrasive soap and water and allowed to dry thoroughly before reuse or storage in their carrying containers. Earmuff cushions should be periodically wiped or washed clean. Their foam liners can also be removed for washing but must be replaced since they do affect attenuation. Earplugs and earmuff cushions should be discarded when they cannot be adequately cleaned or no longer retain their original appearance or resiliency.

Stressing hygiene beyond practical limits, however, can compromise the credibility of the HPD issuer/fitter. It is often difficult enough to get employees to replace or repair worn out HPDs, let alone clean them routinely. And in spite of this, the available epidemiological data give no indication that the use of HPDs significantly increases the prevalence of external ear disease.

Closing Remarks

Examination of the physiology of the typical healthy earcanal suggests that its natural defense mechanisms render it resistant to infection. This observation is substantiated by the available anecdotal and epidemiological data on the prevalence of otitis externa among both users and nonusers of HPDs. For both groups prevalence is approximately 2%. Although hearing protection devices should not be worn in the presence of some preexisting earcanal pathologies, and care must be exercised regarding selection and use under certain environmental conditions, regular wearing of HPDs does not normally increase the likelihood of contracting otitis externa.

For additional information and references see Berger (1985) which can also be accessed on the web at:
www.e-a-r.com/hearingconservation/earlog_main.cfm

Berger, E. H. (1985). "EARLog #17 — Ear Infection and the Use of Hearing Protection," *J. Occup. Med. 27*(9), 620–623.

Hearing Aids – *continued from page 1*

A quantitative model for the prediction of "safe" amounts of hearing aid gain based on the levels of noise exposure and amount of HPD attenuation was recently developed and tested on an acoustic test fixture (Verbsky, 2002). The "safe" or maximum acceptable exposure (MAE) is defined with reference to octave-band sound pressure levels measured in the unoccluded earcanal as it is exposed to a noise of 85 dBA. When hearing protectors are worn in concert with hearing aids in a given noise environment, the hearing-aid gain must then be limited so the levels (again measured in the earcanal) do not exceed the MAE specified above. Eighty-five dBA was chosen because it is the maximum noise level that does not require the use of HPDs in the workplace according to NIOSH recommendations (NIOSH 1998). It is possible that the reason persons have already acquired NIHL is that they may be more susceptible to the damaging effects of noise than their coworkers. Therefore, if this method of accommodation is implemented, the audiologist should closely monitor the client for evidence of temporary or permanent threshold shift especially during the first few days of combined hearing aid and earmuff use.

Does going to all this trouble really improve speech intelligibility in noise? Yes. Figure 1 shows the results of a study with adult subjects who were tested with their own hearing aids set below the MAE and worn in combination with each of two sets of passive earmuffs in 90 dBA of talker babble (Verbsky, 2002). The dependent variable (shown on the vertical axis in the figure), average speech-to-noise ratio at 50% correct (SNR50), is an indicator of how well a listener can understand speech in noise. A score of 10 dB means that the speech must be 10 dB higher than the noise for 50% of the speech to be understood. Therefore, a numerically lower score indicates better hearing for speech in noise than a higher score.

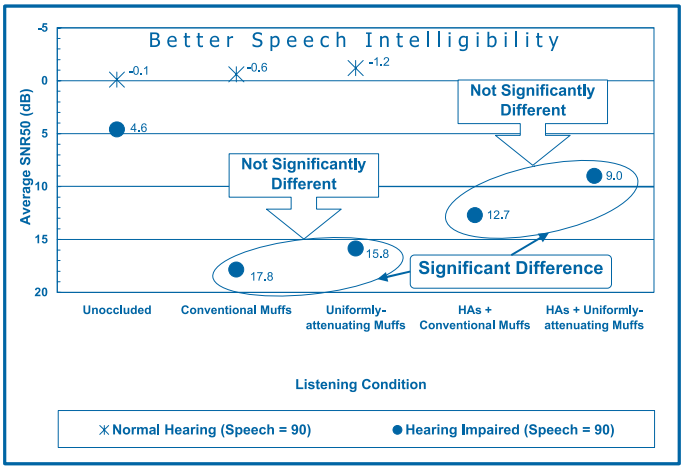
These results support two main conclusions. First, hearing aids worn in combination with earmuffs at "safe" levels significantly improved speech intelligibility over the earmuff-only listening conditions. Second, hearing-impaired listeners were shown to be handicapped in terms of speech understanding ability in the conditions tested while the normal hearing listeners were not.

