



UPDATE

Should You Consider ANR for Hearing Protection?



By Dan Gauger,
Bose Corporation

Introduction

Perhaps you've seen advertisements for active noise reduction (ANR) headphones for airline frequent flyers. Or perhaps you're familiar with the ANR headsets that several companies offer to general aviation. Maybe you've just heard of ANR but don't know much about it. In any case, you may have wondered if ANR should be a tool in your kit for tackling occupational hearing conservation issues. Under what circumstances might ANR offer advantages to your customers?

How It Works

ANR, applied to headphones, is a way to achieve more noise reduction at low frequencies. This is done using an out-of-phase sound from the headphone's speaker to largely cancel unwanted noise at the ear.

The ANR communication headsets built for use by pilots and in military vehicles accomplish this by means of feedback. They need not be pre-programmed with a noise signature for the environment. Instead, a microphone is placed inside each earcup to detect what the wearer is hearing. This is compared to the signal the wearer wants to hear (a signal from an intercom, for example); the difference is the undesired noise to be cancelled. The difference signal is then processed through circuitry to determine a signal to send to the speaker that will minimize the difference. This process goes on continuously and rapidly, with the system reacting to whatever noise gets into the earcup. For example, an instantaneous peak in noise sound pressure is counteracted by the speaker moving slightly to make more room for the air in the earcup, thereby lowering the pressure. The result is additional noise reduction at frequencies from as low as 32 Hz to approximately 500 Hz; acoustical constraints make it difficult to achieve ANR at higher frequencies. Obviously, ANR will offer greatest benefit in situations with substantial low-frequency noise energy.

The passive attenuation of an earcup is largely determined by the tightness of the seal to the head, the mass of the earcup and the volume of air inside it. The stuff (speaker, electronics, microphone) that must be built into an earcup to achieve ANR occupies volume and thus reduces the passive attenuation the earcup alone provides. However, if engineered well, the active and passive attenuation combine to provide a device with fairly flat (frequency independent) attenuation over most of the spectrum.

Note that some ANR headphones built for consumer sale use a different approach called feedforward. In these devices, the microphone is outside the earpiece and senses the sound incident on the headphone. This signal is then inverted and filtered to obtain the canceling signal. This can work well, but it requires that the headphone itself have little passive attenuation so that sound outside the earpiece is closely correlated to the noise to be cancelled at the ear. Accordingly, these devices offer little apparent reduction except in situations in which the noise is almost exclusively at low frequencies.

Use Your Sound Level Meter

Using a sound level meter, you can quickly tell if a given noise environment has enough low frequency energy to make ANR of value. Simply measure both the C-weighted and A-weighted levels of the noise and calculate the difference (C-A) between the two. The larger the C-A difference, the more low frequency energy dominates the spectrum. Looking at this measure of noise and what values are typical for different environments tells a lot about why ANR has proved useful in some situations while causing barely a ripple in industrial hearing protection (Berger, 2002). ANR has been widely adopted in general aviation (C-A = 8 to 16 dB), military armored vehicles (C-A = 7 to 20 dB) and, increasingly, by frequent airline travelers (C-A ≈ 9 dB). By comparison, the 10th to 90th percentile range of C-A in industrial noise environments is -1 to 6 dB with a median of 1 dB (Gauger, 2002). The lesser low frequency content of the noise in industrial settings means that people get less benefit from ANR.

Figure 1 (Gauger, 2002) (see page 9) presents this graphically. The circles and triangles show the result of doing an octave-band calculation of the reduction of A-weighted level in a large collection of noise spectra. The attenuation data used are subject-fit MIRE data (more on that in the next section) measured on a variety of general aviation headsets, both ANR (solid color symbols) and conventional or passive (white-filled symbols). Color indicates the type of noise. The chart shows that ANR starts making a difference at a C-A of about 4 to 5 dB.

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CAOHC Approved Courses

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

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



Chair's Message

By Theresa Y. Schulz, PhD

Representative of the Military Audiology Association

These are exciting times for CAOHC. The CAOHC Council met in Chicago recently for a tactical planning session to help us progress further toward the strategic plan we've had since 1999. We've made some significant progress since then:

- We improved the "Hearing Conservation Manual" and introduced it as the 4th edition in January of this year.
- We've adapted new curriculum requirements to better meet the needs of OHCs.
- We revised the Scope of Practice statement for certified OHCs and developed a new Scope of Practice for Professional Supervisors.
- We added the American Society of Safety Engineers (ASSE), and the American Academy of Audiology (AAA) as Component Professional Organizations represented on the CAOHC Council.

And that's just a sample of our recent accomplishments. For more, visit our homepage at www.caohc.org, choose "What is CAOHC," and then select "Accomplishments" from the rollover menu.

But we're not resting on our laurels! Your CAOHC Council representatives are an energetic group ready to serve. Our tactical planning session gave us time to devise the implementation of the "continuous improvement of quality" that is our constant goal. You'll see many changes in policy and services in CAOHC over the next few months and years.

- We're developing new materials (teaching tools) for Course Directors (CDs) to use in their OHC courses.
- We're improving (with lots of help from CDs) the bank of questions available to CDs for the Occupational Hearing Conservationist (OHC) certification exam.
- We're developing courses titled *Professional Supervisor of the Audiometric Monitoring Program* to provide training for those professionals (audiologists and physicians) who are ultimately responsible for audiometric monitoring in hearing conservation programs.
- We're planning more Course Director recertification workshops to assist CDs in continuously improving their own courses.

You'll hear details about all this and more in this and future UPDATE issues. And don't forget to check out our ever-improving web site at www.caohc.org.

Although this is my last "Chair's Message," I'll remain on the CAOHC Council as Immediate Past Chair, continuing to represent the Military Audiology Association. I'm looking forward to change – both in my role and in CAOHC. Change is the key to moving toward personal and organization goals.

Spring 2004 Course Director Workshop

The Council will conduct the spring Course Director Workshop on Friday, March 12, 2004 at the Philadelphia Airport Marriott Hotel located at Philadelphia International Airport. This workshop is a requirement for Course Director Certification, and can also be utilized for recertification, as well.

The Course Director is the individual responsible for planning and conducting training courses for occupational hearing conservationists. Candidates interested in applying for certification or recertification may obtain further details and forms by accessing the CAOHC website at www.caohc.org and selecting "Information for Course Directors" on the left side menu.

