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29th Annual NHCA Hearing Conservation Conference

February 19-21, 2004
Hilton Seattle Airport
Seattle, Washington

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Spectrum is available without charge to NHCA members in all categories. Anyone interested in publishing in *Spectrum* should contact Karen Wojdyla at the national office, or David Byrne or Kevin Michael, Co-Editors.

Because of our concern for the environment, we use recycled paper and soy-based inks for *Spectrum.*

WELCOME TO SEATTLE

We want to thank you for taking time out of your busy schedules to join us at NHCA's 29th Annual Conference. It is obvious that all of you, as hearing conservation professionals, value the opportunity to contribute and learn. Also, a special welcome to all of our student and first-time attendees. Our NHCA Program Committee has assembled an outstanding collection of workshops, lectures and posters featuring new research in our field, as well as practical tools and ideas from the many outstanding men and women who will be conducting and presenting them.

We trust that you will visit with the many and varied companies that are exhibiting at our conference. They offer the latest products, services and training tools that assist the hearing conservation professional in their everyday tasks and research. Also, the exhibit hall will have our "Silent Auction," with many unique items, and will be the location to view, and learn from, a large collection of outstanding poster presentations.

In addition, please join us in the exhibit hall Thursday evening for our opening reception. It is a great opportunity to meet and network with our members, students and guests. Friday night is our "Special Event," which is our Royal Argosy Dinner Cruise. So join us as we "Sail the Sound" through Elliot Bay. It will be a great time, with great people and a lot of fun with our now infamous live auction.

We are looking forward to a great conference in the beautiful Pacific city of Seattle. We want to thank Laurie Wells, your Vice President and Program Chair, and our NHCA Program Committee, for once again planning an excellent conference, which truly offers something for everyone working in the field of hearing loss prevention.

Again, welcome to the 29th Annual NHCA Conference. Thank you for coming!

Tim Bailey, President

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Outstanding Hearing Conservationist Award

Established in 1990, the Award for Outstanding Contributions to the Field of Hearing Conservation is given to a person whose work is exemplary in our field. It is a pleasure to announce that this year's recipient is Dr. John Franks. His contribution to research, standards and his devoted advocacy for preventing occupational hearing loss are exemplary.

The breadth of Dr. Franks' impact in our field undoubtedly stems from the diversity of his academic training. In 1967, Dr. Franks received a B.A. in psychology from the University of Missouri (St. Louis). He received an M.A. in audiology in 1969 from the Central Institute for the Deaf, Washington University, St. Louis, Missouri, and in 1975, he received his Ph.D. in audiology with a minor Master of Science in mechanical engineering from Purdue University, West Lafayette, Indiana. Since that time, Dr. Franks has distinguished himself as a leading researcher in our profession. He currently serves as the Chief of the Hearing Loss Prevention Section of the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention.

Dr. Franks' research contributions have profoundly influenced the field of bioacoustics and hearing loss prevention. He is the author, or first author, of seven book chapters, and the second author, or co-author, of four more book chapters. Additionally, Dr. Franks is the author, or first author, of 13 articles published in refereed journals, and the second author, or co-author, on 17 additional refereed journal articles. He has also written numerous NIOSH publications. Furthermore, Dr. Franks has pioneered web-based dissemination of hearing loss prevention materials.

His efforts have contributed to our understanding of earmold acoustics, speech communications, hearing protection devices (HPDs) and hearing loss prevention. For example, Dr. Franks' research on how hearing protectors attenuate sound has led to new American National Standards Institute (ANSI) standards and widely accepted practical guidelines for describing the protection people can expect as HPDs are worn in the "real world." As an orchestrator of, and primary author for, *Criteria for a Recommended Standard: Occupational Noise Exposure* (NIOSH, 98-126), he was instrumental in bringing American occupational noise exposure criteria (3-dB exchange rate, 85 dB PEL) in line with international guidelines. This document has achieved acceptance among hearing conservation professionals as the gold standard for "best practices" in preventing occupational noise-induced hearing loss.

John Franks

Dr. Franks' exemplary service to our profession is also evidenced by his contributions toward the development of acoustical standards. Since 1985 he has served as a member of the ANSI Accredited Standards Committee on Noise (S12). He just completed a three-year term as Vice Chair for the ANSI Committee on Bioacoustics (S3). Other ANSI activities include serving as a member of technical writing groups S3/WG76, S12/WG11, and S12/WG12.

Having authored/co-authored 20 invited papers and 30 additional papers at professional meetings, Dr. Franks is acknowledged as an international authority on the effects of noise and preventing occupational hearing loss. He is an active reviewer for *Ear and Hearing, Journal of the Acoustical Society of America, American Journal of Industrial Medicine, Journal of the American Industrial Hygiene Association, Noise and Health, American Journal of Industrial Medicine* and *ASHA.* His expertise on the cutting edge of hearing science and bioacoustic technology has not only well-served the numerous authors whose manuscripts he has reviewed, but also the many graduate students whose theses and dissertations he has directed. These efforts, and his present role as the team leader of the Hearing Loss Group for the National Occupational Research Agenda (NORA), ensure that his positive contributions to preventing noise-induced hearing loss will extend well into the next century.

Dr. Franks' tireless efforts include much behind-the-scenes work. He is regularly called upon to direct or sit on thesis and dissertation committees. He has organized many conferences and forums that have richly benefited our profession. These efforts include serving as program chair for two NHCA conferences, as well as organizing conferences to advocate best practices in preventing occupational hearing loss. He is a leader in developing research programs for addressing the effects of ototoxicants such as solvents, heavy metals, and asphyxiants. His patent for an in-the-ear hearing protector/communication system is being field-tested, and holds great promise as an emerging solution for those who must work and communicate in loud noise.

The esteem with which Dr. Franks is held by his peers is reflected by the leadership positions he has held in professional organizations. He served both as the Executive Vice-President and President of the Arizona Speech and Hearing Association. He chaired the Task Force on Principles and Practices for Audiometric Enclosures for Committee

E33.03Q of the American Society of Testing and Materials (ASTM). Dr. Franks' involvement with the National Hearing Conservation Association (NHCA) includes serving as the Commercial Delegate to the Executive Council from 1984 to 1987 as well as serving as Member Delegate from 1988 though 1992. He has also actively served on numerous NHCA committees throughout his membership tenure. The Association presented him with the Michael Beall Threadgill Award in 1997 in recognition of his outstanding service to NHCA. In 1999 the Acoustical Society of America honored Dr. Franks by awarding him Fellowship status for his contributions in preventing noise-induced hearing loss.

Dr. Franks' life has been dedicated to helping people keep the hearing they were born with. It is fitting that the National Hearing Conservation Association bestows this honor on one for whom it is so richly deserved.

By Rena Glaser

2004 STUDENT CONFERENCE AWARDS

NHCA is pleased to announce the recipients of this year's Student Conference Awards. This award is available to students who are actively pursuing a degree in a discipline related to hearing conservation and who are enrolled at least half time in an accredited educational institution. Applications were submitted by students from a variety of academic programs across the country. Recipients receive free conference registration and partial reimbursement for travel expenses. Special thanks go to our 2004 sponsors for making this program possible: The American Industrial Hygiene Association, Quest Technologies, Tim Bailey, and Elliott Berger.

Please welcome this year's award winners to the conference:

Antony Joseph, Michigan State University
Ph.D. program in Audiology (Epidemiology/Hearing Science)

Jeff Lancaster, Virginia Tech
Ph.D. program in Industrial Engineering (Human Factors & Ergonomics)

NHCA AWARD

Michael Beall Threadgill Award

The Michael Beall Threadgill Award was established in 1985 to honor those individuals who have contributed in a significant way to the growth and continuing excellence of the National Hearing Conservation Association by their outstanding commitment of time and effort. In 2004, the NHCA is proud to present this prestigious award to Lee Hager.

Lee made his first appearance on the NHCA stage as a workshop presenter at the 1993 annual conference in Albuquerque. Apparently he found value in what he saw and heard at that meeting, and he liked the folks he met so he became a member of our illustrious organization in 1994. Not one to sit back and observe, Lee was soon on the leadership express. His first appointment was to the Public Relations committee and in 1995 he became the chair of the committee and held that post for the next two years. While chair of the PR Committee, Lee brought forth the NHCA Practical Guide brochures, which remain a valuable offering of the organization to this day.

In 1997, the longtime editor of *Spectrum*, Marty Lane, decided it was time to step down. I recall the concern of the council at that time and the dilemma of who in the world will ever be able to replace Marty. Lee realized that someone would have to step up, and he graciously accepted the call, knowing he had some mighty big shoes to fill. Without missing a beat, Lee assumed the editorship with aplomb. A valuable new addition to *Spectrum* that debuted during Lee's tenure as editor was Noise and Hearing Resources on the World Wide Web. Additionally, Lee was instrumental in the development and maintenance of the NHCA website.

Lee's tenure as *Spectrum* Editor came to an end when, in 1998, he was elected President Elect. He eagerly accepted the post and began to prepare and lay the groundwork for what would become a successful term as President in 1999-2000. Lee's efforts were tireless in promoting NHCA. Always eager to spread the word and look for collaborative opportunities, Lee organized and chaired the Best Practices in Hearing Loss Prevention symposium in conjunction with Wayne State University in Detroit. This collaboration served as a successful model for future workshops and symposiums and has proved to be a valuable method to attain both educational and financial goals of the organization.

Lee Hager

Most Past-Presidents, upon completion of their three-year stint, are comfortable (relieved) to step down and let others take over the active roles of leadership. Not so for Lee. His enthusiasm and dedication to NHCA did not wane. He continues to serve on the Steering Committee, the Publications Committee, and the Program Committee. In 2002, at the request of the President, he agreed to chair an Ad Hoc Membership Campaign. He developed a Power Point presentation to promote NHCA and made it available to any member who wanted to sing the organization's praises. He continues to organize, arrange, and present technical sessions at major conferences on hearing loss, and he continues to maintain active memberships with several professional organizations, always putting NHCA at the top of the list.

It's clear that Lee Hager's dedication to the National Hearing Conservation Association is solid and his tireless efforts to promote this organization that is so near to his heart are exceptional. Those of you who have worked with Lee appreciate his willingness to get the job done, with a down to earth style and his ever-present sense of humor.