Is this method of accommodation "safe" for all noise environments and earmuffs? No! Unless the values for all three of the quantitative model's variables (hearing aid gain, HPD attenuation, and octave band noise levels) are known, no worker should be permitted to wear his or her hearing aids in combination with HPDs.

The Future

The solution proposed in this paper must not be the final answer to the problem. There are too many adverse noise environments in which this accommodation is inappropriate. As audiologists and occupational hearing conservationists continue to advocate for access to advanced technology for the enhancement of communication in the workplace, newer procedures may be developed for determining how best to accommodate the hearing-impaired worker who must continue to work in noise.

Figure 1– Normal-hearing listeners were able to understand 50% of what was being said when the speech was the same level as the noise. The use of conventional or uniformly-attenuating passive earmuffs did not change their performance. Hearing-impaired listeners needed the speech to be nearly 5-dB louder than the noise even without earmuffs, and the use of earmuffs greatly reduced their speech intelligibility. Hearing aids worn under earmuffs significantly improved speech intelligibility, but did not restore the unoccluded performance. Although some improvement was measured with the uniformly attenuating earmuffs compared to the conventional earmuffs, the differences were not statistically significant.



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Verbsky, B. L. (2004). "Accommodation of hearing-impaired workers in noise," presentation at the 2004 Convention of the American Academy of Audiology, Salt Lake City, Utah.

Babette Verbsky is a research audiologist at the National Institute for Occupational Safety and Health, Robert A. Taft Laboratories, Cincinnati, Ohio. She received her PhD in Hearing Science from Ohio State University.

Ototoxicity: An Issue in Hearing-Loss Prevention In The Workplace

By Thais C. Morata, PhD
Research Audiologist, Hearing Loss Prevention Section
National Institute for Occupational Safety and Health (NIOSH)

Skepticism is a common reaction people have when they hear that chemicals in the workplace may affect hearing. I have to admit that before studying chemicals, I asked myself, "If this is a serious issue that can impact the quality of life, how could it have been overlooked by the scientific and public health community for this long?" My professional experience and an examination of the literature on noise and hearing conservation lead me to believe that since noise is often present in most occupational settings where chemical exposures occur, the hearing disorders observed in these situations were often attributed to noise exposure alone. Not much consideration, if any, was given to the possibility of other factors. Only workers who have noise exposures above 85 dBA TWA are required to have their hearing tested periodically, by means of pure-tone air-conduction audiometry. Pure-tone audiometric thresholds only identify the magnitude of the hearing disorder, not the cause. The audiometric configuration in cases of noise-induced hearing loss and ototoxicity can be identical. If careful analyses of these results were not performed and attention not given to all the exposure conditions, it is possible that the observed hearing disorders were attributed solely to noise. These factors could explain the scarcity of research conducted until recently on ototoxic properties of chemicals present in the environment and in the workplace.

Some of the reports that motivated further research on the issue were from neurotoxic studies from the early 1980s indicating that toluene affected the auditory system of experimental animals in the absence of excessive noise. Barregard and Axelsson, in a review paper published in 1984, briefly discussed five occupational studies and four case reports that suggested an ototraumatic interaction between noise and organic solvents and discussed its biological plausibility. The incidence of sensorineural hearing loss was higher than expected in noise-exposed workers who were also exposed to solvents. As organic solvents are known for their neurotoxic effects to the central and peripheral nervous system, the authors hypothesized that solvents could have a peripheral and a central effect on the auditory system as well.

A 20-year longitudinal study of hearing sensitivity in 319 employees showed that a large proportion of the workers in the chemical division showed compensable hearing loss (23%) compared with groups from non-chemical environments (5–8%). This effect was found despite the lower noise levels in the chemical division (80–90 dBA) when compared with other divisions (95–100 dBA). Thus, the exposure to industrial solvents was implicated as an additional causative factor for those hearing losses (Bergstrom, Nystrom, 1986).

