HEARING LOSS PREVENTION

DEFINITION AND ASSESSMENT OF ENGINEERING NOISE CONTROLS

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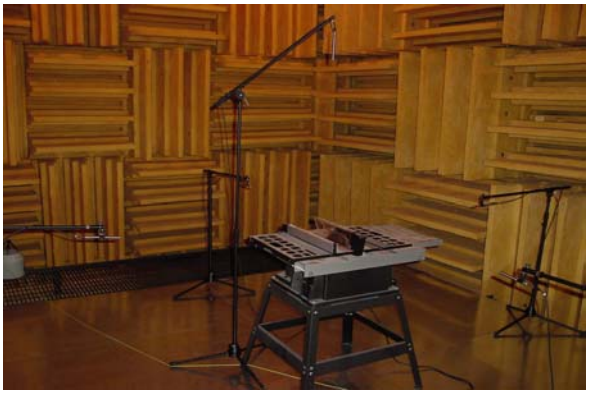

Sound power level of a table saw being measured in a semi-anechoic environment.

PURPOSE: Reduce noise emissions on construction sites, thus reducing noise-induced hearing loss among construction workers. Survey noise levels and the availability and effectiveness of engineering control of noise from powered hand tools and small machinery. Demonstrate noise reduction solutions for these tools wherever feasible.

RESEARCH SUMMARY: Over 2.9 million construction workers are exposed to noise that is harmful to hearing. Studies of carpenters have shown that hearing loss begins early in their working careers and that by age 50, 50% have hearing impairment. Noise control is the best way to prevent noise-induced hearing loss.

In the construction industry, little, if any, attention has been given to controlling noise through engineering, and thus it is necessary to seek out the availability of controls, assess their effectiveness and feasibility of application, identify those areas for which no engineering noise controls exist, and provide recommendations to reduce these noise emissions. While the construction industry has few resources available to aid workers in selecting quieter power tools, studies have shown these tools contribute substantially to construction workers' exposures to noise.

The two aspects of the project-development of a database on the sound levels of powered hand tools and research on noise reduction—rely on university partners for access to scientific expertise, facilities, and specialized acoustics equipment. The powered hand-tool manufacturing industry is being encouraged to join in this work.

As a result of this project and partnership, a database of quieter tools and machines will be made available to construction workers to assist in making "buy quiet" decisions. Industry is provided with recommendations for product improvement, universities are provided with research opportunities in occupational safety and health, and most importantly, noise exposure and resultant noise-induced hearing loss among construction workers will be reduced.

KEYWORDS: Engineering, noise, power tools

RECENT CITATIONS:

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HEARING LOSS INTERVENTION FOR CARPENTERS

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PURPOSE: Collect survey and observational data to assess the effectiveness of NIOSH's hearing loss prevention program in promoting carpenters' worksite hearing health behaviors.

RESEARCH SUMMARY: An estimated 2.9 million workers in the construction industry are exposed to potentially damaging noise levels. A 1995 NIOSH Health Hazard Evaluation of over 600 carpenters revealed that by age 25, these carpenters had hearing equivalent to a 50-year-old worker who had not been exposed to noise, and by 55 years of age, most of the carpenters needed hearing aids. The data show that carpenters began to develop occupational hearing loss soon after entering the trade and that this hearing loss continued until they were substantially hearing impaired. When estimating the potential economic impact just for its members, the United Brotherhood of Carpenters determined that it would cost the union half a billion dollars just to provide the first pair of hearing aids to members that needed them. Clearly, preventing noise-induced hearing loss would be preferable to compensation and rehabilitation costs.

A theory-driven program specifically focused on teaching apprentice carpenters how to prevent hearing loss has undergone pilot tests. A new 3-year effort will determine the effectiveness of this program in positively influencing hearing health behaviors. Carpenters participating in the NIOSH model hearing loss prevention program (HLPP) will be compared to a control group that participates only in the current OSHA compliance program. Information about attitudes, beliefs, and knowledge about hearing loss prevention; behavioral intentions; and worksite behaviors will be collected over a 2-year period and evaluated. This research will enable NIOSH to (1) quantify the extent to which the NIOSH program increases carpenters' knowledge about noise-induced hearing loss and the retention of that knowledge over the 2 years of the study, (2) correlate the relationship between attitudes, beliefs, and behavioral intentions with actual hearing loss prevention behaviors (i.e., the use of hearing protectors), and (3) compare the effects of instructional group size (6 or less versus 15-20 or more). Feasibility of program adoption will also be evaluated.

The results of this research will contribute directly to a reduction in noise-induced hearing loss among construction workers.

