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The Newsletter of the Council for Accreditation in Occupational Hearing Conservation

The Modern Evolution of Hearing Conservation Regulations

By Theresa Y. Schulz, PhD

It is interesting to study the noise standards that have been promulgated in the US over the last decade or so. These regulations are likely to have long-lasting impact. The Occupational Safety and Health Administration (OSHA) Hearing Conservation Amendment (March 1983) continues to have influence not only in the workplace but in the debate over new regulations. Both the Mine Safety and Health Administration (MSHA) and Federal Railroad Administration (FRA) regulatory preamble documents state the desire to be consistent with OSHA. An examination of Table 1, which compares the major components of the three regulations and the 1998 NIOSH "best practices" criteria, depicts the extent to which that intent is met (see pages 5-8).

There has been some regulatory activity in the last decade which may give some hope for evolution and updating based on the wealth of science that has occurred during the last quarter of a century since the OSHA regulation was enacted. However there has also been some "back-sliding" toward more lenient standards.

The MSHA noise standard made regulatory progress in September 2000 by emphasizing engineering and administrative controls, followed by personal protective equipment, in the hierarchy of noise intervention. MSHA's requirement for technician certification (today only available from CAOHC) strengthened the training requirements for audiometric testing in hearing conservation programs and MSHA also added the requirement of dual hearing protection at 105 dB TWA.

There were many subtle differences between OSHA and MSHA based on comments and a desire to clarify some of the vague aspects of the OSHA noise standard, and meet the needs of the regulated mining industry. One example pertains to the ceiling for exposures. OSHA says, "no exposures >115 dBA," which is interpreted to mean no *unprotected* exposures above that level, giving credit for the assumed effectiveness of hearing conservation programs, hearing protection devices and administrative and engineering controls. MSHA specified that a "P" code[1] violation be issued for any protected or unprotected exposures >115 dBA.

The Federal Railroad Administration (FRA) noise standard for railroad operating employees, which went into effect February 26, 2007, was expressly based on the OSHA standard but also uses MSHA for comparison. The preamble states that the FRA defers to OSHA as the "primary regulator of noise in the workplace," but also acknowledges the need for some departure from the OSHA regulation (FRA Preamble II.B). As an example, FRA requires testing at 8000 Hz "because it will allow employers to identify hearing loss sooner." The FRA rejected MSHA's hierarchy of noise controls in favor of requiring specific engineering interventions and focusing on appropriate hearing protection which would still allow communication and audibility, and identification of excessive noise through employee-filed "excessive noise reports."[2] Where OSHA has no specific mandate requiring employees to take advantage of the employer-paid audiogram, it has been traditionally a condition of employment and is generally accepted that OSHA-covered workers require an annual audiogram. MSHA addressed this issue in its preamble; however, they made no significant change. MSHA employers are required to *offer* annual audiograms but MSHA stopped short of requiring employees to comply with annual audiometric testing. The MSHA preamble does allow that mine operators can also make audiometric monitoring a condition of employment. FRA requires employees to complete audiometric testing and hearing conservation training only every three years, but requires that training be *offered* at least once a year.

[1] A "P" Code is an administrative device to document (in an MSHA database) when overexposure conditions remain despite the implementation of all feasible engineering and administrative controls to reduce the miner's noise exposure to or below the Permissible Exposure Limit (PEL). The term "P" Code derives from the requirement to wear protective equipment (e.g. HPDs).

[2] The term "Excessive Noise Report," refers to a report filed by a locomotive cab occupant that indicates that the locomotive is producing an unusual level of noise such that the noise significantly interferes with normal cab communications or that the noise raises a concern with respect to hearing conservation. The employee is required to report such excessive noise and the training requirements include how and when to make an excessive noise report. The railroad is required to respond to each report.

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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

The Cost of Quality

By James D. Banach, MBA

I'm confused. Oh, that really isn't so surprising, I'm often confused. But right now I'm really confused. So let me share some thoughts and ask some questions. Maybe you can help me understand and break through the confusion.

Throughout the business world QUALITY is one of those words every manager uses in their daily discussions. The higher up you go in management, the more you realize "quality" is not just a politically correct mantra, it is a necessity for survival. No one would seek a high-level job on the premise that "quality doesn't matter." Any forward-thinking, big-picture, Wall-Street-Journal-reading manager knows there must be a focus on quality in every aspect of business.

This is no difference when it comes to safety, environmental and health policies. A quality focus is growing much like the approach to product development, manufacturing, and performance have been for years. Right next to quality standards like ISO 9000 is an increasing awareness of ANSI/AIHA Z10-2005 (guidelines for improvement of occupational health and safety programs), OHSAS 18000:1999 (guidelines to improve OH & S management systems) and OHSAS 18002:2000 (explanation of the underlying principles of OHSAS 18001). The elements of these programs seem basic and obvious. They include: setting policy, determining leadership, asserting accountability, planning, establishing measures, monitoring performance, and striving for continuous improvement. It really is about the fundamentals of doing something well...no short cuts.

In fact, the entire CAOHC procedure fits these quality model approaches. Our focus on test protocol, results documentation, communication, protection selection and fitting training is consistent with doing a quality job of hearing conservation. It is why we constantly assess our Course Director Workshops looking for ways to improve them. It is at the heart of our initiative to educate Professional Supervisors [of the Audiometric Component of the Hearing Conservation Program]. And it is rooted in our challenge to Course Directors to keep their offerings fresh, to do more than the minimum and to include multiple disciplines and perspectives.