New requirements for recertification become effective beginning in 2005. Please see "Recertification Requirements" on page 5 in this newsletter. All questions may be directed to Barbara Lechner, Executive Director, at 414/276-5338.

The Effects of Hearing Protectors on Speech



By Jennifer Tufts, Ph.D., CCC-A
Walter Reed Army Medical Center in Washington, DC
Audiology & Speech Center

"I can't hear what people are saying when I wear hearing protectors."

This statement is familiar to most of us. Workers in high-noise environments often express concern that they cannot understand speech or hear important machinery or warning signals when they wear hearing protection devices (HPDs). The inability to hear speech or other signals causes frustration, at the very least; at worst, it constitutes a real safety hazard. As a result, workers may wear HPDs intermittently, if at all. They may physically alter their HPDs or wear them in such a way as to reduce the attenuation they provide. Such non-compliance with consistent and proper HPD use puts these workers at increased risk for developing or worsening noise-induced hearing loss.

Improving communication in noise presents a challenge to workers and hearing conservationists alike. Berger (2000), in a review of the literature, reported that people with normal hearing do not experience any loss in their ability to understand words in high noise levels (above approximately 80 dBA) when they wear passive HPDs. The reduction in the total amount of sound reaching the listener's ear probably improves intelligibility by allowing the cochlea to function at sound pressure levels that do not cause distortion. However, as Berger (2000) pointed out, the laboratory setting cannot re-create all of the various conditions under which communication takes place in the workplace. In the work environment, noise may be intermittent or level-varying. Workers may have hearing loss due to previous noise exposure or other causes. These and many other factors may indeed reduce the ability to understand speech when HPDs are worn.

To add to the difficulty, even the production of speech itself is affected by HPDs. When a person wears HPDs in high noise levels, his/her speech is lower in level than it is when the ears are unoccluded (e.g., Casali et al., 1987; Howell & Martin, 1975). Obviously, this phenomenon could affect the intelligibility of workers who wear HPDs in noise.

A recent study conducted at the Pennsylvania State University addressed the issue of speech production and HPD use. In this study, the speech of 16 men and 16 women was measured as they read short passages in quiet and in pink noise ranging from 60 to 100 dB SPL. The talkers were instructed to speak in such a way that a conversation partner listening in the same level of noise (or quiet) would be able to understand what was said. Each speech measurement was made twice: once while the talker was wearing either foam earplugs or triple-flange earplugs, and once without earplugs. The differences between the speech measurements with and without the earplugs were examined to determine if and how wearing earplugs affected the talkers' speech.

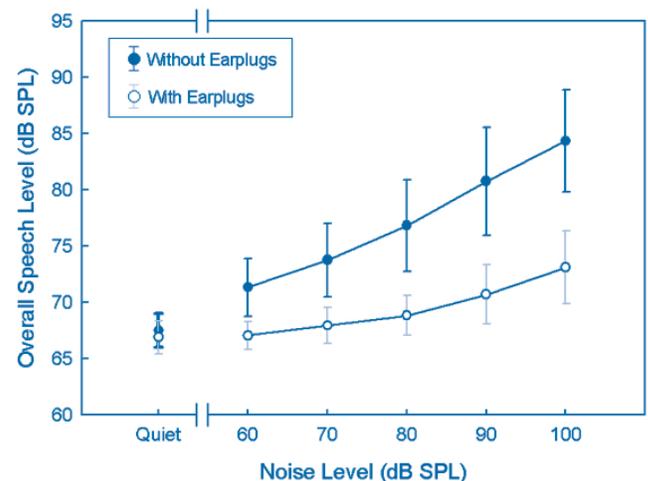


Figure 1. Mean overall speech levels and standard deviations (in dB SPL) as a function of noise level with and without earplugs (N=32 for each ear condition).

Figure 1 shows the overall speech levels (and standard deviations) of the talkers in quiet and in noise, with and without earplugs. For ease of comparison, the data were collapsed over the two earplug types (foam and triple-flange). As expected, the lowest speech levels (approximately 67 dB SPL) were recorded when the talkers were speaking in quiet. As the noise level increased from 60 to 100 dB, the talkers automatically attempted to compensate by raising their voices to higher and higher levels (up to 73 dB SPL with earplugs and 84 dB SPL without earplugs). However, at each noise level, the talkers' overall speech levels were lower when they wore earplugs than when their ears were open. The figure also shows that the difference between the speech levels with and without earplugs widened as the noise level increased. At a noise level of 60 dB, for example, the talkers' speech level was 4 dB lower on average when they wore earplugs compared with open ears. At a noise level of 100 dB, the talkers' speech level was 11 dB lower with earplugs. (In quiet, there was almost no difference in the level of a talker's voice with and without earplugs, as shown by the overlapping symbols in the figure.)

To better characterize these effects, the intelligibility of the talkers was predicted by calculating the Speech Intelligibility Index (SII) (ANSI, 1997). The SII estimates the proportion of speech information that a listener receives from the talker under the given conditions, and it ranges from a maximum of 1.00 (signifying perfect transmission) to a minimum of 0.00 (signifying no information transmission). In quiet, the SII was 1.00 with and without earplugs. At a noise level of 100 dB, the SII was essentially zero both with and without earplugs. At the intermediate noise levels of 60 to 90 dB, however, the SII was 0.13 to 0.25 lower when the talkers wore earplugs than when their ears were open. The lower SII values predict that the intelligibility of the talkers would be lower when they wore earplugs.

Two reasons likely account for the effect of HPDs on speech in noise. First, the amount of bone-conducted speech energy reaching the talker's cochlea increases when the ears are occluded with earplugs. As a result, the talker's voice will seem louder to him/her than when the ears are open. The talker

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CAOHC Establishes Standardized Format for OHC Exam

By Gayle S. Rink, RN, MS, COHN-S
Representative for the American Association of Occupational Health Nurses



CAOHC has been working since 1999 to standardize the content and administration of the written exam component of the 20-hour OHC certification course. Efforts to date have resulted in a prescribed testing format that CAOHC Course Directors (CDs) will be required to implement as of January 1, 2004. Input for reaching this initial standardization milestone included multiple CD surveys, CAOHC's review of sample exams submitted by CDs, sample questions submitted by CAOHC Council members, and course feedback during the new exam format's "trial year" (2003). CAOHC undertook this important initiative to address several objectives: (1) to support the OHC student's interest in being fairly evaluated relative to all CAOHC course offerings, (2) to enhance the credibility and value of OHC certification, (3) to provide an additional learning experience for the OHC student through the reinforcement of course content referenced in the written exam, and (4) to support the CD's need to administer a test that effectively measures the OHC student's knowledge of the course curriculum.