KEYWORDS: Intervention, hearing loss, effectiveness research

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FIELD HEARING PROTECTOR TESTING METHODS AND RATING SCHEMES

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PURPOSE: Develop the instruments and methods necessary to assess and rate the protection provided by hearing protection devices both in the laboratory and at worksites.

RESEARCH SUMMARY: More than 30 million workers are exposed to potentially hazardous noise and, at present, the primary redress available is use of hearing protective devices. Accompanying each hearing protector sold in the United States is a label showing the Noise Reduction Rating (NRR) of the device. The NRR was developed so that it could be subtracted from a worker's noise exposure level to determine the protected level of exposure. Unfortunately, because of problems with the test method and market pressures for high ratings, they have been inflated to the point where they may not be used reliably to predict protected levels of exposures. Nonetheless, the NRR is still required by law (40 CFR Part 211, Subpart B).

NIOSH and other laboratories have determined that the present NRR for hearing protectors is not predictive of the protection workers actually receive and thus it is not possible to calculate workers' protected exposure levels. In response, NIOSH has been working with other governmental and non-governmental organizations to design hearing protector rating schemes that will yield a more predictive measure of hearing protector performance. In addition, methods for determining the actual hearing protection received by a worker for the device he or she is using are being developed. Past NIOSH research has resulted in a newer psycho-acoustic test method for hearing protectors that has been embodied in an American National Standards Institute standard. Additional work is necessary to establish the relation between the data obtained with the older and newer test methods. The primary goal is to incorporate the new method into the existing EPA labeling regulation for hearing protection devices.

Key parameters will be determined for test methods that allow accurate characterization of the attenuation of hearing protectors. It is anticipated that it may be necessary to employ rating adjustment factors to make the two methods equivalent and that these rating adjustment factors may need to be applied to laboratory data for each class of hearing protector or even for each hearing protector. Thus, a person or company should be able to select an appropriate protector based on new laboratory data or the worksite test.

In this project, protectors will be tested using both methods, as well as the present method required by EPA, to determine key performance parameters. The results should provide the information necessary for a protector to be chosen that is appropriate for the noise for which the protector is to be worn.

KEYWORDS: Hearing, protective equipment, rating

HEARING LOSS PREVENTION STRATEGIES PROGRAM COORDINATION

KEYWORDS: Hearing loss, noise, control technology

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PURPOSE: Coordinate the NIOSH noise program to identify effective hearing loss prevention strategies.

RESEARCH SUMMARY: Noise-induced hearing loss is the most common occupational illness in the United States today, with 30 million workers exposed to excessive noise levels. Of particular concern are the mining and construction industries where over 3.3 million workers are exposed to damaging noise levels. For example, where hearing loss data are available, approximately 90% of coal miners, nearly 70% of metal/nonmetal miners, and over 50% of construction workers exhibit a hearing disability by age 50. Four out of seven carpenters with at least 20 years of employment have hearing impairment due to noise exposure.

The noise program expands current NIOSH noise research studies to fill the gaps in information for standards and regulatory groups and adds research in noise control to the efforts to improve and disseminate information on hearing loss prevention program strategies and management. The program will focus on assessing the status of noise exposure and hearing loss (cross-sectional and longitudinal surveillance) and noise exposure control technology (including hearing protection), primarily in the construction and mining sectors. The effectiveness of strategies (personal protection, engineering controls, etc.) for preventing hearing loss will be noted as part of the assessment and surveillance activities.

In the next few years, key regulatory actions will be initiated or implemented for preventing occupational hearing loss in the construction and mining sectors. NIOSH has been contacted by OSHA and MSHA to play a central role in developing the requisite information base and recommendations to assure that these noise control and hearing loss prevention efforts are effective and technically sound and feasible. To accomplish this task, an integrated program of assessment, intervention evaluation, and information dissemination is needed.

This program will make it possible to safeguard the hearing of workers by reducing noise exposure and implementing hearing loss prevention programs. It will also provide baseline data for the documentation of progress. Although the initial focus of the program is on construction and mining, the databases, strategies, and programs will also facilitate application of strategies to other occupational sectors.

PROSPECTIVE STUDY OF HEARING DAMAGE AMONG NEWLY HIRED CONSTRUCTION WORKERS

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KEYWORDS: Hearing loss, hearing, distortion product, otoacoustic emissions

PURPOSE: Monitor noise exposure in a cohort of newly hired construction apprentices and controls and characterize the effects of this exposure on hearing acuity (via standard audiometry) and distortion product otoacoustic emissions (DPOAE) over a 4-year period.