And so, this is where my confusion arises. In a world where management is focused, or maybe better said 'obsessed' with quality, and the CAOHC Council, our certified Course Directors and Occupational Hearing Conservationists stand ready to help by making one part of an occupational health and safety management system first class, why is it that hearing conservation can be compromised for a dollar, a quarter, even a nickel per employee? If it isn't the money — it's the minutes! How can it be that the decision on service providers, the front line contact to the worker, is determined by the lowest cost per audiogram or the fastest test time? I'm confused.

Certainly a good quality approach tries to weed out waste, control cost, and avoid time that does not create value. But is the lowest price or the fastest test time the best measure of a quality service provider? Of course not. Sometimes the realization that efficiency includes effectiveness gets lost. If the outcomes are not good, if the employee does not become part of the solution and passionate about their own ears, then even a nickel is too much to pay because the return on investment will be zero. Cutting waste and seeking value are admirable, cutting corners… well, that just isn't quality.

We can not forget that hearing conservation is about ears and the people who use them. It is a human encounter that involves teaching, understanding, challenging and inspiring. It is not button pushing and dial turning — and never has been.

Recently I've been reminded of a business philosophy that a CEO I admire espouses. It goes like this…"Business is a system of human relationships. The quality of these relationships determines the success achieved." Success is an audiogram without baseline shift because good controls, adequate protection, and employee motivation have come together to prevent a hearing loss. That is quality.

Yep, I'm confused, but ever hopeful. Effective hearing conservation can and does happen. It is rooted in the principles of quality. All we have to do is live the principles. CAOHC – there is no equal!

OHC Corner

Conference Focuses on Children and Noise

By Ted K. Madison, MA CCC-A

Are young ears more susceptible to noise? Are teens who listen to loud music several hours per day at greater risk for hearing loss? Is the incidence of noise-induced hearing loss (NIHL) on the rise among children? These are just a few of the questions that participants in the first ever scientific conference on Noise Induced Hearing Loss (NIHL) in Children at Work & Play discussed on October 19-20, 2006, in Covington, Kentucky.

This truly unique program, organized by conference co-chairs, Deanna Meinke, PhD, an Assistant Professor of Audiology and Speech-Language Sciences at the University of Northern Colorado, and William Martin, PhD, a professor of Otolaryngology/Head & Neck Surgery at the Oregon Health & Science University, included not only presentations of traditional research in this area, but also the results of long term epidemiological and behavioral studies, observations on the practical aspects of teaching children about hearing loss prevention, health communication theory, and the outcomes of student research. Dr. Meinke described the two-day conference as, "a sequential exploration of the relevant theoretical and experimental work in the related fields." Participants had the opportunity to hear more than two dozen platform presentations and visit nearly 20 posters and interactive tables to learn about programs and projects designed to inform and motivate people to prevent noise-induced hearing loss. The conference was sponsored by an unprecedented coalition with an interest in hearing loss prevention, including: the National Institute on Occupational Safety and Health (NIOSH), the National Hearing Conservation Association (NHCA), the Marion Downs Hearing Center (MDHC), the National Institute on Deafness and Other Communication Disorders (NIDCD), the Oregon Health & Science University (OHSU) and the University of Northern Colorado (UNC).

On the topic of susceptibility of young ears to noise, University of Washington researcher, Dr. Ed Rubel, presented a review of a number of studies on the development and maturation of the auditory system. He described the possible risks for hair cell and neurological damage due to excessive noise and ototoxic agents. Dr. Sharon Kujawa, from the Harvard Medical School, presented research findings on the effects of noise exposure on the auditory systems of laboratory animals at varying ages and how permanent those effects may be as the animals grow older. A review of fetal noise exposure research was presented by Dr. Floyd Thurston, Indiana University. He concluded that the womb is a rather noisy place due to the mother's own body sounds, and that the evidence is not conclusive as to whether external noise transmitted to the fetus in-utero is hazardous.

A number of presenters discussed research being conducted on the attitudes of children and youth about the risks associated with exposure to loud sounds and how best to formulate health communication messages that are effective in prompting healthy behaviors. Dr. Alice Holmes and her colleagues from the University of Göteborg, in Sweden, described research findings on differences between Swedish and American youth in terms of attitudes and behaviors about loud music and other noises and the possible cultural influences that may account for those differences. Several presentations from the researchers at the Oregon Hearing Research Center described the unique, multi-faceted health communication approach being implemented through the Dangerous Decibels® project and which intervention strategies have been most effective.

One of the highlights of the conference was a presentation of the findings of a unique, long-term study of leisure-time noise exposures of adolescents by Dr. Mario Serra and Dr. Ester Biassoni from the National Technical University in Córdoba, Argentina. Although certain subgroups of teens in

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Jodi Rasmussen, RN

OHC Spotlight

One of the most enjoyable aspects of teaching a CAOHC-approved OHC certification course is getting to know friendly, interesting people. One such person I met in 2006 is Jodi Rasmussen, RN, from Minnesota. She is the Occupational Health Nurse Coordinator for a health services provider. In addition to hearing conservation services, their team of CAOHC-certified occupational health nurses (OHNs) provides a wide variety of clinic based and on-site services to employers throughout Southeast Minnesota, including: pre-placement examinations, medical surveillance, drug testing, fitness-for-duty evaluations and case management of employee illness and injury.

Jodi, who is working toward certification in Occupational Health Nursing, describes herself as the resource person for the occupational health nursing staff and the "liaison between Fairview and our clients." When it comes to hearing conservation, she says that the best source for up-to-date, accurate information is CAOHC. Using the resources such as the CAOHC manual, the newsletter UPDATE, and the CAOHC website has helped Jodi respond to her staff and clients more quickly and professionally.

