

Responses to Questions and Complaints Regarding Hearing and Hearing Protection (Part III)

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The dialogue of the EARLog series ¹, which began in #8 and continued in #9, is concluded in this EARLog, #10. We address additional problems that hearing conservation administrators may encounter in their ongoing efforts to educate and motivate employees concerning the importance of protecting their hearing.

Question:

How can I tell when a noise may be harmful to my ears?

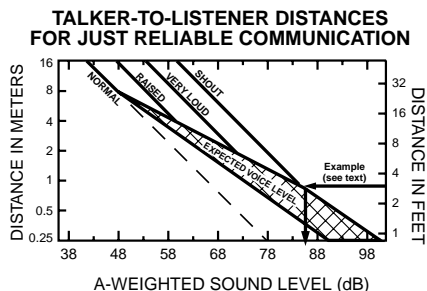
Response:

When a noise is loud enough that you feel the need to shout at a distance of 3 feet in order to communicate with a normal hearing person, the noise levels are probably around 85 dBA or more and may be hazardous to your hearing. Additional information on using speech levels to judge noise levels can be gleaned from Figure 1, which depicts the ability to conduct face-to-face communications as a function of the A-weighted sound level. Figure 1 is a rough guide that is applicable for communication in non-reverberant conditions.

If, after a noise exposure, your hearing appears dulled as though you had a temporary loss (temporary threshold shift or TTS), or you hear a ringing or hissing noise in your ears (tinnitus), this is an indication that the particular exposure overstimulated your hearing. Repeated exposures over a period of weeks, months, or years, to noises which cause TTS or tinnitus, may in time lead to a noise induced hearing loss which is permanent and irreversible . . . so take the hint before it's too late-if you can't avoid the noise exposure, wear hearing protection.

Complaint:

Hearing protectors make my voice sound strange to me and make me more conscious of other body noises such as breathing and walking. They also make



The region below each curve shows the talker-to-listener and noise-level combination for which just reliable face-to-face communication is possible. The parameter on each curve indicates the relative voice level. The shaded triangular region shows the range of expected voice levels due to the normal raising of one's voice in noisy surroundings. The A-weighted sound levels shown on the abscissa are approximate. Data from ANSI S3.14-1977²

Figure 1

it difficult for me to judge how loudly to talk.

Response:

This is generally true. A properly fitted hearing protection device (HPD) creates an occlusion effect ³ which results in an increase in the ear's sensitivity to bone or tissue conducted sound. This tends to amplify internal body noises such as those generated by one's own speech and breathing. The effect is most pronounced for devices that cap the canal entrance, such as semi-aural HPDs ⁴, although it is usually noticeable for most properly fitted protectors. In fact, listening for a resonant or bassy characteristic to one's own voice while adjusting earplugs, semi-aural devices, or most earmuffs, is a useful technique to aid in attaining a good acoustic seal.

Wearing HPDs will cause most people to talk more quietly in noisy environments since the protector reduces the perceived noise level, while at the same time, due to the occlusion effect, it amplifies the apparent level of the talker's own speech. Thus, the perceived speech-to-noise ratio is distorted so that the individual believes he is speaking

more loudly than actually is the case. This problem can be overcome as wearers become more experienced in the use of their HPDs and if co-workers remind them to speak up.

Question:

Why can't I modify my hearing protectors to make them more comfortable?

Response:

When designing an HPD, there is often a trade-off to be made between comfort and attenuation. Most alterations that improve comfort, such as low headband tension for earmuffs, removal of earplug flanges, undersizing premolded inserts, removing material from fiberglass, foam, or wax plugs, and cutting holes to permit a device to breathe, will increase an HPD's comfort at the expense of its noise reducing capability. Since only the manufacturer or a special test laboratory possesses the capability to determine the exact effects of such modifications, and since manufacturers' reported test data are always for new, unmodified devices, it is likely that user alterations will result in reduced and unverifiable attenuation for the modified hearing protector.

If a particular protector is found to be uncomfortable for a given employee or group of employees, then a preferred solution is to offer acceptable alternative brands or models of HPDs until a suitable product is found. Responding to employees' grievances in this way, and also allowing them some influence in the final selection process, will not only increase the likelihood of successfully fitting the employees with an effective protective device, but also result in greater acceptance and increased usage of HPDs.

