

# TerranearPMC Safety Share

## Week of February 1, 2016 – Noise Cancellation Headphones

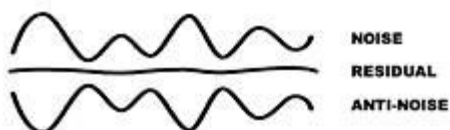
Recently I presented an OSHA 8-hour HAZWOPER Refresher Course and during the Hearing Conservation section, I was asked a question about noise-canceling headphones. Do these devices provide any protection from noise and do they have an associated Noise Reduction Rating? Well, I don't like to tap dance in front of a group of people when I am not sure of the answer, so using my better judgement, I said that I truly did not know, but I would research the topic and let him (as well as the rest of the class) know what I find.

While allowing for increased verbal communications in high noise areas, noise canceling headphones generally have two different methods to help protect the wearer from elevated noise levels. That is, passive and active modes.

Current noise cancellation headphones focus on low frequency noises; generally within the range of 20 – 800 Hertz (Hz). These sounds are quite low and many humans cannot even hear sounds in the lower end: and even more persons cannot determine the pitch being produced, although they can “hear” a low-sounding noise (FYI, the range of hearing for the most fit humans – generally young females in their early 20's - is from 20 – 20,000 Hz).

Ear plugs and ear muffs, are not as effective for damping low frequencies as they are in higher frequencies. This is because air plugs and ear muffs, work passively as they merely block or muffle air waves from entering into the ear. As such, low-frequency noise generated by engines, motors, and fans is more challenging. Low-frequency noise waves, which are prevalent in many industrial environments, are longer, and therefore, each wavelength can travel great distances, penetrating passive barriers, including cement walls and ear plugs/muffs.

Through technological advances, noise canceling – rather than noise muffling – has been achieved to a certain degree. This technology is referred to as Active Noise Reduction (ANR) and is designed to attenuate only low-frequency noise. This technology incorporates the use of small microphones in each ear cup that measures the incoming frequency and then produces an equal but opposite wavelength (i.e. mirror image), thereby canceling the noise. This effect is termed Electronic Noise Cancellation (ENC), Active Noise Cancellation (ANC), or “anti-noise.” This is visually illustrated below:



(OHS Online June 5, 2007: <https://ohsonline.com/Articles/2007/06/Active-Noise-Reduction.aspx>)

It is because of these headphones' ability to cancel low frequencies that they have become popular during air travel as the low hum of the jet engines and plane vibrations are removed, thereby allowing the wearer to enjoy a greater level of silence.



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However, higher frequencies, such as those created from moving parts, excavation activities, and heavy equipment operations, are not attenuated via ENC technology and therefore, the traditional passive noise reduction is still necessary to achieve protection from noise in occupational settings. As a result, many companies that manufacturer hearing protection devices, now make ear muffs that incorporate both noise attenuation technologies: the passive muffling and ANC methods.

Typically, these devices have a noise reduction rating (NRR) of 25 (some a little higher, some lower). The result is an increased ability to communicate verbally (as low frequency noise has been cancelled) while the overall noise level is attenuated. Thus noise exposures measured at 100 dBA, would be attenuated to 82 dBA with ear muff having an NRR of 25 (using the calculation method for the A-weighted scale, per Appendix B of the OSHA Hearing Conservation Program: 29 CFR 1910.95): this exposure is well within the OSHA PEL of 90 dBA and the ACGIH TLV of 85 dBA.

Now, to answer the original question brought up during my HAZWOPER class: noise cancelation headphones, by themselves may offer an increased listening comfort as low frequency noise is removed; however, the noise created by occupational settings will still need appropriate hearing protection. Therefore, it is still necessary to assess noise exposure levels and to assign appropriate hearing protection devices (i.e. using noise attenuation values per the NRR of the specific hearing protection device used). – I hope this helps!

**Life isn't about finding yourself. Life is about creating yourself.**

George Bernard Shaw