Although she's been in her position less than a year, Jodi understands the value of CAOHC certification very well. When I talked to her recently, she told me that having a staff of CAOHC-certified OHCs has enhanced the value of the services they offer to employers in the region. "We offer employers more than just a hearing test," she explained, "We provide our clients a more comprehensive approach to hearing conservation." I couldn't agree more.

Conference – continued from page 3

the study demonstrated stable hearing thresholds over time, other teens (those with "tender ears") developed a significant hearing threshold shift by age 17. These findings are being used to help educate teens in the importance of routine audiometric testing and to establish practical limits on exposure to loud music and other loud sounds.

Fellow CAOHC Council member, Elliott Berger, and I had the opportunity to speak on the subject of hearing protection for children. Although very little research has been published on the effectiveness of hearing protectors for children, we were able to share with the participants some of the practical considerations when fitting various ages with protectors and training them to use them. Attendees received samples donated by Aearo, Etymotic Research and 3M.

This conference featured students from middle and high school and included up to graduate school. Students presented posters and papers on attitudes about personal music players and hearing loss, perceptions of how loud is too loud, and how best to raise the awareness of parents about the hearing health of their children. The presence of these students added a feeling of youthful fun to the conference, as did the chance to "play" with some of the teaching tools, such as the "Walkometer" (also known as "The Big Purple Head") and the sound measuring mannequin, "Jolene."

The extensive public interest in loud music and personal listening systems that was apparent in 2006 was one of the hot topics of the conference. Several presenters described novel techniques for measuring and understanding the risks involved in listening to their favorite music as it related to listening time, earphone type, listening level, and the interaction of occupational and non-occupational exposures.

Because of the media attention being paid to the issue of music-induced hearing loss, many of us who are involved in hearing loss prevention have the perception that the prevalence of NIHL among children and adults is increasing. Two of the speakers suggested that the evidence does not fit with these perceptions. William Clark reported that data from a NIOSH study of the hearing thresholds of newly hired young adults suggests that hearing has not declined over the last 25 years, and may even have improved in the high frequencies. While Dr. Clark agreed that education is the key to hearing loss prevention, he cautioned us to take an evidence-based approach to the issue and to avoid overstating the hearing loss risks associated with noise exposure. Likewise, Howard Hoffman described a declining trend of NIHL in the data obtained as part of the U.S. Health Examination Surveys conducted over the last 40 years.

When asked about what's next, conference co-coordinator Deanna Meinke said, "There is much to be done in terms of substantiating the damage-risk criteria for children, determining the most effective means for early identification of NIHL in school-age youth, providing effective hearing protection devices, implementing and disseminating effective intervention and educational programs, and ultimately providing a consensus for a scientifically based public health agenda."

Although there may not yet be consensus as to whether or not young people are at greater risk than adults for developing NIHL, it seems clear that further research of this type and education on these issues will be necessary in order to increase awareness about hearing loss prevention and to motivate parents and children to adopt healthy hearing behaviors. Toward that end, representatives from the Centers for Disease Control office of Division of Adolescent and School Health (DASH) held a meeting at the conference to form a working group that will assist in the development of hearing health guidelines for schools to help educators promote hearing loss prevention and raise awareness of NIHL.

By the end of the conference, I concluded that the answers to the questions posed at the beginning of this article were: "maybe," "possibly," and "it doesn't look like it." While not everyone who attended the conference may agree with me, I'm sure they would all agree that the conference was a success, and very enjoyable.

Mr. Madison is employed by 3M Occupational Health and Environmental Safety Division as a Senior Technical Service Representative in St. Paul, MN. He is a representative on the CAOHC Council for the American Speech-Language-Hearing Association (ASHA).

For more information go to these web locations:

http://www.hearingconservation.org/conf_childrenconf_program_Posters.html
http://www.hearingconservation.org/conf_childrenconf_speakers.html
http://www.dangerousdecibels.org/

Certification Workshop for Course Directors Scheduled for Fall 2007

The Council will conduct a Course Director Workshop on Friday, November 2, 2007 at the Sheraton Gateway Suites Hotel O'Hare in Rosemont, Illinois.

The Course Director (CD) is the individual responsible for planning and conducting training courses for OHCs and ensuring that specific CAOHC guidelines are followed. Course Director certification and recertification is granted for a five-year period.

This workshop is a requirement for certification of new and recertifying Course Directors. Attendees are to submit an application and fee for approval by the CAOHC Screening Committee prior to the workshop. Application and registration is available on-line at www.caohc.org.

