

NOISE EXPOSURE DISTRIBUTIONS IN AUTOMOTIVE PRODUCTION FACILITIES. E.D. Zaban, James, Anderson & Associates, Inc., Okemos, MI; R. Brogan, Ford Motor Co., Dearborn, MI; T. Simpson, Wayne State University, Detroit, MI

An analysis of a noise exposure database of automotive production facilities was performed. Sound exposure data for over 70,000 employees in more than 50 plants were examined. Exposure distributions were plotted for each type of facility, ranging from light assembly to metal fabrication. Each distribution was evaluated for normalcy with the intent of providing guidance to Hearing Loss Prevention Program (HLPP) implementors using various sampling strategies.

Worker sound exposures were developed utilizing an organization-based sampling strategy and a task-based sound exposure profiling methodology. Monitoring was conducted in a manner consistent with ACGIH criteria, including a maximum 8-hour threshold limit value of 85 dBA and exchange rate of 3 dB. Data points result from representative monitoring, based on groups of employees who exhibit potential to rotate or change jobs with no associated change in personnel record keeping status; who are engaged in a similar kind of work; and whose sound exposures are expected to be similar. Monitoring was conducted for operation(s) reasonably believed to exhibit representative exposure potential, with the resulting 8-hour time-weighted average considered representative of the group. Histograms detailing the number of employees at various exposure risk levels for each type of production facility are accurate predictors of potential exposures near action levels, and subsequent HLPP enrollment requirements.

NOISE EXPOSURE IN COMBINATION WITH OTOTOXIC AGENTS. W.J. Murphy, NIOSH, Cincinnati, OH

This paper will review the effects of exposure to noise in combination with other ototoxic agents. Current OSHA standards do not consider the effects of interactions of ototoxic agents in combination with noise exposure. Such agents include common solvents, prescription and nonprescription drugs, and metals.

The effect of noise exposure in combination with other ototraumatic agents is an emerging area of concern for the development of comprehensive standards for hearing loss prevention. Hearing loss can generally be categorized as conductive, cochlear, and retrocochlear. Low-level noise exposures (<100 dB SPL) damage the outer hair cells in the organ of Corti. High-level noise exposures produce mechanical damage first to the outer hair cells, then inner hair cells and, with sufficient energy, the organ of Corti can be ripped. Organic solvent-induced hearing loss presents impairment that is similar to noise-induced hearing loss, but tends to produce damage by poisoning the hair cells. As well, the exposure to solvents can effect the afferent and efferent auditory pathways. Ototoxic drugs have been shown primarily to affect the hair cells. Aminoglycosides exhibit strong ototoxic effects on the outer hair cells while carboplatinum acts to destroy the inner hair cells. Exposures to metal such as lead and

mercury produce bilateral uniform threshold shifts. Human and animal studies have shown combined exposures of noise with these ototraumatic agents can produce nonadditive hearing loss. This presentation will classify ototoxic agents according to their effects on the peripheral or central auditory system both in laboratory animals and humans.

TEMPORARY THRESHOLD SHIFT IN DIVERS CAUSED BY TWO COMMONLY USED NOISY UNDERWATER TOOLS: PORTABLE WATERJET CLEANING SYSTEM AND STANLEY HYDRAULIC BREAKER. B.S. Samimi, J. Kelly, San Diego State University, San Diego, CA

An overwhelming number of studies are conducted on the dreadful effects of air-transmitted high intensity noise on human hearing. But water-transmitted noise created by noisy tools used by professional divers has not been adequately studied. Two noisy underwater tools, the portable Waterjet Cleaning System (WCS) and the Stanley Hydraulic Breaker (BR67), are commonly used by underwater construction divers in demolition/construction jobs. These tools are popular because they are lightweight and easy to handle in and out of inflatable support craft. The specific applications of the WCS and BR67 are cleaning surfaces of concrete piles and breaking/removing concrete clumps, respectively.

