Demystifying Noise Exposure Assessment

Top 7 Noise Myths

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Agenda:

- Pre-Knowledge Check
- Preliminary Walkthrough with SLM
- Personal Noise Monitoring Standards
- Myth 1: Equipment
- Myth 2: Measurement criteria for compliance
- Myth 3: Interpretation of Results
- Myth 4: Extended Shifts
- Myth 5: US vs Global OELs and Measurement Criteria
- Myth 6: Using averages for variable exposures
- Myth 7: One result above, one result below
- Questions

Poll – How many TWAs (channels) must you collect for compliance with OSHA Noise Standard?

- A: 1
- B: 2
- C: 3
- D: 4

Answer

• 2

	OSHA Hearing Conservation	OSHA Permissible Exposure Limit
Threshold	80	90
Criterion	90	90
Exchange Rate	5	5
Weighting	A	A

Background: Initial walkthrough with SLM

- Identify noise sources
- Where workers located in relation to noise sources?
- How loud?
- Frequency content, tonal or broadband?
- Duty cycle of work
- Document sources of variability: Temporal, Spatial, Operational, between SEG and within SEG

Variability of Noise: Integrating SLM measurement values

- Leq (LAeq): A-weighted continuous equivalent level.
- Ln10:
- Ln50:
- Ln90: Background
- Ln10 Ln90 = Range or variability in levels
- Ln50 will be lower than LAeq if sound level is relatively steady state.
- LAmax, LAmin, Lpeak

Define representative work for each SEG

- Similar exposure groups (SEG) are workers having same general exposure profile for the agent being studied because of similarity and frequency in:
 - How tasks are performed
 - Materials and processes
 - Proximity to primary determinants of exposure



Things to consider

- Noise exposure is a function of how loud and for how long.
- Representative work
- Variability
 - Spatial
 - Temporal
 - Operational
 - Within SEG
 - Between SEG

Personal monitoring techniques

- Full-shift dosimetry
 - Pros: Variability over shift
 - Cons: Full-shift result; requires good notes to parse out tasks with high dose rate. More expensive
- T-BEAM (Task-Based Exposure Assessment Methodology)
 - Pros: Task contribution. Can be less expensive and faster because of shorter measurement durations.
 - Cons: Variable noise or tasks not well defined.

Myth 1 – I can use any SLM, noise dosimeter, phone app to measure noise

Myth 1 – Any SLM, noise dosimeter, phone app?

- Truth: Noise exposure assessment standards require at least type 2 equipment that is factory calibrated in accordance with manufacturer instructions and field calibrated before and after the measurement event. Additionally, OSHA or state plan equivalent: 29 CFR 1910.95(d)(2)(ii): Instruments used to measure employee noise exposure shall be calibrated to ensure measurement accuracy.
- Standards (ISO 9612, ANSI S12.19, CSA 107.56) require at least Type II instrumentation, calibrated annually, and;
- Field calibrate before and after measurement period.

Smartphone app – <u>Screening tool</u>

- Accurate within ± 2 dBA
- Meets Type 2 requirements of IEC 61672:3 SLM with calibrated external microphone.
- Includes multiple metrics: LAeq and TWA, Max, Peak Levels, dose, projected dose
- All three major weighting networks (A, C, and Z)
- Capability to calibrate either internal or external microphone.
- Ability to report and share data.
- Only available on iOS devices.
- Verifying the accuracy of an Androidbased app is not currently possible.



Myth 2: In the US, I only need one TWA channel for compliance.

Myth 2: In the US, I only need one TWA channel for compliance

- Truth: OSHA (and California) noise standards require you to determine each employees' compliance with the Permissible Exposure Limit and the Action Level.
- This means you need to measure two different criteria.
 - Why?

Why two channels? (Two thresholds)

- "Please be aware that during the revision period, the period during which OSHA conducted rulemaking to establish the new provisions of the Hearing Conservation Amendment, only that section, 1910.95(b)(3) [now 1910.95(c)], was opened for revision.
- Therefore, because the 90 dBA threshold level was retained for all other provisions of the remaining standard, no exposure below 90dBA can be used for documentation of 1910.95(a) and (b)(1) violations."

Myth 2 Continued

 Truth: For the US, you need to measure two different criteria, the Action Level and the Permissible Exposure Limit. They are measured differently and the results from each can only be compared to the applicable occupational exposure limit.

	OSHA AL	OSHA PEL	ACGIH TVL	Leq
Threshold Level	80	90	80	None
Criterion Level	90	90	85	§
Exchange Rate	5	5	3	3
Weighting Scale	А	А	А	А

- § CAN criteria:
 - Federal: Lex,8 = 87 dBA.
 - 13 provinces have Lex,8 = 85 as criterion.
- § EU Criteria
 - ELV: Lex,8 = 87 dBA. Only time hearing protection considered for exposure assessment.
 - UEAV: Lex,8 = 85 dBA.
 - LEAV = Lex,8 = 80 dBA.

Myth 3: I have results from the 80 dBA threshold channel of 93 dBA 8-hour TWA. I have exceeded the PEL.

Myth 3: In the US, I have results from the 80 threshold channel of 93 dBA 8-hour TWA. I have exceeded the PEL.