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Exposure Limit	PEL=90 dBA TWA	Similar to OSHA, except integration range explicit in regulation (62.101), and is for all sounds from 90 to *at least* 140 dBA	Same as OSHA	Recommended Exposure Limit (REL) = 85 dBA TWA. REL is exceeded when TWA ≥ 85 dBA, integrating all sounds from 80 - 140 dBA
Action Level	85 dBA TWA	Similar to OSHA, except integration is for all sounds 80 to *at least* 130 dBA	Same as OSHA	Does not have Action level, but REL is 85 dBA TWA for HL prevention, noise controls and HPDs
Exchange Rate	5 dB	Same as OSHA	Same as OSHA	3 dB
Impulse/Impact	Should *not* exceed 140 dB peak SPL; to be integrated with measurements of all other noises	Integrate with measurements of all other noise	Same as OSHA	To be integrated with measurement of all other noise, but *not to exceed* 140 dBA
Ceiling	No exposures > 115 dBA, interpreted as no *unprotected* exposures, give credit for HCP, HPDs and engineering controls	No exposures > 115 dBA, no adjustment for use of hearing protection. "P" code issued where the miner is still over-exposed even though feasible engineering and administrative controls are in place	No exposures >115 dBA, except continuous >115 dBA and ≤ 120 dBA are permissible, provided total daily exposure ≤ 5 seconds	No protected or unprotected exposure to continuous, varying, intermittent or impulse noise > 140 dBA
Monitoring noise exposure	Once to determine risk, HCP inclusion, then as conditions change resulting in more potential exposure	Mine operator must establish system to evaluate each miner's exposure sufficiently to determine continuing compliance with rule	Same as OSHA; Measurement artifacts may be removed	Every 2 years if any exposure ≥ 85 dBA TWA
Noise control	Feasible engineering controls required where TWA > 90 dBA, compliance policy (OSHA can change/revoke any time) permits proven HCP in lieu of engineering where TWA < 100 dBA	Feasible engineering and administrative controls required for TWA > 90 dBA; even if controls do not reduce exposure to PEL, they are required if feasible (i.e.≥ 3-dBA reduction). Administrative controls must be provided to miner in writing and posted	FRA describes the specific actions that railroads and manufacturers must take when designing, building, and maintaining locomotives (instead of engineering controls); "noise operational controls" (administrative controls); hearing protection (same); "FRA has no hierarchy of noise controls"	Feasible controls to 85 dBA TWA
Administrative controls/Noise operational controls	Feasible administrative controls required where TWA > 90 dBA	Administrative controls must be provided to miner in writing and posted	FRA does not require the use of noise operational controls but makes them optional.	Administrative controls must not expose more workers to noise
HPDs	Optional for ≥ 85 dBA TWA, mandatory for > 90 dBA TWA, ≥ 85 dBA TWA for workers with STS	Same as OSHA , but amount of protection *not specified.* Dual protection (muff plus plug) required at exposures >105 dBA TWA	Same as OSHA, but shall consider an employee's ability to understand and respond to communications and audible warnings	Mandatory for ≥ 85 dBA TWA. Must protect to 85. Dual protection recommended at exposures > 100 dBA TWA

Table 1: Comparison of Noise Exposure Regulations

ISSUE	29 CFR 1910.95 OSHA. Occupational Noise Exposure; Hearing Conservation Amendment; Final Rule, effective 8 March 1983	30 CFR Part 62 MSHA, Published on 13 September 1999, effective 13 September 2000	49 CFR 227 and 229, FRA Final Rule on Occupational Noise Exposures for Railroad Operating Employees, effective 26 February, 2007	Pub. No. 98-126. NIOSH Criteria Document. The Document is a recommendation, " Best Practice Guide, and not a compliance document
HPD Variety	Offer variety, at least 1 type plug and 1 type muff	Choices must include 2 plugs and 2 muffs.	Variety of suitable HPD with a range of attenuation levels	Offer variety
HPD Attenuation	Protect to 90 dBA or to 85 dBA after STS. 50% derating when comparing relative effectiveness of HPDs and engineering controls	No method included in standard. Compliance guide will follow with suggested procedures.	Always use NRR with 7-dB correction and dBA, and either derate by type (muffs 20%, formable plugs 40%, other plugs 60%), or use ANSI S12.6 Method B data, or make objective measures.	Protect to 85 dBA TWA; derate muffs 25%, slow-recovery plugs 50%; other plugs 70%
Background noise levels for audiometry	40 dB @ 500 and 1000, 47 dB @ 2000, 57 dB @ 4000 and 62 dB @ 8000 Hz	According to scientifically validated procedures	Same as OSHA for supra-aural earphones; for insert earphones: 50 dB @ 500, 47 dB @ 1000, 49 dB @ 2000, 50 dB @ 4000 and 56 dB @ 8000 Hz	Per ANSI S3.1-1999 or latest revision; 19-dB more stringent than OSHA at 500 Hz and 13 to 25 dB more stringent at other frequencies
Audiometry	Required test frequencies: 500, 1000, 2000, 3000, 4000 and 6000 Hz	Same as OSHA	Required test frequencies: 500, 1000, 2000, 3000, 4000 , 6000 and 8000 Hz	Same as OSHA, but recommends 8000 Hz as option
Use of Insert Earphones	de minimis violation unless testing completed with both types of headphones per 1993 "OSHA Standard Interpretation"	Same as OSHA	Allowed under Appendix E provisions; Requires double testing if transitioning from supra-aural (See OSHA 1993 Standard Interpretation)	Not indicated
Audiometry - Baseline	Audiometry required annually for workers exposed to ≥ 85 dBA TWA. Baseline within 6 months of exposure, 12 months if use mobile testing, with HPD use in the interim. QUIET PERIOD prior to baseline is 14 hours with HPD use acceptable as alternative	Annual audiometry (same as OSHA), but choice of whether or not to take audiogram is at the miner's discretion. Quiet period same as OSHA	Audiometry required every 3 years for workers exposed to ≥ 85 dBA TWA. Baseline within 6 months of exposure, 12 months if use mobile testing, with HPD use in the interim. QUIET PERIOD prior to baseline is 14 hours with HPD use acceptable as alternative; Professional Supervisor to determine validity of existing baselines	Required for all workers exposed ≥ 85 dBA TWA. Baseline test pre-placement or within 30 days of exposure
Audiometry - Periodic	Annually, if exposed to ≥ 85 dBA	Same as OSHA	Audiometry must be offered annually, required at least once every 1095 days (3 years)	Required for all workers exposed ≥ 85 dBA TWA. Best practice is to test workers exposed > 100 dBA TWA twice per year
Audiometry - Other	May obtain a follow-up audiogram retest within 30 days and substitute for annual audiogram for STS re-tests	May obtain follow-up audiogram retest within 30 days and substitute for annual audiogram for STS re-tests	May obtain a follow-up audiogram retest within 90 days and substitute for annual audiogram for STS re-tests	If STS, must provide confirmation audiogram within 30 days
Audiogram review/supervisor; Professional Supervisor	Licensed or certified audiologist, otolaryngologist, or other physician	Licensed or certified audiologist or physician	Audiologist, otolaryngologist, or other physician who has experience and expertise in hearing and hearing loss	Audiologist or physician
STS (Standard Threshold Shift)	≥ 10-dB average shift from baseline testing hearing levels at 2000, 3000 and 4000 in either ear	Same as OSHA	Same as OSHA	Significant threshold shift (NIOSH) is a hearing loss that is ≥ 15-dB worse than baseline at any test frequency, in either ear, confirmed with follow-up test for same ear or frequency

