



RESPIRATORY PROTECTION PROGRAMS - BREATHE EASY

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OCCUPATIONAL HYGIENIST**



Presentation Outline

- Why respiratory protection?
 - Legislative Requirements
 - CSA Z94.4-18
- Hazard Assessments
 - SDS / Tools / Air Sampling / TLVs
 - Forms of Contaminants
 - Respirator Types (Air Purifying/Air Supplying)
 - Respirator Examples
- Selection of respirator
- Program Elements
 - Training / Fit-testing / Cartridge change-out /
Cleaning & Maintenance

Why do we need respiratory protection?

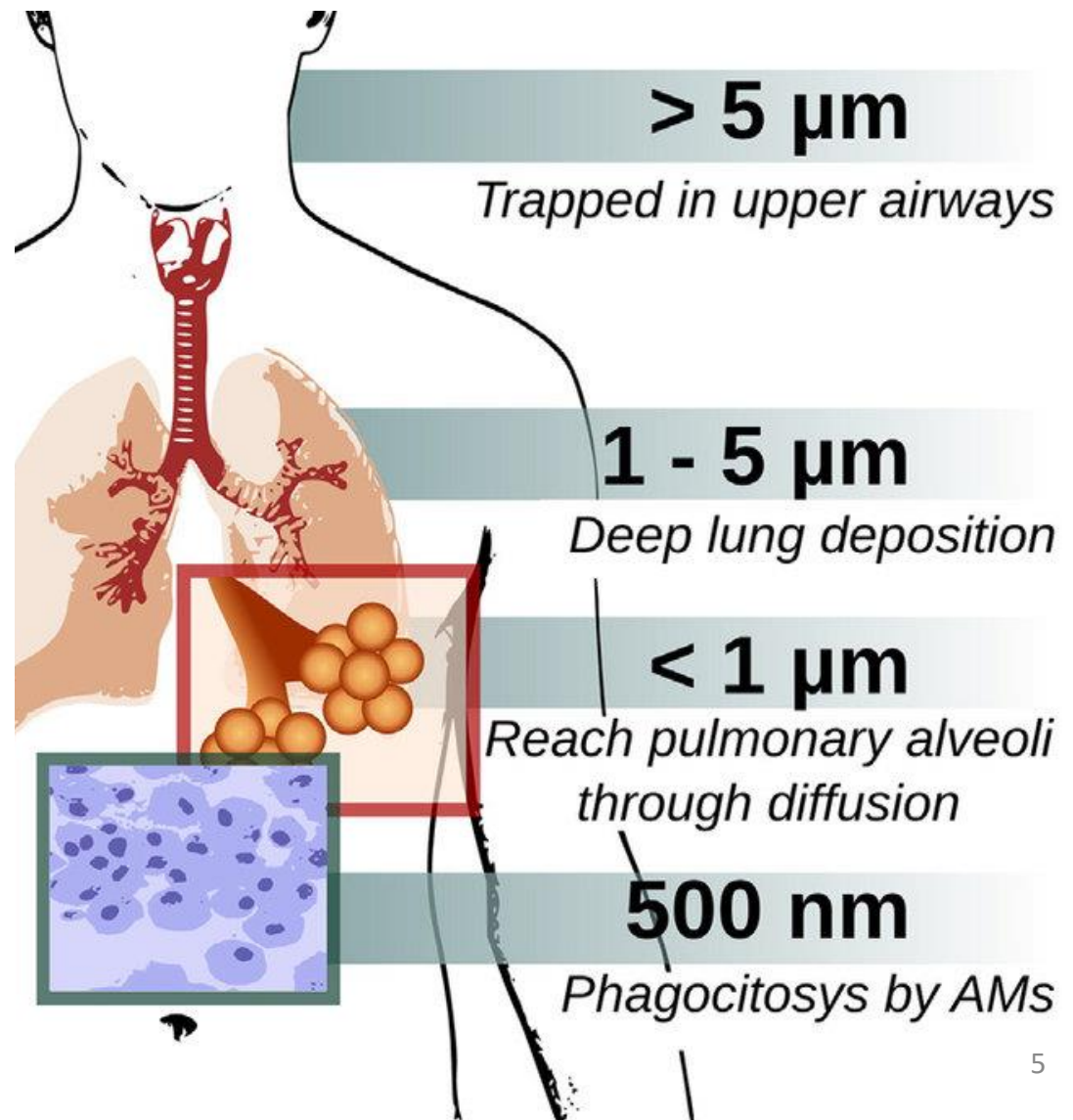
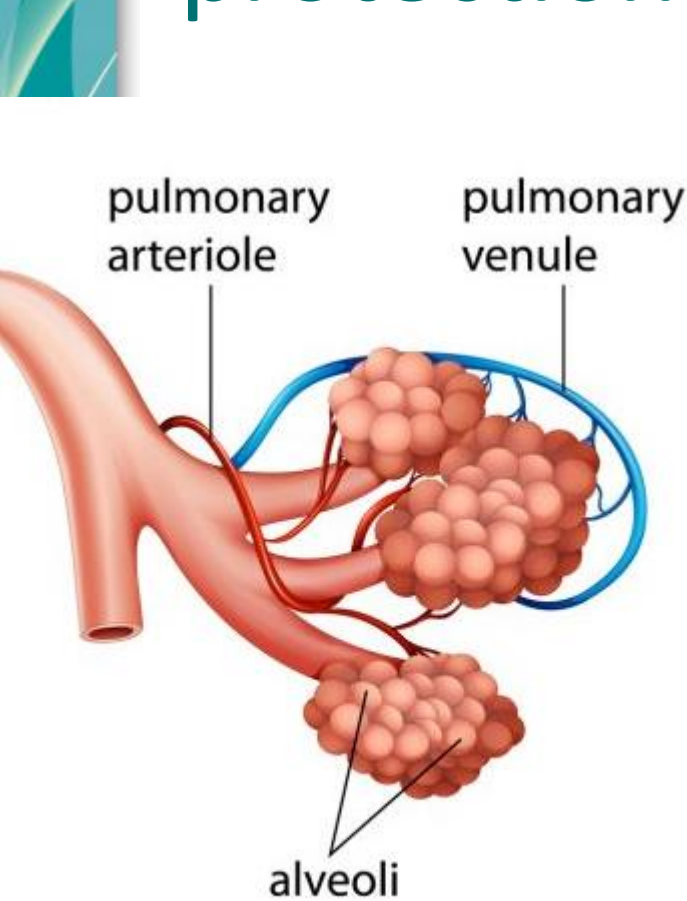
- **What is the main route by which a chemical (or contaminant) enters a person's body?**

