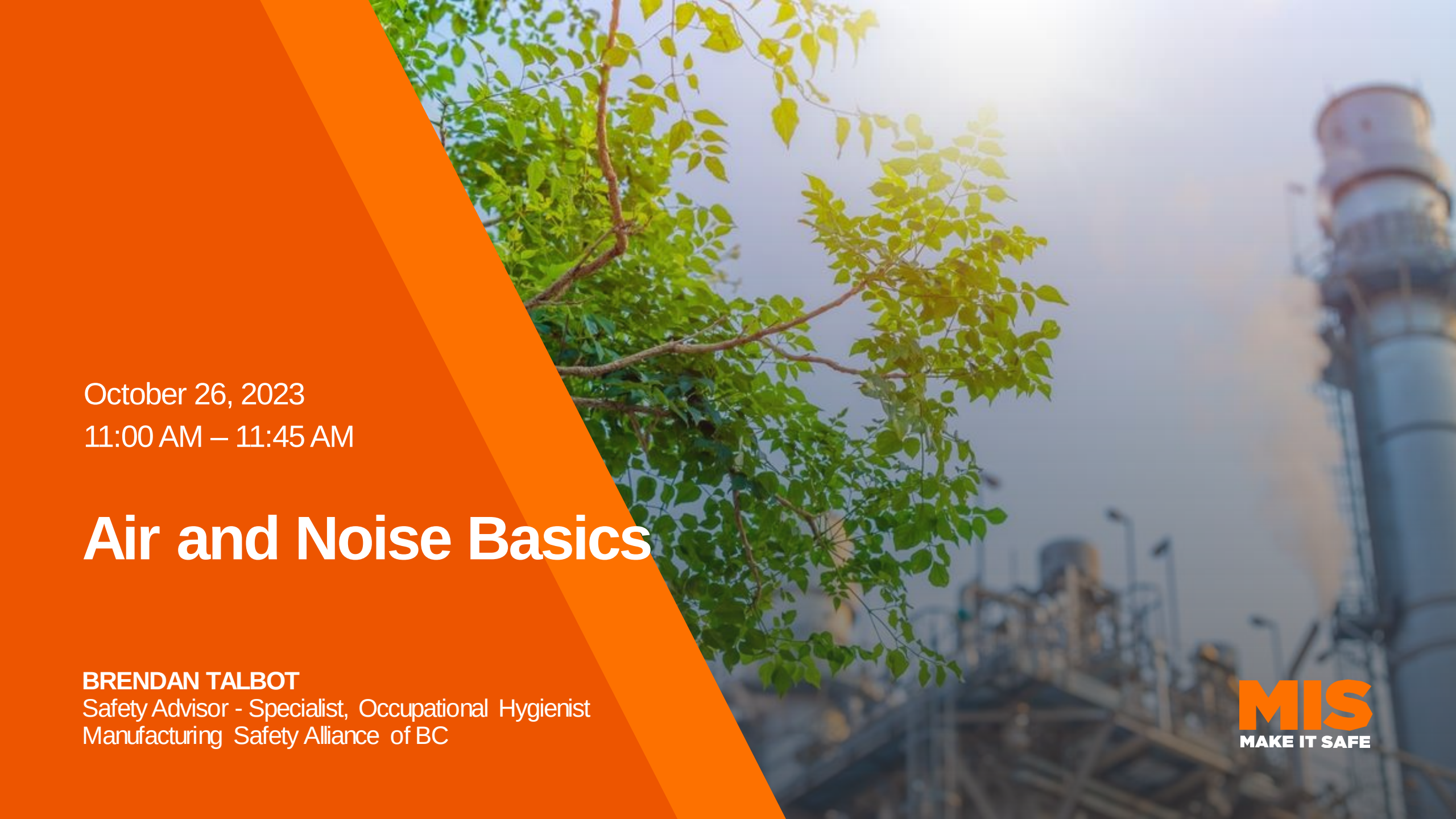
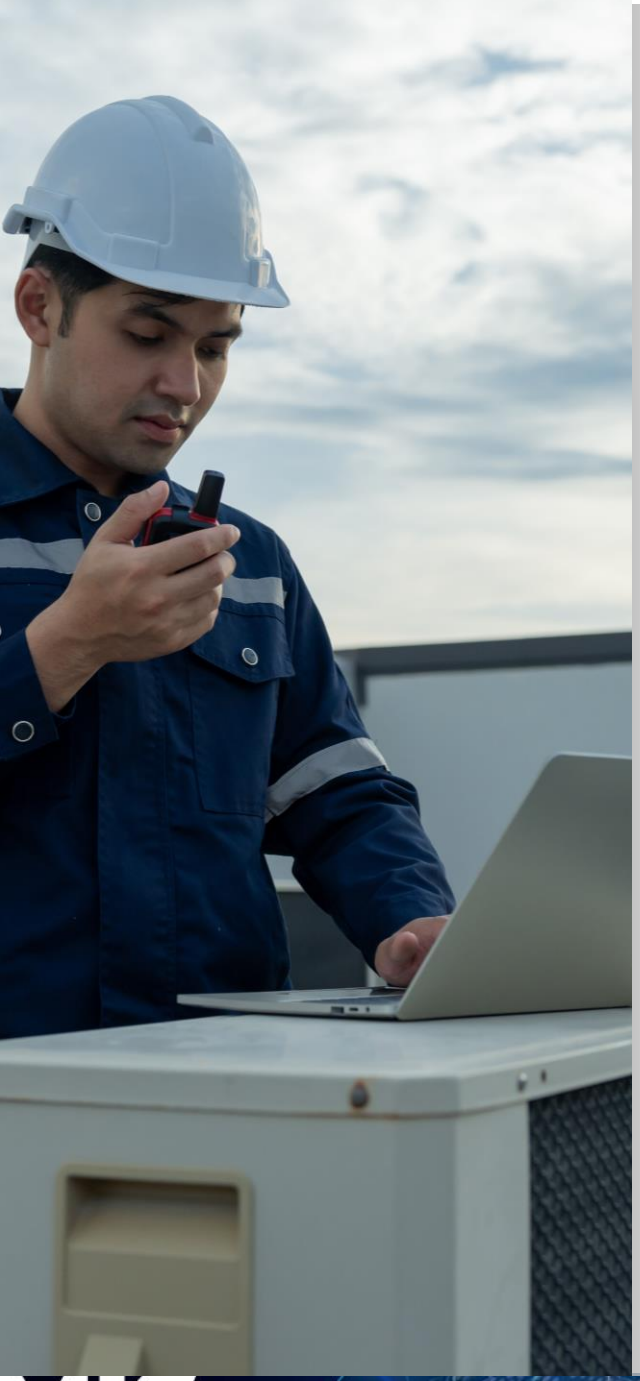