The objectives of this study were (1) to monitor the sound pressure levels at various underwater construction operations and (2) to determine whether working with these tools results in significant temporary threshold shift (TTS).

The study was conducted over a 5-day period on eleven 25-36 years old qualified Navy divers. The site of the study was at Port Hueneme in California. Divers wore either Mark 20 or Mark 21 diving helmet. The number of dives performed was 12, 6, and 11 for BR67, WCS, and control divers, respectively. Exposure to each tool was limited to 1 hour, which the Navy considered a practical time for using the tools. The tools were used by the divers at a depth of 14-20 feet. There was no tool noise exposure during the control dive. The noise level was measured at the diver's left ear over a spectrum of 125-8000 HZ. Hearing tests were performed on both ears of all study subjects prior to and immediately after the termination of underwater task.

The overall mean noise levels for WCS, BR67, and control divers were 141.5 dB (N=39), 147.7 dB (N=50), and 128.4 dB (N=3), respectively. The ranges of mean TTS for different study groups at octave bands of 500-6000 HZ were 5.4-11.3 dB (max at 3000 HZ) for WCS, 2.5-8.7 dB (max at 1000 HZ) for BR67 wearing Mark 20, 1.25-10 dB (max at 4000 HZ) for BR67 wearing Mark 21 helmet, and 1.5-3.5 dB (max at 4000) for control divers. The maximum TTS observed on any individual diver was 35 dB at 3000 HZ and 35 dB at 4000 HZ after 60 minutes of work with WCS and BR67, respectively. On the basis of these results, the Navy is requiring that future use of the WCS and BR67 tools be limited to a maximum of 30 and 15 minutes, respectively, for divers wearing the Mark 20 helmet. For divers wearing the Mark 21 helmet the maximum work period would be 60 minutes.

COMPREHENSIVE USE OF HEARING PROTECTORS: INTEGRATION OF TRAINING, FIELD MONITORING, COMMUNICATION, AND DOCUMENTATION. K.L. Michael, Michael & Associates, Inc., State College, PA

Among the problems associated with the use of hearing protectors in industry are poor training and motivation on proper wearing techniques, impaired communication, and differences between labeled noise reduction ratings and achievable field attenuation. New standards efforts will provide guidelines for the hearing conservationist to address these issues in a methodical and well-accepted manner. ANSI S12/WG11 is developing a standard on hearing protector field monitoring systems that will describe a method for measuring the attenuation provided to the individual hearing protector wearer. ANSI S12/WG35 is developing a method for selecting hearing protectors that maximize the ability to communicate in specific high-noise environments. Tests in industry have demonstrated that field monitoring systems are instructive, effective, and well-accepted by employees. Field monitoring system measurement data has been used as evidence of effective hearing protector use in worker's compensation litigation. A comprehensive approach to hearing protector management involves selecting hearing protectors that maximize communication based on field measurement data. This approach eliminates reliance on laboratory best-fit attenuation data or estimates of field attenuation. In addition, industry is provided with documentation that effective training and selection have been performed and that communication requirements were considered.

DEVELOPMENT OF STRATEGIES, MODELS, AND TOOLS FOR ASSESSING EMPLOYEE EXPOSURES

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LESSONS LEARNED IN EXPOSURE MODELING FOR QUANTITATIVE HEALTH RISK ASSESSMENT AND RISK MANAGEMENT: ONE INDIVIDUAL'S EXPERIENCES. S.F. Arnold, Dow Corning Corp., Midland, MI

Employing exposure modeling for the purposes of quantitative human health risk assessment is a valuable and powerful tool in providing quantitative data for human health risk assessment and management. The lessons learned in one case study are presented herein as a means of helping others maximize their potential for success when using this tool.

Formaldehyde has been used historically in many industrial applications, including biocidal applications. A request to review draft exposure calculations for the use of formaldehyde as a biocide in an industrial coating product revealed the need to quantify the uncertainty, or better define certain values. This resulted in an exposure assessment using a mathematical exposure model known as the two-box model or near field-far field model. The application of this model allowed a more realistic review of

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