Why do we need respiratory protection?

1. Inhalation

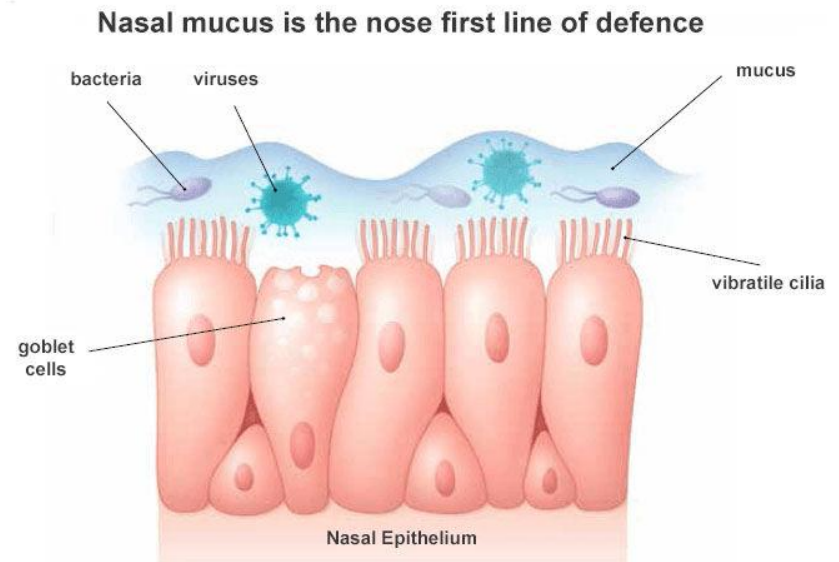
- 2. Dermal (skin contact)
- 3. Ingestion
- 4. Puncture (or broken skin)

Why do we need respiratory protection?



Why do we need respiratory protection?

- Our natural defenses are helpful but not enough.
 - Nose hair (> 10 microns)
 - Cilia (move particles 2.5 cm/hour)
 - Mucus
 - Reflexes (cough, sneeze)