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STS Follow-up Criteria	Notify worker within 21 days (unless not work-related). Fit or re-fit HPDs and select higher attenuation if necessary, refer for further testing if problem due to HPDs, inform employee of need for exam if a problem unrelated to HPD use is suspected	Within 30 days of receiving evidence or confirmation of STS, unless not work-related, must retrain the miner and provide an HPD or different HPD. Review effectiveness of any engineering or administrative controls to correct deficiencies	Notify worker within 30 days (unless not work-related). Fit or re-fit HPDs and select higher attenuation if necessary, refer for further testing if problem due to HPDs, inform employee of need for exam if a problem unrelated to HPD use is suspected	Notify worker within 30 days. Must take action such as explain effects of noise, re-instruct and re-fit with HPDs, provide additional training in hearing loss prevention, or reassign to quieter area
OHC Qualification	Responsible to audiologist, otolarnyngologist or physician. Certified through CAOHC, or demonstrates competence. If microprocessor used, certification not required	Must be under direction of supervisor. Must be certified by CAOHC or equivalent certification organization	Responsible to Professional Supervisor. CAOHC certification or equivalent certification or has demonstrated competence.	Must be under direction of audiologist or physician. Must be certified by CAOHC or equivalent certification organization
Employee Notification	Not specified, unless STS is detected, then follow STS criteria	Audiograms must be reviewed within 30 days and feedback provided in writing to each miner within 10 days thereafter	Required for noise monitoring results (all monitored employees), ID of STS	Not specified unless STS is detected, then follow NIOSH STS follow-up
Baseline Revision	Annual audiogram substituted for baseline, when STS is *persistent*, or thresholds show significant improvement	Annual audiogram substituted for baseline when STS is permanent, or thresholds show significant improvement	Determined by Professional Supervisor. Method: NHCA Guidelines are Appendix C	Annual audiogram substituted for baseline when the confirming audiogram validates an STS
Presbycusis or Age-correction	Is allowed	Is allowed	Is allowed	Not allowed
Work-Relatedness	CFR 1904.10 "physician or other licensed healthcare professional"	Same as OSHA	Physician or audiologist determines work-relatedness	Not indicated
Recordable or Reportable Hearing Loss	CFR 1904.10-Work related STS (≥ 10-dB shift at 2000, 3000 and 4000 Hz, in either ear), if shift plus baseline threshold levels total ≥ 25 dB above audiometric zero. Age adjustment allowed for STS, but not to determine if average levels ≥ 25 dB	≥ 25-dB avg shift from baseline, or revised baseline at 2000, 3000, and 4000 Hz in either ear	Same as OSHA	Not indicated
Recordkeeping and Retention	Two years for noise surveys, duration of employment for audiograms, with requirement to transfer records to successor if business closes	Employee noise exposure notices and training records for duration of enrollment in HCP + 6 months. Audiograms for duration of employment + 6 mos with requirement to transfer records to successor mine operator	Same as OSHA; training records for 3 years; electronic records allowed	Noise surveys for 30 years, audiograms for duration of employment + 30 years, calibration records for 5 years, and record transfer per 29 CFR 1910.20 (h)

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Training and Education	Annual for all employees exposed ≥ 85 dB TWA; include effects of noise, HPDs, purpose and explanation of audiometry	Same as OSHA, except must begin within 30 days of enrollment in HCP and include description of mine operator and miner's responsibilities for maintaining noise controls	Training must be offered annually, required at least once every 1095 days (3 years); includes same topics as OSHA plus: explanation of noise operational controls, noise range and appropriate HPDs, noise monitoring information, access to records, criteria for excessive noise report and how to file such reports	Same as OSHA, but must also include psychological effects of noise and roles/responsibilities of both employers and workers in program
Program evaluation	Continuing, effective HCP	Not indicated	Same as OSHA	Required annually by comparing rates of STS for exposed and non-exposed workers
Postings	Hearing Conservation amendment will be posted in workplace	No requirement for posting, but when *admin controls* are utilized the procedures must be posted	Post understandable noise monitoring results at crew origination point for a least 30 days.	Signs must be posted at entrance to areas with TWAs routinely ≥ 85 dBA
Requirements for new locomotives	Not applicable	Not applicable	New locomotives required to meet static testing requirements	Not discussed
Maintenance requirements for existing locomotives	Not applicable	Not applicable	Protection of sound-insulating properties in existing locomotives, repair of certain noise sources as identified by crews	Not discussed

Evolution of Hearing... – continued from page 1

The FRA loosened some OSHA requirements as well:

- Audiometric retest can occur within 90 days of the periodic test vs. OSHA's 30 day requirement;
- Employees must be notified within 30 days about changes in their hearing vs. OSHA's 21 days;
- Exposures up to 120 dB(A) are allowed for up to 5 seconds, citing the safety issue of needing horn blasts to warn the public of oncoming trains.

