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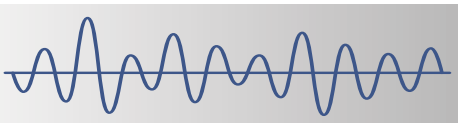
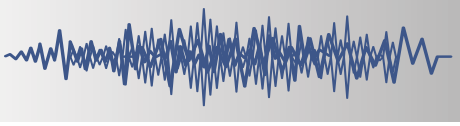
INDUSTRIAL NOISE
Introduction

If you're dealing with environmental noise - whether during the day or at night - you might be curious about where it's coming from. Understanding noise pollution, its sources, prevention methods, and existing noise standards can help you create a quieter, more peaceful and safer environment.
So, join us as we explore this form of environmental pollution in more detail.

SOUND



NOISE



Sound is a vibration that falls within our audible range. Noise, on the other hand, is a kind of sound that is typically unpleasant, unwanted, irritating, and in worst cases damaging.

What Is Industrial Noise?

Industrial noise refers to the excessive or disruptive sounds produced by machinery, equipment, and industrial processes in places like factories, power plants, and construction sites. According to the International Organization for Standardization (ISO), noise is defined as "unwanted sound," which, in the industrial environment, typically comes from operations such as metal cutting, welding, grinding, and the movement of heavy machinery (ISO 1996-1:2016). The Occupational Safety and Health Administration (OSHA) recognizes industrial noise as an occupational hazard when sound levels exceed recommended limits, as prolonged exposure can harm workers' health and lead to hearing loss (OSHA, 29 CFR 1910.95).

✓ Noise intensity is measured in decibels (dB), and prolonged exposure to levels above 85 dB over time is linked to hearing damage and other health concerns (World Health Organization, 2021).

Why Is Industrial Noise a Type of Pollution?

Industrial noise is classified as a form of pollution because it disrupts both human and natural environments. Pollution, by definition, is any harmful factor in the environment, and industrial noise fits this description due to its negative effects on health, productivity, and overall quality of life.
(Environmental Protection Agency, 2022)

Unlike air or water pollution, noise pollution doesn't leave a physical effect, but its consequences are significant, contributing to stress, sleep disturbances, and even cardiovascular diseases. It also interferes with wildlife communication, leading to behavioral and physiological changes in animal species (Barber et al., 2010).

Because of these impacts, various regulations have been established by organizations such as the European Environment Agency (EEA) and the U.S. Environmental Protection Agency (EPA) to help reduce industrial noise pollution and protect both workers and the general public.

Industrial environments produce different levels of noise, quite often above 85 dB and in some cases in excess of 150 dB, depending on the machinery and processes. The noise levels are measured in decibels (dB); a logarithm scale, where every 10 dB increase means ten times more sound.
A machine with 80 dB, for example, will be ten times louder than 70 dB, and a jet engine with 140 dB will be 1,000,000 times more intense than a silent office with 40 dB.
Below is a table of average noise levels for various industrial processes:

NOISE LEVEL (dB)	SOURCES	POTENTIAL IMPACT
35 - 50 dB	Office, Control Rooms, Background Noise	Minimal disturbance
60 - 70 dB	Conversation, Light Machinery	Tolerable but may affect concentration
75 - 85 dB	Forklifts, Welding, Loud Factories	Uncomfortable / Disruptive
90 - 100 dB	Heavy Machinery, Presses, Power Tools	Risk of hearing loss (OSHA limits prolonged exposure)
105 - 115 dB	Metal Stamping, Jackhammers, Chainsaws	Immediate damage is possible without protection
120 - 130 dB	Jet Engine at 100m, Sirens, Pneumatic Tools	Pain threshold, can cause instant hearing damage
140 dB+	Explosions, Firearms, Rocket Launch	Instant hearing damage

Noise Measurement and Standards

Industrial noise measurement is essential for evaluating and managing workplace noise levels to ensure compliance with safety regulations and reduce risks to workers' health. Various tools and techniques are used for precise measurement, including:

Sound Level Meters are handheld instruments that measure noise levels in decibels (dB). They capture immediate sound pressure levels and are classified into two types:

- **Class 1:** High-precision meters designed for laboratory and field use.
- **Class 2:** General-purpose meters suitable for most industrial applications.

Noise dosimeters are wearable devices that track an individual worker's noise exposure over time. They provide a time-weighted average (TWA) noise level, helping organizations ensure compliance with occupational noise exposure limits.

Octave Band Analyzers break down noise into different frequency bands, making it easier to identify dominant frequencies and develop targeted noise control strategies.

By using Real-Time Monitoring Systems, some industries utilize continuous noise monitoring systems with IoT capabilities to track noise levels in real time and ensure compliance with regulatory requirements.

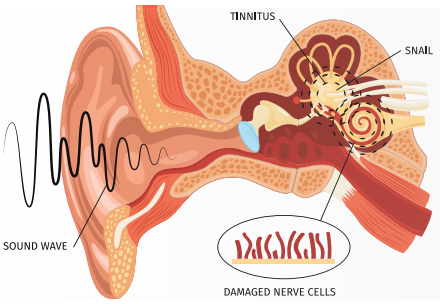
Various international and regional organizations have established noise exposure standards to protect workers from excessive noise levels. Below you can find relevant standards and regulations:

Regulatory Body	Standard/Regulation	Permissible Exposure Limit (PEL)	TWA
OSHA	OSHA 29 CFR 1910.95	90 dB(A)	8 hours
NIOSH	NIOSH Criteria for a Recommended Standard	85 dB(A)	8 hours
EPA	EPA Noise Control Act of 1972	Varies based on environment	N/S
ISO	ISO 1999:2013	Based on hearing damage risk models	Variable
EU Directive	European Union Occupational Noise Directive	87 dB(A)	8 hours

Permissible Exposure Limits (PELs) & Time-Weighted Averages (TWAs)

PELs define the maximum allowable noise level a worker can be exposed to over a specified duration. The TWA is a measurement that accounts for varying noise levels throughout the work shift, calculated using the formula:

$TWA = 16.61 \times \log_{10}(D_{100}) + 90$ Where D is the noise dose percentage.



Excessive noise exposure can lead to:

Hearing loss (temporary or permanent)
Increased stress levels
Reduced productivity
Communication difficulties

Noise pollution harms both human health and the environment, especially wildlife. Many animals depend on sound to communicate, navigate, and detect predators or prey. When noise levels rise, it disrupts these important activities, leading to habitat loss and fewer animals. For example, birds find it hard to communicate over city noise, which affects their mating and migration. Marine animals, like whales and dolphins, also suffer. Noise from ships, industrial activities, and sonar can confuse them and prevent them from using echolocation, leading to disorientation and stranding. Additionally, loud noise in natural areas can reduce biodiversity. Animals either adapt or leave, which can disrupt entire ecosystems. The impact of noise pollution on human health and the environment highlights the need for stronger noise regulations and better solutions.

To comply with regulations and protect workers, industries implement:

Engineering controls (e.g., silencers, barriers, enclosures)
Administrative controls (e.g., rotating workers to limit exposure)
Personal protective equipment (PPE) (e.g., earmuffs, earplugs)

We will delve deeper into these topics in our upcoming white papers. Follow us to stay updated!

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