It is with sincere pleasure and the gratitude of the membership that NHCA presents Lee Hager with the Michael Beall Threadgill Award. Congratulations, Lee.

By Mary M. McDaniel

LIVE AND SILENT AUCTION

Participate in NHCA's Live and Silent Auctions and bid on items to help support our organization! If you are interested in donating an item for one of the auctions, please bring that item(s), or a certificate, to the conference registration desk. The live auction will be held on Friday evening during the dinner cruise. The Silent Auction will run through Saturday morning.

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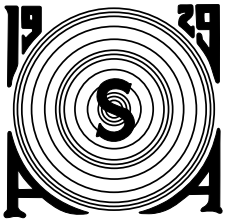


COMMITTEE & ALLIED MEETINGS

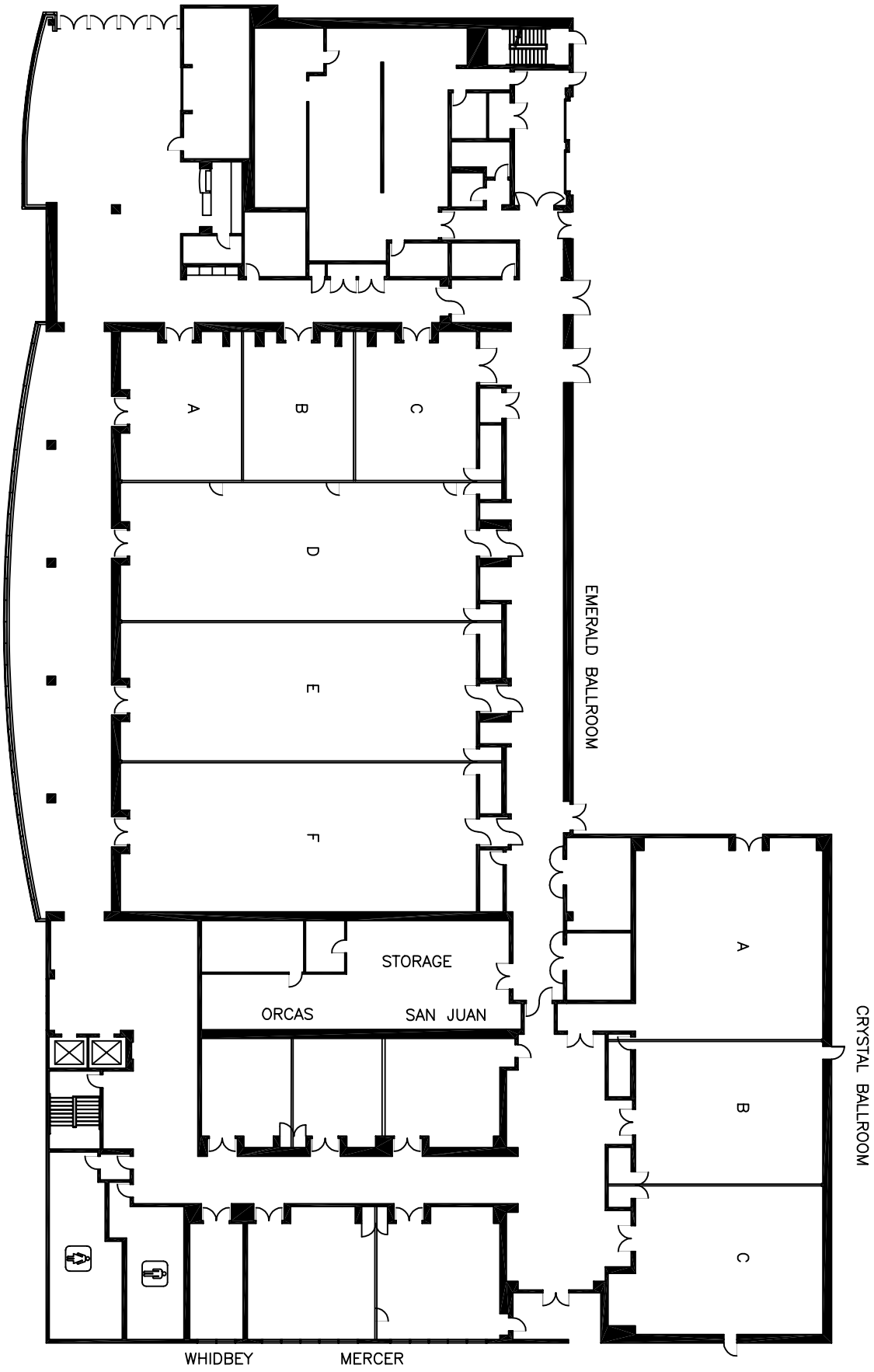
WEDNESDAY, FEBRUARY 18

Time:	*Group:*	*Room:*
9:00 A.M.–NOON	Steering Committee	Orcas A
1:00 P.M.–6:00 P.M.	Executive Council	Orcas B
6:00 P.M.–7:00 P.M.	Program Committee	Orcas A

SUNDAY, FEBRUARY 22

8:30 A.M.–Noon	ANSI S12/WG11 Hearing Protector Attenuation and Performance	Mercer A

HILTON SEATTLE AIRPORT CONFERENCE CENTER



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❖❖ 3M Occupational Health and Environmental Safety Division

The remarkable comfort of 3M™ Hearing Protectors helps increase wear time in order to reduce exposure to hazardous noise and loud sounds. Stop by the 3M exhibit to see new Soft Foam Ear Plugs 1120 and Corded Soft Foam Ear Plugs 1130 featuring a patented 3M design. This unique, "articulated" design helps the ear plug to better conform to the shape of the ear canal. The soft, low-pressure foam results in greater comfort for a wider range of ear sizes. 3M Reusable Ear Plugs have also been enhanced for greater comfort. These pre-molded ear plugs now feature a softer elastic material for longer wear time and a unique finger-grip stem for easy insertion. Check out our full line of ear muffs and banded hearing protectors as well. You'll see why 3M Occupational Health and Environmental Safety Division is the global leader in personal protective equipment.

❖ Acoustical Society of America

The Acoustical Society of America will be celebrating its 75th anniversary at its 147th meeting in New York City, May 24-28. Its purpose is to diffuse the knowledge of acoustics and promote its practical applications. A person or corporation interested in acoustics is eligible for membership in this Society http://asa.aip.org. Members of the Acoustical Society are involved in the study of noise, its measurement, its effects, ways of reducing noise to improve the human environment, and the necessary standardization to achieve that end. Recently the Society has been successful in producing a standard on classroom acoustics and promoting material for the public on the importance of good listening environments for learning. At this meeting, ASA will provide packages of multiple standards on CD-ROM, which focus on specific needs of hearing conservationists, audiologists, and industrial hygienists at a reduced price.

❖ American Academy of Audiology

The American Academy of Audiology represents over 8,500 audiologists and is dedicated to providing quality hearing care services through professional development, education, research, and increased public awareness of hearing and balance disorders. To learn more about the audiology profession and how audiologists are helping the 28 million Americans who suffer from hearing loss, please visit the Academy's website at www.audiology.org.

❖ American Industrial Hygiene Association

The American Industrial Hygiene Association (AIHA), founded in 1939, is the world's largest association of occupational and environmental health professionals, and its members play an important role on the frontline of worker health and safety. The 12,500 members come from government, labor, industry, academia, and private business. AIHA is the most diverse professional association dedicated to the improvement of the health and well-being of workers, the community, and the environment.

❖ American Speech-Language-Hearing Association

ASHA is the professional, scientific, and credentialing organization representing over 107,000 audiologists, speech-language pathologists, and hearing and speech scientists who provide hearing conservation, diagnostic, rehabilitative, and consultative services and conduct research for children and adults who are at risk for or have hearing, balance, speech, language, and/or swallowing disorders. Approximately 45 percent of ASHA's audiologists provide hearing conservation services for industry. For more than a decade, ASHA coordinated the efforts of the Coalition to Protect Workers' Hearing, which address federal regulatory initiatives from OSHA, NIOSH, MSHA, and agency reform efforts by Congress. ASHA has a Special Interest Division on Hearing Conservation.

Benson Medical Instruments Co.

Benson Medical Instruments manufactures a full-line of industrial audiometers, hearing conservation software and accessories with advantages in testing speed, quality, ease of use, and data handling. We offer solutions for a single clinic and for multi-station mobile testing.

❖❖ Bilsom

Founded in Sweden in 1968, Bilsom leads the industry in developing innovative sound management technologies and products that are used in some of the most challenging environments in the world. Bilsom is a part of the Bacou-Dalloz™ Hearing Safety Group. Combining the innovation and expertise of Bilsom® Earmuffs and Howard Leight® Earplugs, the Bacou-Dalloz Hearing Safety Group is a world leader in hearing safety. Visit us at www.bilsom.com.

❖ Centers for Disease Control and Prevention; National Institute for Occupational Safety and Health

The National Institute for Occupational Safety and Health (NIOSH) is the federal agency responsible for conducting research, disseminating information, and making recommendations regarding prevention of work-related disease injury. NIOSH is part of the Centers for Disease Control and Prevention (CDC) and also investigates potentially hazardous working conditions when requested by employers or employees. Headquartered in Washington, D.C., NIOSH has offices in Atlanta, Georgia, and research divisions in Cincinnati, Ohio; Morgantown, West Virginia; Bruceton, Pennsylvania; and Spokane, Washington.

❖ Council for Accreditation in Occupational Hearing Conservation (CAOHC)

CAOHC is dedicated to the establishment and maintenance of training standards for those who safeguard hearing in the work-

❖❖ Conference Sponsor ❖ Conference Affiliate

place. CAOHC has been a leader in providing standards for occupational hearing conservation programs since its inception in 1973. CAOHC certification offers the certified occupational hearing conservationist (COHC) credibility and serves as verification that the conservationist has been trained to the highest standards. CAOHC certification is recommended by the Occupational Safety and Health Administration (OSHA) and is mandatory for the Mine Safety & Health Administration (MSHA). In 2003 the 4th Edition *Hearing Conservation Manual*, by Alice Suter, Ph.D., was introduced. All hearing conservation team members will find this manual vital in the front-line defense against hearing loss in workers. More information available about CAOHC on the worldwide web at www.caohc.org.