The FRA states that audiologists or physicians are responsible for the audiometric testing in a hearing conservation programs and qualifies that the physician must have "experience and expertise in hearing and hearing loss."

There appears to be a general reluctance to deviate too far from the OSHA regulation however. As an example, FRA wrote to OSHA asking of any plans to move from a 5-dB to a

3-dB exchange rate. OSHA replied that there were no such plans and FRA has stayed with 5 dB despite recommendations from experts in the field to the contrary.

Discussion

One would hope that employers would want to use "best practices" rather than being minimally compliant but the realities of the workplace reveal the unfortunate focus on minimal compliance. The preamble documents for these regulations are rich with information. One would also hope that with the evolution of hearing conservation regulations each would "build" on its predecessors. In some aspects that has occurred but in others, the new regulations "tear down" the gains made by previous regulations. Table 1 is set up with the regulations in chronological order and the NIOSH Criteria Document to the right. See if you think there is "progress" or "regress" as you move from left to right.

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OHC Spotlight and YOU!

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Portable Digital Music Players and the Potential Risk for Hearing Loss

By Brian J. Fligor, ScD, CCC-A

Few topics in the hearing sciences have had such broad appeal and instant recognition as the recent popular interest in the potential for hearing loss from using iPods and other portable listening systems. Over 70 million portable digital music players have been sold since their introduction to the market in 2001, with the Apple iPod holding roughly 70% of that market share (Canalys, 2005).

The potential risk to hearing from the (abusive) use of portable music players has been a topic of investigation since the inception of the Sony Walkman® (Katz et al., 1982). While hearing loss from overuse of headphones is not the most common complaint for a child coming into the pediatric audiology clinic at Children's Hospital Boston, it is not unheard of. Considering that teenagers have presented in rare instances with 4000-Hz notches and a history consistent with music-induced hearing loss, it is not improbable that some workers in industry have minimal (yet measurable) hearing loss from similar histories.

One such example is the motivation behind a study of portable compact disc players and the potential risk to hearing (Fligor and Cox, 2004). A 15-year-old boy came into the audiology clinic with a complaint of difficulty hearing in his right ear. It was apparent when looking in his ear with an otoscope that the boy had an earwax impaction in the right ear; the left ear was clear. After the nurses flushed out his right ear, we tested his hearing and found his right-ear hearing was normal. In his left ear, (the ear without the earwax), he had a mild 4000-Hz sensorineural notch — the hearing loss pattern consistent with noise-induced hearing loss. He denied any noise exposures from work, firearms, or from attending concerts and the like, but volunteered that he listened to his CD player at very high listening levels. He asked, "Why, is that a problem?" Our answer was, "Most likely, yes." His next question was harder to answer: "Ok, so how loud can I listen?" We did not, nor did the published literature, have useful guidelines for him at the time.

Using an acoustical mannequin known as KEMAR and various noise and music samples, Fligor and Cox (2004) reported the dynamic range of free-field equivalent A-weighted level of a series of CD players and different headphone styles. In an effort to provide a "speed limit" for listening (as the 15-year-old boy above was requesting), the authors reported the allowable time of exposure at the various volume control levels according to NIOSH (1998) noise exposure criteria. The findings indicated that all CD players surveyed could be used in a manner exceeding a 100% noise dose (85 dBA TWA, 3-dB time-intensity trading ratio). Listening guidelines targeting not more than 50% noise dose were suggested. For example, listening to a Sony CD Walkman® with stock over-the-ear headphones at 60% of maximum volume for 60 minutes was suggested as a "cut-off" as this would result in that 50% noise dose.

Updated findings

Recent studies, discussed below, have just been completed that further investigate use of portable music players in terms of updating the listening guidelines of CD players to MP3 players and consider strategies to reduce risk of music-induced hearing loss.

Fligor & Ives Study: With support from Etymotic Research, Inc., my collaborator, Terri Ives, ScD, AuD, Assistant Professor at the PCO School of Audiology in Elkins Park, PA, has finished data collection for the study titled, "Chosen Listening Level in 100 Normal Hearing College Students." This study comprehensively investigated music-listening behaviors in various levels of background noise to determine how many and under what circumstances people chose listening levels that put them at risk for hearing loss.

The actual sound levels at the subjects' reported "chosen listening level" were recorded in the subject's earcanal using a thin tube attached to a microphone, that fed the information out of the booth to a computer for recording. Corrections were applied to the levels recorded in the earcanal to equate to free-field equivalent.

Results: Figure 1 shows the average chosen listening levels for our subjects across the different background noise levels. The solid symbols show the chosen listening levels when subjects listened in artificial noise ("pink noise"), and the unfilled symbols show listening levels in simulated real-life scenarios.