For some CAOHC courses the new exam requirements will not significantly change the exam experience, but for others several exam-related changes will be necessitated as of January 1, 2004. Highlights of the newly instituted format include:

- the clear communication and consistent application of the CD's passing score criteria
- the advance announcement of the allotted time for completing the written exam

- a minimum number of items/questions (50) dedicated to CAOHC's basic course curriculum
- a question bank from which CDs are required to select at least 35 questions (allocated according to the proportion of time allotted to the questions' topics within CAOHC's curriculum).

The question bank incorporates several hundred question items and includes (among others) all the questions provided in CAOHC's 4th Edition Manual. Therefore, OHC students will find the manual an extremely useful resource in preparing for their certification exam.

While this process for standardizing the written exam applies to *only* the initial 20-hour certification course at this time, Council will be reviewing similar policies relative to a written exam requirement for OHC 8-hour *recertification* courses. Watch for more details in future CAOHC UPDATE newsletters.

CAOHC will continue to monitor and refine the written exam component of the initial certification course in 2004 and beyond. As is the case with respect to all CAOHC course matters, Council members will seriously process all feedback from both students and CDs as this initiative is implemented. Whether favorable or critical, information from the certifying student about his/her written exam experience will be appreciatively received and thoughtfully considered. Such input is a valuable resource in ensuring the effectiveness of this on-going process. You may send comments to CAOHC by contacting us through the "Contact CAOHC" menu selection at www.caohc.org or you may mail or fax your comments. You'll find contact information for CAOHC on page 2 of this newsletter.

Wanted: Certification Course Feedback from OHCs

OHCs play an essential role in the fight against occupational hearing loss. Today, thousands of OHCs will:

- Administer hearing tests
- Educate and motivate both employees and employers about the hazards of excessive noise exposure
- Fit hearing protection
- Counsel employees

The quality of the hearing testing of the noise-exposed workforce rests in your hands. If employees aren't properly educated and motivated to wear hearing protection or if they wear it improperly, and are then overexposed to noise, many of them will incur noise-induced hearing loss. At your certification or recertification course, you learned the importance of your role on the hearing conservation team.

CAOHC is interested in receiving your thoughts about the adequacy of training you have received. Do you feel prepared to do your job? Was the course you took adequate to prepare you for your role as an OHC? Have you acquired other knowledge that you think all OHCs should have? How would you rate the material used in your course? Tell us about the instructors. Please give us feedback.

If you have access to the Internet, go to www.caohc.org and select "Contact CAOHC" then select "Feedback." This will take you to a questionnaire about you, your course, and your Course Director, and it will give you the opportunity to "speak your mind" about anything related to the CAOHC-approved course you attended.

If you don't have easy access to the Internet, don't let that stop you from sharing your valuable insights and knowledge. You'll find our address on page 2 of this newsletter. Thanks in advance for your valuable contribution.

OHC Scope of Practice, Objectives and Limitations

The following "Scope of Practice and Limitations" of a CAOHC Certified Occupational Hearing Conservationist (COHC) has been excerpted from the newly revised OHC Curriculum [described on page 6 of this newsletter]. This information will be posted on our

website at www.caohc.org for downloading. Click on "Certification for Technicians" and on "Scope of Practice." While the course curriculum is not effective until July 1, 2004, you may reference this document immediately.

CAOHC Certified Occupational Hearing Conservationist Scope of Practice and Limitations

SCOPE OF PRACTICE

The Occupational Hearing Conservationist (OHC; also known as an industrial audiometric technician) can, with supervision, conduct the practice of hearing conservation including pure-tone air-conduction hearing testing and associated duties (related to knowledge gained as described in the Course Objectives below). The OHC is expected to be a key member of the Occupational Hearing Conservation Program Team. OHC skills are intended for the occupational setting and may not be applicable in nonoccupational practices.

COURSE OBJECTIVES

(Course Objectives effective July 1, 2004)

The objective is to prepare students to be eligible for certification through the Council for Accreditation in Occupational Hearing Conservation (CAOHC). Students will gain background knowledge as well as a basic and fundamental understanding of the following:

- A) Responsibilities and limitations of an OHC, including the need for supervision by an audiologist or physician (referred to as the "Professional Supervisor" for the audiometric monitoring portion of the hearing conservation program).
- B) Responsibilities of other members of the OHC Program Team, with particular attention to the professional supervisor
- C) Basic anatomy and physiology as they relate to hearing evaluation
- D) Types and causes of hearing loss
- E) Parameters of sound as they relate to hearing conservation
- F) Noise and hearing regulations: Federal, State, OSHA, MSHA, and Dept. of Defense (DoD) (as applicable)
- G) Types of audiometric instrumentation
- H) Performance check and calibration of audiometric instrumentation
 - 1) Biological
 - 2) Electroacoustic (in concept)
- I) Care and troubleshooting of instrumentation
- J) Pure-tone threshold testing and otoscopic screening techniques
- K) Appropriate feedback to employees concerning test results and criteria for employee referral.
- L) Basic concepts and principles of noise measurement and control
- M) Personal hearing protection devices
 - 1) Types and selection
 - 2) Fitting, as well as training employees to fit and use
 - 3) Monitoring
- N) Employee hearing conservation education, training, and motivation
- O) Basics concepts and principles of hearing conservation program evaluation
- P) Recordkeeping

LIMITATIONS

OHC certification by the Council for Accreditation in Occupational Hearing Conservation (CAOHC) has specific meaning and limitations. Certification *does not* prepare an individual (unless otherwise qualified) to:

- A) Assume the role of a professional supervisor of the audiometric monitoring portion of a hearing conservation program
- B) Assume the role of an instructor of other OHCs
- C) Interpret audiograms
- D) Conduct any type of audiometric testing other than air conduction, such as bone-conduction testing or speech audiometry
- E) Diagnose hearing disorders
- F) Independently evaluate hearing conservation program effectiveness
- G) Conduct noise surveys and analyses, or be responsible for noise-control solutions

Excerpted from: Courses Leading to Certification and Recertification as an Occupational Hearing Conservationist (OHC): Scope of Practice, Objectives and Limitations, Requirements and Curriculum Outline [EFFECTIVE: JULY 1, 2004]. This document is available in its entirety on www.caohc.org Click on "Courses for Technicians" and select OHC Curriculum – Effective July 1, 2004.