- Truth: You can only compare the Action Level channel to the Action Level of 85 dBA as an 8-hour TWA and the permissible exposure limit channel to the PEL defined as 90 dBA as an 8-hour TWA.
- Why?
- They are measured differently:

	OSHA AL	OSHA PEL	ACGIH TVL	Leq
Threshold Level	80	90	80	None
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Weighting Scale	А	А	А	А

Myth 4: Noise OELs are an 8-hour time-weighted average, so I only need to measure 8 hours.

Myth 4: The OEL is an 8-hour limit so I only need to measure 8 hours.

- Truth: Kind of, depending on the OEL.
- The OSHA PEL only takes 480 minutes (8 hours)
 - Worst continuous 8 hours from full shift, or multiple samples adding to 8 hrs.
- AL, TLV, Lex,₈ require full-shift measurements
 - Three options for extended shifts

Source: <u>https://www.osha.gov/laws-regs/standardinterpretations/2021-10-12</u>

Myth 4 continued: Extended Shifts (AL, PEL, Lex, 8)

- OSHA Three options for extended shifts:
- 1: Use full-shift dose or;
- 2. Use sliding scale and compare average (L_{avg}) over full-shift measurement period to reduced AL or;
- 3. Normalize all extended shifts to 8 hours for direct comparison to 8-hour AL of 85 dBA TWA.

Myth 5: I measured (both) OSHA criteria and therefore I'm in compliance globally.

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- Truth: Did you collect data in accordance with the applicable OEL you will be comparing your results to?
- Global and local considerations
- OSHA AL: 85 dBA 8-hour TWA
- OSHA PEL: 90 dBA 8-hour TWA
- ACGIH TLV: 85 dBA 8-hour TWA
- EU:
 - Lower Exposure Action Value: Lex,₈ = 80 dBA
 - Upper Exposure Action Value: 85 dBA, Lex,8
 - Exposure Limit Value: 87 dBA, Lex,8
- Canada:
 - Federal: Lex,8 = 87 dBA.
 - 13 provinces have Lex,8 = 85 as criterion
- Federal vs. province vs. state. Measured exposure is a function of threshold, criterion, exchange rate.
- All of the above, with the exception of EU ELV, do not take the attenuation of hearing protection into account during exposure assessment.

Myth 6: I'm just going to average my results for a SEG

Myth 6: I'm just going to average

- Truth: OSHA: While it may be more difficult to track the noise exposure because of their mobility in their jobs, no employee is to be excluded from the HCP because of intermittent or variable exposures. In arriving at each employee's exposure, employers may use any approach involving measurements or calculations that are considered *appropriate.* Compliance with the 8-hour, time-weighted average 85 dB exposure level is determined through the integration of all continuous, intermittent and impulsive sounds between 80 dB and 130 dB.
- FSD, T-BEAM Employer's responsibility.

Myth 7: I previously received a representative result above the OEL. The next time I measure, I get a result below the OEL and there have been no changes to production, process, equipment or controls. I can use the most recent data point.

Myth 7: If I get one result above, then next time I measure, it's below, I'm good!

- Truth: No. If nothing has changed in production, processes, equipment, or noise controls, you have simply gathered another data point to further characterize the exposure profile for the SEG. For results near the occupational exposure limit, you will need more data to characterize variability to ensure employees are consistently exposed to noise less than the Action Level.
 - (one day of exposure \geq AL = HCP)
- AIHA Category 3 decision: Either choose to gather more data to increase confidence in decision or choose to control (cat 4) and reallocate sampling resources to prioritized SEGs.

Myth 7 continued

- OSHA Standard Interpretation: The OEL for noise is a daily limit, therefore it takes one day of exposure at or over the AL for inclusion in a hearing conservation program (HCP).
- The occupational noise exposure standard requires that all employees exposed to noise levels at or above 85 dB on an 8-hour time-weighted average (TWA) must be included in a HCP. This includes employees who may have only occasional exposures at this level.

Myth 7 Continued – Uncertainty

- Measurement criteria and standards: ANSI S12.19, ISO 9612, CSA 107.56, AS1269, etc
- Methods for uncertainty
 - AIHA method quantification of SEG variability and decision statistics for acceptable exposures, e.g. 95th percentile of lognormal dose
 - ISO 9612 and CSA 107.56 method: quantification of variability using normal distribution and upper tolerance limits.
- In US, always best practice to measure OSHA AL and PEL for compliance, even if you have internal company standard that is more stringent.
 - Only data collected on a specific channel can be compared to the applicable OEL. Recall discussion of exchange rates and criterions.

Best Practices

- Define SEGs as much as possible before data collection and prioritize SEGs for personal monitoring.
- Standardize the collection and reporting of occupational noise exposure data using an internal company document that can be executed in-house or by consultants with precision and accuracy.
- Standardized data collection can support exposure modeling and prediction given clearly defined environmental and work practice inputs.

Next Steps – I have results, now what?

- Implement hearing conservation program as applicable.
- Noise Control Prevention through Design (PtD)
- Noise Control Retrofit
 - Source
 - Path
 - Direct Barrier
 - Indirect Absorption
 - Receiver
- Noise controls are frequency dependent.
- Prioritize noise control based on agreed criteria with all stakeholders, including operational leaders. Suggested criteria include feasibility, impact, cost, and ease/speed of implementation.

Q&A