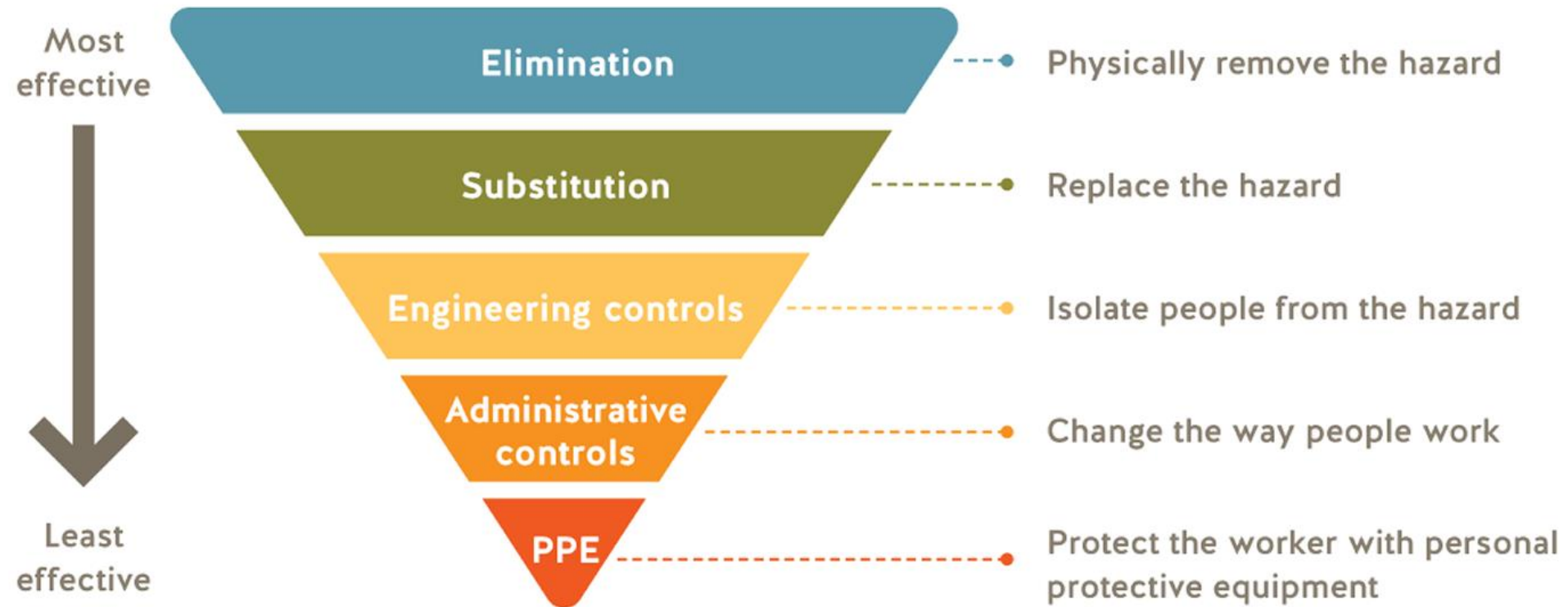


Legislative Requirement

- Part 11.3 Where the air of working areas is contaminated by vapours, fumes, gases, mists or other impurities which constitute a hazard to the health or safety of workers, **suitable means of ventilation** shall be provided by the employer to reduce contamination in the atmosphere at or below the **threshold limit values...**

Legislative Requirement

- Part 45.17(1) Every employer shall ensure that when workers are or may be exposed to an oxygen deficient atmosphere or harmful concentrations of air contaminants **mechanical means of engineering design** shall be used to prevent or to eliminate such hazardous conditions.



Legislative Requirement

- Part 45.17(2) The employer shall ensure that where the prevention or elimination of such hazardous conditions is not reasonably practicable, or where the exposure results from temporary or emergency conditions only, every worker exposed shall wear **approved protective respiratory** equipment.