Course Director Recertification Requirements Revised for 2005

The CAOHC Council recently revised the recertification requirements for Course Directors (CDs). Effective January 1, 2005 all CDs will be required to recertify before the conclusion of their five-year certification by attending a CAOHC-sponsored workshop. CD Survey results indicate that aligning the workshop with professional conferences would be helpful in meeting this obligation. Details regarding attendance specifics will be provided to Course Directors and conference sites announced in future newsletters. (There will be no other option for fulfilling recertification requirements, and CAOHC continues to require professional licensure or certification by component organizations in order for Course Directors to qualify for certification or recertification.)

It is expected that the workshops will include topics such as: CAOHC expectations of a CD when conducting an OHC Course; Regulatory Changes; Hearing Protection Fitting; Quality Assurance; and Hot Topics in Hearing Conservation.

Revised OHC Course Curriculum For OHCs Announced! Effective: July 1, 2004

By Elliott Berger, MS, INCE, Bd Cert.

Representative for the American Industrial Hygiene Association

Revised Course Curriculum for OHC Certification and Recertification Courses

For the past year the Council has been examining, revising, and fine tuning the curriculum for courses that are taught for certification and for recertification of occupational hearing conservationists (OHCs). Input to this process came from Course Directors (CDs) who have responded to surveys, letters they have written to our Executive Director (which were in part the impetus for this review and revision), as well as from all of the members of the CAOHC Council.

The revision process also surfaced questions about the objectives of the courses, the appropriate scope of practice for an OHC, and the limitations of her or his scope of practice. The document that resulted has been titled "Courses leading to certification and recertification as an occupational hearing conservationist (OHC): Scope of practice, objectives and limitations, requirements and curriculum outline." The specifications in this document represent CAOHC policy that will become effective for all courses taught on or after July 1, 2004. The new policy is posted on the CAOHC web site www.caohc.org click on first box on the homepage.

The purpose of these changes is to update and more appropriately define the course content as well as the description of the OHC's appropriate duties. The new document also clarifies prior wording that was open to misinterpretation, and revises certain course criteria to provide a better learning opportunity. The principal changes are outlined below.

- 1) **Revised scope of practice** to emphasize the need for supervision of the OHC, and to better reflect how the OHC integrates into the hearing conservation program (HCP) team. (see page 5 this issue)
- 2) **Revised course objectives** to clarify and more precisely define the responsibilities and the limitations of the OHC. For example, although the OHC needs to learn about employee referral, s/he is not qualified to design or implement the referral system. (see page 5 this issue)
- 3) An **explicit description of the professional supervisor** to make it clear that such a supervisor need oversee only the audiometric portion of the hearing conservation program and is defined in OSHA regulations as an audiologist, physician or otolaryngologist.
- 4) Although the prior curriculum outline did state that two practicums were included (audiometry and hearing protection) and it did require a 6/1 ratio for student to practicum trainers, most Course Directors (CDs) overlooked the fact that the hearing protection practicum required the 6/1 ratio and applied the rule only to the audiometric practicum. The new document clarifies this point and has adjusted the **student/practicum instructor ratio** to 8/1 for both practicums. Additionally the **student/audiometer ratio** has been changed from 3/1 to 2/1.
- 5) To simplify compliance with the student/teacher ratio it is explicitly stated that **practicum instructors** need not meet the professional discipline requirements.
- 6) The definition of **acceptable curriculum instructor disciplines** has been moved to a footnote and clarified.
- 7) CAOHC has retained the requirement that an **instructor must be physically present** and that the CD must be readily available at all times.
- 8) The **times allotted** to the various topics have been adjusted and it has been explicitly stated that the times are **contact hours**; thus, break times must be added in and cannot be taken from the 20 hrs. that are specified. The revised document also clarifies that the discretionary hour is discretionary only in terms of its content; the instructor may not forego that hour of instruction or choose to use it for break time.
- 9) Discussion of **microprocessor audiometry** has been explicitly included in the outline, although it was decided that due to the wide variety of microprocessor audiometers available today there would be no requirement to actually have one present at the course.
- 10) The **otoscopy training** has been redefined to clarify that it must not only be discussed with respect to audiometric testing but with respect to hearing protector fitting as well.
- 11) The details of Sections 11 and 12 on **hearing protection devices (HPDs) and the HPD practicum** have been clarified and enhanced.
- 12) Requirements have been added to discuss **OSHA Form 300** and recordability, as well as the Health Insurance Portability and Accountability Act (**HIPAA**).
- 13) **Examination time** has been lengthened by 50% and the section on **HPD fitting practicum** and ear inspection was deleted since it was felt that this would have been tested adequately during the HPD practicum session. This provides instructors additional time to give the exam and to adequately review it with the class.
- 14) The **times and content** of the various sections have been modified to improve the course and its teachability. Although the general sections that were present in the prior curriculum are all still present, the descriptions have been revised in sections and certain content has been moved between sections.
- 15) The times for the **recertification course** have been adjusted, the practicum instructor/student ratios modified to correspond to the 20-hr. course, and a ½-hr. hearing-protector fitting practicum has been added. The requirement for only one instructor discipline (the Course Director) in an 8-hour recertification course remains in effect. Additional instructor disciplines may be added at the CDs discretion.

The new curriculum requirements represent another step forward in CAOHC's ongoing efforts to refine our certification programs. We encourage CDs to familiarize themselves with the new outline and begin to implement it as soon as possible, keeping in mind that the effective dates for all CAOHC certification courses will be July 1, 2004.

Henderson Joins Council as ASHA Representative Council



Donald Henderson, PhD joins the Council as a second representative for the American Speech-Language-Hearing Association (ASHA). Dr. Henderson is a Professor of Communicative Disorders and Sciences at the State University of New York at Buffalo, New York. He is an internationally-known auditory researcher, specializing in the physiological and auditory effects of impulse and continuous noise on hearing. Dr. Henderson's current research focuses on novel approaches in the prevention and reversal of noise-induced hearing loss. He received his PhD in Sensory Psychology from the University of Texas and his Post-Doctorate from the Central Institute for the Deaf.