October 26, 2023
11:00 AM – 11:45 AM

Air and Noise Basics

BRENDAN TALBOT
Safety Advisor - Specialist, Occupational Hygienist
Manufacturing Safety Alliance of BC

MAKE IT SAFE



Agenda

1. **Overview of Occupational/Industrial Hygiene**
2. **Chemical, Physical and Biological Agents**
3. **Air Quality at Work**
   a. Air Quality Hazards
   b. Health Effects
   c. Determining Exposure Level
   d. Controlling Exposure
4. **Noise Hazards at Work**
   a. Sound vs. Noise
   b. Exposure Limit
   c. Health Effects
   d. Controlling Exposure
5. **Summary / Q&A**

Intr

- Oc

Occupational / Industrial Hygiene

Industrial Hygiene (IH) is a science and art devoted to the anticipation, recognition, evaluation, control, and confirmation of protection from those environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and well being, or significant discomfort among workers or among citizens of the community.

- I am IH. (n.d.). American Industrial Hygiene Association. Retrieved October 23, 2023, from https://www.aiha.org

Chemical, Physical and Biological “Agents”

CHEMICAL

- Solids
- Liquids
- Gases
- Vapours
- Particulate aerosols
- Dust
- mist
- fumes

BIOLOGICAL

- Allergens
- Infectious agents
- Bacteria
- Viruses
- Fungi

PHYSICAL

- Noise
- Ionizing and non-ionizing radiation
- Temperature
- vibration

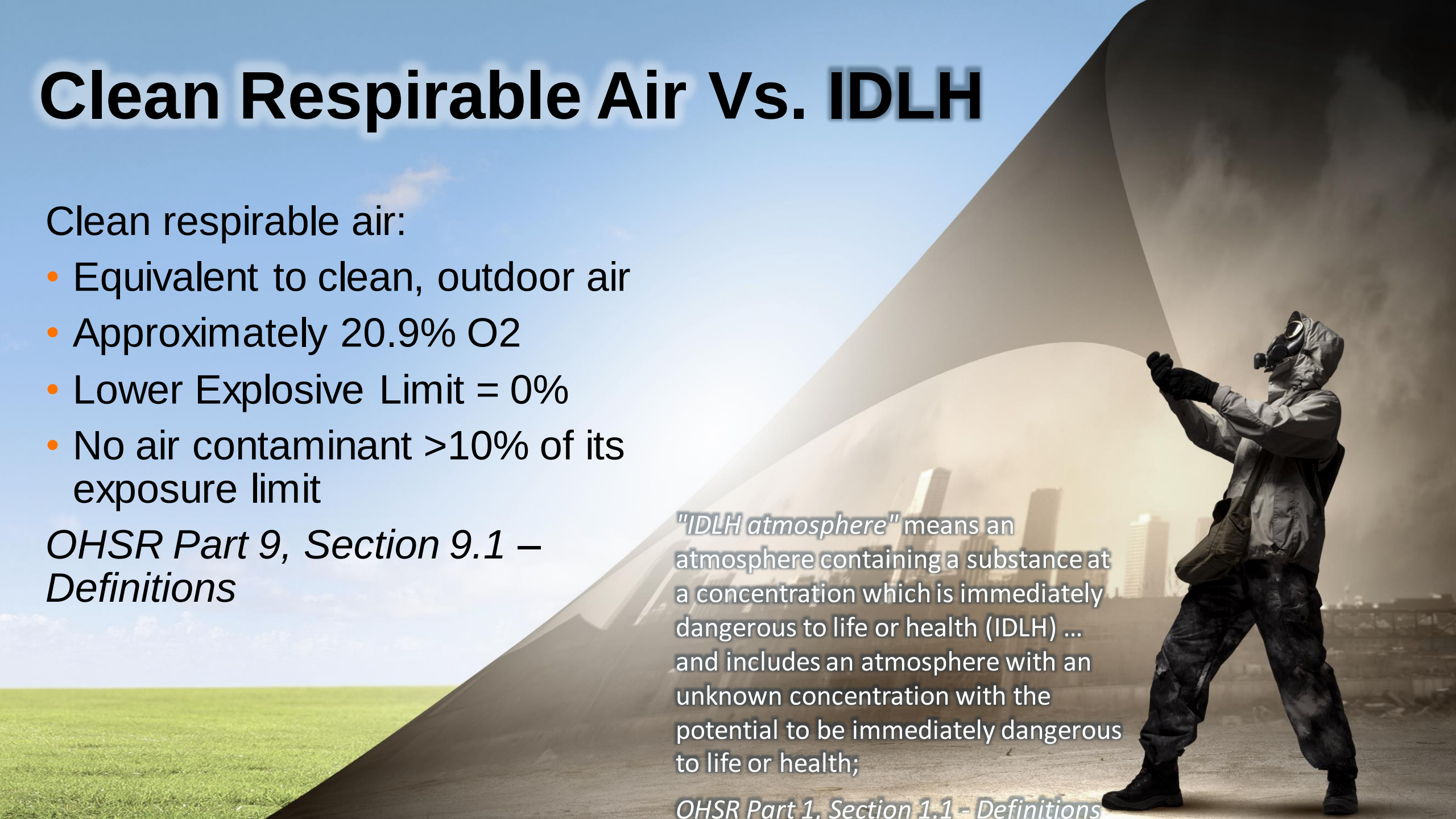
<u>These can become air quality hazards!</u>

Clean Respirable Air Vs. IDLH

Clean respirable air:

- Equivalent to clean, outdoor air
- Approximately 20.9% O2
- Lower Explosive Limit = 0%
- No air contaminant >10% of its exposure limit

