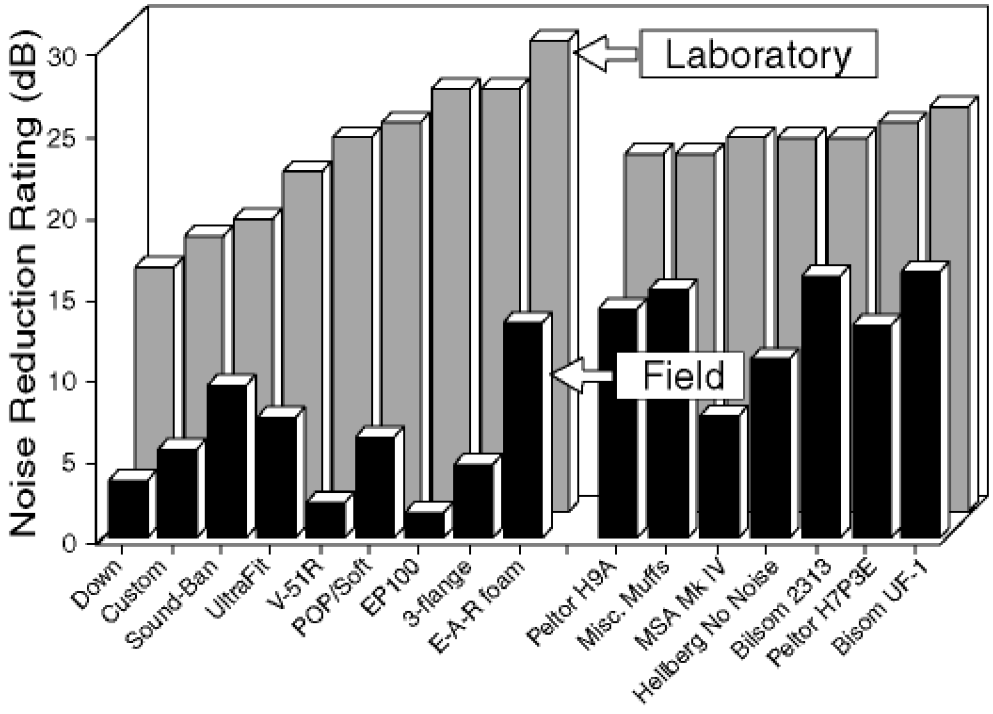
Hearing Protectors: Don't Rely On Labeled NRRs For Performance Adequacy

The United States Environmental Protection Agency requires that manufacturers of hearing protectors label products with a Noise Reduction Rating (NRR). An NRR is a numerical value posted on hearing protector packaging intended to give the buyer an estimate of the noise attenuation (reduction) a particular device delivers.

Noise reduction ratings are generated in the manufacturer's laboratory under optimal conditions. We now know through valuable research that labeled NRRs should not be used as a determination of a hearing protector's real world performance.

Elliott Berger, the consensus leader in hearing protector research, has demonstrated how the manufacturers' labeled NRRs fail to stand up to real world attenuation measurements on a wide variety of mainstream hearing protectors. The following graphic clearly demonstrates why NRRs must never be trusted and that real world attenuation found on most mainstream hearing protectors is significantly less than labeled NRRs might suggest:

Figure 1 - Comparison of NRRs published in North America (labeled values based upon laboratory tests), to real-world "field" attenuation results derived from 20 separate studies.



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There is no conspiracy on behalf of manufacturers to misrepresent their products. Since labeled NRRs result from tightly controlled laboratory assessment, real world variables are known to negatively affect labeled NRRs.

Many factors are responsible for discrepancies in labeled versus real world performance for any given hearing protector. The primary reason is the fact that laboratory assessments of hearing protector attenuation are measured using well-trained test subjects under optimal conditions. Another factor is simply the improper use of the product. Less experienced users of earplugs, for example, fail to insert a chosen (or assigned) device correctly. As we know, solid training is a key to successful protector fittings. User mobility and physical movements such as chewing, head lowering/raising, and frequent removal of devices lessen performance. Daily wear and tear, exposure to dirt and chemicals, heat, cold, and moisture reduce hearing protector effectiveness over time. Cracks in earmuff cushions may expose the ear to less than desired attenuation. Earmuff cushions may harden and loose their ability to properly seal the auricle.