The findings of research with laboratory animals offered a biological basis for the arguments above, indicating that environmental chemicals such as solvents not only may have an effect on the auditory system, but also may interact synergistically with noise (Lataye et al., 2000).

Field studies in Sweden, Denmark, Brazil, Colombia, and Poland have shown that hearing losses are more common in work settings where chemical exposures occur (Jacobsen et al., 1993; Morata, 2003; Sliwinska-Kowalska et al., 2004). Hearing losses from ototoxicity are moderate to severe, as is the case with noise-induced hearing loss. The audiometric high-frequency "notch" is often present following long-term exposures, but some reports indicate that a wider range of audiometric frequencies are affected when compared with the range of frequencies affected by noise.

Another class of chemicals, asphyxiants (including carbon monoxide and hydrogen cyanide), do not seem to affect the auditory system of laboratory animals by themselves, but they have been shown to potentiate noise-induced hearing loss. Chen et al. (1999), and Rao and Fechter (2000a) indicated that even under intermittent noise exposure with long quiet periods, carbon monoxide exposure could produce unexpectedly large, permanent threshold shifts.

What to do about it?

In two documents published in 1996 and 1998, the National Institute for Occupational Safety and Health (NIOSH) argued for broadening the scope of risk assessment and preventive initiatives (Franks, et al., 1996, NIOSH, 1998). NIOSH recommended that hearing loss prevention programs take chemical exposures into account when monitoring for hazards, assessing hearing, and controlling exposures. Since 1998, the American Conference of Governmental Industrial Hygienists in its *Threshold Limit Values and Biological Exposure Indices* (TLVs® and BEIs®) publication went a step further, including a note in its noise section that states: "In settings where exposure to toluene, lead, manganese or n-butyl alcohol occurs, periodic audiograms are advised and should be carefully reviewed. Other substances under investigation for ototoxic effects include trichloroethylene, carbon disulfide, styrene, mercury and arsenic." The ACGIH also aims to develop recommendations and disseminate information addressing hearing loss prevention strategies that are not limited to exposures to excessive noise levels.

In 2002, NIOSH and the National Hearing Conservation Association (NHCA) co-sponsored the *Best Practices Workshop: Combined Effects of Chemicals and Noise on Hearing* to gather input from the occupational health community and to develop more specific recommendations on the issue. To see the presentations go to: **http://www.cdc.gov/niosh/topics/noise/research/noiseandchem/noiseandchem.html**. For a summary of the discussions, see Morata, 2003.

continued on page 9

25 Most Active Course Directors in 2003 Announced

The CAOHC Council is pleased to announce the twenty-five most active Course Directors for 2003. A total of 2,112 new and recertifying students were certified as Occupational Hearing Conservationists from these 25 teachers alone. This represents 64% of ALL the students who certified or recertified last year. Many of these Course Directors were in CAOHC's Top 25 last year. We welcome the newcomers to this list, too. Congratulations to all!

