



STIC Note



Enhanced Hearing Personal Protective Equipment

BACKGROUND/PROBLEM

As part of mission execution, the U.S. Coast Guard (USCG) performs inspections on many different vessels. During these inspections, there are discussions with the crews on vessel operations and procedures for machinery operations. Since engineering spaces can be especially noisy, conversations can be difficult to conduct.

These missions can be hazardous due to the sound levels produced by the engine room equipment. Levels range from 80 to as high as 105 dBA*¹ making conversation difficult (especially if a language barrier exists). Traditional inert foam hearing protection may require removal and reinsertion of used foam (or insertion of new foam) to protect hearing after removal for conversation. Circumaural muffs are easier to use in this scenario; however, the member may need to momentarily expose at least one ear while conversing.

Inspectors have requested enhanced hearing protection that is within Coast Guard Policy and protects users from excessive noise.



Figure 1. Typical example of circumaural muffs and inert foam ear protection.

METHODS

Market research found that there are two basic types of enhanced hearing protection. These mirror the inert types that have been on the market for several years. The basic types are: (1) inert foam ear plugs that fit into the ear canal and (2) circumaural head phone muffs worn over the ears.

Market research found two manufacturers of electronic ear plugs (not inert) available from OTTO Engineering and 3M. The distinction between OTTO Engineering and 3M electronic ear plug styles and inert ear plugs is that the electronic devices have enhanced amplification.

These electronic devices have circuits designed to lower the energy level of the frequencies that have been shown to cause a loss of hearing while amplifying the frequencies used in human speech. The two devices cost approximately \$400 each and the primary difference between the two is that the OTTO Engineering device has a charger built directly into the case.



Figure 2. OTTO ear buds, charging case, alternate ear tips, and maintenance tools.

EVALUATION

The STIC sent samples of the earbud style devices to two operational units for their evaluation. Three OTTO Engineering kits were sent to Sector Long Island Sound's Domestic Inspection Division (DID). Sector Boston's DID received three OTTO Engineering and two 3M units. Both kits have Noise Reduction Ratings (NRR) that attenuate the noise level below the maximum allowed limit. Based on this attenuation level, the maximum allowable limit (per COMDTINST M5100.47C *2) is not violated.



Figure 3. 3M ear buds and alternate foam tips.

CONCLUSIONS

Although the ear protection does keep the level of sound below the maximum level, initial user response is a feeling that the ear protection may not be working since it is now easier to hear normal conversations. This can be disconcerting at first but, as the wearer gets more experience with them, the sense that they are not protected dissipates. Once users acclimated to the devices, feedback was highly favorable.

The units are not intrinsically safe; there is a requirement for intrinsically safe use in hazardous areas as defined in the NFPA (National Fire Protection Association), Sections 500 and 505 *3.

However, intrinsically safe units are available, and OTTO is currently working on producing a conforming product that has yet to be certified as intrinsically safe. Presently, units can utilize existing electronic ear bud systems for hearing protection in non-hazardous areas.

FUTURE WORK

The hearing protection is being used at both Sector Long Island Sound and Sector Boston for long term evaluation. The STIC will monitor use of non-intrinsically safe devices as well as availability of the intrinsically safe devices to gather data to further assess usage of those intrinsically safe devices for electronic ear bud systems for hearing protection.

The Science and Technology Innovation Center (STIC) is a DHS S&T and USCG collaboration.

*1 Source: Maritime Medicine

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*2 Source: COMDTINST M5100.47C

Chap 10. A.3, page 10-2

Chap 10. Section 3, page 10-3 thru 10-4

*3 Source: National Fire Protection Association, NFPA 70 National Electrical Code, Sections 500 and 505.