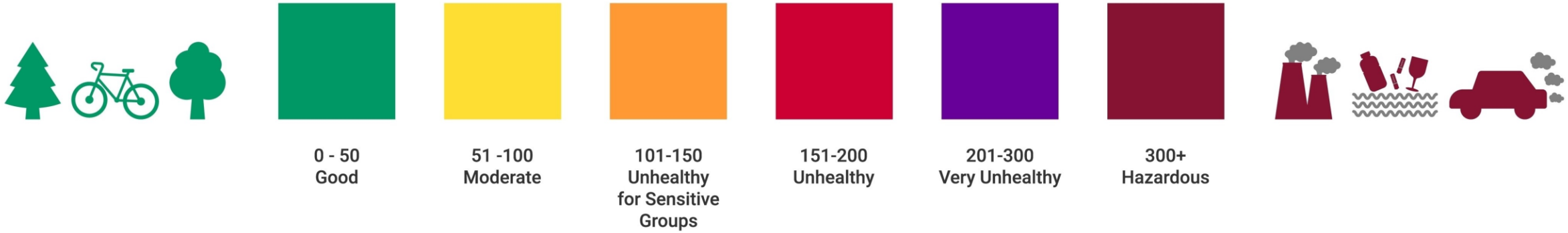
OHSR Part 9, Section 9.1 – Definitions



"IDLH atmosphere" means an atmosphere containing a substance at a concentration which is immediately dangerous to life or health (IDLH) … and includes an atmosphere with an unknown concentration with the potential to be immediately dangerous to life or health;

OHSR Part 1, Section 1.1 - Definitions

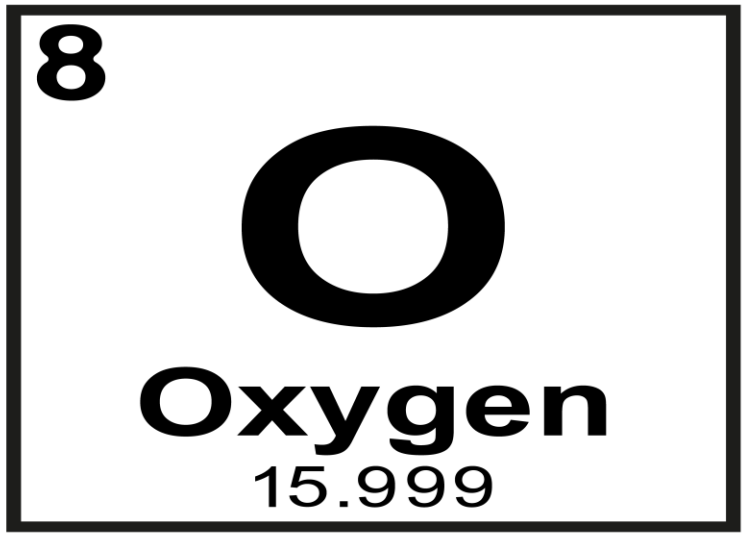
Air Quality Concerns



Typically fall in the range between clean, respirable air and IDLH atmospheres:

Oxygen Deficiency and Enrichment

Oxygen Deficiency (<19.5% O2)		Oxygen Enrichment (>23% O2)	
Caused by:	Example(s)	Caused by:	Example(s)
Chemical processes	Rusting	Processes that generate O2	Welding or cutting
Biological processes	Decomposition of organic matter	Equipment leaks	Leaking oxygen cylinders or piping
Combustion	Welding, Propane Heaters		
Displacement by:	See below		
Simple Asphyxiant. Often odourless and low- or non-toxic.	Argon, Acetylene, CO2, Natural Gas, Nitrogen, Propane		
Chemical Asphyxiant. Often odourless and of high toxicity.	CO		



Oxygen Deficiency

O2 (%)	Symptoms and Health Effects
18 – 21	No discernible symptoms. A risk assessment must be conducted to determine cause of O2 deficiency.
11 – 18	Reduction of physical and intellectual performance (coordination and judgement). Increased pulse, breathing rate.
8 – 11	Possibility of fainting within a few minutes without warning. Risk of permanent heart damage and death below 11%.
6 – 8	Fainting occurs quickly, but resuscitation is possible if immediate action taken.
0 – 6	Fainting almost immediate. Brain damage likely, even if successfully rescued.
0	1-2 breaths will cause sudden loss of consciousness and death.

Oxygen enrichment aids combustion and renders fires more difficult to extinguish!

Toxic Atmospheric Contaminants

Range from relatively benign to highly toxic:

IDLH atmosphere
Immediate impairment, possible death

Toxic contaminants
Prominent Health Effects

Nuisance level contaminants
No observable health effects

Odours
“musty” or stagnant air
CO_2 from exhaled air
General Stuffiness

Toxic Contaminants

Class	Examples
Gases	Ammonia, CO2, CO, SO2, H2S, O3
Vapours	Volatile Organic Compounds, Benzene, Toluene, Styrene, Varsol, Acetone
Particulate Aerosols – Dust, mist, fumes, fibres.	Flour and grain dust, silica dust, welding fume, asbestos fibres, wood dust
Biological Aerosols	Allergens: powdered food ingredients containing wheat/gluten, milk, egg, crustacean/shellfish, peanuts, tree nuts, soybeans, walnuts shells
	Infectious agents: legionella, moulds/mycotoxins, viruses, bacteria

Chemical Vs Biological Air Contaminants

Chemical

Occupational Exposure Limits (OELs) – protect workers from adverse health effects rel

Wo
Ex
Su

OE
or

8-h
min Short-Term Exposure Limit, and and/or Ceiling limit.

Biological

Generally, do not have an associated OEL, but can produce

In general, the lower the OEL the more hazardous the substance

Caution: Not always true

Health Effects

ACUTE – Immediate health effects due to a short-term, high concentration exposure (ex. H2S exposure)

CHRONIC – Delayed health effects, typically over years or decades. Continuous or frequent exposure to low-medium concentrations for long periods of time (Ex. Asbestos or silica exposure)

LOCAL – Affects site of exposure

Includes: Eye, nose, throat, upper respiratory, skin irritation, rashes, or burns

SYSTEMIC – Affects entire body, may target specific organs or systems

Includes: Cardiovascular dysfunction, lung disease, sterility, Central Nervous System damage, kidney damage, liver damage, cancer

Determining Exposure

QUALITATIVE EXPOSURE ASSESSMENT - Used to determine when to move to quantitative exposure assessment.

Goal: Determine agents, frequency and d[illegible]n – For a task such as welding. What material is being w[illegible] any times per day and for how long are they w[illegible]

Contact MSABC!

QUANTITATIVE EXPOSURE ASSESSMENT - Measurement of actual exposure. Involves occupational or industrial hygienists, who will use specialized equipment to measure actual exposure to various agents.

Goal: Compare with regulatory, professional and internal standards – compare quantitative data with OELs.

Qualitative Exposure Assessment

Want to review…

MATERIALS – products. Ex. Flour

OPERATIONS – What are you doing with the product? Ex. Baking bread

PROCESSES –Tasks, tools and equipment used with the product of concern Ex. Weighing products in open scale, pouring products into mixing bowls. Can readily release agents into the air and cause exposure.