❖❖ E-A-R®

E-A-R, leading the advancement of hearing protection worldwide, provides truly innovative products including foam, premolded and push-in foam earplugs. Products include the Classic®, E-A-Rsoft®, SuperFit®, UltraFit® and our latest innovation, Push-Ins™. E-A-R also sells specialized devices such as the noise-activated flat-attenuation Ultra 9000® earmuff, the clear-sounding UltraTech® earplugs, and the Eartone® insert audiometric earphones. Visit our website at: www.E-A-R.com.

Eckel Industries of Canada Limited

Eckel Industries is a manufacturer of noise control products and services, including audiometric booths, rooms and suites and an infant acoustic isolette for hearing screening testing and clinical evaluation; architectural noise control panels for control of room acoustics; machinery and other types of industrial enclosures; anechoic testing facilities for noise research.

EI, Inc.

EI offers a variety of occupational health services to ensure employee health, wellbeing, and productivity. These include a full range of hearing conservation services such as mobile testing, CAOHC-approved training courses, audiometer calibrations, sound level checks, and access to Audio Assessor, our innovative, web-based audiometric data management system.

❖❖ Howard Leight Industries

From our beginnings as a one-man operation more than 30 years ago, Howard Leight Industries has grown into one of the largest manufacturers of in-ear hearing protection in the industrial market and the recognized innovator in protection and fit. Since 2001, we've been part of the Bacou-Dalloz™ Hearing Safety Group. Combining the innovation and expertise of Howard Leight® Earplugs and Bilsom® Earmuffs, the Bacou-Dalloz Hearing Safety Group is a world leader in hearing safety. Visit us at www.howardleight.com.

Larson Davis

Larson Davis is a leading supplier of Noise and Vibration measurement instrumentation since 1981. Products include Audiometric Calibration systems, Personal Noise Dosimeters, Type 1 Sound Level meters, Octave Band, and Real-time analyzers, and a Hand - arm / Whole Body Vibration monitor for evaluating human exposures to ISO 2631 and 5349.

Maico Diagnostics

A leading U.S. manufacturer of audiometers has been chosen by major corporations and the U.S. Department of Defense to carry them into the future. If you need a new audiometer, Maico has the products to meet your needs. In addition, Maico, in connection with the House Ear Institute, will show the HINT (Hearing in Noise Test) that measures speech intelligibility under conditions that allow assessment of the subject's use of both ears together to hear in quiet and in noise. Stop by our booth for a free demonstration.

Moldex-Metric, Inc.

Moldex is one of the most recognized names in hearing and respiratory protection in industry and healthcare. Comfort, quality and value are all synonymous with a Moldex product. Moldex has a strong history of perpetual innovation. We strive to design and engineer products that provide comfort and style for workers. Products they want to wear. This focus is backed up with over fifty patents for innovative and unique products like our EZ-ON and HandyStrap respirators as well as our Plug Station earplug dispenser. Moldex has manufacturing facilities in the United States and Europe, plus sales offices and warehouses in all major markets worldwide and distribution in over fifty countries.

Occupational Marketing, Inc.

Best known for its spirometry software and continuing education courses, OMI has always been considered a leader in the field of occupational health. Keeping the needs of a program administrator in mind, OMI has created one of the most comprehensive audiometric software packages available today. Let us show you.

❖❖ Peltor®

Peltor, preferred by professionals everywhere, has long been considered the leader in protective communication headsets and earmuff hearing protectors. All Peltor products are designed to provide the optimum attenuation, maximum comfort, and the most sophisticated technology available. Innovative designs include the dual-shell H10 Extreme Performance earmuff, the High Performance Series™ of clear cup earmuff for easily monitored dual protection, and the Tactical 6-S electronic "listening" earmuff. The PowerCom™ two-way UHF radio headset has a transmission range of up to 2 miles. The newest communication device is the Hearplug™ featuring communications abilities through popular E-A-R® style hearing protectors. Visit our website at www.peltor.com.

❖❖ Quest Technologies, Inc.

Quest Technologies, Inc., is one of the most widely recognized and respected worldwide manufacturers for both the Quest and Metrosonics brands of occupational hygiene, safety and environmental instruments, and audiometric calibration systems for measurements and analysis. Included are basic and logging versions of sound level meters, octave band analyzers, hand-arm, whole-body and machine vibration monitors, noise dosimeters, audiometric calibration systems, gas detectors, heat stress monitors, and indoor air quality monitors. Quest Technologies maintains a Registered Quality Management System to ISO 9001:2000 Standards and

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A2LA Accredited Calibration Laboratory to ISO 17025. The Quest brand is dedicated to offering a "Systems Solution" via our QuestSuite Professional software, whereas the Metrosonics brand is committed to providing "Guaranteed Simple Solutions at an Affordable Price" with uncompromising quality. Our products are available through our worldwide distribution network or for direct orders via our U.S. GSA contract. Quest is proud to be a member of NHCA, AIHA, ASA, NATA, NSC and VPPPA.

❖❖ Sonomax

Sonomax is dedicated to lowering the incidence of noise-induced hearing loss (NIHL) by developing and marketing leading-edge hearing protection products, and by working to raise public awareness of the unacceptable costs of NIHL. The Sonomax Solution™ is a hearing protection system for industry that combines uniquely designed earpieces, optimized proprietary hardware and an easily navigable Windows®-based support application. Sono-Pass™ software, which drives the fitting process, confirms the acoustic seal, calibrates the level of sound attenuation achieved and records the results. In combination, Sono-Pass™'s hardware and software provide for a simple, on-the-spot procedure, allowing a technician to deliver hearing protection that is custom fitted to the wearer, and function tested for reliability. In addition, the application provides employers the unique ability to quantify and track hearing protection performance and produce thorough reports on collected data that can support an effective and comprehensive hearing conservation program.

TASCO Corporation

Tasco Corporation, leading the industry as the premier manufacturer of circumaural, semiaural, disposable and reusable hearing protection for twenty-nine years. All of our products are proudly made in their entirety in the USA and tested at a NVLAP facility. Government and other independent testing have proven the TASCO Products' high performance and repeatability of NRRs. You can trust TASCO for all of your Hearing, Face and Head protection needs.

Tremetrics Occupational Health Group

Tremetrics Occupational Health Group provides a complete line of microprocessor/digital audiometers, space-saving mobile testing systems, hearing test booths and comprehensive hearing/health data management software. The NEW Tremetrics HT Wizard® /Easy Touch audiometer provides truly new and innovative features never before offered in a stand-alone screening audiometer. Turn to Tremetrics for total, one source hearing testing solutions consisting of audiometers, booths, software, world-wide service and calibration.

EXHIBIT SCHEDULE — EMERALD BALLROOM

THURSDAY, FEBRUARY 19

Exhibit Set-up and Registration
11:00 A.M. – 4:00 P.M.

Exhibit Open
Opening Reception in Exhibit Hall
5:00 P.M. – 9:00 P.M.

FRIDAY, FEBRUARY 20

Continental Breakfast/
Exhibits Open
7:00 A.M. – 8:00 A.M.

Break/Exhibits Open
10:00 A.M. – 11:00 A.M.

Luncheon with
Exhibitor Introductions
12:00 NOON – 1:40 P.M.

Break/Exhibits Open
3:15 P.M. – 3:45 P.M.

SATURDAY, FEBRUARY 21

Exhibits Open
7:30 A.M. – 8:00 A.M.

Break/Exhibits Open
10:10 A.M. – 11:10 A.M.

Exhibit Dismantling
12:00 NOON – 4:00 P.M.

PROGRAM

THURSDAY, FEBRUARY 19

7:30 a.m. - 5:30 p.m.	REGISTRATION AND INFORMATION DESK OPEN	**Emerald Foyer**
7:30 a.m. - 8:30 a.m.	CONTINENTAL BREAKFAST	**Emerald Foyer**
8:30 a.m. - 11:30 a.m.	MORNING WORKSHOPS	
1:00 p.m. - 4:00 p.m.	AFTERNOON WORKSHOPS	

a.m. or p.m.

1. HI-TECH HEARING CONSERVATION TRAINING: STEP-BY-STEP TECHNIQUES FOR DEVELOPING AND DELIVERING YOUR OWN EXCITING MULTI-MEDIA PRESENTATIONS **Crystal C**

Richard Danielson, *National Space Biomedical Research Institute and Baylor College of Medicine, Houston, TX*
Beth Cooper, *Acoustical Testing Laboratory, NASA John H. Glenn Research Center, Lewis Field, Cleveland, OH*

a.m. or p.m.

2. NIHL: ANATOMY, PHYSIOLOGY, OXIDATIVE MECHANISMS AND PHARMACOLOGIC PROTECTION **Crystal B**

Kathleen Campbell, *Southern Illinois University, School of Medicine, Springfield, IL*

a.m. only

3. PRACTICAL NOISE CONTROL OPTIONS AND APPLICATIONS **Mercer A**

Dennis Driscoll, *Associates in Acoustics, Inc., Evergreen, CO*

p.m. only

4. CLASSROOM ACOUSTICS: REMOVING ACOUSTICAL BARRIERS TO LEARNING **Mercer A**

David Lubman, *D. Lubman & Associates, Westminster, CA*

a.m. only

5. DANGEROUS DECIBELS™: A MODEL FOR DEVELOPING, DELIVERING AND EVALUATING A HEARING LOSS AND TINNITUS PREVENTION PROGRAM THAT TARGETS POPULATIONS OF ALL AGES **Crystal A**