New Executive Committee Named to CAOHC Council

The Council for Accreditation in Occupational Hearing Conservation held their semi-annual Council meeting on October 2, 2003 in Rosemont, Illinois. [For details on the Tactical Planning session that was held on the previous day, please go to the "Chair's Message" on page 2 of this issue.] The various committees reported activities that have been planned and/or completed since the last meeting, received an update from the Executive office staff about the certification process and other business matters, and discussed other pertinent issues relating to hearing conservation. At the close of the meeting, it was announced that a new Executive Committee had been elected by Council ballot. These officers will serve a two year term to fall 2005:

The Chair, **Beth A. Cooper, PE INCE. Bd.Cert.**, will serve replacing Theresa Schulz. Ms. Cooper is an acoustical engineer and Manager of Acoustical Testing Services at the NASA John H. Glenn Research Center at Lewis Field, where she provides noise control engineering support to help Glenn Research Center's science experiment payloads meet International Space Station hearing conservation goals. She has served on the CAOHC Council since 1999 as a representative for the Institute of Noise Control Engineering, and serves as a presenter in the Course Director Certification courses.

Richard Danielson, PhD, replaces Beth Cooper as the Vice-Chair on the Council. Dr. Danielson is a representative for the American Academy of Audiology (AAA) and is currently an associate professor of otorhinolaryngology and communicative sciences at Baylor College of Medicine and the National Space Biomedical Research Institute (NSBRI), Houston TX, and is serving as the Manager for Audiology and Hearing Conservation, Johnson Space Center - National Aeronautics and Space Administration (NASA).



James Banach, MBA, who is a representative for the American Industrial Hygiene Association (AIHA) and a member of the CAOHC Council since 1997, will serve in the capacity of Secretary-Treasurer for the Council. A member of the Quest Technologies management team since 1984, he is currently the CIO and Vice President of Operations. He has been a past president of the National Hearing Conservation Association (NHCA) and past chair of the American Industrial Hygiene Association's Noise Committee (AIHA). Mr. Banach has been an instructor in CAOHC OHC certification courses and Course Director Certification workshops

Theresa Y. Schulz, PhD (photo on page 2) was recognized by the Council for her efforts as the previous Chair and she will continue service on the Council as Immediate Past-Chair. Dr. Schulz represents the Military Audiology Association and has been a member of the CAOHC Council since 1997 and is a CAOHC Course Director. She is the Deputy Director for Plans and Programs for the Air Force Human Systems Wing at Brooks City-Base, Texas.

What Would You Give Up?

By Linda Kraniske, RN, BSN, COHN-S, COHC
A CAOHC Certified Occupational Hearing Conservationist

As a part of the annual educational component of the hearing conservation program, I tell my audience that when I was a little girl, my girlfriend and I used to challenge each other by dauntlessly asking questions like, "If you had to give up one or the other, between vision and hearing, which would you give up?" We would then ponder the idea of losing one of these most precious senses. What would be most missed? Would it be a beautiful sunset and a loved one's face? Would it be a favorite song and the sound of voices including our own?

As the audience lets this sink in, I tell them that many of us may already be effectively making that choice every day by subjecting ourselves to loud noise levels without the benefit of wearing hearing protection.

I have heard the arguments, such as, "I want to be able to hear other traffic noises while I ride my motorcycle," or "If I come into harm's way on the job, I want to be able to hear it coming so that I can protect myself." I counter with, "If you wear hearing protection, it reduces all noise fairly equally. If you do not wear hearing protection, the loss of sound will be like permanently wearing hearing protection for the rest of your life. When that happens, you may, inadvertently be making an irrevocable choice to hear or not to hear. If you do not protect your hearing, you may lose the ability to hear well, forever!"

AAA Joins CAOHC Council

The American Academy of Audiology (AAA) recently accepted an invitation from CAOHC to join the Council as one of nine Component Professional Organizations (CPO). AAA is a professional organization for audiologists with an active membership of more than 8,000 audiologists who join together to provide high-quality hearing healthcare services to children and adults. The American Academy of Audiology works to advance the profession of audiology through leadership, advocacy, education, public awareness and support of research.

Representatives for AAA are **Richard Danielson, PhD** and **Mark Stephenson, PhD**. Dr. Danielson a previous Council representative for the Military Audiology Association (photo on page 7 of this newsletter). He is currently an associate professor of otorhinolaryngology and communicative sciences at Baylor College of Medicine and the National Space Biomedical Research Institute (NSBRI), Houston TX, and is serving as the Manager for Audiology and Hearing Conservation, Johnson Space Center - National Aeronautics and Space Administration (NASA).

There, he supports NASA's International Space Station and Shuttle hearing loss prevention programs for astronaut crew, pilots, and other noise-exposed personnel. He also provides audiological services to Johnson Space Center, including NASA's unique on-orbit hearing assessment and acoustics countermeasures programs.

Mark Stephenson, PhD is currently serving as a Research Audiologist at the Centers for Disease Control and Prevention's (CDC) National Institute for Occupational Safety and Health (NIOSH). He is the director of a NIOSH research project that is developing hearing loss prevention programs for the construction industry.



Dr. Stephenson joined NIOSH in 1993 after having completed a 20-year career in the USAF. Mark spent most of his Air Force career at the Aerospace Medical Research Laboratory where he investigated the effects of hazardous noise, hearing protector performance, and voice communications in noise.

COUNCIL REVISES EXPIRATION LIMIT FOR OHCs

Effective July 1, 2004 certification extensions for OHCs will be limited to 60 days beyond their current expiration date. All requests must be received at the CAOHC office 30 days prior to the expiration and are subject to the approval of the CAOHC Council. This is intended for OHCs having difficulty locating a course in a specific geographic area, for serious illness, or for a death or serious illness in the family (example: an OHC due for renewal July 1, 2004 would have until August 29, 2004 to take an 8-hour refresher course).

When submitting a request for extension: 1) mail, fax, or E-mail CAOHC indicating the circumstance a minimum 30 days prior to your expiration date. (*CAOHC address, fax and e-mail can be found on the inside front page of this newsletter.*) We will provide you with a written response from the Council indicating whether your extension has been allowed. If you are granted an extension, please present that to your CAOHC Course Director at the time of your recertification course. Your new certification expiration date will be five years forward of that course date.

If your recertification date expires, without approval for extension, you are required to take the 20-hour course.