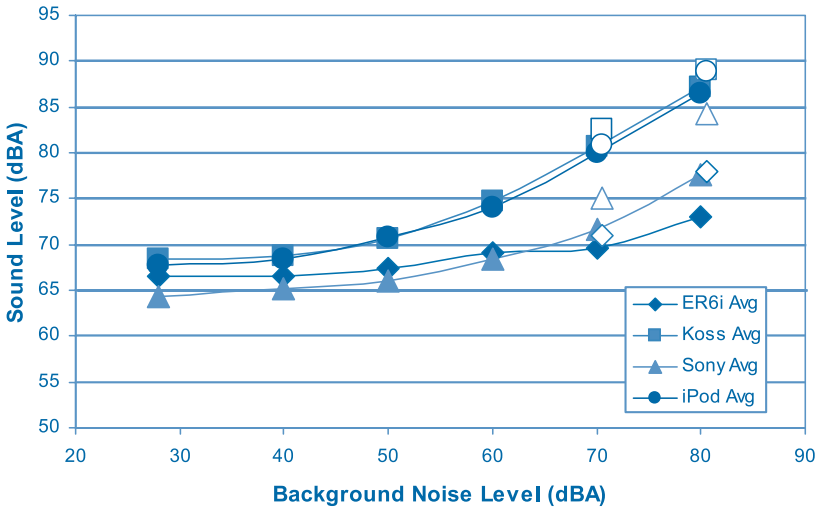

Figure 1: (Fligor & Ives Study) Average chosen listening levels using four different earphones in the various background noises. Filled symbols show chosen levels in "pink noise," and open symbols show chosen levels in real-world noise conditions. The open symbols offset at 70-dBA background noise show listening levels in restaurant noise, and the open symbols offset at 80-dBA background noise show listening levels in airplane cabin noise. These real-world noises were recorded by the experimenters and replayed in the testing booth at the actual real-world measured levels.

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As anticipated, chosen listening level in quiet was not affected by the type of earphone. Subjects do not listen at any higher level with in-ear earphones than they do with over-the-ear headphones. The statistical analysis showed that the level of background noise had a large impact on chosen listening levels, and that a large number of people who listened at benign levels in quiet, set the volume control to riskier levels in the noisier conditions like the airplane setting. This riskier behavior was ameliorated, though, when sound isolating earphones (like the ER6i) were used instead of earphones that did not block out background noise.

Portnuff and Fligor Study: The other study germane to this topic recently completed was conducted with University of Colorado doctorate candidate Cory Portnuff. If the "Chosen Listening Level" study conducted with Dr. Ives investigated "how fast people drive" their headphones, this study sought to "set a speed limit" for the volume control.

The dynamic range of five MP3 players from three manufacturers was evaluated, using stock earphones as well as four other models of earphones with each player. Output levels were measured using KEMAR (as described in Fligor and Cox, 2004) from five popular music genres, noise, and pure tones using each of the players and each of the earphones. From these recordings, we determined the full range of output, from very low to maximum settings on the volume control.

Results: The graph below (Figure 2) shows how the output level changes as the volume control increases, for each of the five players, when using their stock earphones. It is interesting to note that the output levels are fairly similar across players, especially toward the maximum volume control.

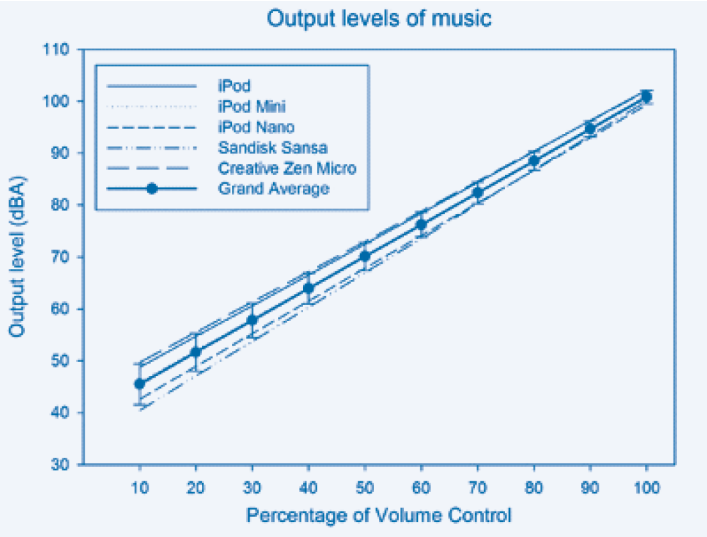

Figure 2: (Portnuff and Fligor Study) Free-field equivalent output levels of five MP3 players, using stock earphones, as a function of volume control settings. The grand average is the mean of all music genres across all players. Error bars represent 1 standard deviation around the grand average.

Recommendations

Based on NIOSH (1998) exposure criteria, we sought to provide that "speed limit" for using MP3 players. The table below shows our suggested maximum listening time per day (not to exceed 50% noise dose), depending on the style of earphones used and the volume control settings on the player. On this table, the "Isolator" style refers to earphones that have been reported to block out background noise, and the "Supra-Aural" style refers to earphones that sit on top of the ear. The final column shows our measurements for the iPod, using the stock earbuds (mini-earphones) from Apple.

% of Volume Control	Maximum listening time per day			
	Earbud	Isolator	Supra-Aural	IPod, stock earphones
10-50%	No limit	No limit	No limit	No limit
60%	No limit	14 hours	No limit	18 hours
70%	6 hours	3.4 hours	20 hours	4.6 hours
80%	1.5 hours	50 minutes	4.9 hours	1.2 hours
90%	22 minutes	12 minutes	1.2 hours	18 minutes
100%	5 minutes	3 minutes	18 minutes	5 minutes

Table 1: Suggested maximum listening time per day using NIOSH damage-risk criteria. "Earbud" includes stock earphones for all 5 MP3 players (all were of the earbud style). "Isolator" includes Etymotic ER6i and Shure E4c aftermarket earphones. "Supra-Aural" includes the aftermarket Koss headphones that rest on top of the ear. The column titled "iPod, stock earphones" is from data included in the first column "Earbud" and shown separately for comparison to the more general "Earbud" category, given that the iPod is the most popular device. Note: This table provides suggested maximum listening times across earphones, but cannot be considered to suggest one earphone is "riskier" than another. Risk is determined by how people use the device, not the device itself.