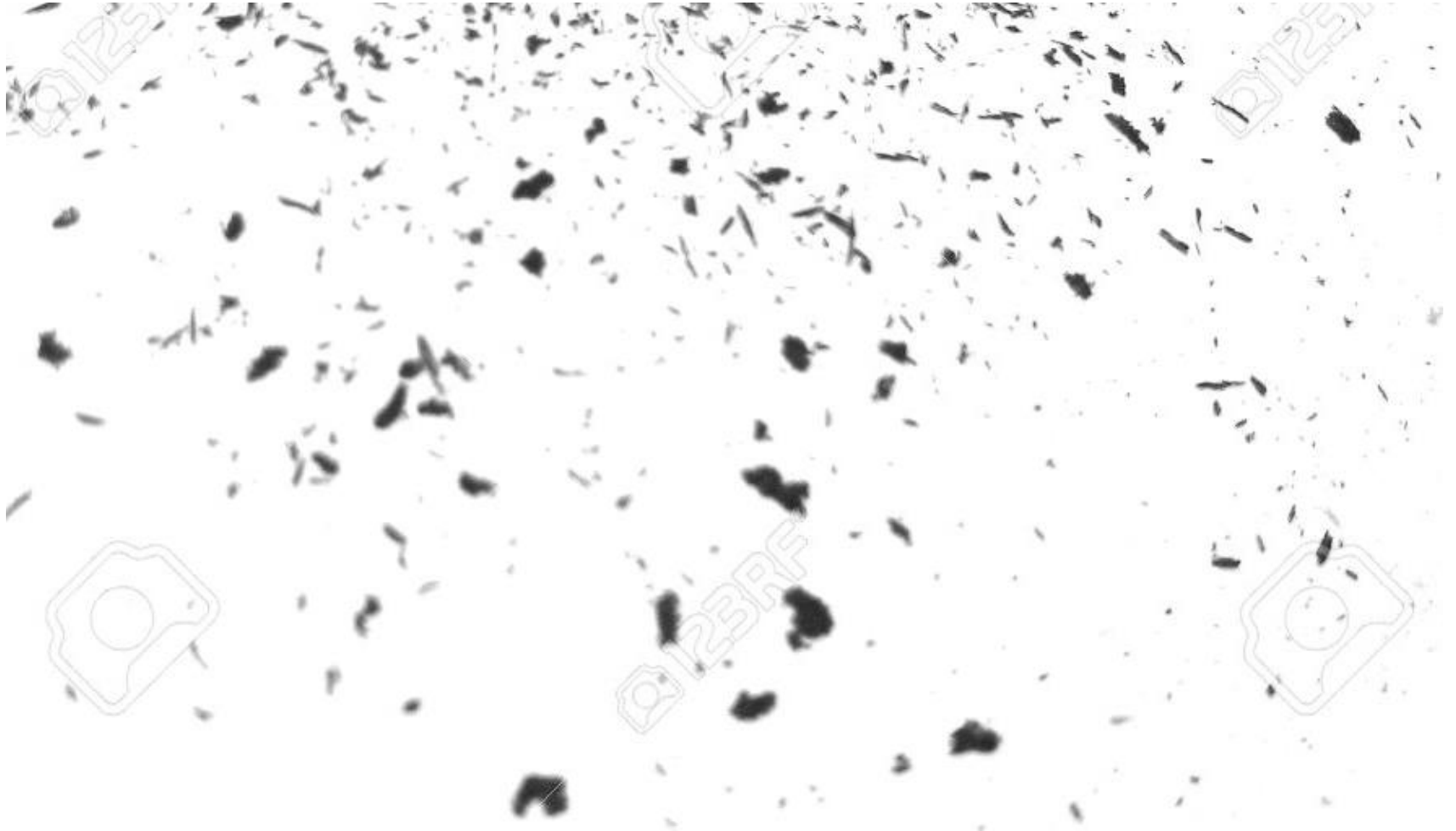


Legislative Requirement

- Part 45.18(1) The employer shall ensure that the selection, use and care of respirators meets the applicable standards and specifications set out and referred to in the **CSA Standard Z94.4-18, “Selection, use, and care of respirators”**



Forms of Contaminants



Dusts



Formed when:

- Solid materials broken into smaller particles.
- Drilling, grinding, crushing.
- The smaller the dust, the longer it hangs in the air and the easier it is to inhale.

Mists



Tiny Liquid Droplets

- Spraying liquid creates a mist.
- Some mists are a combination of chemical ingredients.

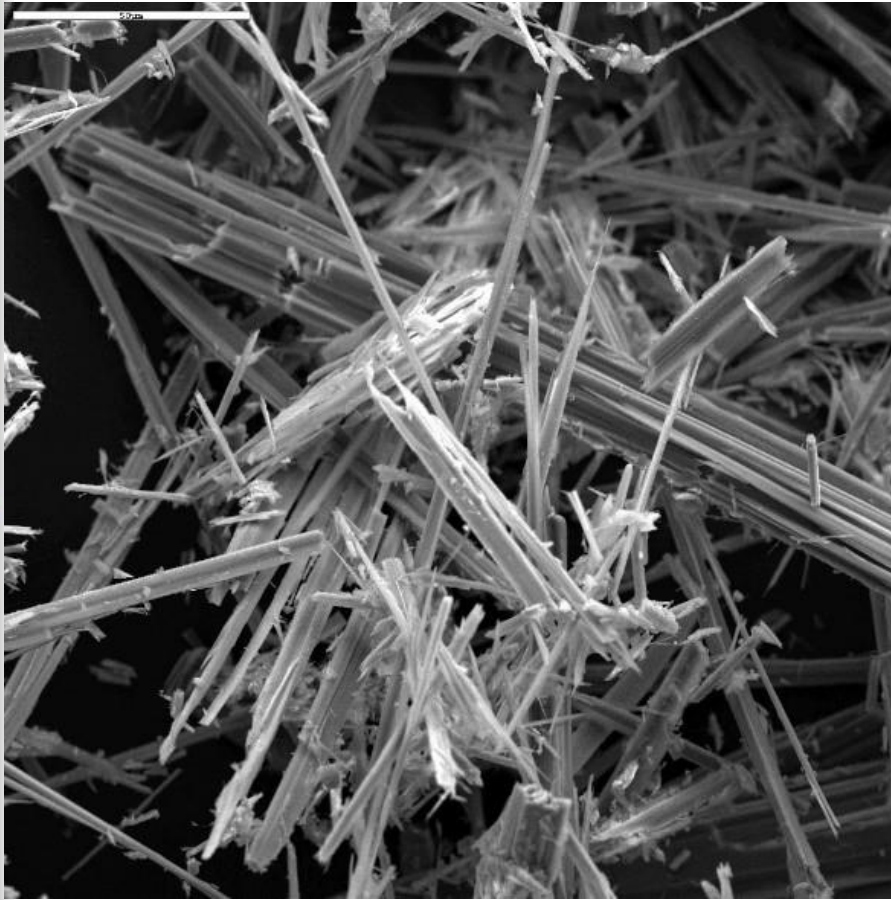
Fumes

Vapourized metal that is quickly cooled

- This process creates fine solid particles and most of these particles become aerosolized.



