**Selecting Personal Attenuation Rating for DOD Personnel**

The Personal Attenuation Rating (PAR) for a hearing protection device is a measure of estimated attenuation that can be achieved by the specific user of their hearing protection device. With the advent of hearing protector fit testing within the Department of Defense, the question has been raised of how to determine the desired PAR value for individuals being fit tested.

**Determining required PAR:**

If the noise exposure level ($L\_{Exp}$) and desired protected exposure level ($L\_{Protected}$) are known, then the target PAR ($PAR\_{Target}$) is calculated as the difference between the exposure and desired protected exposure values, i.e.:

$$PAR\_{Target}=L\_{Exp}-L\_{Protected}$$

(reference 1).

For example: if a person is exposed to 95 dBA, and the desired protected exposure level is 85 dBA, then the target PAR can be calculated as 10 dBA.

This formula also works with 8-hour time weighted average values.

For example: if a person is exposed to an 8-hour TWA of 100 dBA, and the desired 8-hour TWA is 85 dBA, then the target PAR can be calculated as 15 dBA.

**How do I determine the** $L\_{Exp}$**?**

If personnel are working around specific pieces of equipment that have been subjected to a health hazard assessment, then noise levels at locations occupied by personnel should be available from the Program Manager or public health organization that produced the health hazard assessment. These levels may also be found in Technical Manuals or other training information for this equipment.

For example: the health hazard assessment for a generator may show that personnel working at the generator control panel are exposed to noise levels of 88 dBA.

Similarly, if noise surveys or dosimetry have been conducted in specific shops or workspaces, or around specific pieces of equipment, that information may provide noise levels useful in determining the exposure level.

For example: noise surveys in a machine shop may show that a person operating a milling machine is exposed to 97 dBA. Dosimetry of personnel working in a ship’s engine room may show that those personnel are exposed to levels ranging from 96 to 105 dBA over the course of an 8-hour shift, with an 8-hour TWA of 103 dBA.

Noise levels for an individual may not be constant for an entire workday, and they may not be the same day to day. The exposure level may only be valid when operating a specific piece of equipment, or when operating in a particular area.

If no other information is available, personnel should be aware if they are required to wear single or double hearing protection in their work areas. Army regulations require single hearing protection when exposed to steady state noise levels of 85 dBA or greater (regardless of duration) up to a 103 dBA 8-hour TWA, and double hearing protection when the TWA is between 103 and 108 dBA (reference 2). Similarly, Navy regulations require single hearing protection when exposed to steady state noise levels of 85 dBA or greater (regardless of duration), and double hearing protection when exposed to steady state noise levels of 104 dBA or greater (regardless of duration) (reference 3).

It is reasonable, then, to assume that working in areas that require single hearing protection will expose workers to noise levels between 85 and 104 dBA. For these areas, a PAR value of 15 dBA is a reasonable target. When double hearing protection is required, a target PAR of 20 dBA with only earplugs is reasonable, based on the assumption that the second hearing protector will provide an additional 3-5 dBA of attenuation. Note: these assumptions are not ideal, but in the absence of additional data, they provide a target to assist personnel in achieving some hearing protection.

**How do I determine** $L\_{Protected}$**?**

In general, DOD regulations require that hearing protection lower an individual’s 8-hour TWA to below 85 dBA (references 2 through 5). If the TWA is known, then the PAR can be calculated as described above. Similarly, if the desire is to reduce exposure levels below a certain value, this can be accomplished as described above.

For example: if a mill operator is exposed to 97 dBA, and an exposure level of 85 dBA is desired, then a PAR of 12 dBA will be required. If engine room personnel have an 8-hour TWA of 103 dBA, a PAR of 18 dBA will be required to lower the TWA to 85 dBA.

If noise levels when operating certain pieces of equipment are known, but the duration is not, then you can ensure an 8-hour TWA below 85 dBA by lowering the exposed level to below 85 dBA, assuming exposure will be no more than 8 hours (note: if someone has an exposure time longer than 8 hours, the protected exposure may need to be below 85 dBA to produce an 85 dBA 8-hour TWA. If exposed for 24 hours, for example, the protected exposure level would need to be approximately 80 dBA.).

For example: if a generator exposes a maintenance technician to 100 dBA whenever the technician is performing maintenance on the generator, and maintenance tasks may take as little as 30 minutes, but up to 8 hours, an acceptable TWA can be achieved with a PAR of at least 15 dBA.

You don’t want to lower the effective exposure level too far, as this leads to over-protection, which may reduce auditory situational awareness. You want the effective exposure level to be between 70 and 85 dBA (reference 1).

For example: if a person is exposed to 95 dBA, and the desired protected exposure level is between 85 and 70 dBA to avoid overprotection, then the target PAR should be between 10 and 25 dBA.

As stated before, noise levels may not be constant for an entire workday. If noise levels are similar throughout the day, then the target PAR can be calculated easily. If an individual is exposed to noise levels that vary more than about 15 dBA, a single type of hearing protector may not be ideal for avoiding over-protection.

For example: if a person is exposed to 85 dBA for 4 hours, and 95 dBA for 4 hours, their 8-hour TWA would be 92.4 dBA. A PAR of 15 would reduce this to 77.4 dBA, with the effective exposure levels equal to 70 dBA and 80 dBA respectively.

If, however, a person is exposed to 85 dBA for 4 hours and 110 dBA for 4 hours, their 8-hour TWA would be 107 dBA. A PAR of 25 would reduce this to 82 dBA, but the effective exposure level when exposed to 85 dBA would be 60 dBA. This level of overprotection may be undesirable.

It may be unreasonable, however, to expect personnel to have and maintain multiple types of hearing protection. One strategy may be to have personnel use double hearing protection when exposed to higher noise levels, then switch back to single hearing protection when exposed to lower noise levels, assuming the second hearing protector will provide an additional 3-5 dBA of attenuation. This may also be useful when service specific regulations require double hearing protection when exposed to specific noise levels (references 2 and 3).

**What about impulse noise?**

There is currently no general, direct correlation between PAR values and impulse noise exposure. Most military regulations require hearing protection when peak impulse noise levels exceed 140 dB Peak. Additionally, some specific weapon systems (such as the M3E1 MAAWS) have required PAR values for personnel firing those weapons.

For individuals firing small arms, where impulse noise levels should be around 165 dB Peak or below, a reasonable rule of thumb would be to require a PAR value of 25 dB to lower the exposure level to 140 dB Peak. This isn’t mathematically accurate, but it provides a target for this situation. If personnel exposed to this sort of noise experience hearing complaints or threshold shifts, then refitting with a higher target PAR may be appropriate.

**Other considerations when selecting a PAR value.**

Individual susceptibility to noise-induced hearing loss needs to be considered any time an employee is exposed to hazardous noise. In addition to selecting and determining the PAR, employees should be counseled to continue to monitor themselves for signs and symptoms of noise-induced hearing loss. If employee’s experience muffled hearing or ringing in the ears after exposure to hazardous noise, even when using hearing protection, they may be under protected and need to consult their local safety officer or hearing conservation program manager.

**References**

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3. Office of the Chief of Naval Operations Manual 5100.23 Chapter 18. *Hearing Conservation.* June 5, 2020.
4. Air Force Instruction 48-127. *Occupational Noise and Hearing Conservation Program.* February 26, 2016.
5. Department of Defense Instruction 6055.12. *Hearing Conservation Program (HCP).* November 22, 2023.