Assessments of hearing protector *adequacy* are carried out to comply with the portion of the Hearing Conservation Amendment (OSHA CFR 29 1910.95) stating that hearing protectors must attenuate noise exposure to 90 dB (8 hour TWA [time weighted average) or 85 dB 8 Hour TWA for those with confirmed Standard Threshold Shifts. When given this task, OSHA's **50%derating** must be considered.

In 1983, OSHA released a memo to field inspectors outlining how and when to enforce the recently promulgated noise standard. The memo urged inspectors not to cite companies who failed to install engineering and administrative controls having time weighted averages between 90-100 dB(A) as long as an "effective" hearing conservation program was in place. This policy was politically motivated so as to relieve corporations from financial burdens that would result from having to install engineering controls. Since lack of engineering and administrative controls were now less likely to be cited, OSHA inspectors would have to actively assess a facility's attempt to protect worker hearing through review of hearing protection usage. To do this, OSHA implemented the concept of 50% derating of labeled NRRs as a tool to make determinations of hearing protector adequacy. Studies found that on average, workers only received approximately 50% of the published NRR values and OSHA felt that this should be accounted for especially in programs with high STS rates.

Before this memo was published, the noise standard described methods to determine hearing protector performance. When measuring noise using a "C" weighted device, the standard stipulated subtracting the labeled NRR from the "C" weighted measurement to obtain an "A" weighted estimate of protector attenuation. However, the "*7 dB rule"* was prescribed to estimate "A" (scale) weighted attenuation of hearing protectors using labeled NRRs when "C" weighted dosimetry was not available. Using the prescribed "A" weighting, the standard

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stipulated that 7 dB first be subtracted from the labeled NRR to arrive at an estimate of protector attenuation.

The memo introducing 50% derating simply meant that the NRR of a hearing protector was to be divided by half in an effort to more realistically assess a protector's real world attenuation.

To illustrate, consider this case:

Upon inspection, an OSHA inspector suspects high-level TWAs. A sound survey measures an "A" weighted TWA of **99** dB. The hearing protector worn by this employee has a NRR of **25**. Since the measurement is "A" weighted, the inspector subtracts 7 dB from the protector NRR yielding a value of 18. Then having to derate the NRR by 50%, a value of 9 results. Finally, subtracting 9 from the 99 TWA estimates the protector attenuating noise exposure to 90 dB…OSHA compliant, but dangerously close to the limit and in fact over the limit when a confirmed Standard Threshold Shift has occurred.

This example demonstrates the risk of relying solely on a manufacturer NRRs when selecting adequate hearing protectors. At first glance, one would logically deduce that a protector with an NRR of 25 would generously protect a worker with noise exposure up to 110 dB (85 dB [OSHA standard] plus 25 dB [NRR] =110). However, after the 50 % derating coupled with the real world factors we know to skew laboratory NRR assessments, NRRs overrate real world attenuation.

Changes to the current noise exposure standard may not be far off. In 1998, NIOSH (OSHA's research arm) proposed recommendations to institute variable derating of hearing protectors. Variable derating assigns specific derating percentages assigned to the type of protector. Proposed variable derating percentages for NRRs are 25%, 50%, and 70% for earmuffs, foam earplugs, and all other earplugs, respectively.

In 1997, ANSI developed a new test method called the subject-fit method as an alternative way to measure real world attenuation of hearing protectors (ANSI S12.6-1997). This method was developed to better estimate real world attenuation by employing untrained subjects in laboratory testing. NRRs using this method are denoted by "SF"-short for "subject-fit".

In a recent OSHA technical manual, OSHA has amended sections within this manual that seem to support the National Hearing Conservation Association's (NHCA) "Task Force On Hearing Protector Effectiveness" recommendation to support dual labeling on hearing protectors. ***This means that we will now likely see hearing protector manufacturers attach dual NRR values: the standard NRR and the more desired NRR(SF).***

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