Question:

Are all foam earplugs the same?



ATTENUATION OF TWO NONSTANDARD HEARING PROTECTORS COMPARED TO A TYPICAL EARPLUG

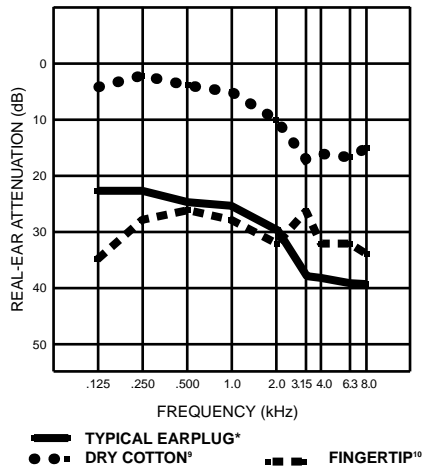


Figure 2

* Average data from 16 earplugs measured according to ANSI S3.19 in the E•A•RCALSM Laboratory.

Response:

A number of design parameters affect the performance of the foam earplugs. The most important of these are the recovery characteristics of the foam and its stiffness. These properties should be optimized for best performance, and be relatively independent of humidity and temperature. If a plug expands too rapidly or is too soft it may be difficult or impossible to insert. Conversely, if it expands too slowly it may dislodge before fully seating, and if it is too stiff it will be less comfortable to wear.

A principal feature affecting the above properties is the material from which the plug is made, typically polyvinyl chloride (PVC) or polyurethane (PU). PVC is generally preferred because of stability. PU plugs tend to rapidly absorb moisture when stored in high humidity conditions or are exposed to excessive perspiration. This can dramatically speed their expansion, degrading one's ability to properly insert the plugs for optimum comfort and attenuation.

Question:

Can I use noise reducing earplugs for swimming?

Response:

Yes. Certain noise reducing earplugs such as those made from vinyl, closed-

cell foam, silicone, and even wax-impregnated cotton can be successfully used in many cases for swimming and showering^{6,7,8}. In fact they will generally perform better than the plugs that are sold over-the-counter as "swimmer's plugs" since they fit the ear canal more comfortably and snugly. The plugs should be inserted in a dry condition, before entering the water, and the user should not submerge his head more than a few feet below the surface since this increases the likelihood of water being forced around the plug.

Question:

Can I use cotton or my fingers to reduce harmful noise exposures?

Response:

Occasionally one finds persons wearing nonstandard HPDs such as gum, putty, cotton, cigarette filters, empty bullet casings and other items which will not adequately seal the ear canal or simply do not possess the needed physical characteristics to effectively attenuate sound. Additionally, such devices are often uncomfortable and unhygienic. For example, ordinary dry cotton is a very poor hearing protector as shown in Figure 2. Interestingly, a finger tip, although it certainly cannot be utilized for extended periods of time, does provide very good protection (see Figure 2) when forced tightly into the ear canal.

Comment:

My mother always said "never put anything smaller than your elbow in your ear."

Response:

This platitude is representative of the numerous preconceptions and misconceptions that many people have regarding the use of HPDs. Of course when mother delivered the above pronouncement she had in mind the pencils, pins, toothpicks, and clumsily maneuvered Q-tips[®] that could damage the delicate eardrum, or other miscellaneous objects that might become lodged in the ear canal. Unfortunately, she was not aware of the lasting negative mental imprint that this would create with regard to the safe and correct use of properly designed and fitted noise reducing earplugs (c.f. EARLog #9¹, Question 7). In order to overcome such notions it will frequently be necessary for a trainer to correctly insert earplugs for the employee at least

one time during an instructional session, so the employee can experience the sensation of a correctly inserted earplug placed well into the ear canal. Often, fitting one of the employee's ears, and then asking him to fit the other so both ears "feel the same," is a helpful technique.

Conclusion

The material reviewed in this and the preceding two EARLogs can provide a basis for formulating either verbal or written responses (newsletters, bulletins, pamphlets) to questions and complaints regarding hearing protection and hearing conservation. We have reviewed the more common, and in our opinion the more significant issues that may be raised, but other concerns certainly exist. We invite you to address additional questions to us so that we may assist you, and perhaps include the information in future EARLogs. Letters should be sent to Mr. Berger at the address shown below.

References and Footnotes

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