Dear Editor,

I am an OSHA compliance Industrial Hygienist and conduct many investigations to determine compliance with the OSHA Noise Standard. It appears to me that the articles by Susan Megerson involving recording hearing loss on the Form 300 may have erroneous information. Specifically, in Volume 15 - Issue 1, [Winter-Spring 2003] "Amendments to OSHA's Final Rule for Recording Occupational Hearing Loss," Table 1: Example Protocol for Determining STS Recordability, Step 4, Ms. Megerson asks "Has a qualified health care professional determined that the shift in hearing is more likely than not work-related?" If no health care provider is involved with the process (which is typically the case) then there will be no Yes to the question and the STS would not be recordable. According to Ms. Megerson, a health care provider must confirm the STS to be valid and recordable. I do not believe this is correct.

*Harvey Johnson, CIH
Michigan*

Dear Mr. Johnson,

Thank you for your comments on this potentially confusing portion of my recent articles regarding 1904.10. As you know, OSHA requires professional review of problem audiograms under the Noise Standard, 1910.95. The table incorporated in my UPDATE articles was intended to provide only a simplified summary of a more complicated review process within the context of an effective, and compliant, hearing conservation program. It had not occurred to me that the guidance in the table could be misconstrued to suggest that a company could avoid recording work-related STSs simply by neglecting to have their audiograms professionally reviewed. I certainly agree with you that if the cause of a potentially recordable STS is inconclusive or undetermined, the company should accept work-relatedness by default and record the case. For a more detailed discussion on the topic, readers may wish to refer to the original article in the series: Megerson, S. C. (2002). "OSHA's Final Rule for Recording Occupational Hearing Loss," CAOHC UPDATE, 14(3), 1, 3, 10.

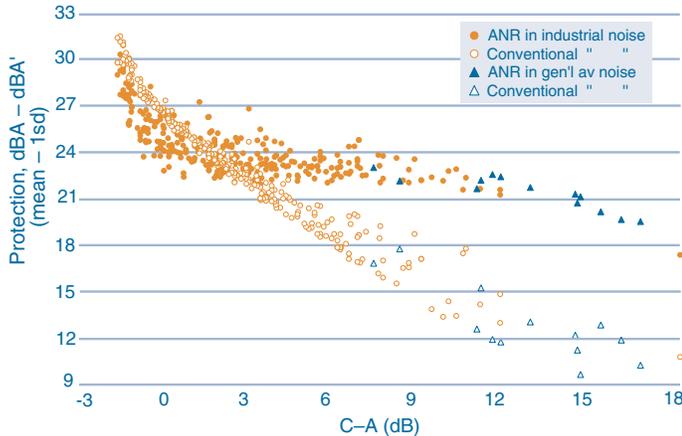
Susan C. Megerson, MA CCC-A
The University of Kansas
Intercampus Program in Communicative Disorders

ANR for Hearing Protection?

continued from page 1

Only about 10% of industrial noise environments exceed this value. This is a key reason why most ANR manufacturers have focused on applications other than industrial hearing protection.

Figure 1: Protection versus C-A using communication headset MIRE data



Two other things should be noted. First, the figure shows that the protection provided by ANR devices is much less dependent on spectrum (C-A) than for conventional devices. This is because the attenuation varies less with frequency. This flatter attenuation response also provides the wearer with a more natural perception of his or her acoustic environment that may offer safety advantages or address one source of resistance to wearing a hearing protector.

Where's the Label?

You won't see a Noise Reduction Rating (NRR) label on the packaging for an ANR headphone. Why? The main reason is that the test method for measuring attenuation prescribed by the rules defining the NRR can't be used accurately with ANR devices. This test, the real-ear attenuation at threshold (REAT, ANSI S3.19 or ANSI S12.6) method, uses the hearing threshold of human subjects as the measurement instrument; the difference in the threshold in a semi-reverberant environment with and without the protector being worn is presumed to be the protector's attenuation. The electronics in an ANR headphone, just like any audio electronics, produces a quiet yet audible "hiss" when operating. This is loud enough to mask the test signals for normal-hearing subjects when the device is being worn, leading to inaccurately high attenuation values.

An alternative test used by the military to assess ANR headset performance is the MIRE method (microphone in real-ear, ANSI S12.42). MIRE replaces the subject's hearing threshold as the measurement instrument with a spectrum analyzer connected to small microphones placed in the ear canal. Unfortunately, REAT and MIRE data differ at low frequencies, because of masking by sounds of physiological origin, with REAT tests overstating attenuation at low frequencies, by 5 dB on average at 125 Hz (Gauger, 2003). This should be allowed for in comparing data obtained using the two methods. The NRR rule provides no means to do this.

Even if there were not the REAT versus MIRE issue, ANR manufacturers would not like their products judged by an NRR. The NRR calculation gives no indication about how much protector performance varies with spectrum or C-A. It presumes noise with a C-A near the industrial median value

of 1 dB. As Figure 1 shows, ANR offers no protection advantage in such noises.

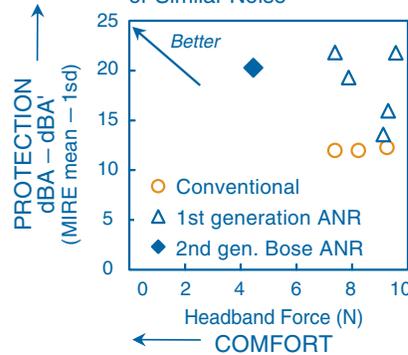
There are other issues that make using NRRs to evaluate hearing protectors problematic, even in the case of conventional passive plugs and muffs. This was the subject of a workshop held by the EPA in March 2003. At that workshop, Bose offered proposals (Gauger, 2003) suggesting how a revised rule should address ANR devices. For now, consumers buying ANR headphones must rely simply on what they hear when they try the device—arguably the most important criterion for their purposes.

Beyond dB/\$

One of the other issues with the present NRR is that it describes the performance a hearing protector provides if used (fitted) optimally, not the way people may realistically use it (Berger et al., 1996). This, along with a lack of incentive to consider other factors such as comfort, auditory awareness and worker preference for different protector types, has contributed to an excessive focus on which product has the most dB/\$ (NRR decibels per dollar). We all seek simple means to make decisions; dB/\$ would seem to be the obvious one for choosing a hearing protector. But if a protector isn't comfortable a worker may not use it properly—or at all. In that case, you haven't picked the right protector for the job.

A key benefit of ANR is that it can be used to design devices that are more comfortable to wear because they don't just rely on a tight seal and weight to block noise. Figure 2 illustrates this.