1) Timothy A. Swisher, MA CCC A (Hearing Safety - Pittsburgh, PA)
2) John H. Elmore, MA MBA (Precision Hearing Conservation - Helotes (Houston, TX)
3) Melette L. Meloy, MS CCC A (Sound Solutions - Dallas, GA)
4) Robert C. Rhodes, PhD (Occupational Marketing, Inc. - Houston, TX)
5) Georgia W. Holmes, MA CCC A (Deep South Center -AUM Speech & Hearing Clinic - Montgomery, AL)
6) Thomas D. Thunder, MA FAAA INCE Bd.Cert (Acoustic Associates, Ltd. - Palatine, IL)
7) Kathryn M. Deppensmith, MS CCC A (Occupational Marketing, Inc. - Houston, TX)
8) Kirsten R. McCall, MS CCC A (Center for Hearing Health - San Ramon, CA)
9) Pamela J. Gordon, MS CCC A (Gordon Hearing Conservation, Inc - Danvers, MA)
10) Roger M. Angelelli, PhD (Audiometric Baseline Consulting - Bethel Park, PA)
11) James Jerome, MA CCC-A (Hearing Safety-Midwest, Inc. –Fishers, IN)
12) Laurie Wells, MS, FAAA (Associates in Acoustics, Inc. Loveland, CO)
13) Mary M. McDaniel, MS CCC A (Pacific Hearing Conservation, Inc. - Seattle, WA)
14) Charles E. Fankhauser, PhD (MEDI, Benicia, CA)
15) Michael Fairchild, MS JD CCC-A (Michael H. Fairchild & Associates, Aloha, OR)
16) William K. Wolfe, MA (Environmental Technology Corp, Roswell, GA)
17) Mark Cheple, AuD FAAA (Associated Hearing & Audiology -West St. Paul, MN)
18) Edward W. Korabic, PhD CCC-A (Marquette University, Speech Pathology & Audiology, Milwaukee, WI)
19) Meredy Hase, AuD (Hearing Services LTD., Waukesha, WI)
20) Michael Seidemann, PhD (Audiological Associates, Inc. – Kenner, LA)
21) George R. Cook, Jr., BS MEd CCC A (Workplace Hearing, LLC - Greensboro, NC)
22) Annette M. MacDonald, BS COHN-S (CHD Meridian Healthcare, Latham, NY)
23) Diane Brewer, MA CCC-A (George Washington University – Washington, DC)
24) Paul F. Kurland, MA (Bay Hearing Conservation, Inc. Green Bay, WI)
25) Pamela Cronin, MS BA CCC-A (Jordan Valley Audiology, West Jordan, UT)

Congratulations.

Fall 2004 Council Meeting

The CAOHC Council will hold their semi-annual meeting prior to the fall Course Director Workshop on Thursday, October 28, 2004 in Rosemont, IL at the Sheraton Gateway Suites O'Hare. The Council is comprised of two representatives from each of the Component Professional Organizations assisting CAOHC in meeting its mission (see outside back cover for these representatives and their organizations). The Council meets twice a year to report on the status of committee projects, discuss tactics for carrying out future tasks, and to review the fiscal activities of CAOHC.

OSHA Hearing Conservation Program for Construction Workers

Occupational noise-induced hearing loss (NIHL) is a serious problem among construction workers, and the current OSHA regulations concerning construction noise exposure are not nearly as comprehensive or protective as those for general industry. Among the problems contractors face when complying with the current OSHA requirements are determining noise exposure levels from a complex combination of noise sources, the unpredictability of tasks and the short-lived nature of the work.

CAOHC participated at an OSHA stakeholders meeting on March 25, 2004 in Chicago, IL on the proposed 29 CFR Part 1926 hearing conservation program for construction workers. There was representation from company owners, unions, health-care providers and organizations. CAOHC is encouraged by OSHA's demonstrated efforts to develop, and legislate, effective hearing conservation programs for the construction industry. Thousands of American construction workers are at risk from noise-related hearing loss.

There are many issues yet to be resolved for this population. We will keep you informed of further progress.

Professional Supervisor Courses Presented at National Forums

As part of its focus to enhance the quality of occupational hearing conservation programs, CAOHC recently offered two successful programs for Professional Supervisors of audiometric monitoring programs. These all-day workshops were a comprehensive tutorial aimed at physicians and audiologists seeking instruction in their role and scope of practice as professional supervisors of Occupational Hearing Conservationists (OHCs). On March 31, over forty people attended a course held in Salt Lake City, UT. prior to the American Academy of Audiology Conference. A sold-out crowd of 125 attended a subsequent course, held at the American Occupational Health Conference in Kansas City, MO. on May 2, 2004 with an affiliation with the American College of Occupational & Environmental Medicine.

In each, attendees were interested in topics that discussed the roles and responsibilities of the Professional Supervisor and OHCs. Faculty members were members of the Council (Beth Cooper, Dick Danielson, Peter Rabinowitz and Bob Goldenberg), who discussed concepts that will help these professional supervisors understand (and better support) their roles in establishing audiometric monitoring programs, problem audiogram review, determinations of work-relatedness (including OSHA reports), follow-up, and database management. In addition, presenters reviewed contemporary issues in identification and prevention of noise-induced hearing loss through noise monitoring and hearing protection devices.

