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A Case Study of the Noise Engineering Control (NEC) Protocol for a Chemical Plant under Malaysia's 2019 Noise Exposure Regulation

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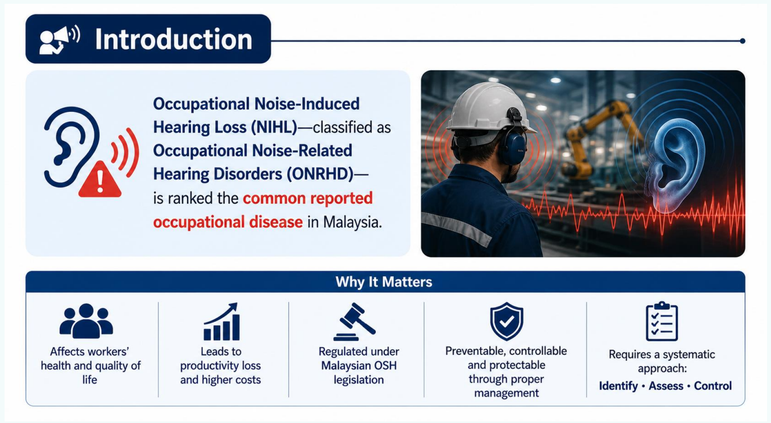
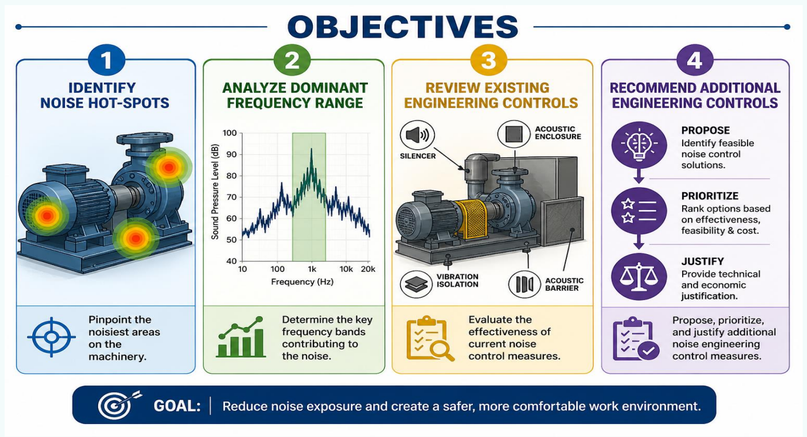
BACKGROUND



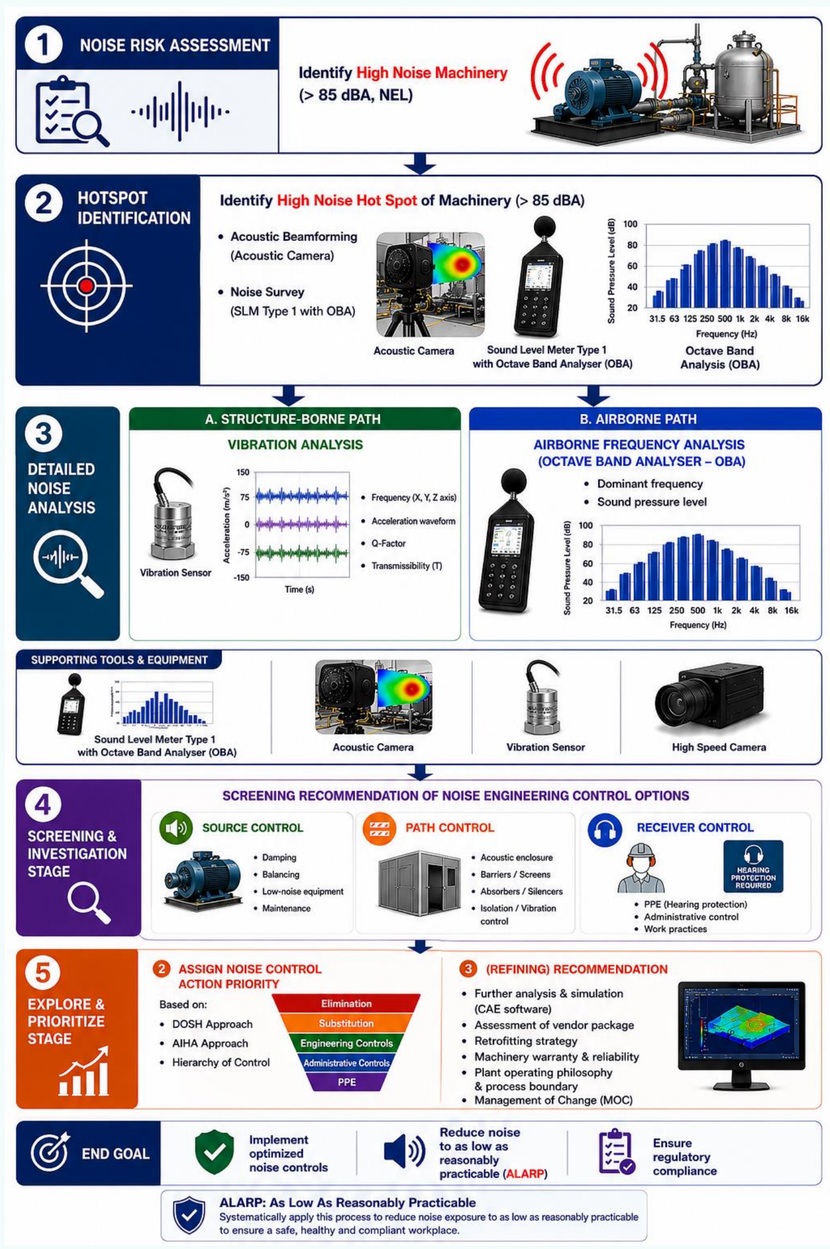
Under the Malaysia Occupational Safety and Health (Noise Exposure) Regulations 2019 and the Industry Code of Practice for Management of Occupational Noise Exposure and Hearing Conservation 2019, workplace machinery noise must be identified (i.e., using a noise hazard identification checklist), assessed (i.e., through a noise risk assessment), and controlled (i.e., via a noise control practicality assessment). The noise control must be demonstrated to the authority and meet the acceptance criteria for reducing the noise level to as low as reasonably practicable.