Figure 2: Noise Reduction versus Comfort in General Aviation or Similar Noise



It shows that, in high C-A noise, one ANR aviation headset provides good noise reduction at greater comfort than competitive products. Hopefully, ANR will eventually prove to be a valuable tool in occupational hearing conservation, in part because of this new solution to the comfort/attenuation tradeoff.

To get there it will take both newer ANR products appropriate for industrial use as well as improvements to the NRR and a change in the undue focus on dB/\$.

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Biography

Dan Gauger (SB/SM Electrical Engineering, MIT '79) has worked at Bose since 1980 and contributed, in various engineering and management capacities, to Bose's work in active noise reduction since near its inception. He is a member of the ASA and actively contributes to the work of standards committee S12/WG11.

ERRATA

The following clarifies a few points published in our previous issue's *OHC Corner*, "Mobile Audiometric Testing – On the Job Tips" (Vol. 15, Issue 2, Summer 2003).

- Re item 4: Please note that the requirement for 14 hours of quiet prior to audiometric testing applies only to the baseline, not the annual, audiometric test. In fact, most hearing conservationists and the ANSI Technical Report S12.13TR *Evaluating the Effectiveness of Hearing Conservation Programs through Audiometric Data Base Analysis* strongly recommend that annual audiometric tests be administered at varying times during the workshift under "everyday" hearing protection conditions. In this way, any *temporary* shifts in hearing that may be incurred due to inadequate protection are more likely to be detected. This monitoring protocol allows the employer to intervene earlier, with such actions as employee counseling and retraining, hearing protection refitting, and engineering or administrative noise controls, and hopefully, to prevent *permanent* shifts in hearing. (A copy of S12.13TR-2002 is included as Appendix P of the *Hearing Conservation Manual, 4th Edition*; for information on how to order, see the CAOHC website at <http://www.caohc.org/manual.html>).
- Re item 6: Although OSHA's Hearing Conservation Amendment does not require retesting of individuals who have demonstrated a Standard Threshold Shift (STS) in hearing, OSHA does state that retesting must occur within 30 days when the retest is to be used in lieu of the original annual test. For more information on audiometric retesting, refer to Chapter VIII of the CAOHC *Hearing Conservation Manual, 4th Edition* and the CAOHC website's update on recording work-related hearing loss on the OSHA Form 300 <http://www.caohc.org/oshafinal.html>.
- Re item 6: If you are utilizing multiple audiometric testing services, such as a local occupational health clinic and a mobile testing service, please remember it is imperative that your professional reviewer (audiologist or physician) receive copies of *all* tests completed for each employee. Otherwise, your reviewer will be unable to correctly identify baseline vs. annual tests, the presence of STSs, and so on. For more information on review of audiograms, please refer to the CAOHC *Hearing Conservation Manual, 4th Edition* or talk with your Professional Supervisor.

The Effects of Hearing Protectors....

continued from page 3

may lower his/her voice in response. Second, the ambient noise will not seem as loud when the talker wears earplugs. Therefore, he/she will not feel the need to speak as loudly.

The consequences for communication are great. When *not* wearing earplugs, people speak at a higher level, which improves the speech-to-noise ratio, an important predictor of intelligibility. The speech itself also contains more high-frequency energy than speech spoken at a softer level, which also improves intelligibility in noise (Summers et al., 1988). When *wearing* earplugs, talkers (and their listeners) are at a disadvantage, since the amount of high-frequency energy in their speech is reduced, and their speech-to-noise ratio is lower. Ironically, HPDs potentially reduce the intelligibility of the talker most at noise levels in which the HPDs are most needed. (That said, in very high noise levels, talkers will not be intelligible either with or without earplugs.)

Of course, other factors affect the intelligibility of talkers wearing HPDs, such as the availability of visual and contextual cues, the type of noise in the environment, the distance from talker to listeners, the hearing threshold levels of the listeners, and so on. These factors assume greater importance as the acoustic speech signal itself is degraded. It is impossible to predict with certainty how intelligible a particular talker will be when wearing HPDs without taking all of these factors into consideration.

Nevertheless, these findings underscore the deeply-rooted nature of the difficulty of communicating in noise with HPDs. At this time, an inexpensive and universally effective way to improve communication is lacking. Some potential solutions, including the use of communications headsets with active technology, may be effective in certain environments (e.g., military applications), but may be impractical in others due to

cost and human factor issues, especially if the employee's exposure level is not much greater than the action level or permissible exposure level. Ideally, management and safety personnel will collaborate to find mutually acceptable solutions for their particular work environments and employees. Such solutions might include achievable administrative and/or engineering controls combined with greater employee awareness. In the meantime, work continues to tackle the problematic interface between noise, HPDs, and communication.

(This article is based is on a study published in the August 2003 issue of the Journal of the Acoustical Society of America [Tufts, J.B., & Frank, T. (2003). Speech production in noise with and without hearing protection, *Journal of the Acoustical Society of America*, 114(2), 1069-1080].)

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Jennifer Tufts, PhD, CCC-A, is currently a research associate at the Army Audiology & Speech Center, Walter Reed Army Medical Center in Washington, DC. Her research areas include hearing conservation and the psychoacoustics of music perception.

