Vipperman JS, **Prince MM**, Flamm AM [2003]. Analysis of impact/impulse noise for predicting noise-induced hearing loss. Proceedings of the 145th Meeting: Acoustical Society of America, Nashville, TN, April 28-May 2, 2003. *J. Acoust. Soc. Am.* Vol. 113:2196.
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The slope of peak reduction with peak level for the Ultra9000 device was about 0.5 dB/dB, while the slopes for most earplugs were about 0.1 to 0.3 dB/dB for weapons impulses between 159- and 170-dB peak level. The peak reductions ranged from 6 dB for the North Ear valve to 30 dB for the EAR Classic foam earplug.

3:50

**1pNS9. Relation between peak pressure and spectrum for small caliber muzzle report and ballistic shock.** Michael J. White and Larry L. Pater (U.S. Army ERDC/CERL, P.O. Box 9005, Champaign, IL 61826)

It might seem impossible to reconstruct the peak signal level of an impulsive sound from its spectrum if the phase information is not kept. Without such an estimate, sound propagation assessments made in the frequency domain are at a disadvantage when it is the peak level that is desired. From a set of experimental measurements of small caliber firearm noise at Camp Guernsey, muzzle report and ballistic shock signals were time-gated to obtain 1/3-octave sound exposure spectra and peak levels from each signal. The rms bandwidth of each signal was determined by summing the squared frequency, weighted by the relative 1/3-octave band exposures. Finally, a relation was presumed only such that the sound exposure was equal to a product of squared peak pressure, the reciprocal of the rms bandwidth, and an undetermined constant. Constants equal to 3 dB for muzzle blast and 3.5 dB for ballistic shock fit the data sets, with approximately 3 dB standard error. Greater error tended to coincide with smaller measured bandwidths, by overestimating the peak level.

4:05

**1pNS10. Noise sampling issues for impact/impulse noise surveys.** Mary M. Prince (NIOSH, IWSB/DSHEFS, 4676 Columbia Pkwy., R-16, Cincinnati, OH 45226) and Jeffrey S. Vipperman (Dept. of Mech. Eng., Univ. of Pittsburgh, 531 Benedum Hall, Pittsburgh, PA 15261)

Noise-induced hearing loss (NIHL) has been recognized as a serious health concern for decades. ISO Standard 1999:1990 provides a means to predict noise-induced hearing loss (NIHL) based on $L_{Aeq}$ measurements in the working environments of workers. This standard seems to work well for predicting hearing loss in continuous noise fields. However, it is possible that ISO 1999 does not apply well to impact, impulsive, or other transient noise fields. NIOSH and University of Pittsburgh are currently developing noise-sampling strategies to measure impact and impulse noise in a manufacturing environment with the aim of developing new impulsive noise metrics. As part of the study, broadband impact/impulse pressure measurements will be made. Issues such as instrumentation, data quality, repeatability, spatial sampling, equipment portability, and calibration are addressed. Also, the annotation, digitization, and editing of the waveforms will be discussed. As part of the project, an archival database of manufacturing impulse/impact will be created to support the future algorithmic development. The ultimate goal of the project is to develop new metrics to characterize the hazards of impact/impulse noise that will complement ISO 1999 for predicting NIHL.

4:20

**1pNS11. Analysis of impact/impulse noise for predicting noise induced hearing loss.** Jeffrey S. Vipperman (Dept. of Mech. Eng., Univ. of Pittsburgh, 531 Benedum Hall, Pittsburgh, PA 15261), Mary M. Prince (NIOSH, IWSB/DSHEFS, Cincinnati, OH 45226), and Angela M. Flamm (Univ. of Pittsburgh, Pittsburgh, PA 15261)

Studies indicate that the statistical properties and temporal structure of the sound signal are important in determining the extent of hearing hazard. As part of a pilot study to examine hearing conservation program effectiveness, NIOSH collected noise samples of impact noise sources in an automobile stamping plant, focusing on jobs with peak sound levels ($L_{pk}$) of greater than 120 dB. Digital tape recordings of sounds were collected using a Type I Precision Sound Level Meter and microphone connected to a DAT tape recorder. The events were archived and processed as .wav files to extract single events of interest on CD-R media and CD audio media. A preliminary analysis of sample wavelet files was conducted to characterize each event using metrics such as the number of impulses per unit time, the repetition rate or temporal pattern of these impulses, index of peakedness, crest factor, kurtosis, coefficient of kurtosis, rise time, fall time, and peak time. The spectrum, duration, and inverse of duration for each waveform were also computed. Finally, the data were evaluated with the Auditory Hazard Assessment Algorithm (AHAAH). Improvements to data collection for a future study examining different strategies for evaluating industrial noise exposure will be discussed.

MONDAY AFTERNOON, 28 APRIL 2003 — ROOM 204, 2:00 TO 4:40 P.M.

## Session 1pPP

## Psychological and Physiological Acoustics: In Memory of Evan Relkin

Robert L. Smith, Chair

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**Chair's Introduction—2:00**

### *Invited Papers*

2:10

**1pPP1. Estimating the similarity of temporal discharge patterns of auditory neurons.** William Shofner (Parmly Hearing Inst., Loyola Univ. Chicago, 6525 N. Sheridan Rd., Chicago, IL 60626, wshofne@luc.edu)

Behavioral data obtained from stimulus generalization experiments are often interpreted to imply how similar animal perceptions of test stimuli are to a training stimulus. An appropriate decision variable would be useful for evaluating physiological responses in the context of stimulus generalization tasks. The decision variable $P(A)$ obtained from ROC analysis of spike count distributions is useful for evaluating rate coding schemes [e.g., Relkin and Pelli, J. Acoust. Soc. Am. 82, 1679–1691 (1987)], but it ignores temporal information which may exist in responses to periodic sounds. Neural autocorrelograms show temporal firing patterns following a spike