Susan Griest, *Oregon Hearing Research Center, OHSU, Portland, OR*
Linda Howarth, *Oregon Hearing Research Center, OHSU, Portland, OR*
Dr. Billy Martin, *Oregon Hearing Research Center, OHSU, Portland, OR*

p.m. only	**6.** SOUNDS LIKE FUN: PRESENTED BY THE COLORADO STATE UNIVERSITY LITTLE SHOP OF PHYSICS AND BILLY MARTIN **Crystal A** ***Dr. Billy Martin,*** *Oregon Hearing Research Center, OHSU, Portland, OR* ***Facilitated by*** ***Susan Griest,*** *Oregon Hearing Research Center, OHSU, Portland, OR* ***Deanna Meinke,*** *Associates in Acoustics, Inc., Greeley, CO*
8:30 a.m. - 4:00 p.m.	ALL DAY SEMINAR - HEARING LOSS PREVENTION: THE BASICS **Orcas A, B** ***Elliott Berger,*** *E-A-R/Aearo Co., Indianapolis, IN* ***Mary McDaniel,*** *Pacific Hearing Conservation, Inc., Seattle, WA* ***Susan Megerson,*** *University of Kansas, Shawnee Mission, KS* ***Rick Neitzel,*** *University of Washington, Seattle, WA* ***Tim Swisher,*** *Hearing Safety, Pittsburgh, PA* ***Nancy Vause,*** *Human Research and Engineering Directorate, Aberdeen Proving Ground, MD*
9:45 a.m. - 10:15 a.m.	WORKSHOP & SEMINAR BREAK WITH REFRESHMENTS **Emerald Foyer**
11:30 a.m. - 1:00 p.m.	LUNCH (on your own)
1:00 p.m. - 4:00 p.m.	AFTERNOON WORKSHOPS - SEE WORKSHOPS LISTED ABOVE
2:15 p.m. - 2:45 p.m.	WORKSHOP & SEMINAR BREAK WITH REFRESHMENTS **Emerald Foyer**
4:00 p.m. - 5:00 p.m.	FREE NETWORKING TIME
4:00 p.m. - 6:00 p.m.	PUBLIC SCHOOL WORKSHOP FOR LOCAL K-8 CLASSROOM EDUCATORS AND SCHOOL PROFESSIONALS **Mercer B** ***Facilitated by Linda Howarth and Charles Fankhauser, Ph.D.*** HAVE FUN FIGHTING DANGEROUS DECIBELS ***Presented by The National Hearing Conservation Association Task Force on Hearing Conservation for Children and Adolescents and Oregon's Dangerous Decibels™*** ***Charles Fankhauser, Ph.D.,*** *MEDI, Benecia, CA* ***Linda Howarth,*** *Oregon Hearing Research Center, OHSU, Portland, OR*
5:00 p.m. - 9:00 p.m.	OPENING RECEPTION IN THE EXHIBIT HALL **Emerald A, B, C, D**

FRIDAY, FEBRUARY 20

7:00 a.m. - 5:30 p.m.	REGISTRATION AND INFORMATION DESK OPEN	**Emerald Foyer**
7:00 a.m. - 8:00 a.m.	CONTINENTAL BREAKFAST IN THE EXHIBIT HALL	**Emerald A, B, C, D**
8:00 a.m. - 8:10 a.m.	OPENING REMARKS ***Tim Bailey,*** *Quest Technologies, Inc., Oconomowoc, WI* *NHCA President* ***Laurie Wells,*** *Associates in Acoustics, Inc., Loveland, CO* *Program Chair*	**Emerald E, F**
8:10 a.m. - 9:00 a.m.	KEYNOTE PRESENTATION: OSHA/NHCA ALLIANCE ***Paula White,*** *Director, Directorate of Cooperative and State Programs, OSHA*	**Emerald E, F**
9:00 a.m. - 9:30 a.m.	HAIR CELL REGENERATION ***Yehoash Raphael,*** *Kresge Hearing Research Institute, University of Michigan, Ann Arbor, MI*	**Emerald E, F**
9:30 a.m. - 9:50 a.m.	D-METHIONINE AS AN OTOPROTECTANT ***Kathleen Campbell,*** *Southern Illinois University, Springfield, IL*	**Emerald E, F**
9:50 a.m. - 10:00 a.m.	POSTER INTRODUCTIONS ***Greg Flamme,*** *University of Iowa, Iowa City, IA* MEDIA THEATER INTRODUCTIONS ***Rick Neitzel,*** *University of Washington, Seattle, WA*	**Emerald E, F**
10:00 a.m. - 11:00 a.m.	BREAK - EXHIBITS, SILENT AUCTION, POSTERS AND MEDIA THEATER	**Emerald A, B, C, D** **Media Theater - Orcas A, B**
11:00 a.m. - 11:20 a.m.	NIOSH/NHCA BEST PRACTICES WORKSHOP ON IMPULSIVE NOISE ***Chuck Kardous,*** *NIOSH, Cincinnati, OH* ***John Franks,*** *NIOSH, Cincinnati, OH*	**Emerald E, F**
11:20 a.m. - 11:40 a.m.	NUMBER RATINGS, NRRs AND THE EPA'S LABELING REGULATION ***Elliott Berger,*** *E-A-R/Aearo Co., Indianapolis, IN*	**Emerald E, F**
11:40 a.m. - 11:55 a.m.	NHCA BUSINESS MEETING	**Emerald E, F**
12:00 Noon - 1:40 p.m.	LUNCHEON - ACOUSTICAL ARCHEOLOGY ***David Lubman,*** *D. Lubman & Associates, Westminster, CA*	**Crystal A, B**

	CONCURRENT SESSIONS
1:45 p.m. - 3:15 p.m.	NEW TECHNOLOGIES IN HEARING PROTECTION: PRACTICAL APPLICATIONS AND RESEARCH CHALLENGES IN PERFORMANCE MEASUREMENT **Emerald E, F** ***John Casali,*** *Virginia Tech, Blacksburg, VA* ***Gary Robinson,*** *Virginia Tech, Blacksburg, VA*
1:45 p.m. - 3:15 p.m.	HEARING CONSERVATION IN THE CONSTRUCTION INDUSTRY **Crystal C** ***Rick Neitzel,*** *University of Washington, Seattle, WA* ***Carol Merry-Stephenson,*** *CDC/NIOSH, Loveland, OH*
1:45 p.m. - 3:15 p.m.	LITIGATION STRATEGY UNDER THE NEW OSHA HEARING PROTECTION STANDARDS **Mercer A, B** ***Aaron Owada,*** *Northcraft, Bigby & Owada, P.C., Seattle, WA*
3:15 p.m. - 3:45 p.m.	BREAK - EXHIBITS, SILENT AUCTION, POSTERS AND MEDIA THEATER **Emerald A, B, C, D** **Media Theater - Orcas A, B**
3:45 p.m. - 5:00 p.m.	POINT/COUNTERPOINT: COMPONENTS IN NIHL - CAN THEIR RELATIVE EFFECTS BE FAIRLY AND EQUITABLY DISCERNED? **Emerald E, F** ***Robert Dobie,*** *University of California at Davis, Sacramento, CA* ***David Lipscomb,*** *Correct Service Inc., Stanwood, WA* ***Mary Wilson,*** *Assistant Attorney General, State of Washington, Seattle, WA*
5:00 p.m. - 6:00 p.m.	NETWORKING TIME
6:00 p.m. - 10:30 p.m.	SPECIAL EVENT: ROYAL ARGOSY DINNER CRUISE Enjoy an evening of food, fun, beautiful night lights and the Live Auction aboard the Royal Argosy as it sails through Elliot Bay. **The buses will begin departing the hotel at 6:00 p.m. for a 6:45 p.m. boarding. Return to the hotel is scheduled for 10:30 p.m.**

SATURDAY, FEBRUARY 21

7:30 a.m. - 8:00 a.m.	EXHIBIT HALL OPEN	**Emerald A, B, C, D**
7:30 a.m. - 5:30 p.m.	REGISTRATION AND INFORMATION DESK OPEN	**Emerald Foyer**
8:00 a.m. - 9:00 a.m.	ROUND TABLE DISCUSSIONS - BREAKFAST	**Crystal A, B, C**
9:10 a.m. - 9:30 a.m.	HEARING CONSERVATION FOR THE VERY SMALL BUSINESS ***Carol Merry-Stephenson,*** *CDC/NIOSH, Loveland, OH*	**Emerald E, F**
9:30 a.m. - 9:50 a.m.	THE KEOKUK RURAL HEALTH STUDY ***Greg Flamme,*** *University of Iowa, Iowa City, IA*	**Emerald E, F**
9:50 a.m. - 10:10 a.m.	NOISE EXPOSURE LEVELS FOR WORKERS IN THE WOOD INDUSTRY ***Michael Stewart,*** *Central Michigan University, Mt. Pleasant, MI* ***Kari Koltes****, Central Michigan University, Mt. Pleasant, MI* ***Mark Lehman****, Central Michigan University, Mt. Pleasant, MI* ***Jim Bennie, Jim Dougovito, Joe Pryal, Angelo St. Juliana and Jayne Szukalowski,*** *M-TEC at Bay College*	**Emerald E, F**
10:10 a.m. - 11:10 a.m.	BREAK - EXHIBITS, SILENT AUCTION, POSTERS AND MEDIA THEATER	**Emerald A, B, C, D** **Media Theater - Orcas A, B**
11:10 a.m. - 11:30 a.m.	NOISE EXPOSURE AND HCP's IN SELECTED INDUSTRIES IN WASHINGTON STATE ***William Daniell,*** *University of Washington, Seattle, WA*	**Emerald E, F**
11:30 a.m. - 11:50 a.m.	WORKING IMPAIRED IN DANGEROUS SETTINGS: WHAT WORKERS TELL US ABOUT THEIR COMMUNICATION AND HEARING NEEDS ***Robert Randolph,*** *NIOSH, Pittsburgh, PA*	**Emerald E, F**
11:50 a.m. - 12:10 p.m.	SOUND LOCALIZATION WEARING LEVEL-DEPENDENT HPD (COMBAT ARMS EARPLUG) ***Lorraine Babeu,*** *U.S. Army Research Laboratory, Aberdeen Proving Ground, MD*	**Emerald E, F**
12:10 p.m. - 12:30 p.m.	EVALUATION OF LEVEL-DEPENDENT HPDs FOR USE WITH IMPULSIVE NOISES ***William Murphy,*** *U.S. Public Health Service, NIOSH, Cincinnati, OH*	**Emerald E, F**