UPCOMING OHC CERTIFICATION AND RECERTIFICATION COURSES* 2003 & 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 November, 2003 (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	Begin Date	State	City	Course Director	Phone
11/18/2003	ME	Waterville	Anne Louise P. Giroux	207/872-0320	3/4/2004	VA	Newport News	Henry C. Hecker	757/874-4665
11/18/2003	PR	San Juan	Donald D. Hogan	787/728-3535	3/10/2004	NC	Greensboro	George R. Cook	336/831-8775
11/18/2003	NC	Morrisville	Tamara H. Thompson	919/967-6064	3/10/2004	VA	Richmond	Tamara H. Thompson	919/967-6064
11/18/2003	MN	Fairmont	John S. Tunnell	507/238-5061	3/17/2004	IL	Oak Park	Robert C. Beiter	708/445-7171
11/19/2003	MD	Baltimore	Mary Lynette Doyle	410/955-0423	3/23/2004	CA	Sacramento	Kirsten R. McCall	425/254-3833
11/19/2003	OR	Portland	Michael Fairchild	503/259-2685	3/24/2004	CA	Sacramento	Kirsten R. McCall	425/254-3833
11/19/2003	Canada	Calgary	Thomas H. Moore	403/364-1130	4/1/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775
11/20/2003	PA	Bethel Park	Roger M. Angelelli	412/831-0430	4/13/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
11/20/2003	TX	El Paso	Harold N. Williams	915/532-4765	4/14/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775
12/1/2003	NJ	New Brunswick	Ellen J. Kelly	732/238-1664	4/20/2004	CA	Ontario	Kirsten R. McCall	425/254-3833
12/2/2003	NC	Morrisville	Tamara H. Thompson	919/967-6064	4/21/2004	CA	Ontario	Kirsten R. McCall	425/254-3833
12/3/2003	NC	Greensboro	George R. Cook	336/931-0178	4/21/2004	OH	Chardon	Basil N. Wolfe	216/289-0112
12/3/2003	TX	Houston	John H. Elmore	800/357-5759	4/28/2004	WI	Brookfield	Meredy Hase	262/547-2227
12/3/2003	FL	W. Palm Beach	Herbert J. Greenberg	561/968-3536	5/11/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
12/3/2003	AL	Birmingham	Georgia W. Holmes	334/300-2691	5/12/2004	IL	Normal	Gail L. Pollock	309/266-9949
12/3/2003	KY	Louisville	James J. Jerome	317/841-9829	5/19/2004	IL	Oak Park	Robert C. Beiter	708/445-7171
12/3/2003	WA	Bellevue	Mary M. McDaniel	206/706/7352	6/1/2004	CA	Santa Clara	Kirsten R. McCall	425/254-3833
12/3/2003	LA	New Orleans	Michael F. Seidemann	504/443-5670	6/2/2004	CA	Santa Clara	Kirsten R. McCall	425/254-3833
12/3/2003	OH	Cincinnati	Timothy A. Swisher	412/367-8690	6/3/2004	NC	Greensboro	George R. Cook	336/834-8775
12/3/2003	IL	Chicago/Woodfield	Thomas D. Thunder	847/359-1068	6/8/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
12/3/2003	GA	Atlanta	William K. Wolfe	770/475-2055	6/9/2004	CO	Greeley	Laurie Wells	970/593-6339
12/6/2003	OK	Edmond	Roy S. Jackson	405/570-6729	6/16/2004	NC	Greensboro	George R. Cook	336/834-8775
12/8/2003	CA	Anaheim	Charles E. Fankhauser	707/746-6334	7/7/2004	WI	Brookfield	Edward W. Korabic	262/547-2227
12/9/2003	MO	Kansas City	Cynthia J. Bloyer	816/471-3900	7/14/2004	NC	Greensboro	George R. Cook	336/834-8775
12/9/2003	UT	Ogden	Omar A. Juarez	801/397-1597	7/14/2004	LA	Kenner	Michael F. Seidemann	504-443-5670
12/10/2003	TX	San Antonio	John H. Elmore	800/357-5759	7/19/2004	VA	Norfolk	Tamara H. Thompson	919/967-6064
12/10/2003	MA	Marlboro	Pamela J. Gordon	508/481-5819	8/4/2004	FL	Jacksonville	Nancy N. Green	904/880-1710
12/10/2003	IA	Des Moines	Laura Kauth	563/355-7712	8/5/2004	NC	Greensboro	George R. Cook	336/834-8775
12/10/2003	TN	Nashville	Melette L. Meloy	678/363-9897	8/24/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
12/10/2003	TN	Johnson City	Daniel R. Schumaier	423/928-5771	8/25/2004	OH	Chardon	Basil N. Wolfe	216/289-0112
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1/7/2004	WI	Brookfield	Meredy Hase	262/547-2227	9/1/2004	CA	Santa Clara	Kirsten R. McCall	425/254-3833
1/7/2004	IL	Normal	Gail L. Pollock	309/266-9949	9/14/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
1/7/2004	VA	Richmond	Tamara H. Thompson	919/967-6064	9/15/2004	IL	Oak Park	Robert C. Beiter	708/445-7171
1/7/2004	CO	Greeley	Laurie Wells	970/593-6339	9/15/2004	UT	Salt Lake City	Pamela Cronin	801/566-8304
1/9/2004	MA	Braintree	Nancy E. Peterson	617/367-0571	9/22/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775
1/13/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064	10/7/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775
1/20/2004	CA	Irvine	Kirsten R. McCall	425/254-3833	10/12/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
1/21/2004	CA	Irvine	Kirsten R. McCall	425/254-3833	10/19/2004	CA	Irvine	Kirsten R. McCall	425/254-3833
1/26/2004	FL	Tampa	Tamara H. Thompson	919/967-6064	10/20/2004	CA	Irvine	Kirsten R. McCall	425/254-3833
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1/28/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775	10/27/2004	WI	Brookfield	Edward W. Korabic	262/547-2227
2/4/2004	UT	Salt Lake City	Pamela Cronin	801/566-8304	11/10/2004	VA	Richmond	Tamara H. Thompson	919/967-6064
2/4/2004	CA	Santa Clara	Charles E. Fankhauser	707/746-6334	11/17/2004	IL	Oak Park	Robert C. Beiter	708/445-7171
2/4/2004	FL	Jacksonville	Nancy N. Green	904/880-1710	12/1/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775
2/5/2004	NC	Greensboro	Sarah E. Ervin	336/834-8775	12/7/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064
2/10/2004	NC	Morrisville	Tamara H. Thompson	919/967-6064	12/8/2004	LA	Kenner	Michael F. Seidemann	504/443-5670
2/11/2004	LA	Kenner	Michael F. Seidemann	504/443-5670	12/9/2004	NC	Greensboro	George R. Cook	336/834-8775
3/3/2004	IA	Iowa City	Laura Kauth	563/355-7712					

Spring 2004 Council Meeting

The CAOHC Council will hold their semi-annual meeting prior to the Spring Course Director Workshop on Thursday, March 11, 2003 at the Philadelphia Airport Marriott Hotel in Philadelphia, Pennsylvania. 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 review the fiscal activities of CAOHC.

Classified Ad

"Noise Destroys Your Hearing", released in January of 2003, is the second in a series of hearing conservation training films focusing on the components of an effective hearing conservation program. Free preview is available. Run time of 6.5 minutes. Visit www.knproduction.com and click on "sales" or call 1-877-773-4698 toll free for information.

CAOHC Council Members and Their Represented Organizations

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Fall 2003



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