Fibers



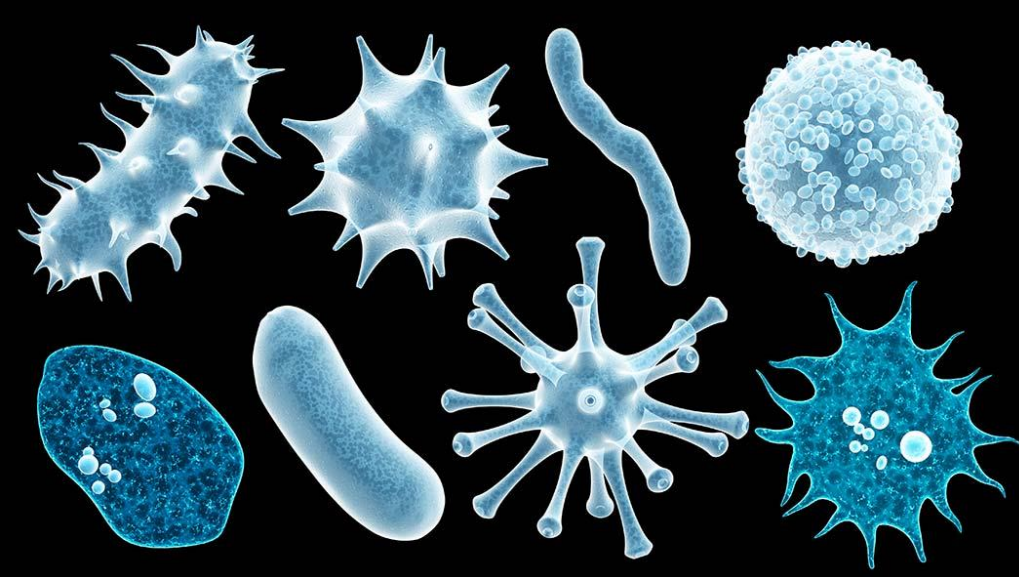
Particles at least 3 x longer than they are wide.

Bioaerosols



Liquid droplet or a solid particle suspended in the air

- This includes living or dead microorganisms, fragments, toxins and particulate waste products from a variety of living things.
- Capable of causing infection or adverse allergic response.
- E.g. mold, viruses, fermentation byproducts.

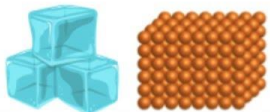
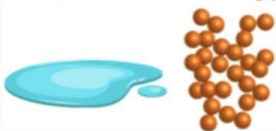



Gases



Not liquid or solid at room temperature.

- Can travel far and fast from their source, often undetected.
- E.g. carbon monoxide, hydrogen sulfide, nitrogen

Solid	Liquid	Gas
<ul style="list-style-type: none">✓ Definite shape✓ Definite volume✓ Definite mass✓ Close particles✓ ↓ kinetic energy	<ul style="list-style-type: none">✗ Definite shape✓ Definite volume✓ Definite mass✓ Close particles✓ ↑ Kinetic energy	<ul style="list-style-type: none">✗ Definite shape✗ Definite volume✓ Definite mass✓ Particles far apart✓ ↑ Kinetic energy
		

Vapours

Substances that evaporate from liquids or solids

- E.g. gasoline, paint thinners, alcohols, solvents (e.g. nail polish remover acetone).



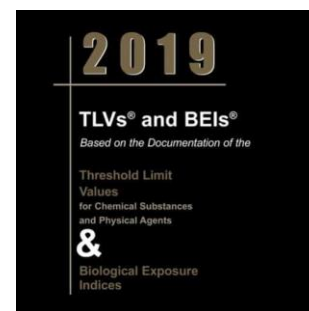
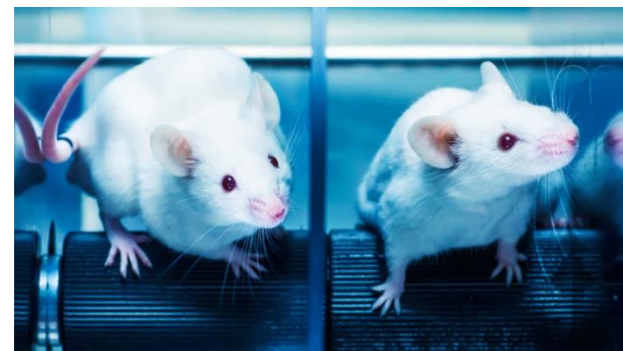
Contaminant Effect on Worker

