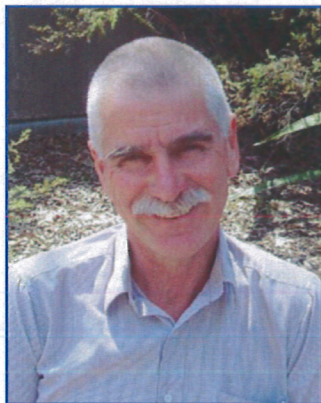


A Refined Single Number Rating System – for Hearing Protectors

An opinion piece by Warwick Williams, National Acoustic Laboratories, Chatswood, 2067, Australia
Warwick.Williams@nal.gov.au



As professionals routinely involved with workplace health and safety activities we realise that the use of hearing protectors (HP) for the control or reduction of noise exposure is considered to be the last resort in the hierarchy of control. It is always preferable to select an exposure solution toward the top of the hierarchy, such as elimination of the hazard, as opposed to the use of personal protective equipment (PPE). The difficulty

is that people don't really like to use PPE and in particular HP.

We've all heard the arguments: 'hearing protectors, don't allow you to hear what's happening around you, are uncomfortable, get in the way, are a general nuisance — and I'm used to the noise and don't have any trouble hearing anyhow'. Many research projects indicate that, as a workplace hazard, the consideration of noise exposure falls well behind anything involving pain, blood and physical injury. You won't go deaf tomorrow so you can wait 'till tomorrow to take preventative action. It's a priority but not right now. For this reason we, the professionals, need to ensure the adoption of HP is facilitated if it is necessary.

The significant majority of people tend to work in small and medium as opposed to large enterprises. Large businesses are more likely to have the assistance of occupational health and safety professionals along with comprehensive training and education programs. Small businesses cannot compete and are left to their own devices which with respect to OHS (Occupational Health and Safety) are usually minimal. They need all of the assistance they can get.

Consider the case of a small business attempting to do the right thing by their employees, supplying HP to their noise exposed worker(s). The simplest and most practical advice to give from a risk management perspective is to suggest finding a hearing protector that fits, is comfortable and that will be worn for the duration of the exposure — not most of the time, the whole time, no exceptions.

Instead what is proposed is a somewhat more complex procedure involving:

- (a) the measurement or calculation of the daily exposure either through dosimetry or task sampling and exposure time estimation, in order to ascertain if the regulated exposure limit has been exceeded;
- (b) the measurement of the workplace C-weighted noise level;
- (c) the determination of the Noise Reduction Rating (attenuation) of the required hearing protector by subtracting the workplace

C-weighted noise level from the desired maximum 'safe' exposure level (usually around 10 dB less than the maximum regulated requirement);

- (d) followed by a hunt for a suitable protector meeting this required NRR.

Alternatively, if the C-weighted workplace noise level is not available then the workplace A-weighted noise level can be substituted for step (b) and the NRR decreased by 7 dB to be on the safe side¹.

The average small business owner has enough to worry about without trying to understand this rather complex procedure. And if you think this is complex, try the NRSA. So what happens in reality? Well, usually it's finding some muffs or plugs from the nearest, convenient supply followed by "Here, wear these or you'll go deaf".

Now what is an NRR? It's the Noise Reduction Rating which is calculated by measuring seven required octave-band attenuations of the particular hearing protector on a specified number of (human) test subjects; subtracting twice the standard deviation (SD_i) from the calculated mean attenuation at each respective band (m_i); then subtracting these attenuations [m_i - (2 x SD_i)] from a specifically 'defined' standard octave-band spectra in order to then calculate the defined attenuation experienced by the test subjects. Technically this is the NRR₉₈, the NRR purportedly experienced by 98% of the test users, it is usually written simply as NRR.

The European system using the SNR and the combined Australian/New Zealand system that uses the SLC₈₀ have similar formulae to calculate a single number parameter the main difference being that they both only use an input of one standard deviation as opposed the two used for NRR.

Have you ever tried to clearly explain to a questioner how the ratings work and what they mean? It can be quite difficult. You have usually lost them by the octave band, standard spectra stage, never mind the decibels and two standard deviations. It is complex, even for the well-educated user. What would be useful is a simple system removing much of the complexity. Something in the form of a measure that presents the average attenuation experienced by the typical user with, perhaps, an indication of the variability in performance as expressed in the standard deviation or the 95% confidence interval.

While it is comforting to have quite detailed hearing protector rating criteria that closely consider the expected frequency of the noise to which the individuals are exposed and estimate the attenuation provided to both conscientious and non-attentive wearers 'Hearing Conservation Programs' that rely on hearing protector use are a "failed experiment"². So why do we persist in using and developing complex hearing protector rating systems that wearers can neither understand or use. Perhaps we need to consider something simple.

¹For full methodology and details see Berger, EH (2000), Hearing protection devices, in The Noise Manual, Fifth Edition, edited by Berger, EH, Royster, LH, Royster, JD, Driscoll, DP and Layne, M, American Industrial Hygiene Association, Fairfax, VA, 2000, page 429

²Suter, AH (2012) Engineering Controls for Occupational Noise Exposure, Sound & Vibration 46(1): 24 - 31