SATURDAY, FEBRUARY 21 *(Continued)*

12:30 p.m. - 1:45 p.m.	AWARDS LUNCHEON **Crystal Ballroom** Michael Beall Threadgill Award Outstanding Hearing Conservationist Award 2003 Outstanding Lecture Award 2003 Outstanding Poster Award 2003 Golden Lobe Awards
1:55 p.m. - 2:15 p.m.	GASAWAY LECTURE **Emerald E, F** ***Richard Danielson,*** *National Space Biomedical Research Institute and Baylor College of Medicine, Houston, TX*
2:15 p.m. - 3:30 p.m.	STS RECORDABILITY PANEL **Emerald E, F** ***George Cook,*** *Workplace Group, Greensboro, NC* ***Lynda Glaspey****, OSHA Region 10* ***Cathy Padolewski Cole,*** *The Sherwin-Williams Co., Cleveland, OH* ***Claude Revels,*** *JM Family Enterprises, Deerfield Beach, FL* ***Carolyn Tolley,*** *ASI Health Services, Dallas, TX* *Moderator -* ***Nancy N. Green,*** *AuD, Industrial Audiologist, Jacksonville, FL*
3:30 p.m. - 3:50 p.m.	RECOMMENDED CRITERIA FOR REMOVING EMPLOYEES FROM A HEARING CONSERVATION PROGRAM **Emerald E, F** ***Dennis Driscoll,*** *Associates in Acoustics, Inc., Evergreen, CO*
3:50 p.m. - 4:10 p.m.	ISSUES IN IMPLEMENTING A GLOBAL CORPORATE HEARING CONSERVATION PROGRAM **Emerald E, F** ***Bruce Kirchner****, Proctor & Gamble Company, Cincinnati, OH*
4:10 p.m. - 4:20 p.m.	PROPOSED CHANGES IN ALLOWABLE AMBIENT NOISE LEVELS FOR AUDIOMETRIC TESTING **Emerald E, F** ***Mary McDaniel,*** *Pacific Hearing Conservation Inc., Seattle, WA*
4:20 p.m. - 4:40 p.m.	IS TESTING 500 Hz NECESSARY WHEN MONITORING FOR OCCUPATIONAL HEARING LOSS? **Emerald E, F** ***Mark Stephenson,*** *CDC/NIOSH, Cincinnati, OH*
4:40 p.m. - 4:45 p.m.	CLOSING REMARKS **Emerald E, F** ***Tim Bailey,*** *Quest Technologies, Inc., Oconomowoc, WI NHCA President* ***Laurie Wells,*** *Associates in Acoustics, Inc., Loveland, CO Program Chair*

THURSDAY, FEBRUARY 19

WORKSHOP 1

Hi-Tech Hearing Conservation Training: Step-by-Step Techniques for Developing and Delivering Your Own Exciting Multi-Media Presentations

Richard Danielson, Ph.D., National Space Biomedical Research Institute and Baylor College of Medicine, Houston, Texas, and Beth Cooper, NASA John H. Glenn Research Center at Lewis Field, Cleveland, Ohio

This workshop will build on the popularity of last year's NHCA training expo, which illustrated how a variety of presentation techniques and technologies could raise hearing conservation awareness. Participant feedback at that time indicated significant interest in an in-depth workshop that focused on production of multi-media presentations (i.e., detailed PowerPoint techniques). This workshop will be a focused, step-by-step tutorial, in which techniques and activities used in multi-media presentations will be incorporated with innovative ideas and resource materials for effective hearing conservation training. At the end of this fun forum, participants will receive a take-home CD containing a presentation that incorporates these techniques and resources in an activity that can be customized for use in any hearing conservation training program.

WORKSHOP 2

NIHL: Anatomy, Physiology, Oxidative Mechanisms and Pharmacologic Protection

Kathleen Campbell, Southern Illinois University, School of Medicine, Springfield, Illinois

Noise-induced hearing loss can occur in many work settings, even with optimal use of hearing protectors. In recreational settings, or in unexpected noise exposures, physical hearing protectors may not be used. Recent research developments suggest exciting future opportunities for preventing and/or reversing noise-induced hearing loss through pharmacologic intervention. These agents are not expected to replace but rather to supplement physical hearing protection. Over the last decades, a variety of pharmacologic agents have been proposed as potential otoprotective agents for ototoxic and more recently noise-induced hearing loss. A wide variety of agents, with various mechanisms of action have been studied but many involve oxidative processes. This presentation will review relevant oxidative mechanisms, cochlear physiology, and the most widely studied and most promising otoprotective agents and describe their potential future application in preventing cisplatin/carboplatin-induced, aminoglycoside-induced, and noise-induced hearing loss, including the author's own research. Clinical trials are being planned.

WORKSHOP 3

Practical Noise Control Options and Applications

Dennis P. Driscoll, P.E., Associates in Acoustics, Inc., and Laurie L. Wells, FAAA, Associates in Acoustics, Inc.

The protection of employees from occupational noise exposure is best achieved through implementation and maintenance of a comprehensive hearing conservation program (HCP). A major component of an HCP is the noise control phase, which provides the best long-term solution to in-plant noise problems. Many noise problems lend themselves to straightforward solutions. With an understanding of the principles of noise control and proper use of acoustical materials, it is feasible for industrial hygienists with a basic knowledge of the fundamentals of noise to develop noise control solutions; establish noise control priorities; identify and select optimum products for retrofitting equipment. Occupational Hearing Conservationists, Industrial Hygienists, and Safety Professionals will be able to develop feasible engineering noise controls through equipment or process redesign, using commercially available products, and/or materials requiring modification based on the customized needs of the problem. As a prerequisite, students must be familiar with the fundamentals of noise and basic terminology, such as A-weighted sound levels, decibel addition, octave-band frequencies, and noise dose and/or employee time-weighted average noise exposure.

WORKSHOP 4

Classroom Acoustics: Removing Acoustical Barriers to Learning

David Lubman, D. Lubman & Associates, Westminster, California

It's great news that America is rediscovering the importance of good acoustics to learning! Through a remarkable example of interdisciplinary cooperation, the noise, acoustics and hearing communities developed the first American standard for classroom acoustics, ANSI S12.60-2002. Its proponents have convincingly shown that attention to the acoustical design of schools and classrooms can significantly boost student achievement, improve student behavior, increase social inclusiveness, and aid teacher retention. Some (all?) of the modest costs for good acoustics are returned to the community through educational benefits. Everyone benefits from good acoustics, but it is of inestimable importance for persons with hearing, language, and learning disabilities. Attend this seminar to learn something of the historical, scientific, engineering, economic and political basis for this important and ongoing development. Better yet, leverage your standing as a noise professional by becoming the ambassador for good classroom acoustics in your community.

WORKSHOP 5

Dangerous Decibels™: A Model for Developing, Delivering and Evaluating a Hearing Loss and Tinnitus Prevention Program That Targets Populations of All Ages

Billy Martin, Oregon Hearing Research Center, Oregon Health & Sciences University, Portland, Oregon, Susan Griest, Oregon Hearing Research Center, Oregon Health & Sciences University, Portland, Oregon, and Linda Howarth, Oregon Hearing Research Center, Oregon Health & Sciences University, Portland, Oregon

Would you like to put some life into your hearing loss prevention program plus bring about significant changes in knowledge, attitudes and behaviors related to noise exposure?

Edutainment—entertaining education—is an increasingly effective means of communicating important health information to *at-risk* populations of all ages. Dangerous Decibels™ is a program developed using innovative, creative, interactive and effective methods to communicate specific hearing health messages:

1. What are sources of dangerous sounds?
2. What are the consequences of dangerous sounds?

3. How do I protect myself from dangerous sounds?

This workshop will present the following:

Program Development: How do I develop, structure, fund and run a program?

Program Delivery: What are creative ways and venues in which I can present hearing health messages?

Program Evaluation: What should be evaluated and how do I evaluate it?

Research opportunities: Examples of ongoing research in program effectiveness, public noise exposures, and factors linked to noise-induced hearing loss and tinnitus will be presented.

WORKSHOP 6

Sounds Like Fun

Presented by the Colorado State University Little Shop of Physics and Billy Martin

Facilitated by Susan Griest and Deanna Meinke

The Colorado State University Little Shop of Physics is an innovative and unique hands-on science outreach program that has had regional, national and international impact.

This workshop is intended to be high activity with minimal lecture format.

- "Thrill your ears" with a diversity of sound sources and demonstrations that can enhance and even entertain! Rejuvenate your enthusiasm for sound and a passion for hearing conservation.
- Specific strategies and concepts for teaching/demonstrating sound, hearing loss and tinnitus prevention to children *and* adults will be explored with direct hands-on interactive teaching techniques.
- Designed for "kids" of all ages
- Dangerous Decibels™ Project will provide samples of interactive and engaging educational program resources. *Presentation of partial classroom program by Dr. Billy Martin.*
- If you've not had your musical ability with metal pipes challenged or a use for your grandfather's pipe cleaners, this workshop is for you.

ALL DAY SEMINAR—HEARING LOSS PREVENTION: THE BASICS

Effective Hearing Protection

E. H. Berger, E-A-R/AEARO Company

As hearing conservationists we can measure, assess, document, and counsel, but when it comes to effective intervention, our primary tool, sometimes our only tool, is a hearing protector. Therefore it behooves us to become knowledgeable about the specification of hearing protection devices and their use in hearing conservation programs. This presentation will focus on hearing protector function, how they are tested and rated (with particular reference to the NRR), the performance gains available from the use of dual hearing protectors, the effects of hearing protectors on speech communications, and useful tips on fitting today's popular products. The attendee will also learn about current developments such as flat and moderate attenuation hearing protectors, and earmuffs with active noise reduction (ANR) circuitry.

New Recordkeeping Requirements for Occupational Hearing Loss

Susan Megerson, The University of Kansas Medical Center Hearing and Speech Department

Determination of work-related hearing loss has long been one of the most complicated and controversial areas of injury/illness recordkeeping. OSHA's recent revision to 29 CFR 1904.10 became effective January 1, 2003, with a separate hearing loss column on Form 300 going into effect January 1, 2004. This presentation will focus on the basic requirements of 1904.10 as well implications for the professional review of audiograms and determination of work-relatedness. Although compliance with the recordkeeping rule is important to the ultimate goal of tracking incidence of work-related hearing loss, emphasis will also be placed on best practices for an effective hearing loss prevention program.