Acute (Short Term)

- Immediate response
- Effect occurs within minutes or hours

Chronic (Long Term)

- Effect occurs in months or years



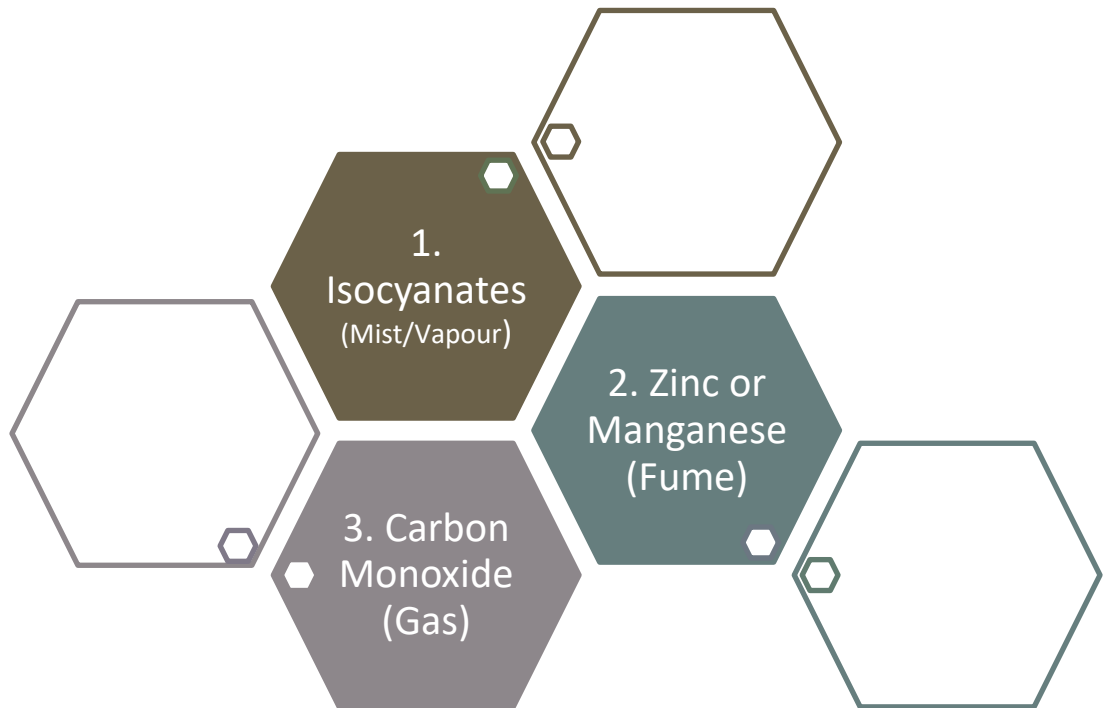
Why do we need respiratory protection?

Occupation & Health Effect (Symptom)

Heavy Equipment Mechanic – sudden headache and red flushed face.

Painter in Car Shop – overtime experiences difficulty breathing at work.

Welder welding galvanized metal – dizzy and shaky at end of shift.



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Threshold Limit Values

- Part 11.3 ...to reduce contamination in the atmosphere at or below the threshold limit values specified by the **American Conference of Governmental Industrial Hygienists (ACGIH)** in the 2019 edition of the publication "**Threshold Limit Values and Biological Exposure Indices**", as amended from time to time".

