What I Don't Know Part 2 of 2

The U.S. Occupational Safety and Health Administration (OSHA) 90 dBA Exposure Limit. This OSHA limit purports to protect workers' hearing. No one ever accused me of knowing too much about the health effects of noise. If asked, I quote the OSHA limits. I wonder how much "good science" was used to develop the criteria. Consider the available technology back then: no integrating sound level meters, many noisy industries, no standard measuring methodology, and strong politics to encourage or kill a regulation's development. So I ask, what data were used to determine whether hearing damage may ensue if someone is exposed to A-weighted sound pressure levels of 90 dB for 8 hours/day for his or her lifetime? I do not question the intense-noise relationship with hearing loss, I just wonder how the data were considered sufficient enough to be so precise in the wording of 29CFR1910.95. Without sophisticated instrumentation (like dosimeters or integrating-averaging meters), and measurement methodology, I suspect there was not such strong epidemiological evidence between a particular noise level and the expected hearing loss.

Correcting' for Ambient Noise. To correct for ambient noise, we normally use an equation that is in the form of a table: $L_p(\text{source}) = f[L_p(\text{source+ambient}) - L_p(\text{ambient})]$. The equation and table require that $L_p(\text{source+ambient})$ be greater that $L_p(\text{ambient})$. From this table, if the difference between the source with only the ambient is 10 dB, then the correction is about –0.5 dB; if the difference is 5 dB, then the correction is about –1.5 dB, and if the difference is 3 dB, then the correction is –3 dB. If we continue using the equation and the difference is only 1 dB, then the correction is –6.8 dB. However, the conventional rule of thumb is if the source with the ambient is within 3 dB of the ambient alone, then the measurement of the source can't be made. Why the restraint? Keep in mind that community noise, especially ambient noise, is often not steady, which complicates the situation (little guidance is given to defining ambient noise, especially compared to a maximum fast, A-weighted sound pressure level). I suspect this is because of the uncertainty in the instrumentation specifications. Perhaps, with old analog meters, accurately reading a fast moving needle, or averaging it, gave an uncertainty of 3 dB. Also, the 3 dB limit could arise from the uncertainties allowed in the sound level meter standards with different "classes" of instruments. I am suggesting we are currently putting too much time and effort into the measurements and instrumentation than is necessary for the appropriate application of the results.

Transmission Loss (TL). This is a measure of the noise insulation of a partition. I want to discuss what the measured results mean. A flat panel is placed at the opening between two reverberation rooms. Noise is produced in one and the sound pressure level on both sides is measured. The panel area and the receiving room absorption are used to get a TL value. But what is being measured? The specimen's size, shape, and boundary conditions have a large effect on the TL measured. Leaving aside the specimen's internal construction, the TL frequency response will be a function of the aspect ratio, the boundary conditions, and the size. Imagine that a very large specimen would have a very low, low-frequency loss and vice versa for a very small specimen. What confidence can we have with the TL test results?

Uncertainty. Every measurement has an associated uncertainty. It arises from instrumentation imprecision, lack of known bias, operator variability, and procedure variations. Every test method, test report, and piece of test data should have an associated uncertainty so readers know the data is imprecise. This should also go for every algorithm. Since an algorithm is an approximation of a physical process, some uncertainty, determined when the algorithm was developed, should be part of it. The user of the algorithms, consultant or customer, should know that the prediction is no better than the uncertainty. Of course, this complicates reports and explanations and makes our jobs harder.

Field Transmission Loss. If laboratory transmission loss TL results are not well understood, then the field versions are even worse. A realistic comparison between the field and laboratory values of TL is fraught because variability of room diffusion and volume, flanking, measurement method, and specimen area are often impossible to reproduce in the laboratory. My recommendation is to abolish the concept of Field TL and use Noise Reduction (NR) which, in my opinion, is the only realistic measure of isolation of partitions. We should forget trying to compare laboratory tests with field tests.

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