Discussion and Summary

The results of the Portnuff and Fligor study suggest that MP3 players produce high enough sound levels to pose a risk of hearing loss if used at high enough volumes for extended durations. We propose a "speed limit" of listening level no higher than 80% of the maximum volume control and listening duration for no longer than 90 minutes (an "80 for 90" limit), if the listener were using the stock earbud headphones that are provided with the MP3 player.

If a chosen listening level of 85 dBA is deemed the cut-off constituting "risky" behavior, then roughly 6% of subjects listening in a quiet setting are "risky listeners," according to Fligor and Ives study data. What about the loud environment? In this study, subjects were tested in a common environment for using headphones (a "simulated" airplane cabin). Eighty percent of subjects using the Koss over-the-ear and iPod earbud earphones exceeded 85 dBA; these earphones provide essentially no sound isolation. When an ER6i in-the-ear earphone was used (average of 25 dB sound isolation) only 20% exceeded 85 dBA.

These studies together estimate the number of people who listen in excess of "safe" levels, and the factors that influence a person to choose high sound levels, as well as suggesting a "safer" listening limit. Findings from these studies provide consumers and hearing conservationists with specific recommendations to reduce risk for music-induced hearing loss in users of MP3 players.

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UPCOMING OHC CERTIFICATION AND RECERTIFICATION COURSES* 2007

*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 March 2007 (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.

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4/25/2007	LA	Scott	Jim Guillory	337-233-3955
4/25/2007	NC	Greensboro	Cheryl Nadeau	336-834-8775
4/25/2007	PA	Bethlehem	James Robertson	610-868-8606
4/25/2007	PA	Pittsburgh	Timothy Swisher	412-367-8690
4/26/2007	AZ	Phoenix	Kathryn Deppensmith	281-492-8250
4/26/2007	PA	Pittsburgh	Timothy Swisher	412-367-8690
4/30/2007	NJ	Piscataway	Ellen Kelly	732-238-1664
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5/2/2007	MO	St Louis	James Jerome	317-652-6788
5/2/2007	TN	Chattanooga	Melette Meloy	678-363-9897
5/2/2007	TX	Houston	Johnny Sanders	281-492-8250
5/2/2007	OH	Cleveland	Carol Snyderwine	216-491-6104
5/3/2007	FL	Orlando	John Elmore	800-357-5759
5/7/2007	OR	Portland	Rodney Atack	503-614-8465
5/7/2007	ME	Waterville	Anne Giroux	207-872-0320
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5/9/2007	AZ	Sacramento	Kathryn Deppensmith	281-492-8250
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5/16/2007	NC	Morrisville	Thomas Cameron	919-657-7500
5/16/2007	CA	Concord	Charles Fankhauser	707-746-6334
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5/16/2007	DE	Dover	Timothy Swisher	412-367-8690
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5/22/2007	MI	Detroit	Thomas Simpson	313-577-3339
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6/7/2007	NC	Greensboro	Cheryl Nadeau	336-834-8775
6/11/2007	FL	West Palm Beach	Herbert Greenberg	678-352-0312
6/11/2007	NE	Omaha	Thomas Norris	402-391-3982
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6/13/2007	MO	St Louis	Robert Rhodes	281-492-8250

Hear for the Future International Noise Awareness Day • April 25, 2007

"It is time to address the threat that noise poses to hearing, health, learning and behavior," says Amy Boyle, Director of Public Education at the League for the Hard of Hearing. This year the League is once again spearheading a special effort to inform the public of the necessity of creating a quiet home, school and recreational environment.

Continuous exposure to noise above 85 decibels can be harmful to hearing and documented research has found noise does not have to be that loud to lead to physiological changes in blood pressure, sleep, digestion and other stress-related disorders. Studies exist documenting the harmful effects of noise on children's learning and behavior.

Among the many activities planned the public will be asked to observe the Quiet Diet - one minute of quiet, regardless of their location, from 2:15 P.M. to 2:16 P.M.

Additional information on International Noise Awareness Day and how you can participate is available at the Noise Center website at www.lhh.org/noise or by contacting Amy Boyle.

Portable Digital Music... – continued from page 10

References

Canalys webpage. (n.d.). "Portable music player market expected to double by the end of 2005," retrieved from http://www.canalys.com/pr/2005/r2005091.htm on January 16, 2007.

Fligor, B.J., and Cox, L.C. (2004). "Output levels of commercially available portable compact disc players and the potential risk to hearing." Ear and Hearing, Vol. 25, 513-527.

Katz, A.E., Gertsman, H.L., Sanderson, R.G., and Buchanan, R. (1982). "Stereo earphones and hearing loss," New England Journal of Medicine, 307, 1460-1461.

NIOSH (1998). "Criteria for a recommended standard: Occupational noise exposure, revised criteria," National Institute for Occupational Safety and Health. Pub. No. 98,126.

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Professional Supervisor Certification Course Scheduled for Fall 2007

The Professional Supervisor course is aimed at audiologists or physicians seeking instruction in the role and scope of practice of the professional supervisor of the audiometric monitoring component of hearing conservation programs. Attendees will receive continuing education and medical credits, a copy of the Hearing Conservation Manual 4th Edition, and training materials. This course leads to certification and confirms advanced training in audiometric issues in occupational hearing conservation as a Professional Supervisor.

The course will be Saturday, November 3, 2007 at the Sheraton Gateway Suites Hotel O'Hare in Rosemont, Illinois. All certification and registration information can be completed at http://www.caohc.org/professional_supervisor/course.php.

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