Appendix IV:C. Methods for Estimating HPD Attenuation

Appendix IV:C. Methods for Estimating HPD Attenuation

The actual effectiveness of any individual hearing protector cannot be determined under workplace conditions.

However, OSHA's noise standards (29 CFR 1910.95(j)(2) and 29 CFR 1926.52(b)) require that personal hearing protection be worn to attenuate the occupational noise exposure of employees to within the limits shown in Tables G-16, G-16a, and D-2, respectively. Hearing protectors are evaluated under laboratory conditions specified by the American National Standards Institute in ANSI S3.19-1974 (OSHA's experience and the published scientific literature indicate that laboratory-obtained real ear attenuation for hearing protectors can seldom be achieved in the workplace).

- Appendix B: Methods For Estimating the Adequacy of Hearing Protector Attenuation provides information on how to determine the adequacy of hearing protector attenuation using the noise reduction rating (NRR) of a given hearing protector.
- Use the following formulas to estimate the attenuation afforded to a noise-exposed employee in a work environment by muffs, plugs, or a combination of both.
  - A common method used for **single protection** (either muffs or plugs) is as follows

    1. Determine the laboratory-based noise attenuation provided by the HPD. This is referred to as the Noise Reduction Rating (NRR) and is listed on the packaging.

    2. Subtract the NRR from the C-weighted TWA workplace noise level, as follows:

    Estimated Exposure (dBA) = TWA (dBC) - NRR

    If C-weighted noise level data is not available, A-weighted data can be used by subtracting a 7 dB correction factor from the NRR, as follows:

    Estimated Exposure (dBA) = TWA (dBA) - (NRR - 7)

    Example:

    TWA=100 dBA, muff NRR=19 dB

    Estimated Exposure = 100 - (19-7) = 88 dBA

  - For **dual protection** (ear muffs and plugs are used simultaneously) use the following:

    1. Determine the laboratory-based NRR for the **higher** rated protector (NRR_h).

    2. Subtract 7 dB from NRR_h if using A-weighted sound level data.

    3. Add 5 dB to the field-adjusted NRR to account for the use of the second hearing protector.

    4. Subtract the remainder from the TWA as follows:

    Estimated Exposure (dBA) = TWA (dBC) - (NRR_h + 5) , or

    Estimated Exposure (dBA) = TWA (dBA) - [(NRR_h - 7) + 5]

    Example:

    TWA=110 dBA, plug NRR=29, and muff NRR=25 dB

    Estimated Exposure = 110 - [(29 - 7) + 5] = 83 dBA

  - OSHA's experience and the published scientific literature have shown that laboratory-obtained real ear attenuation for HPDs can seldom be achieved in the workplace. To adjust for workplace conditions, **OSHA strongly recommends applying a 50% correction factor** when estimating field attenuation. This is especially important when considering whether engineering controls are to be implemented. The equations above would then be modified as follows:

    - Single Protection:
      Estimated Exposure (dBA) = TWA (dBC) - [NRR x 50%], or

      Estimated Exposure (dBA) = TWA (dBA) - [(NRR - 7) x 50%]

    - Dual Protection:
      Estimated Exposure (dBA) = TWA (dBC) - [(NRR_h x 50%) + 5] , or

      Estimated Exposure (dBA) = TWA (dBA) - {[(NRR_h - 7) x 50%] + 5}