CONDITIONS – Indoors vs outdoors, ventilation options, PPE. Ex. Is there a local exhaust system used, general ventilation or natural airflow, are workers using a respirator.

Materials - Safety Data Sheets

- Review pictograms and hazard statements
- Vapour Pressure – Higher vapour pressure= more volatile
- Vapour and relative density – determines settling characteristics of vapour
- pH – indicates whether product is alkaline (caustic) or acidic (corrosive)
- PPE and exposure control sections will suggest whether respiratory protection is required

Important

- Substances carrying IARC Group 1, 2A, 2B or ACGIH A1 or A2 notations. Ex. Silica, Hexavalent chromium, wood dust, benzene
- Sensitizers - S, S(D) or S(R) notations. Ex. Flour dust, wood dust
- Reproductive toxins – “R” notation. Ex. CO
- If unsure, ASK MSABC!

Operations - Interviews

Engage workers and ask questions:

Do you ever experience irritation when breathing?

Do you ever experience irritation of the eye, nose, throat, or skin?

Do you ever feel the need to wear a respirator at work?

Do you ever feel the need to hold your breath?

Are there any tasks that product a strong smell?

Are there any tasks that produce dust?

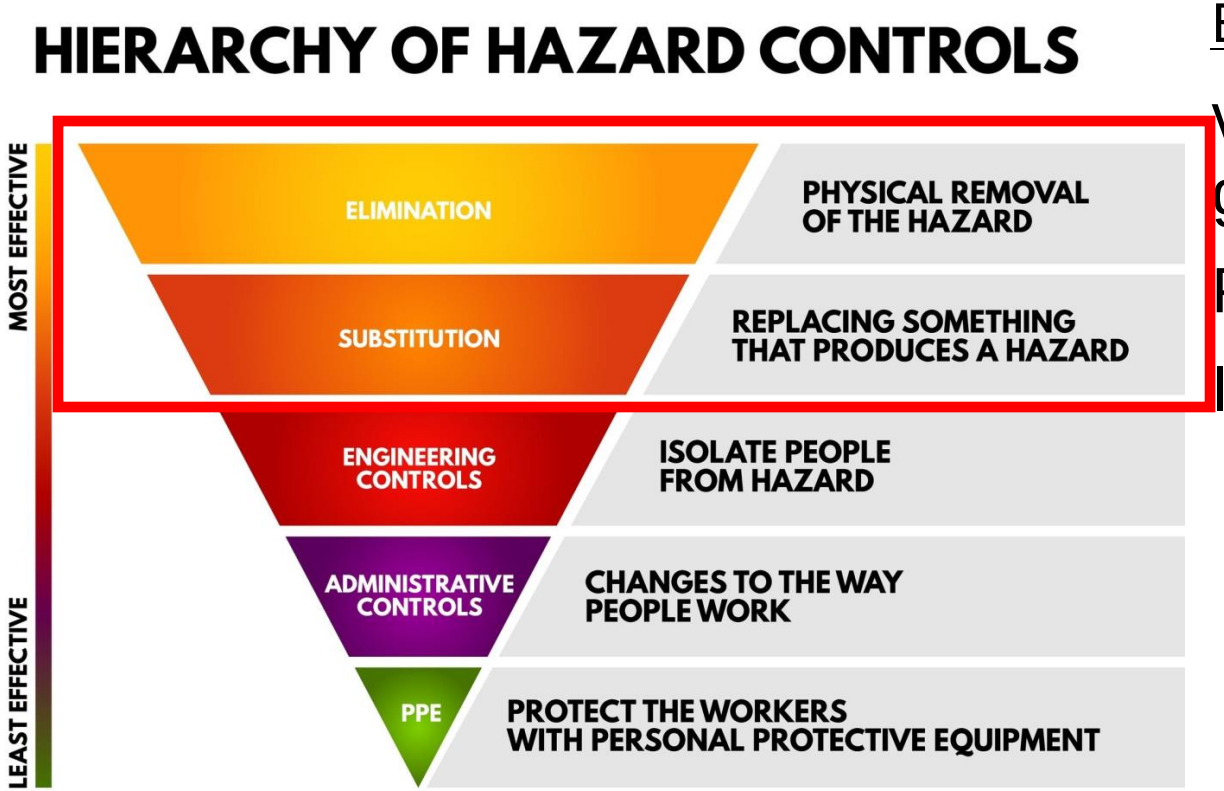
How frequently do you conduct this task? Multiple times/day, daily, weekly, monthly.

How long does this task usually last?

Processes and Conditions - Observe the Work

- Observe tasks and rely on your senses
- Note any visible emissions (dust, mist, smoke) - Could be generated at the point of operation or open equipment
- Accumulation of particulates on su)
- Note any unusual tastes
- Smells – the human nose is incred substances at concentrations in th
- Watch for symptoms of exposure: ng, loss of coordination, confusion
- Note ventilation in the area - Emiss space vs open air