OBJECTIVES



The study was conducted at the petrochemical plant in Malaysia from 2022 to 2025.
The key objectives of the study: (i) To pinpoint the noisy "hot spot" on the machinery. (ii) To analyze the frequency range of the dominant noise. (iii) To review existing noise engineering controls. (iv) To propose, prioritize, and justify additional noise engineering control measures.

METHODS & MATERIALS



The noise engineering control study algorithm was developed by CIH Consult Sdn Bhd in collaboration with UniMAP. The method was considered novel to the Malaysian market at the time the study was conducted in 2022, after COVID.

RESULTS

Case Study 1: Petrochemical Refinery in Kerteh, Trengganu, Malaysia

Machinery: Valtek Sulamericana Control Valve (Tag No: FV 1602-01)
Early Diagnostic: Turbulence noise at Valtek Sulamericana Control Valve

Figure 1: The results of the acoustic camera (beamforming) showing the localized spot of excessive noise at the sampling point #1 and sampling point #2.

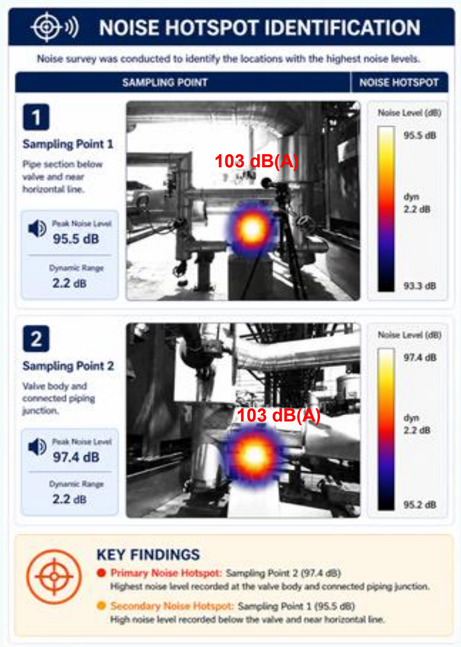
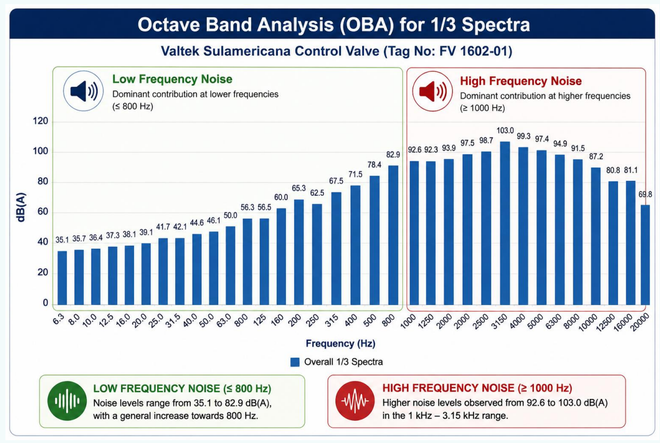


