

Fit for Hearing Protection with Earplug Testing

By Dennis A. Colucci, AuD, MA

In industry, the goal for safety and health is to eliminate all accidents, keep employees working to their potential, and avoid debilitating long-term injuries or loss of life. In occupational audiology, this objective means avoiding hearing loss and the exacerbation of central presbycusis's potential long-term effects as employees age.

Working as part of a team, the audiologist evaluates standard threshold shift (STS) cases by reviewing dosimetry measures of time-weighted average (TWA) and peak values for comparison against the Occupational Safety & Health Administration (OSHA) permissible exposure limits (bit.ly/OSHA-limits).

While the TWA is a useful tool, the OSHA permissible exposure rules were negotiated as a political compromise among stakeholders. The law leaves a one-percent risk factor for acquiring hearing loss at 80 dBA, three percent at 85 dBA, and eight percent to 11 percent at 90 dBA (Dobie RA. *Medical-Legal Evaluation of Hearing Loss*. 2nd ed. San Diego, CA: Singular Publishing Group; 2001:186).

Therefore, best practices would suggest that attempting to lower the limit of sound at the eardrum to 75 dBA to 80 dBA would provide the preferred noise protection over time. For most industries, 10 dB to 15 dB of attenuation is sufficient, and is a practical goal for earplug use (*Noise Health* 2011; 13[51]:152-162).

FIT AND FUNCTION

To obtain better-fitted hearing protection, user compliance, and operator error reduction, fit testing (measures of attenuation by the hearing protector) with appropriate counseling is at the top of the list.

Fit testing is necessary because noise reduction ratings (NRRs) provided by earplug manufacturers are laboratory ratings and have little correlation with protection in the field. For this reason, OSHA has derated NRRs (bit.ly/OSHA-NRR).

Most importantly, fit testing can be used to identify ear canals with unusual configurations that are not earplug compatible.



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It is not sufficient for fit-test equipment programs to pass an earplug; special precautions should still prevail.

For example, a second review must include how much attenuation is obtained in the low tones (250 Hz to 500 Hz), as slit leak venting and an improper fit can still occur. When low-tone attenuation is 20 dB or more, a vent leak is less likely.

Also, a significant performance difference between the two ears at the low tones may represent a fit issue.

The best-fitted earplugs are snug in the ear canal and fit deeply to the second bend without causing user discomfort. Three-quarters of the length of the earplug should be in the ear canal. The earplug should not slip out over time, have substantial slit leaks, move outward with temporomandibular joint articulation, nor be


removed easily without moderate retention.

Technically, the most important and often missed issue in earplug fitting is acquiring a seal deep in the ear canal at the second bend. For most employees, this means using tapered or flush foam earplugs, especially since no significant difference in earplugs is detected when hearing protection is properly fit (*J Occup Environ Hyg* 2007;4[2]:114-122).

The greatest benefit of fit testing is the opportunity for the clinician to teach and train every employee on proper earplug insertion and use (*Noise Health* 2011;13[51]:132-141) while reinforcing the need for continuous protection at work and off the job. Regardless of data obtained from real-ear probe testing or circumaural headphone fit tests, long-term results depend on the user.

GOALS AND OUTCOMES

The goals of testing are to identify those people whose earplugs need to be changed to a more appropriate fit, and to find those whose earplugs fail altogether, making custom devices or earmuffs warranted.

Regardless of the earplug evaluated, proper insertion and methods of use must be instilled in each employee, including for when they're not on the job. The outcomes of stringent use of these protocols is fewer occurrences of standard threshold shift and hearing loss, and better hearing for life for those whom we serve. 



Dr. Colucci is a clinical and forensic audiologist in private practice in Laguna Hills, CA.