Controlling exposure



Engineering

ventilation local exhaust ventilation or general (dilution) ventilation

Administrative

Process and equipment modification

Written exposure control programs, policies, safe work practices

Isolation/automation

Training

Exposure Monitoring

PPE

Inspections and maintenance

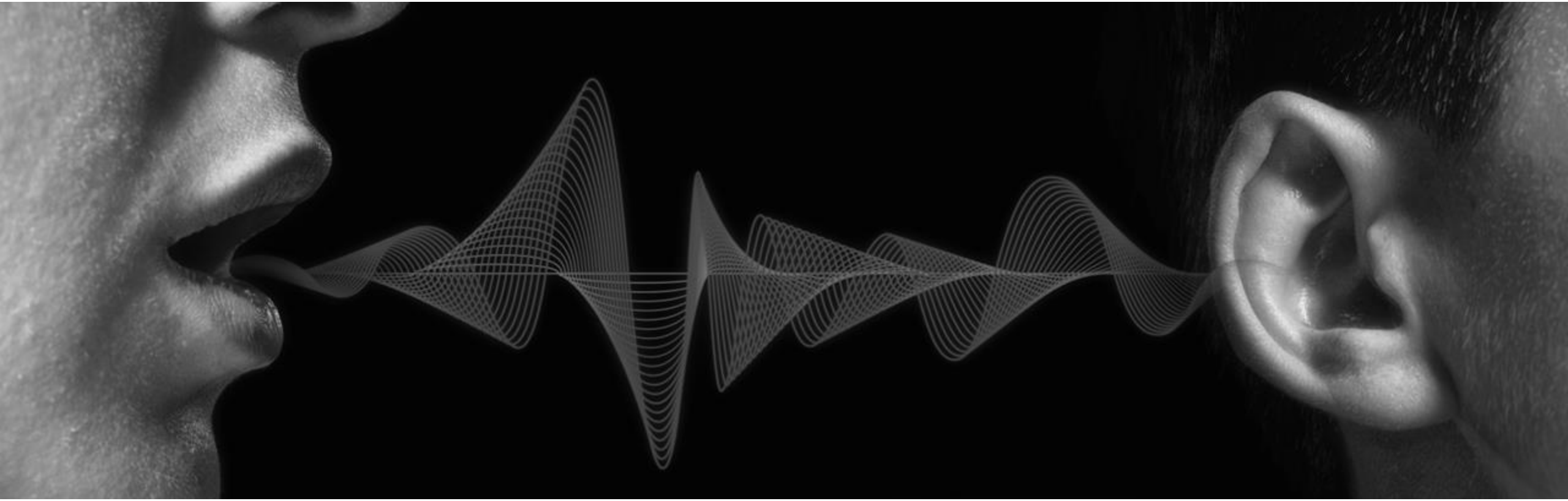
Respiratory Protective Equipment (RPE)

Signage

Chemical-resistant clothing

Always try to eliminate the hazardous agent first!

Noise 101

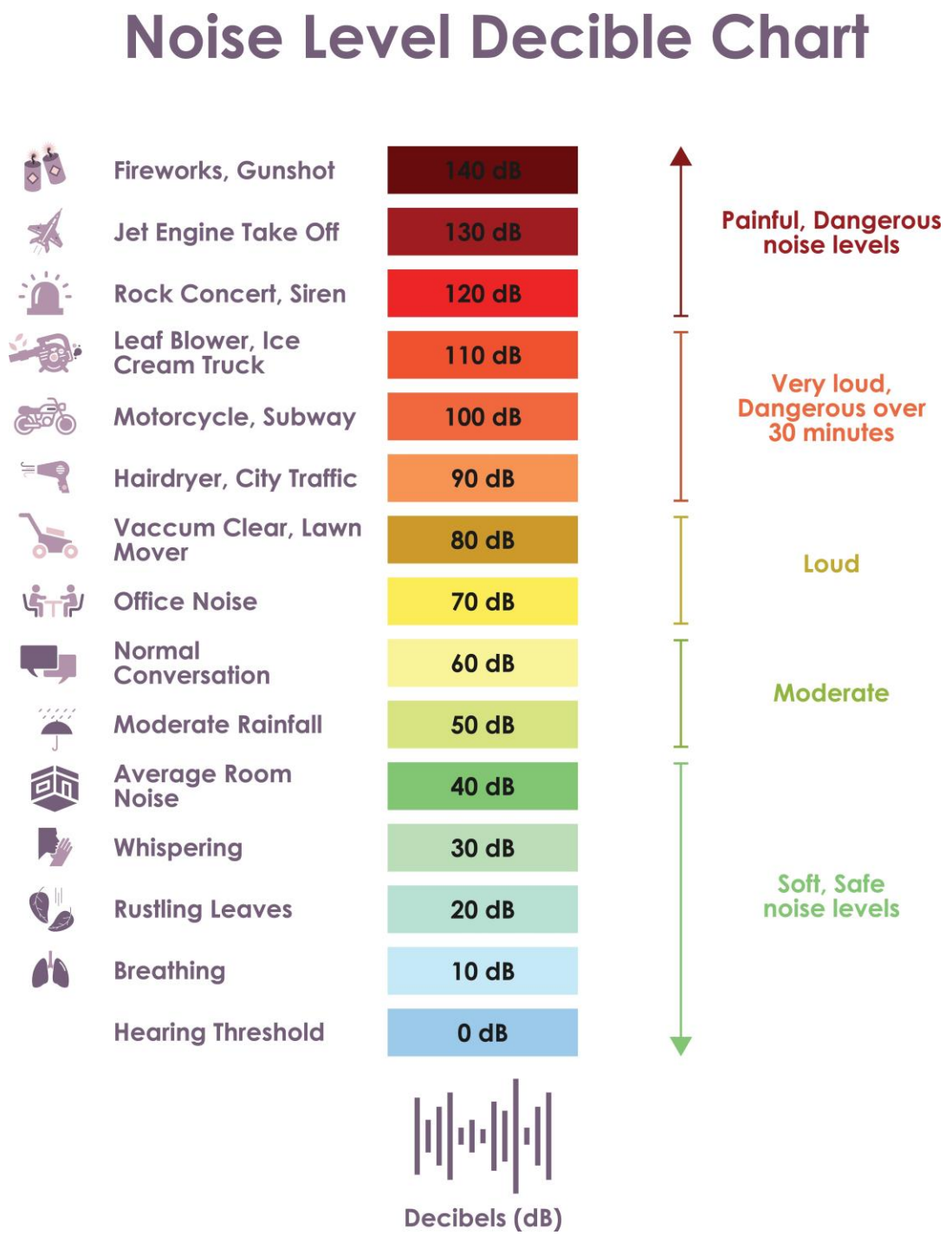


Sound Vs. Noise

- Sound - changes in air pressure (vibrations) which are detectable by the human ear. “sound waves”
- Frequency - number of vibrations per second in Hz
  - Can hear between 20 and 20,000 Hz
- Intensity – loudness of the sound, known as sound pressure level (SPL) in decibels (dB)

The Decibel

- The unit for measuring sound, the Decibel (dB), is on a logarithmic scale
- Measured as either:
- A-Weighted – dBA – designed to mimic the human ear
- C-Weighted – dBC – measures wider range of frequencies



Sound Vs. Noise

NOISE IS A TYPE OF SOUND

- Random
- Carries no information
- Typically considered undesirable or unwanted sound
- Frequent exposure to high noise levels can result in irreversible damage to the auditory system
  - Results in Noise Induced Hearing Loss, nor NIHL
- Noise is one of the most common occupational hazards in North American workplaces

Occupational Exposure Limit

Noise Level (dBA)	Exposure Duration
82	16 hours
83	12 hours
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 mins
100	15 mins

WorkSafeBC exposure limits for occupational noise are 85 dBA Lex, 8-hour and 140 dBC max impulse noise

Lex is noise exposure averaged and adjusted for an 8-hour period.