RESEARCH SUMMARY: Noise-induced hearing loss is one of the most common occupational afflictions, especially in construction workers. Hearing loss usually progresses unnoticed until it begins to interfere with communication, decreasing quality of life and often posing a serious safety hazard. Precise exposure-response relationships for noise-induced hearing loss, especially for the highly variable noise exposures found in the construction industry, are lacking. In recent years, the potential for distortion product otoacoustic emissions (DPOAE) as a screening tool for early hearing damage (and possibly as a marker of susceptibility for hearing loss) has been recognized. However, no studies of this technique as it relates to well-characterized noise exposure and standard audiometry have been conducted.

Four-hundred construction apprentices and one-hundred medical students will be recruited for this study. Each subject will be given an audiometric exam and DPOAE measurements every 6 months for 4 years. Baseline and follow-up questionnaires will be used to characterize risk factors for hearing loss, nonoccupational exposure to noise, characteristics of work, and use of hearing protection devices. Noise exposure will be monitored twice a year on each subject using noise dosimeters in conjunction with time-activity cards. The dosimeters will collect noise levels using 3- and 5-dB exchange rates as recommended by NIOSH and OSHA, respectively, as well as peak exposures. An activity-exposure matrix will be developed from these data to provide estimates of average, peak, and variability of exposure during work and home activities. These data will be used to estimate individual exposures over time. The relationships between noise exposure (using both average levels and variable exposure metrics) will be evaluated, and both audiometric changes and DPOAE's will be analyzed while controlling for co-variants.

EFFECTIVENESS OF COMPUTER-BASED HEARING TEST AND TRAINING

KEYWORDS: Hearing, intervention, heavy construction

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PURPOSE: Prevent noise-induced hearing loss in operators of heavy construction equipment by testing the effectiveness of an intervention that would increase use of hearing protective devices.

RESEARCH SUMMARY: Four specific aims will be addressed in this study.

1. Test the effectiveness of an innovative intervention to increase the use of hearing protective devices among heavy equipment operators.
2. Determine the prevalence of hearing loss in these operators.
3. Demonstrate the feasibility of providing computer-based, self-administrated audiometric screening tests (SAAST's) and hearing protection interventions.
4. Test and refine the "predictors of use of hearing protection" model, which is designed to explain why operators use or don't use protective devices.

To achieve these aims, this research will be conducted in three phases. In phase I, qualitative data on the perceptions, opinions, and attitudes of heavy equipment operators concerning the use of hearing protective devices will be obtained through focus group discussions. The input received will be used to guide development and refinement of an intervention. In phase II, the effectiveness of an individually tailored, interactive, multimedia intervention will be combined with the SAAST's and tested. The intervention will be delivered by computer at a construction worker union training center and the individualized results contrasted with a control intervention. In phase III, workers' feedback on the SAAST and the experimental intervention will be obtained to guide revisions in the program in preparation for national distribution.

This study will build on recent research regarding the effectiveness of individually tailored interventions. The feasibility of using computer-based SAAST's at a union training center will be assessed. Results will provide a model for future intervention research in occupational safety and health and aid in reducing noise-induced hearing loss.

BUILDING TRADES HEARING CONSERVATION PROGRAMS IN WASHINGTON STATE

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CONSORTIUM: **Center to Protect Workers' Rights**

PURPOSE: Develop and implement a common-sense hearing conservation program that can serve all Washington State construction workers and employers.

KEYWORDS: Hearing loss, noise control

RESEARCH SUMMARY: All construction workers are exposed to excess levels of noise, and the number of industrial insurance claims made for hearing loss is growing very rapidly. Construction, with roughly 6% of the work force, now accounts for 25% of all hearing loss claims, up from 16% a decade ago.

Hearing loss, and the compensation costs that result from it, can be prevented through a good hearing conservation program. However, in the construction industry, most workers move from job to job and contractor to contractor. Therefore, it is not feasible for most employers to establish effective hearing conservation programs on their own. For these reasons, we are implementing a pilot program to establish the groundwork for the development of an industry-wide program. The program consists of the following:

- Worker and supervisor training using construction-specific instructional materials.
- Training in the fundamentals of noise control.
- Fitting and training in use of hearing protection devices.
- Audiometric surveillance.
- Centralized record keeping.
- Continuous evaluation of program quality and industry penetration.

Many people and organizations are collaborating on this project. Among them are the Washington State Building and Construction Trades Council, University of Washington, Puget Sound Safety and Health Construction Partnership, Laborers Safety and Health Fund, Puget Sound Area Construction Safety Summit, Washington State Apprenticeship Coordinators Association, Western Washington Coordinators Association, and the Washington State Dept. of Labor and Industry.