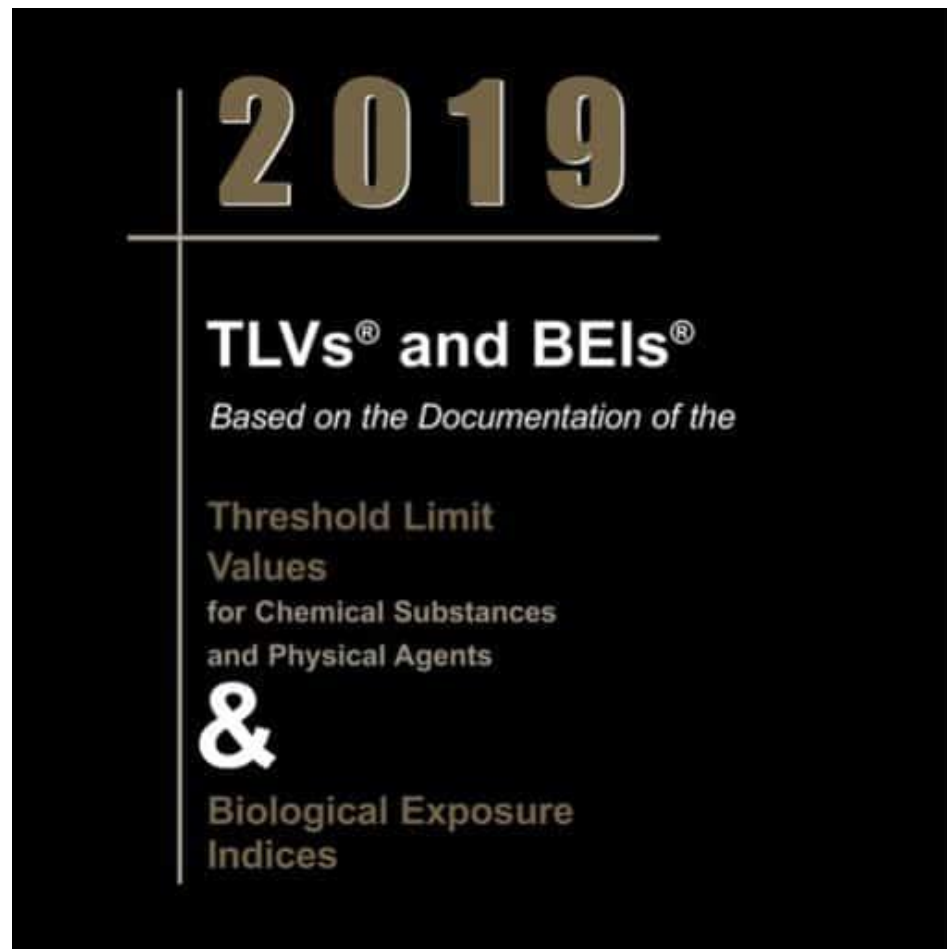
Threshold Limit Values

Occupational Exposure Limit (OEL)

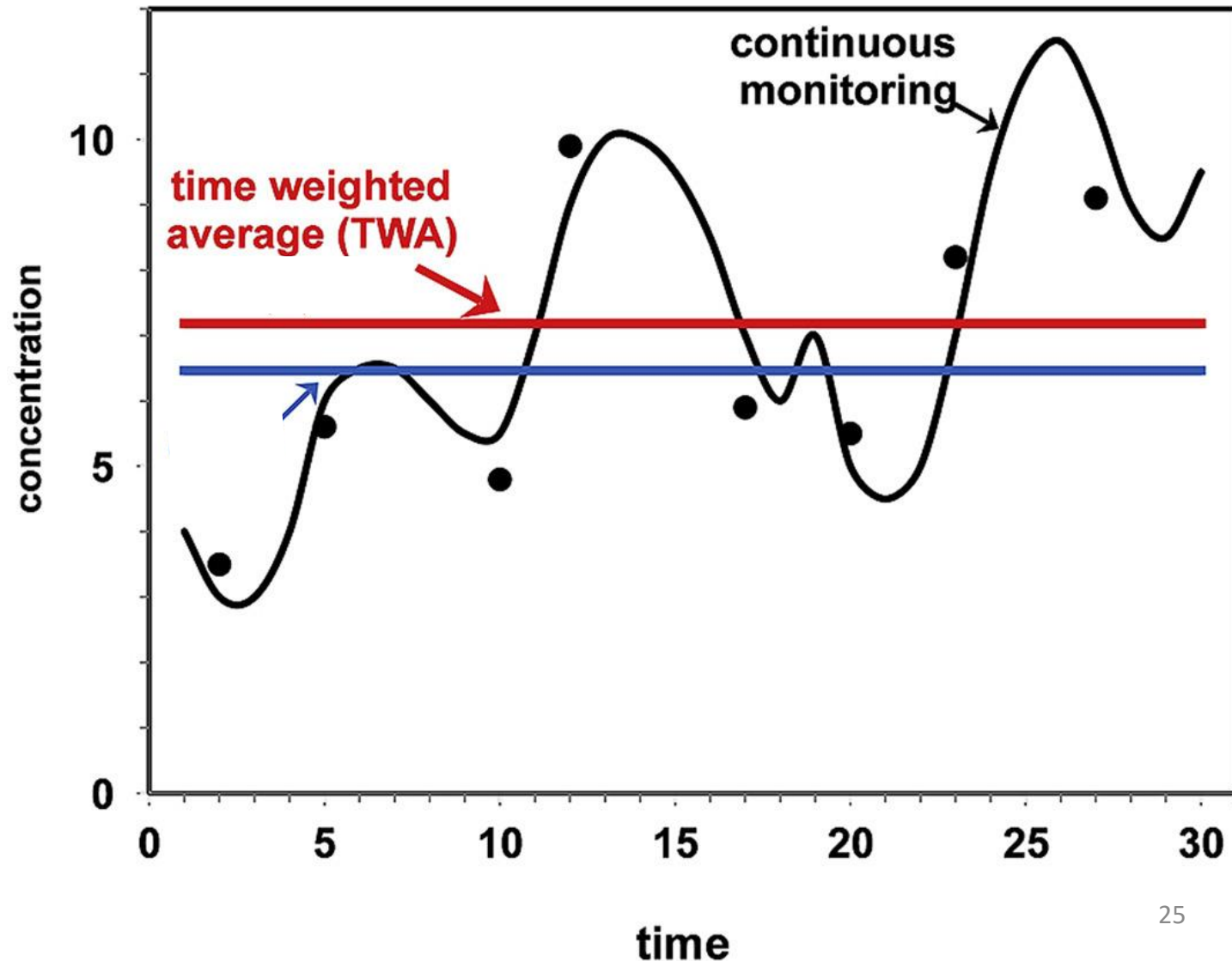
- Maximum concentration of air borne contaminants deemed to be acceptable, as defined by the authority having jurisdiction.