Lex can be calculated for other shift lengths

3 dBA exchange rate

For every 3dB increase of SPL, sound energy doubles and is twice as damaging

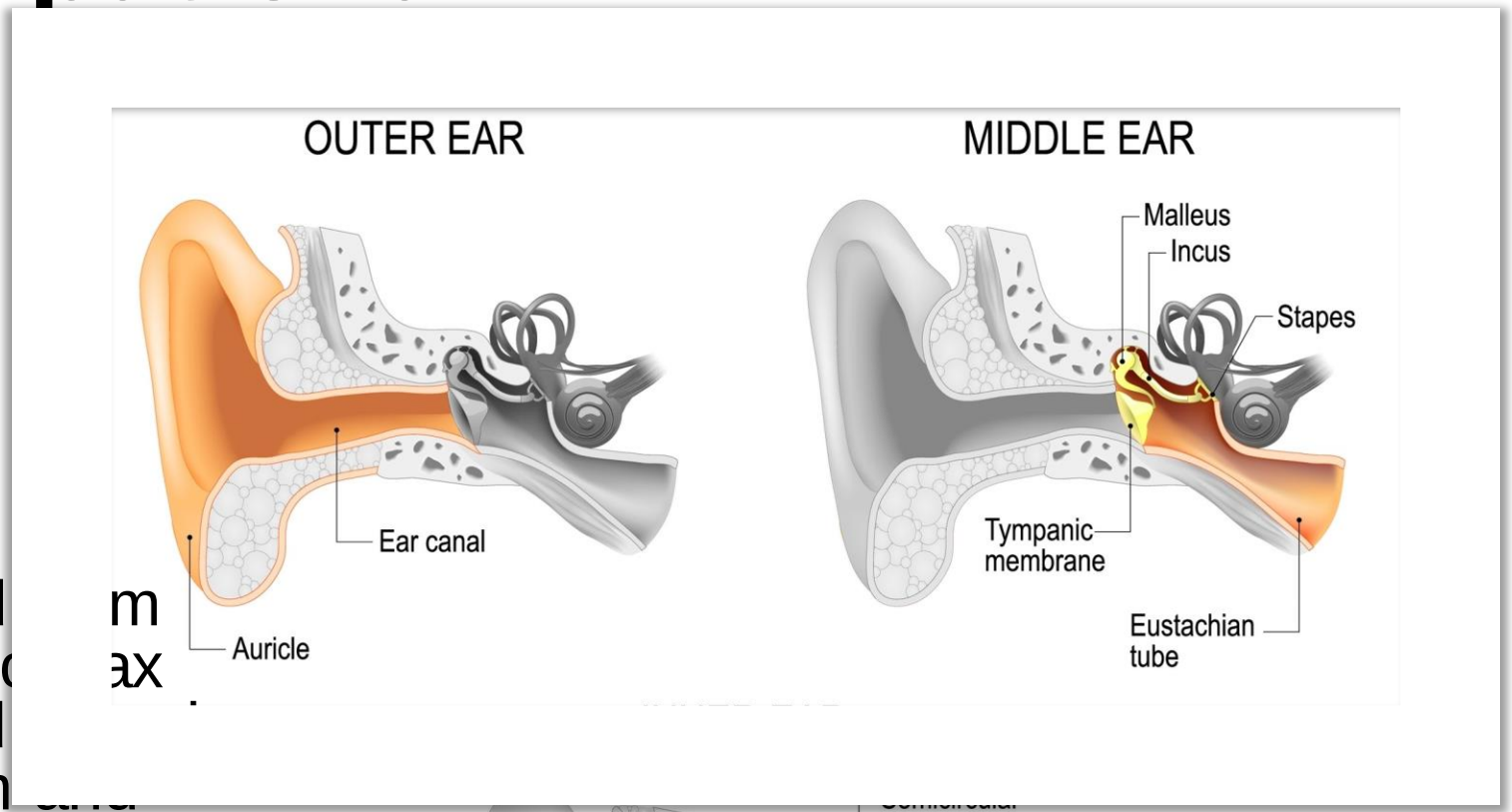
Because it is twice as damaging, we can only be exposed for half the time

Occupational NIHL

- Occupational hearing loss can be conductive or sensorineural.

<u>Conductive hearing loss</u>

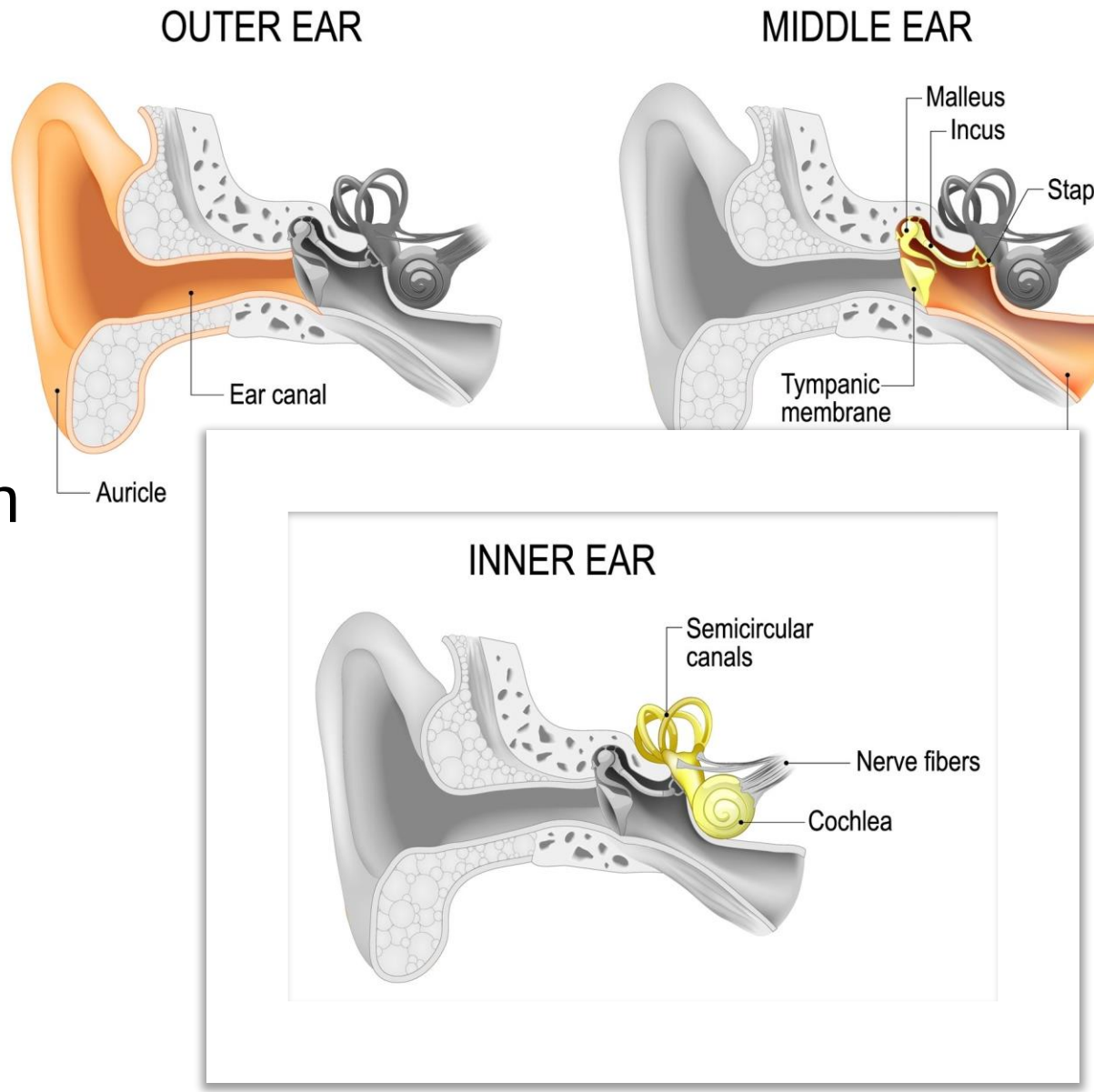
- Sound vibrations blocked m
  inner ear. Could be due to ax
  buildup, infection, or loud
  that damage the eardrum
  middle ear structures.
- Temporary Threshold Shift
- Reversible – naturally or surgically