Measurement of Noise

Rick Neitzel, University of Washington, Seattle, Washington

In his segment of this seminar, Rick will provide an overview of the measurement of noise, including an introduction to that dear friend/archenemy of hearing loss prevention (the decibel), the equipment we use to measure noise (sound level meters, dosimeters, octave band analyzers, oh my!), and how all this relates to protecting people's hearing.

Hearing Conservation in the Real World

Mary McDaniel, Pacific Hearing Conservation, Seattle, Washington

This segment will wrap up the basics workshop with a Q&A session along with a discussion of real world applications. After spending the day examining the necessary elements of an effective hearing conservation program, this session will offer the participants the opportunity to answer the questions and question the answers. We'll look at real world decisions surrounding hearing loss prevention programs that involve management buy-in, personnel limitations, and budget constraints. It's easy to design an effective hearing conservation program when you're in the ivory tower. Let's examine the strategies when you're in a stick frame rambler!!

FRIDAY FEBRUARY 20

Strategies for Cell Replacement Therapy for Deafness

Yehoash Raphael, Kresge Hearing Research Institute, University of Michigan, Ann Arbor, Michigan

The main cause for sensorineural hearing loss is hair cell (HC) degeneration in the cochlea. Because HC loss is permanent, deafness cannot be reversed. Currently, the only possibility to restore hearing is via a cochlear implant. A future biological therapy for hearing loss may be based on cell replacement therapy, accomplished either by introducing stem cells-derived HCs or by using non-sensory cells that remain in the cochlea and converting them to HCs. The gene Math1 is necessary for generation of HCs during normal embryonic development. We have recently developed gene therapy technology for introducing *Math1* into supporting cells that remain in the cochlea after HCs are lost. Over-expression of *Math1* in non-sensory cells generated new HCs. Neurons grew toward the new HCs. This novel strategy may be used to develop therapy for replacing lost HCs.

D-Methionine as an Otoprotectant

Kathleen Campbell, Southern Illinois University, Springfield, Illinois

NIOSH/NHCA Best Practices Workshop on Impulsive Noise

Chuck Kardous, NIOSH, Cincinnati, Ohio, and John Franks, NIOSH, Cincinnati, Ohio

In May 2003, the National Institute for Occupational Safety and Health and the National Hearing Conservation Association co-sponsored the Best Practices Workshop on Impulsive Noise and its Effects on Hearing. The workshop aimed to bring together the leading international experts on impulsive noise from labor, industry, and government an overview of the current state of the art concerning the effects of impulse noise on the auditory system, to develop strategies for the measurement and characterization of impulsive noise, and to identify specific goals and future research priorities. The workshop consisted of a plenary session on the first day and three working group sessions. This paper summarizes the main results of the workshop. Key issues identified by the workshop: (1) need for instrumentation and standards to accurately measure and characterize impulsive noise, (2) need to define impulsive noise metrics and apply animal modeling to humans, (3) characterizing the effect of hearing protection devices on impulse noise in relation to hearing loss, and (4) understanding hearing loss from occupational versus non-occupational exposure.

Number Ratings, NRRs, and the EPA's Labeling Regulation

E.H. Berger, E-A-R/Aearo Company

For nearly 25 years the legally mandated specification of hearing protector effectiveness has been the Environmental Protection Agency's (EPA) Noise Reduction Rating (NRR). In March 2003, the EPA convened a workshop to examine the labeling regulation and the concerns that have been expressed as to its appropriateness and validity. However, besides EPA's avowed intention to revise the regulation, its details and the future are still uncertain. In terms of a scientifically valid approach to predicting protection, one must specify a method of measuring attenuation, define the noise exposure of the population or individual in question, and decide upon a computational method for use of those data (i.e., a rating scheme). The focus of this research is on the latter question, namely computation of a rating for hearing protector attenuation and application of that rating to noise measurements. The conclusion is that a single number computed in a manner similar to the current EPA-mandated NRR, but with suitable adjustments for use with A weighting, provides sufficient precision. To provide additional guidance to the purchaser, two such numbers could be provided on the primary package label—a smaller one to indicate expected protection by most users in practice, and a larger one to indicate the protection that is possible to achieve by individual highly motivated expert users.

Acoustical Archaeology

David Lubman, David Lubman & Associates, Westminster, California

Acoustical archaeology seeks to understand the past by rediscovering ancient uses of sound, and by learning how sound has influenced history. Without our realization, the noise of civilization has separated us from our ancient origins. Recent discoveries suggest that ancient humans placed great importance on sound—because their survival depended on listening. Paleolithics invented practical and spiritual uses for sound, including speech, music, and religion. Myths they created to give meaning to natural sounds survive today as religious and spiritual ideas. Neolithics further exploited sound by manipulating their built environment. This talk describes recent discoveries suggesting awareness and exploitation of sound by ice-age Neolithic cave dwellers in France. It describes ancient pyramids in Mexico that chirp like the Mayan's sacred bird. It describes conch shell horn uses by the Moche civilization of ancient Peru. It also shows how acoustical archaeology is advancing understanding of the origins of Judeo-Christian civilization. Examples (as time permits): speculations that the shofar—a sounding horn frequently mentioned in the bible—was an Israelite shepherd horn; Gregorian chant arose as an adaptation to architectural changes made by Constantine; and acoustical insights into the design of the shrine of an 8th century Saxon saint.

New Technologies in Hearing Protection: Practical Applications and Research Challenges in Performance Measurement

John G. Casali, Ph.D., CPE, and Gary S. Robinson, Ph.D., Auditory Systems Laboratory, Dept. of Industrial & Systems Engineering, Virginia Tech, Blacksburg, Virginia

In the past decade, several important advancements in augmented hearing protection devices (HPDs) have been developed and marketed, with the objectives of providing more "natural" hearing for the user, improved speech communications and signal detection, reduced noise-induced annoyance, and provision of protection which is somewhat "tailored" for the user's needs, noise exposure, and/or job requirements. Some of these benefits are typically realized in practice and others not. As contrasted with conventional HPDs which attenuate noise through static passive means, augmented HPDs incorporate active (electronic) means for noise cancellation or restoration of desirable sounds, nonlinear active or passive elements for altering attenuation as a function of ambient noise level, uniform attenuation networks with a flat attenuation curve, or adjustable leakage paths which can be varied in their attenuation. Despite these potential benefits, certain types of augmented HPDs cannot be properly marketed, or even marketed at all, in the United States as hearing protection due to the fact that the current EPA-promulgated requirements (CFR, 2002) for HPD testing and labeling do not accommodate their special features, nor completely reflect their performance. This presentation provides an overview of augmented HPDs that are currently available (circa 2003), their general performance, application potential, and the current need for performance testing standards to accommodate them.

Hearing Conservation in the Construction Industry

Carol Merry-Stephenson, CDC/NIOSH, Loveland, Ohio, and Rick Neitzel, University of Washington, Seattle, Washington

NIOSH has been developing, implementing, and evaluating a model hearing conservation program specifically designed to meet the needs of construction workers. The study partners have primarily included carpenters and millwrights. Program elements include effective delivery of yearly audiometry, several different approaches to education and training, noise measurement and TBEAM analysis, and behavioral observation of workers and worksites before and after implementation of the program. In this part of our presentation on "hearing conservation in the construction industry," Carol will present results of this study to date. Lessons learned—including mistakes made along the way—will be discussed. Recommendations will be presented for implementing similar programs throughout the

construction industry. Study materials and training products will be displayed and discussed.

The University of Washington (UW) has been assessing noise exposure levels, hearing loss, and hearing protection use among construction workers in Washington for more than five years. Workers from eleven different trades have been examined as part of this research. In this part of our presentation on "hearing conservation in the construction industry," Rick will discuss some of the noise exposures measured for the various trades, tasks, and tools that have been evaluated by UW, as well as self-reported use of hearing protection among the construction workers who have participated in the research. In addition, newly developed hearing conservation outreach materials designed by UW for use by both safety and health professionals and workers in the construction industry will be presented. Recent research on hearing protection performance and cross-shift changes in hearing levels of construction workers will also be discussed.

Point/Counterpoint: Components in NIHL—Can Their Relative Effects be Fairly and Equitably Discerned?

Robert Dobie, University of California at Davis, Sacramento, California, David Lipscomb, Correct Service Inc., Stanwood, Washington and Mary Wilson, Assistant Attorney General, State of Washington, Seattle, Washington

This section has been organized to update attendees on the concept of allocation between etiologies (causation). In all of hearing conservation, few topics have posed a greater challenge to professionals in this avenue of service than the "allocation" concept. To the uninitiated, the audiometric allocation between causative factors might seem to be a simple and straightforward task. Yet, discussions concerning this process have ranged far and wide. There is little or no controversy concerning the need for such a process. The disagreements occur when methods are proposed, considered and evaluated by professional and/or legal entities.

The intent of our presentations will be to bring our understanding of allocation to the new century. While it is acknowledged that there are still disagreements, more recent thinking and legal decisions may not be well known. Thus, we offer this review and update.

Allocation in Cases of NIHL

Robert A. Dobie, M.D., University of California at Davis and Dobie Associates

Many worker's compensation programs require adjustment of awards for hearing loss when more than one cause is present, and distribute liability among employers when more than one employer has exposed a worker to a hazard such as noise. Allocation between noise and aging is accomplished in some states by basing awards on age-corrected audiograms (making many workers ineligible for awards), or by reducing the award by the ratio of the median expected age-related thresholds to the actual thresholds. Other states require a clinical determination of what a claimant's impairment would likely have been absent occupational noise exposure, then base the award on the difference between this estimate and the actual impairment. Whether in worker's compensation or in litigation, allocation estimates are most reliable when there is a detailed audiometric and exposure history. Audiometric shape and trajectory, combined with an understanding of the epidemiology of NIHL, provide the best evidence in most cases."

Point/Counterpoint

David Lipscomb, Correct Service, Inc., Stanwood, Washington

This presentation will cite two underlying assumptions and raise questions about those assumptions: 1. The validity of pure tone test data without benefit of serial hearing testing; and 2. The accuracy of hearing handicap calculations. The discussion will conclude with a summary of the interactive factors in the function of the auditory mechanism and its neural components. The intent of the summarization will be to remind the attendants of the complexity of function our auditory system possesses, complexity that gives audition its outstanding capabilities, yet, complexity that defies simplistic notions for retrospectively calculating the relative contributions of multiple etiologies.