If your professional supervisor is interested in extending his/her understanding of his/her role and responsibility, be sure to route them to the CAOHC website at **http://www.caohc.org/professional.html** where a copy of the basic Scope of Practice document has been posted. Keep checking the website for announcements of future professional supervisor courses, which we hope to provide in 2005 again, in response for focused training in this important area.

Ototoxicity: An Issue In Hearing-Loss – *continued from page 7*

In 2003 the US Army (2003) developed a *Fact Sheet on Occupational Ototoxins and Hearing Loss*, in which it states that since the exposure threshold for ototoxic effects is not known, audiometric monitoring is necessary to determine whether the substance is affecting the hearing of exposed workers. This document is available at **http://chppm-www.apgea.army.mil/documents/fact/51-002-0903.pdf**. The Fact Sheet includes recommendations for annual audiograms for workers whose airborne exposures (without regard to respiratory protection worn) are at 50% or more of the most stringent recommended limits, of either the Occupational Safety and Health Administration Permissible Exposure Limit or the American Conference of Industrial Hygienist Threshold Limit Value to toluene, xylene, styrene, n-hexane, organic tin, carbon disulfide, mercury, organic lead, hydrogen cyanide, diesel fuel, kerosene fuel, jet fuel, JP-8 fuel, organophosphate pesticides, or chemical warfare nerve agents, regardless of the noise exposure level.

The Fact Sheet indicated that the 50% criterion, although somewhat arbitrary, will ensure the collection of data from sub-occupational exposure limit exposures. If there are dermal exposures to these agents and such exposures may result in a systemic dose equivalent to 50% or more of the occupational exposure limit, annual audiograms were also recommended. If a worker is currently participating in a hearing conservation program because of excessive noise, the reviewers of the audiometric data were recommended to be alert to possible additive, potentiating, or synergistic effects between the exposure to noise and a chemical substance and, if necessary, suggest reducing the exposure to one or both.

The strongest argument for research on the ototoxicity of industrial chemicals is still, unfortunately, the ongoing high occurrence of work-related hearing loss in industrialized countries. Considering the number of chemicals that are used in the work environment and the combinations of exposures that are possible, it is necessary that more and more hearing conservationists get involved in the effort to better evaluate and prevent risks to hearing from chemical exposures.

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http://chppm-www.apgea.army.mil/documents/FACT/51-002-0903.pdf