Table 1: The results of the **Sound Pressure Level** (SPL) for Valtek Sulamericana Control Valve (Tag No: FV 1602-01) **distributed over the 1/3 Spectra frequency, measured by Sound Level Meter Type 1 (Octave Band Analyzer).**



During the study period 2022-2025, various high-noise machinery was diagnosed and treated with noise-reduction measures. For this paper, only one machinery case study was presented.

DISCUSSIONS

The noise level measured at the Valtek Sulamericana Control Valve (Tag No: FV 1602-01) exceeded the 85 dB(A) Noise Exposure Limit, reaching 103 dB(A).

During monitoring, the high-noise hot spot was identified as turbulence within the piping and at the connection between the piping and the mounting foot.

Based on the results of the Octave Band Analysis (OBA) for 1/3 Spectra, the noise levels from the octave bands for the Valtek Sulamericana Control Valve (Tag No: FV 1602-01) showed that the noise above 85 dB(A) was contributed by frequencies between 1000 Hz and 10000 Hz. The results were more pronounced at high frequencies (>1000 Hz).

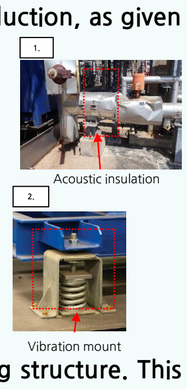
RECOMMENDATIONS

Engineering Control (Source)
1. Acoustic Insulation

The piping can be installed with Acoustic Insulation (AI), which comprises a Noise Adsorbent Layer and Closed Jacketing on the pipe and valve. The noise-absorbent layer could be made of mineral wool, an aerogel blanket, or another suitable engineered material. ISO 15665 - acoustic insulation for pipes, valves, and flanges could be referred to.

The acoustic insulation material selection, configurations, and expected noise reduction, as given in ISO15665, are as follows:
A2 - estimation reduction approximately 4~5 dB(A)
B2 - estimation reduction approximately 5~6 dB(A)
C2 - estimation reduction approximately 10~11 dB(A)
D2 - estimation reduction approximately 12~13 dB(A)

Examples of aerogels include Armaphonic, Pyrogel, and Cryogel.



Engineering Control (Path)
1. Vibration Isolation

To apply vibration isolation mounts or pads between the piping and its mounting structure. This is to minimize vibration transmission and reduce noise.

CONCLUSIONS

Noise Hotspot	Initial dB(A)	Potential Noise Reduction	Post dB(A)	Dominant Frequency
1.Turbulence from inside of the piping and valve 2. Connection between the piping to the mounting foot	103	Approximate improvement by 10-12 dB(A) if all recommendation is applied. Total cost saved for	85-91	1000 Hz - 10K Hz (High Frequency)

Estimated Cost Saved* = RM1500/year/worker x 20workers in that work unit x 5 years (lifespan of machinery before turnaround) = RM150,000.

*Hearing Conservation Program includes the elements of (i) audiometric testing, (ii) testing Equipment, (iii) workers' compensation, (iv) hearing protective devices, (v) training, (vi) hearing loss investigation, & (vii) workers' time. It is estimated that the total cost of a Hearing Conservation Program (HCP) per worker per year (based on various publications) is RM1,500.00.

References

1. DOSH. 2019. Occupational Safety and Health (Noise Exposure) Regulations 2019.
2. DOSH. 2019. ICOP for Management of Occupational Noise Exposure and Hearing Conservation 2019.
3. DOSH. 2025. Guidelines on occupational noise control.
4. ISO 14163:1998. Acoustics - Guidelines for noise control by silencers
5. ISO 15667:2000. Acoustics - Guidelines for noise control by enclosures and cabins
6. ISO 15665:2003 Acoustics - Acoustic insulation for pipes, valves and flanges
7. ISO 11690-1:2020. Acoustics - Recommended practice for the design of low-noise workplaces containing machinery — Part 1: Noise control strategies.