Occupational NIHL

SENSORINEURAL HEARING LOSS

- Occurs when hair cells and nerves in the inner ear are damaged due to loud noise, aging or disease.
- Happens gradually and will likely go unnoticed until a relatively large change has occurred
- Permanent Threshold Shift
- cannot be corrected or reversed



Health Consequences of NIHL

Auditory Health Effects

- Ringing (tinnitus) or buzzing in

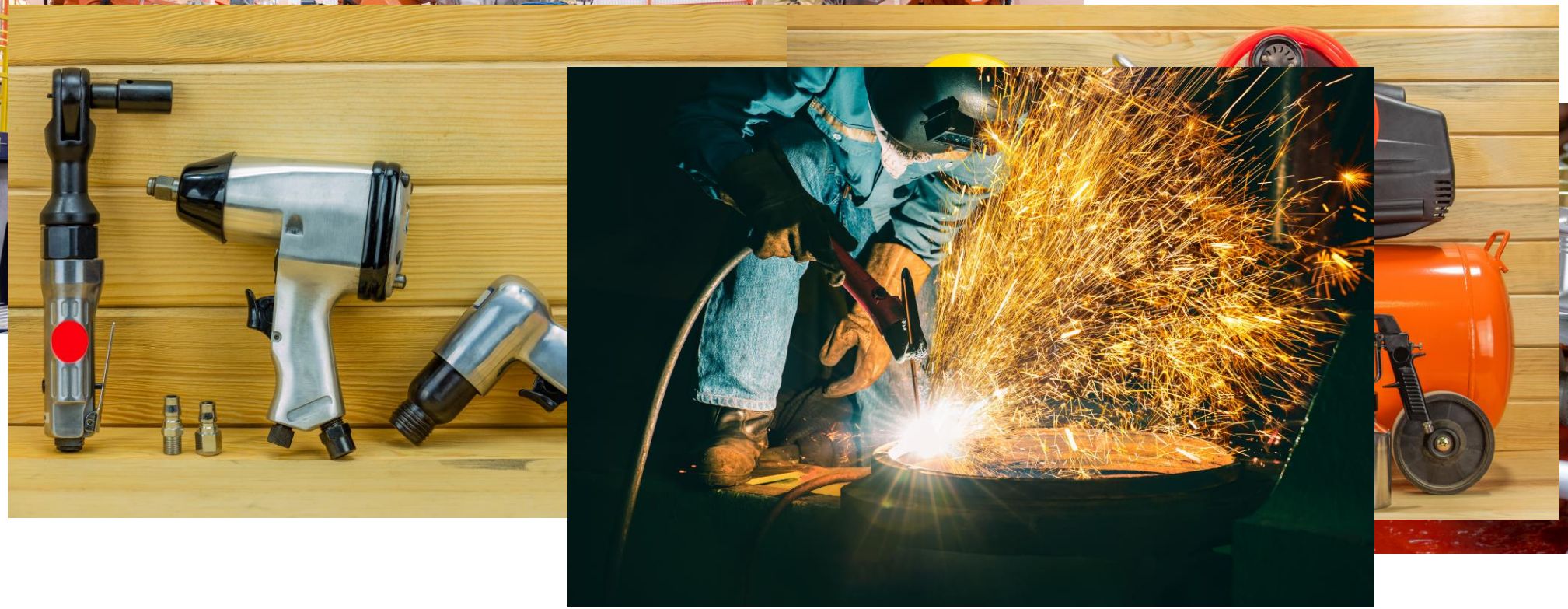
- Unable to hear consonants

Non-Auditory Health Effects

- Psychological stress
- Irritability
- Decreased job performance
- Low morale
- Increased probability of accidents at work

Common sources of excess noise

- Electric Power Tools – Grinders, saws, drills
- Powered Process equipment – conveyors, mixers, robotics



When to test

7.3 Noise measurement required

(1) If a worker is or may be exposed to potentially harmful levels of noise, or if information indicates that a worker may be exposed to a level exceeding 82 dBA Lex, the employer must measure the noise exposure.

(2b) If a ch or the duration o

- *OHSR P*

Practically:

- If you must raise your voice to be heard by a coworker

or

- A smartphone sound level meter indicates 75 dBA

Testing Instruments

- Sound level meter - basic instrument to measure sound pressure variations in air
- Noise dosimeter - combines sound pressure and time to determine personal exposure
- Octave band analyzer - Diagnostic tool to help find appropriate engineering controls to reduce noise levels
- Testing and interpretation must be completed by a qualified person

MSABC can help!

