# POSSIBLE HAZARDS UPON USING RADIO HPDs IN NOISY PLACES

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**Introduction** Continuous exposure to loud noise is one of the most common causes for hearing loss in individuals. There are some special classes of people whose profession sets them to a particular exposition to potentially dangerous noises, such us factory and heavy industry workers, military personnel, construction workers, farmers and music or entertainment professionals. But another class of people, who often are less aware of the risks of hearing impairment, are those using headphones under long hours of the day for listening to music or radio at relatively high volume levels. Indeed, since the advent of the walkman in the seventies, headsets have taken various shapes, and one of the best performing of these hearing devices is the earmuff protector. This kind of hearing protection device (HPD) when incorporating a radio set or a music player is especially suitable in silent environments when the user intends not to disturb people around. In places with considerable occupational noise the worker may use such HPDs to avoid or minimize interference between useful signal and unwanted background noise. Hence in such situations, and for reaching an acceptable degree of intelligibility, HPD users need to turn the volume up. In extremely noisy environments the sound level may exceed the recommended safety value set for limiting the risk of hazardous hearing consequences.

**Hearing protectors and their performance in noisy environment** In the work place the ideal would be to engineer low noise emitting machinery and to plan for space and surfaces with well designed sound absorbing properties in order to provide a satisfactorily quiet working environment. Often, however, these measures are quite prohibitive and therefore individual noise protection measures are required. For this, workers have at their disposal a large variety of hearing protectors for avoiding, or at least reducing the risks of possible occurrence of hearing impairment. These devices come into various shapes and sizes including earplugs, ear caps and earmuffs. The labour legislation in several industrial countries imposes the use of such hearing protectors when the sound level is in excess of 85 dB(A) during a usual 8-hour work day. Higher noise levels may cause more serious damage at the same time that they accelerate the process of hearing loss in the individual. The attenuation of noise attained by wearing muff-like ear protectors depends on how tight they seal around the ear, and when well designed and properly fitted they can achieve between 15 and 30 dB of noise reduction at the eardrum (Hempstock and Hill, 1990). Different methods may be used for rating the performance of hearing protection devices (HPDs) (ANSI, 1995), but sometimes the manufacturers' laboratory data overrate the actual performance of their HPDs. This is more often attributed to the subjects (well trained test persons) than to the method used for testing the protection devices. Relatively simple mathematical models may also be used to predict the attenuation of a headset, and a typical curve for such attenuation is shown in Fig. 1. The low frequency noise reduction is accomplished mainly by the seal stiffness and the shell cavity. From the frequency of around 100Hz and up the attenuation curve is seen to be increasing by about 12 dB/octave, meaning that headsets are best suited for operating at high frequencies.

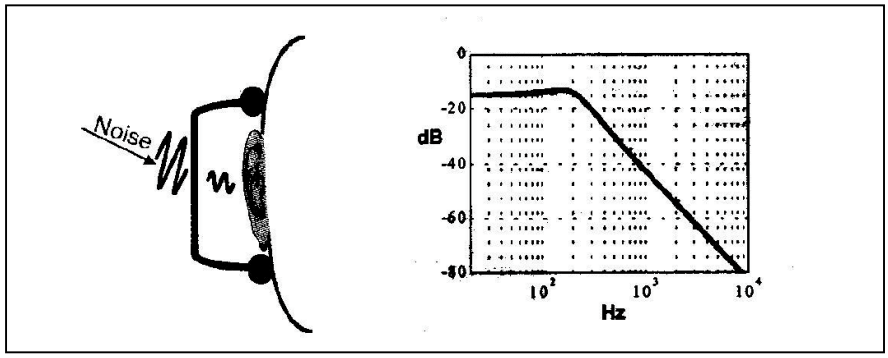


Figure 1 Left: schematic representation of a HPD. Right: a typical curve for its noise attenuation.

**Possible effects on hearing upon using HPDs with combined radio or music player** The use of muff-like HPDs with incorporated music player or FM radio in a highly noisy environment may have serious consequences on hearing. This depends naturally on the type of the occupational noise, its temporal and frequency characteristics, as well as on its level and the time of exposure (Abel et al., 1985; Bauer et al. 1991). This situation seems to worsen in the case of exposition to impulsive low pitched noise (resulting from blasting or from impact producing operations such as in riveting or punch pressing) where the HPD is the least performing. Audiological investigations assert that hearing impairment begins with a loss of sensitivity to high frequencies, sensible at the age of around forty, and to increase markedly afterwards with age, the higher frequencies being the most affected (see for instance Spoor, 1967). With consideration of the size of the loudspeakers used in HPD radios or music players, the user in order to listen with an acceptable level of intelligibility has a tendency to turn the volume up of the apparatus to higher levels, thus exacerbating the problem of high frequency hearing impairment (the reason why some of the manufacturers of sophisticated such devices set a safety level to be turned up at a maximum of 82 dB(A)). Unfortunately, to date no thorough study has yet been conducted on this subject and consequently this paper is a precursor for later more detailed research.

**Conclusions** This paper has for aim to enhance the possible hearing hazards that may accompany the use of radio or music player HPDs in excessively noisy environments. At this stage, this work is rather at a speculative form and therefore acts as a stimulator for future investigations into the subject. Special emphasis should then be concerned with the measurement of sound spectra at the eardrum at wearing HPDs in different noisy contexts, the shape of the frequency response curve of the HPD radio loudspeakers, and lastly on the interaction between the two characteristics at adjusting the sound level for acceptable listening conditions.

**References**

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