Hearing Conservation for the Very Small Business

Carol Merry-Stephenson, CDC/NIOSH, Loveland, Ohio

NIOSH has a particular interest in meeting the health and safety needs of small businesses, i.e., less than 50 employees, but also many "mom and pop shops" with 10 or fewer employees. Typically, these enterprises fall through the cracks and have little or no resources to address OSHA issues. This past year, NIOSH has been working with small business owners in the pallet-making industry. The industry has a disproportionate share of illness and injury—including major problems with noise-induced hearing loss. This presentation will present findings and recommendations from a year of field work in this industry. Generalization of issues, approaches, and solutions for other small cottage industries will be made. A prototype training manual for the owners of these small businesses is under development, and the hearing loss section will be showcased.

The Keokuk County Rural Health Study: Prevalence and risk factors for hearing impairment in rural Iowa

Gregory A. Flamme, University of Iowa, Iowa City, Iowa

Selected results of a population-based study of health outcomes in rural areas will be presented. Prevalence of hearing impairment will be reported using multiple definitions, ranging between mild hearing damage to interference with loud speech. Relationships between hearing status and noise and non-noise risk factors, including exposures, smoking, and health history, will be discussed. A high prevalence of impairment and significant relationships with multiple risk factors were found. Project supported by NIOSH.

Noise Exposure Levels for Wood Industry Workers

Michael Stewart, Kari Koltes, and Mark Lehman, Central Michigan University, and Jim Bennie, Jim Dougovito, Joe Pryal, Angelo St. Juliana, and Jayne Zzukalowski, M-TEC at Bay College

Individual dosimetry was used to determine noise exposure levels for workers in 94 different wood industry jobs. Results revealed over 40% of the wood industry jobs exhibited 8-hour TWAs over 90 dBA, 33% of the jobs had TWAs between 85-89 dBA, while less than 25% of the jobs had 8-hour TWAs below 85 dBA. Eight-hour TWAs for the loudest jobs were over 100 dBA. Eight-hour time-weighted averages (TWAs) and daily noise doses obtained using the currently mandated Occupational Health and Safety Administration (OSHA) measurement criteria were also compared to those obtained using the American Conference of Government Industrial Hygienists (ACHIH) recommended criteria. The ACGIH method yielded significantly higher 8-hour TWAs and daily noise doses than the OSHA method. The effect of variables such as saw size, season, and wood type were also examined. Implications of this study will be discussed.

Noise Exposure and Hearing Conservation Programs in Selected Industries in Washington State

William Daniell, M.D., MPH, Department of Environmental and Occupational Health, University of Washington, Seattle, Washington along with Susan Swan, Janice Camp, Mary McDaniel, Martin Cohen, Robert Leo

We evaluated hearing conservation programs (HCPs) at 76 worksites in eight industries with high rates of hearing loss claims, to characterize the current risk for hearing loss. At each site, we interviewed the HCP coordinator (n=76) and a sample of employees (n=1,557); measured full-shift average noise exposures (n=984); made single-blind observations of hearing protector use (n=602, in five industries); and reviewed existing audiograms.

In each industry, 25% to 94% of monitored employees were overexposed (full-shift average >85 dBA). In general, HCPs were more complete in industries where overexposure was more common, and significantly less complete where overexposure occurred less often. In three industries, only half of observed employees used hearing protection when exposed. Higher levels of management HCP effort were associated with higher employee awareness and effort.

There is still substantial risk for hearing loss in noisy industries, particularly in industries where a limited fraction of employees is typically overexposed.

Working Impaired in Dangerous Settings: What Workers Tell Us About Their Communication and Hearing Needs

Robert Randolph, NIOSH, Pittsburgh, Pennsylvania

This presentation will review the results of a study using a series of focus group discussions with hearing impaired construction workers and miners as well as interviews with their supervisors. These workers and their supervisors have the closest, most detailed view of the particular communication and hearing challenges hearing-impaired employees face in their workplace. Their views can help focus problem-solving efforts and identify issues that might otherwise have been missed.

Sound Localization Wearing Level-Dependent HPD (Combat Arms Earplug)

LTC Lorraine Babeu, Ph.D., U.S. Army Research Laboratory, APG, Maryland, Mary Binseel, M.S., U.S. Army Research Laboratory, APG, Maryland, and Tomasz Letowski, Ph.D., U.S. Army Research Laboratory, APG, Maryland

Soldiers in today's combat environment need hearing protection that is responsive to their communication needs. Current hearing protective devices are effective but are not conducive to verbal communication. A possible solution to the problem is the use of level dependent hearing protection, which allows verbal communication in relatively normal ambient noise levels and provides protection specifically against impulse noise. The U.S. Army recently approved the use of the combat arms earplug (CAE), which is an expanded French version of the level dependent earplug, developed at the French-German Institute. The combat arms earplug has two sides, one (yellow) is the level dependent earplug and the other (green) is the traditional triple-flange earplug. The purpose of this project was to determine the effects of CAE on the soldier's ability to localize sound sources in various listening conditions. The participants were seated in the center of an array of 37 loudspeakers distributed over three circular rings. Three groups of 12 listeners each were used as participants. Group one used the yellow side of the combat arms earplug, group two used the green side of the earplug and group three used the EAR foam plug. Within each group there were four listening conditions: open ears in quiet and noise and protected ears in quiet and noise. Participants were asked to localize various speech and environmental stimuli. Data comparison for all three earplugs has not revealed any significant differences in soldier performance although the yellow (level dependent) earplug resulted in slightly better performance than two others.

Evaluation of Level-Dependent Hearing Protection Devices for Use with Impulsive Noises

CDR William J. Murphy, Ph.D., U.S. Public Health Service, National Institute for Occupational Safety and Health Hearing Loss Prevention Section, Cincinnati, Ohio

As a part of a NIOSH Health Hazard Evaluation of law-enforcement personnel, the attenuation of several types of earplugs and earmuffs was measured in response to impulse noise produced by small-arms gunfire. The protectors were measured on a mannequin built by the Institute de Saint Louis for increased acoustic isolation of flanking pathways to the microphone. The earplugs demonstrated a range of peak reduction between 10 and 28 dB while the earmuffs ranged from 25 to 33 dB peak sound pressure level. The slopes of the peak reduction with peak level for most earplugs exhibited a slope of 0.2 dB/dB while earmuffs tended to have a slope of 0.5 dB/dB. Finally, the risk of hearing loss was estimated with the Auditory Hazard Assessment Algorithm for Humans (AHAAH model) and demonstrated a range of Auditory Hazard Units from 450 to 10 for impulses recorded underneath hearing protectors. AHUs could be reliably be predicted for small-arms fire from the peak level reduction.

STS Recordability Panel

Moderator: Nancy N. Green, AuD, Industrial Audiologist, Jacksonville, Florida

Panelists: George Cook, Workplace Group, Greensboro, North Carolina, Lynda Glaspey, OSHA Region 10, Seattle, Washington, Cathy Padolewski Cole, Sherwin –Williams Co., Cleveland, Ohio, Claude Revels, JM Family Enterprises, Deerfield Beach, Florida, Carolyn Tolley, ASI Health Services, Dallas, Texas

This panel discussion will present information on both the expected and unexpected effects that the recent revision of the OSHA Recordkeeping rule (Part 1904) has had on the provision of hearing conservation services and worker's compensation in the U.S. Panelists will present information from varying points of view including the audiometric service provider, safety director, industrial hygienist, the employer, hearing conservation program consultant, worker's compensation administrator, and OSHA. Each panelist will report on what their experiences have been over the past year, both good and bad, and how procedures/practices have been changed to reflect the new recordability criteria for noise-induced hearing loss.

Recommended Criteria for Removing Employees from a Hearing Conservation Program

Dennis P. Driscoll, P.E., Associates in Acoustics, Inc., and Laurie L. Wells, FAAA, Associates in Acoustics, Inc.

Due principally to recent changes in the Occupational Safety and Health Administration's (OSHA's) occupational injury and illness

recording and reporting requirements (29 C.F.R. 1904.10), some employers are streamlining their hearing conservation program (HCP) enrollment with the sole purpose to minimize their potential recordable incidents on the OSHA 300 Log. The challenges to hearing conservation professionals when presented with requests by their employer or client(s) to reduce program enrollment include (1) what noise exposure criteria should be used when drawing the line between inclusion and exclusion of workers, (2) what type of statistical measures is appropriate when averaging time-weighted average (TWA) data, (3) how do you handle low-value TWAs reported below threshold, and (4) will the criteria hold up to regulator scrutiny or inspections? Recommended criteria addressing these questions/factors and other related issues are presented to assist hearing conservation professionals with satisfying employer requests, yet still maintaining an appropriate degree of protection for the worker.

Issues in Implementing a Global Corporate Hearing Conservation Program

Bruce Kirchner, Proctor & Gamble Company, Cincinnati, Ohio

The implementation of a corporate occupational hearing conservation program globally has its challenges. Besides dealing with a variety of language issues and country legal requirements, there is a wide range of knowledge and experience concerning hearing loss, audiometry and the conservation of hearing. Innovative approaches are needed in order to achieve a universal, quality program.

Proposed Changes in Allowable Ambient Noise Levels for Audiometric Testing

Mary McDaniel, Pacific Hearing Conservation Inc., Seattle, Washington

Over the past two years, at least two states, California and Washington, have held public hearings regarding changes to their hearing conservation regulation. One of the considerations by each state has been to change the allowable background sound pressure levels in the audiometric test environment. Each state was petitioned to amend the regulation to require that industrial hearing conservation programs adhere to the most recent ANSI S3.1-1999 allowable levels as opposed to the current OSHA levels. This discussion will examine the ramifications of this proposed change.

Is Testing 500 Hz Necessary When Monitoring for Occupational Hearing Loss?