How to Test

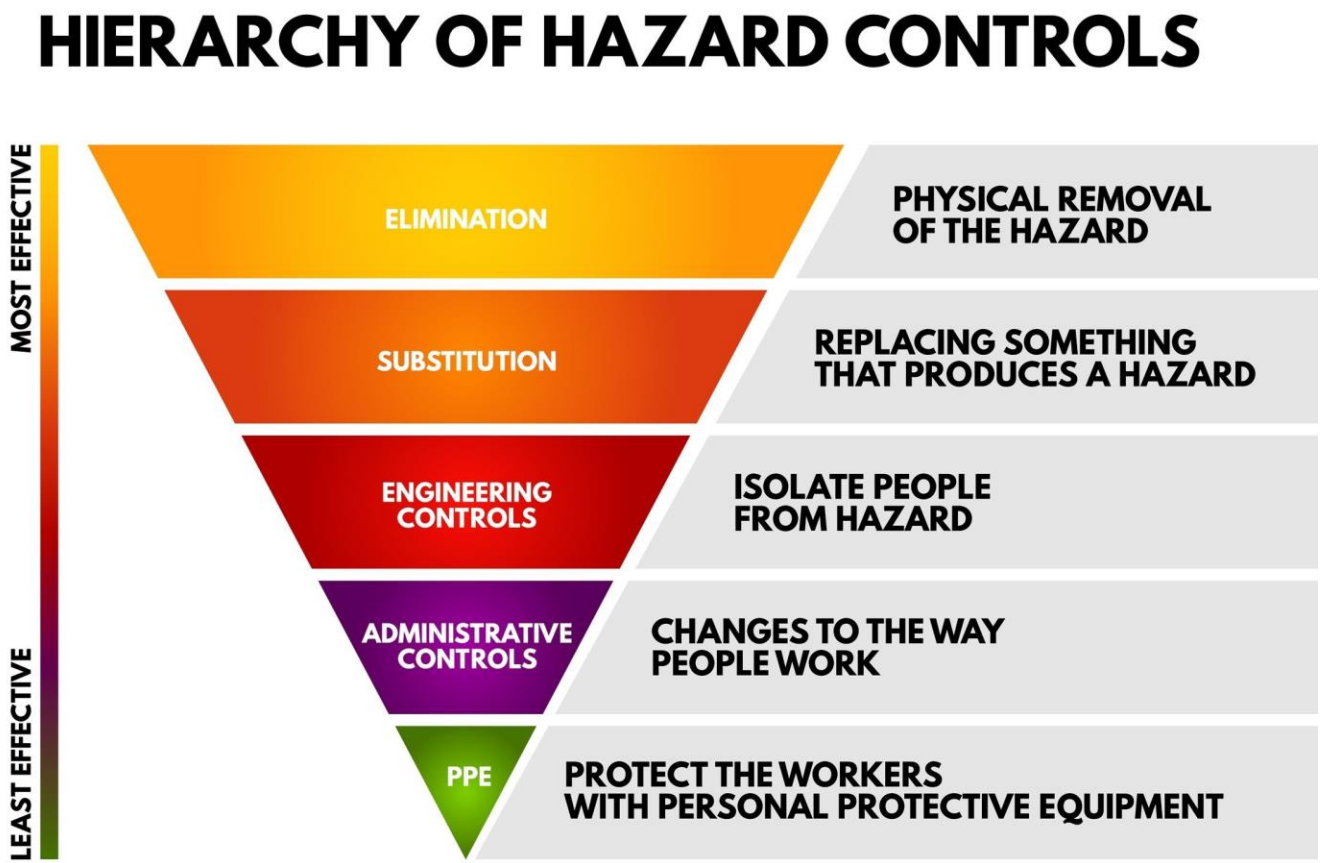
Do's

- *Use Sound Level Meter (SLM) or noise dosimeter, conforming to ANSI Standard S1.25-1991, Specification for Personal Noise Dosimeters*
- *Conduct testing according to CSA Standard Z107.56-94, Procedures for the Measurement of Occupational Noise Exposure*

Don't's

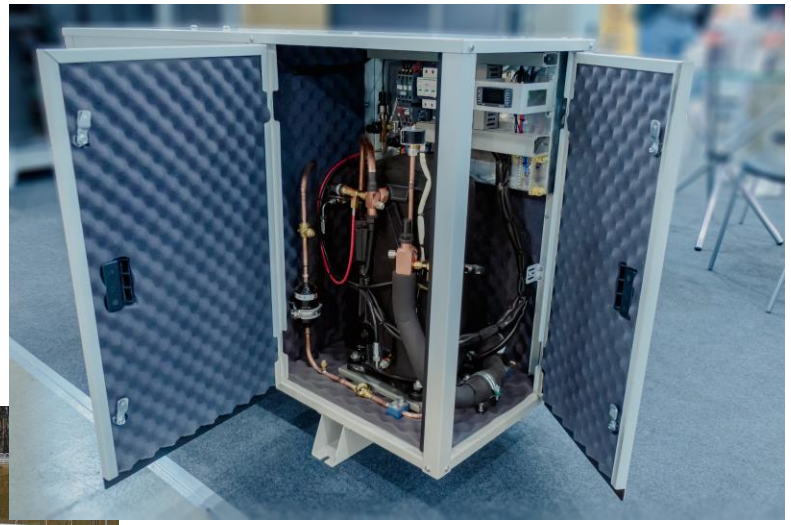
- Do not use smart phone app
- No calibration and large margin for error
  - can vary by up to 10dB
- Not a viable alternative to an integrating SLM or dosimeter

Controlling Noise exposure



Engineering Controls

- Enclose or move noisy equipment
- Use sound barriers or sound absorbing materials to attenuate or deflect noise away from work area
- Perform maintenance (lubricate parts, isolate or tighten vibrating parts)
- Replace worn equipment
- Mufflers, silencers or baffles



Administrative

- Signage *WorkSafeBC requirement
- Written hearing conservation program
- Training - can lead to increased PPE compliance
- Decrease exposure time
- Increase distance from noise source – noise falls by 6db with doubling of distance
- Limit number of personnel being exposed
- Provide quiet areas for breaks
- Reduce pressure of compressed air to minimum required

Personal Protective Equipment (PPE)

- Hearing protective devices (HPDs)
- Can be earplugs, earmuffs, or a combination of both.
- Also, ear canal caps, helmets, etc…
- Receive a NRR or “noise reduction ratio”- maximum number of decibel reduction provided by the HPD - NRR not indicative of real-world attenuation
- Issues with individual fit of device, improper usage of earplugs, poor coupling of earmuffs creating leakage


STAY
SAFE
EVERYONE