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UPCOMING OHC CERTIFICATION AND RECERTIFICATION COURSES* 2004

*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 May 2004 (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
7/6/2004	TX	Brooks AFB	Jenny H. Rainwater	USAF
7/7/2004	OR	Aloha	Michael Fairchild	503-259-2685
7/7/2004	KY	Louisville	James J. Jerome	317-841-9829
7/7/2004	WI	Brookfield	Edward W. Korabic	262-547-2227
7/7/2004	NY	Albany	Timothy A. Swisher	412-367-8690
7/12/2004	TX	Brooks AFB	Jenny H. Rainwater	USAF
7/12/2004	TN	Nashville	Robert C. Rhodes	713-468-3201
7/13/2004	MO	North Kansas City	Linda Kay Ratliff-Hober	816-221-3230
7/13/2004	PA	Philadelphia	James B. Robertson	215-836-9923
7/14/2004	NC	Greensboro	George R. Cook	336/834-8775
7/14/2004	IN	Indianapolis	John H. Elmore	800-357-5759
7/14/2004	MO	North Kansas City	Linda Kay Ratliff-Hober	816-221-3230
7/14/2004	LA	Kenner	Michael F. Seidemann	504-443-5670
7/19/2004	VA	Norfolk	Tamara H. Thompson	919-967-6064
7/21/2004	TX	Houston	Kathryn M. Deppensmith	713-468-3201
7/21/2004	TX	San Antonio	John H. Elmore	800-357-5759
7/21/2004	GA	Atlanta	William K. Wolfe	770-475-2055
7/22/2004	PA	Kittanning	Douglas N. Callen	724-543-7068
7/22/2004	TX	Brooks AFB	Jenny H. Rainwater	USAF
7/28/2004	AL	Birmingham	Melette L. Meloy	678-363-9897
7/28/2004	OH	Dayton	Chris M. Pavlakos	937-436-1161
7/28/2004	OH	Cleveland	Carol J. Snyderwine	216-491-6104
7/28/2004	NC	Morrisville	Tamara H. Thompson	919-657-7500
8/2/2004	IL	Pontiac	Julie A. Sidak	815-842-4589
8/3/2004	TX	Brooks AFB	Jenny H. Rainwater	USAF
8/4/2004	CA	Santa Rosa	Kathryn M. Deppensmith	713-468-3201
8/4/2004	IL	Springfield	James J. Jerome	317-841-9829
8/5/2004	NC	Greensboro	George R. Cook	336-834-8775
8/9/2004	OR	Portland	Rodney M. Atack	503-614-8465
8/9/2004	MD	Bethesda	Lynn E. Cook	301-319-4959
8/9/2004	TX	Brooks AFB	Jenny H. Rainwater	USAF
8/9/2004	MS	Hattiesburg	Robert C. Rhodes	601-264-3545
8/11/2004	NY	Buffalo	John P. Coniglio	716-821-0091
8/11/2004	AZ	Phoenix	John H. Elmore	800-357-5759
8/11/2004	FL	Jacksonville	Nancy N. Green	904-880-1710
8/11/2004	AL	Birmingham	Georgia W. Holmes	205-934-7178
8/11/2004	TN	Knoxville	William K. Wolfe	770-475-2055
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9/1/2004	WA	Bellevue	Mary M. McDaniel	206-706-7352
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9/13/2004	ME	Waterville	Anne Louise P. Giroux	207-872-0320
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9/15/2004	UT	Salt Lake City	Pamela Cronin	801-581-4055
9/15/2004	OR	Portland	Thomas G. Dolan	503-725-3264
9/15/2004	CA	Santa Clara	Kirsten R. McCall	425-254-3833
9/15/2004	NC	Charlotte	Melette L. Meloy	678-363-9897
9/15/2004	MO	Kansas City	Linda Kay Ratliff-Hober	816-221-3230
9/15/2004	PA	Philadelphia	Timothy A. Swisher	412-367-8690
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Fire Fighter Hearing Loss – *continued from page 4*

In spite of the lack of predictable occupational hearing loss resulting from their noise exposures, many fire departments have instituted all or parts of a hearing conservation program for their employees. Audiometry is being conducted in several departments on a routine basis with the results being used to track changes in hearing before they become a handicap to the fire fighter. The use of communication headsets in department vehicles is becoming common throughout the U.S. Manufacturers of emergency vehicles are offering models that are designed to lower the noise exposures to fire fighters riding in them. They are also placing sirens and the other warning devices in locations that have a lesser impact on the vehicle's inhabitants. In general, more fire fighters are aware of the effects noise can have on their hearing and are taking steps to reduce their exposures. It appears that the old adage that "losing hearing is just a natural consequence of being a fire fighter" is not as axiomatic as it used to be.

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CAOHC Announces — The 4TH Edition Hearing Conservation Manual

About the Manual . . .

The Hearing Conservation Manual 4th edition is here! If you're a member of a hearing conservation team in industry, military or mining – including occupational hearing conservationists, audiologists, physicians, industrial hygienists, acoustical engineers, safety engineers, and others – this manual will assist you in the front-line defense against hearing loss in your workers.

The 4th edition contains invaluable information & significant revisions including:

- How to set-up & maintain a hearing conservation program
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About the Author . . .

Alice H. Suter, PhD served as a Senior Bioacoustical Scientist in the U.S. EPA's Office of Noise Abatement and Control. As Manager of the Noise Standard at the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA), she was the chief author of the Hearing Conservation amendment to the noise standard (29 CRF 1910.95). Dr. Suter joined the National Institute for Occupational Safety and Health (NIOSH) in 1988 as a Visiting Scientist and Research Audiologist. She is presently a private consultant in industrial audiology and community noise abatement.

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