Mark R. Stephenson, Ph.D., CDC/NIOSH, Cincinnati, Ohio

Audiometric monitoring is an important element in hearing conservation programs. Nearly every existing hearing conservation standard dictates that hearing thresholds should be measured at specific frequencies, and that 500 Hz be among those frequencies tested. Actual and estimated noise-induced permanent threshold shifts were evaluated as a function of exposure duration and exposure level. The results demonstrate 500 Hz to be of no value in assessing noise-induced hearing loss for typical industrial noise exposures of up to 40 years, at least for time-weighted average exposures of up to 100 dBA. Furthermore, few hearing conservation programs currently require audiometric monitoring to be performed in an environment that meets ANSI standards for maximum permissible background noise levels. This is particularly likely to compromise hearing testing at 500 Hz. Finally, there is a substantial economic burden associated with conducting hearing tests at 500 Hz. As a result, this paper argues against the need for testing at 500 Hz, and recommends it be eliminated as a required test frequency in audiometric monitoring for noise-induced occupational hearing loss.

POSTER ABSTRACTS

1. Characterization of Agricultural Noise Exposure at an Indian Reservation in New Mexico

Chandran Achutan and Randy Tubbs, National Institute for Occupational Safety and Health, Cincinnati, Ohio

This poster presents noise exposures encountered during the processing and packaging of potatoes, and during the manufacture of alfalfa pellets, at an Indian reservation in New Mexico. Four of the twenty employees that were monitored exceeded their total dose of 100%, per the NIOSH criteria. TWA noise levels experienced during these agricultural operations ranged from 80.6-91.6 dBA. This poster discusses the controls currently in place and additional recommendations on further controlling the noise exposures.

2. Now You Hear – Now You Don't (A Clinical Case Study)

MAJ Amy A. Blank, Spring Lake, North Carolina, and COL Nancy L. Vause, Ph.D., Human Research and Engineering Directorate, Aberdeen Proving Ground, Maryland

During routine training, a new soldier fired a common infantry weapon without wearing hearing protection devices (HPDs) suffering significant hearing loss. A military audiologist completed serial clinical assessments documenting temporary and permanent threshold shifts, reduced speech intelligibility in quiet and in noise, and abnormal otoacoustic emissions. This paper presents an analysis of a one-time exposure without HPDs in regard to type of exposure, spectral waveform, hearing protection, audiometric results, and exposure predictions with and without HPDs.

3. Effect of Amplified Earmuffs on Speech Intelligibility in Industrial Noise

Thomas G. Dolan and Dennis O'Loughlin, Portland State University

Data will be presented from a study that explored whether amplified earmuffs can improve speech intelligibility among workers with hearing loss. Three sets of amplified earmuffs were compared: the Elvex COM 55, the Bilsom 707 Impact II and the Peltor Tactical 7-S. The performance of 12 hearing-impaired subjects on the Hearing in Noise Test (HINT) was measured when they listened with each of these devices in a background of recorded industrial noise presented at 85 dBA. Performance was also assessed with passive earmuffs (EAR Ultra 9000) and with no muffs. The results of the study will be presented and their implications discussed.

4. Preferred Listening Levels (PLLs) for Music in Automobiles

Gregory A. Flamme, Catherine C. Nelson, Aline Sundeen

We will report noise levels, spectra, and level distributions in a sample of pre-owned automobiles, across position, road, and blower fan settings. A typical noise was then simulated, using a 16-loudspeaker array controlled via Matlab using TDT hardware. Young adult listeners adjusted the volume of their "favorite" song to their PLL. The relationship between the music's acoustic characteristics at PLL and the noise will be evaluated across four noise attenuation and filter conditions.

5. Application of Advanced Multimedia Computer Technology in Self-administered Hearing Screening & Feedback: Feasibility and Effectiveness

Oi Saeng Hong, Ph.D., School of Nursing, University of Michigan, Ann Arbor, Michigan, and Peter Csaszar, Ph.D., Electrical & Computer Engineering, Lawrence Technological University, Southfield, Michigan

This study incorporated multimedia computer technology to self-administered hearing screening and personalized feedback to prevent noise-induced hearing loss among construction workers. Interactive multimedia program was developed by a multidisciplinary team. The effectiveness of the program was evaluated by participants' feedbacks over 700 operating engineers. About 40% of participants never used the computer. Yet, the majority of them (over 96%) liked getting hearing test by the computer and reported the computerized hearing test worked smoothly.

6. A Human Factors Investigation of Pilot Performance Using Mixed-Modality Simulated Data Link

Jeff A. Lancaster, M.S. (presenter), Gary S. Robinson, Ph.D., and John G. Casali, Ph.D.

Research into synthesized and/or digitized auditory systems has not been conducted utilizing the latest speech synthesis technologies, nor has it been conducted in concert with modern communications technologies such as active noise-reduction (ANR) headsets. Sixteen visual flight rules (VFR)-rated pilots participated in an experiment to investigate performance using a mixed-modality simulated data link in a mixed-factor design. Results were gathered and interpreted to provide recommendations for the integration of voice technologies in the GA cockpit.

7. The Prevalence and Characteristics of Tinnitus among Recreational Firearm Users

Jeremy Scott McCallister, Michael Nerbonne and Michael Stewart

This study examined the relationship between tinnitus and recreational firearm use in order to obtain a more complete picture of the tinnitus experienced by 229 recreational shooters. Survey data revealed that 41% of the shooters reported experiencing tinnitus, but they generally did not perceive tinnitus as a significant problem. The primary factors correlated with tinnitus were reported hearing loss and exposure to other sources of noise in addition to firearms. Items from the Tinnitus Severity Index correlated with overall tinnitus severity. Factors not correlated with tinnitus included use of ear protection and type of firearm used. Inconsistent use of ear protection and lack of an understanding of the relationship between firearm noise exposure and tinnitus were also revealed.

8. Hearing Conservation without Assumptions: Using Daily Microphone-in-Real-Ear Techniques to Verify Safe Exposures for Pot-line Workers in an Aluminum Smelter

Ronda Wilkinson, Alcoa Intalco Works, Ferndale, Washington, and Kevin Michael, doseBusters USA, State College, Pennsylvania

Ten pot line workers at the Alcoa Intalco aluminum smelter were outfitted with the doseBusters USA Exposure Smart Protector (ESP). The ESP measures actual protected exposure: the measurements account for wearing time and quality of fit of the HPD. Using the ESPs, workers were able to limit their protected exposures to safe levels in most cases. Intervention for overexposed individuals resulted in a reduction of protected exposure to a safe level.

9. Calculation of the Intrinsic Error in Hearing Protector Ratings

CDR William J. Murphy, Ph.D., U.S. Public Health Service, National Institute for Occupational Safety and Health, Hearing Loss Prevention Section, Cincinnati, Ohio

The secondary label of the Noise Reduction Rating (NRR) is required to disclose the mean attenuation and standard deviations for the real ear attenuation at threshold (REAT) measurements. However, the overall error of the NRR has been largely ignored. Using covariant statistics, Monte Carlo simulation and Bootstrap simulation methods, the error in the noise reduction rating has been estimated and applied to several experimental studies.

10. Hearing Acuity of Undergraduate Music Students

Julie Phillips, Greensboro, North Carolina

Undergraduate music students at the University of North Carolina at Greensboro are exposed to intensity levels for duration that exceed OSHA standards. The hearing of 200 undergraduate music students was assessed in order to determine whether the accumulated exposure to intense sound levels throughout baccalaureate years negatively affects music students' hearing. Students presented noise notches suggesting that continued exposure throughout these years can contribute to hearing loss in this population. Results confirm that a hearing conservation program be implemented at the UNCG School of Music.

11. Certified Safe Farm: A Description of Hearing Illnesses and Hearing Protection Device Use in a Midwestern Agricultural Population

Sara Schneiders, MS, Greg Flamme, Ph.D., Jeff Lange, Ph.D., Kelley Donham, DVM, MS

Certified Safe Farm (CSF) is an agricultural occupational health research program initiated in 1998 to address the high rate of illnesses and injuries in farmers. This presentation will discuss the impact on the CSF program on the self-reported rate of HPD use among farmers and on the incidence of self-reported hearing illnesses. We will also present data describing on the progression of hearing loss over a 4-year interval. Project supported by NIOSH.

12. Sound and Carbon Monoxide Exposure in Bars and Restaurants

Melissa Teahen and Gregory A. Flamme, The University of Iowa

Hearing damage risk in social establishments catering to college students has not been extensively examined. Potential risk factors in these environments include exposure to high sound levels and increased levels of carbon monoxide (CO). This study involved measurements sound level and carbon monoxide measurements from local bars and restaurants. Damaging sound levels and low levels of CO were found in most environments.

13. Real Noise Exposures of the Highway Patrol

Randy L. Tubbs, Ph.D. and Chad H. Dowell, M.S., National Institute for Occupational Safety and Health, Division of Surveillance, Hazard Evaluations, and Field Studies, Cincinnati, Ohio

NIOSH received a request for an evaluation from a highway patrol concerned about troopers' noise exposures during patrol. Dosimeter measurements were made on troopers in six different counties over three days. Real-time spectral data were collected from locations along the highways. The noise measurements were well below the OSHA PEL and action level. Only four of 53 samples exceeded the NIOSH REL. Noise measured along the freeway ranged up to 88 dBA. Recommendations on implementation of a hearing conservation program and the use of specialized hearing protection devices have been presented to the highway patrol.

14. The Prevalence of High Frequency Hearing Loss in Eighth Grade Children and their Attitudes and Knowledge Regarding Noisy Leisure Time Activities

Dorie Watkins, Ear, Nose & Throat Associates of the Bay Area, Pinole, California

Noise-induced hearing loss is a particularly ominous, insidious and invisible disability, especially in children (Bess, 1985; Niskar, 1998). Even before affecting hearing acuity, noise exposure has been reported to result in learning disabilities, delayed reading scores, an inability to complete problem solving tasks and impaired sensori-motor development (Niskar, 1998). Approximately 3,500 eighth grade students were seen for annual pure tone hearing screening, of which 6.5% (N=226) were seen for retesting. During the retest appointment, students were asked to complete a 14-question survey assessing their attitudes toward activities. Twenty-seven percent of the students with confirmed hearing loss upon retest exhibited audiometric configurations consistent with a history of excessive noise exposure. Student responses to the survey suggest that these children do possess some knowledge of the hazardous effects of noise but do not recognize the immediate threat to their hearing health and are not avoiding loud noise or protecting their hearing.

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