Threshold Limit Values (TLV)

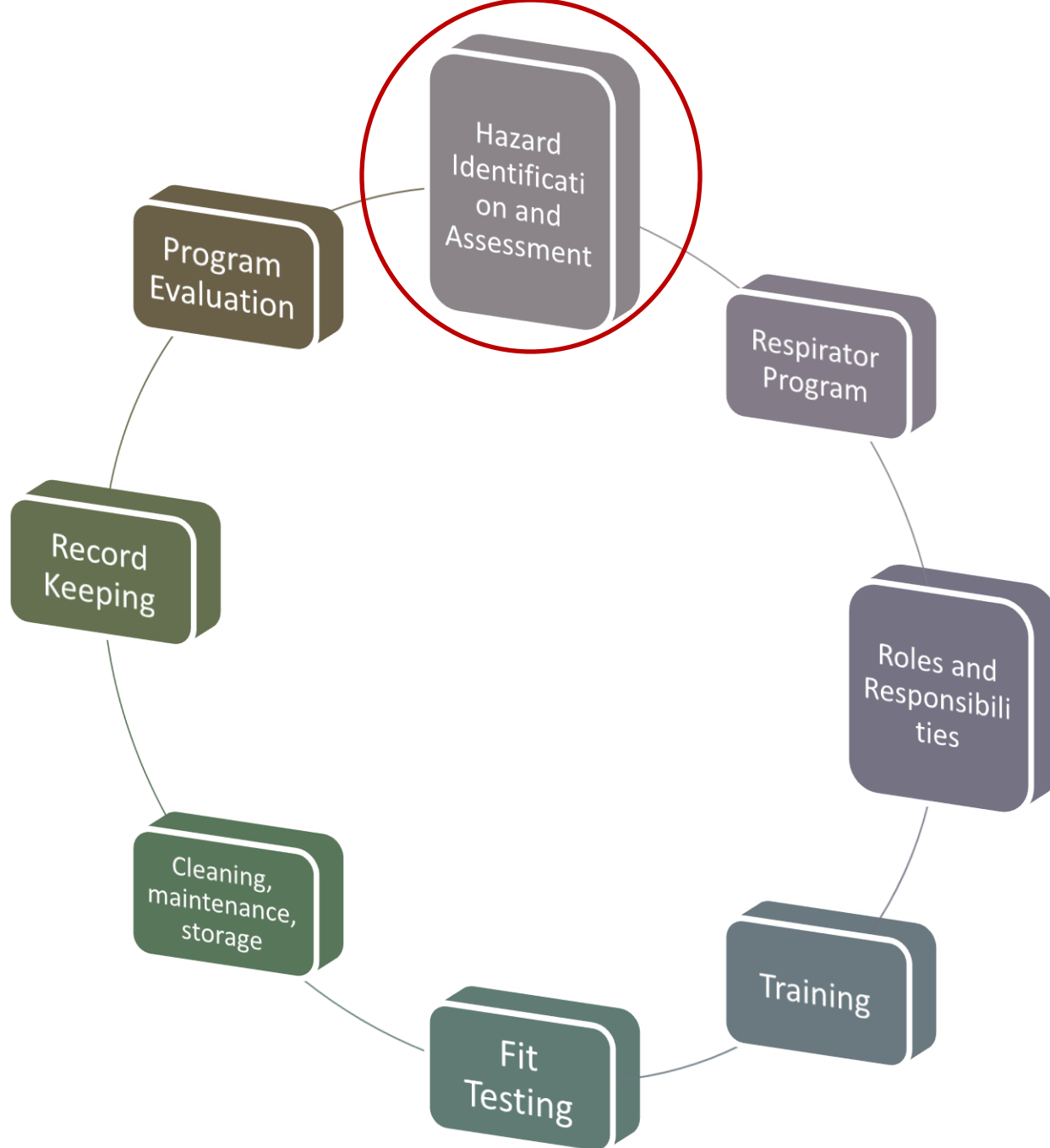
- Time Weighted Average (TWA 8 hours)
- STEL (15 minutes)
- Ceiling Limit

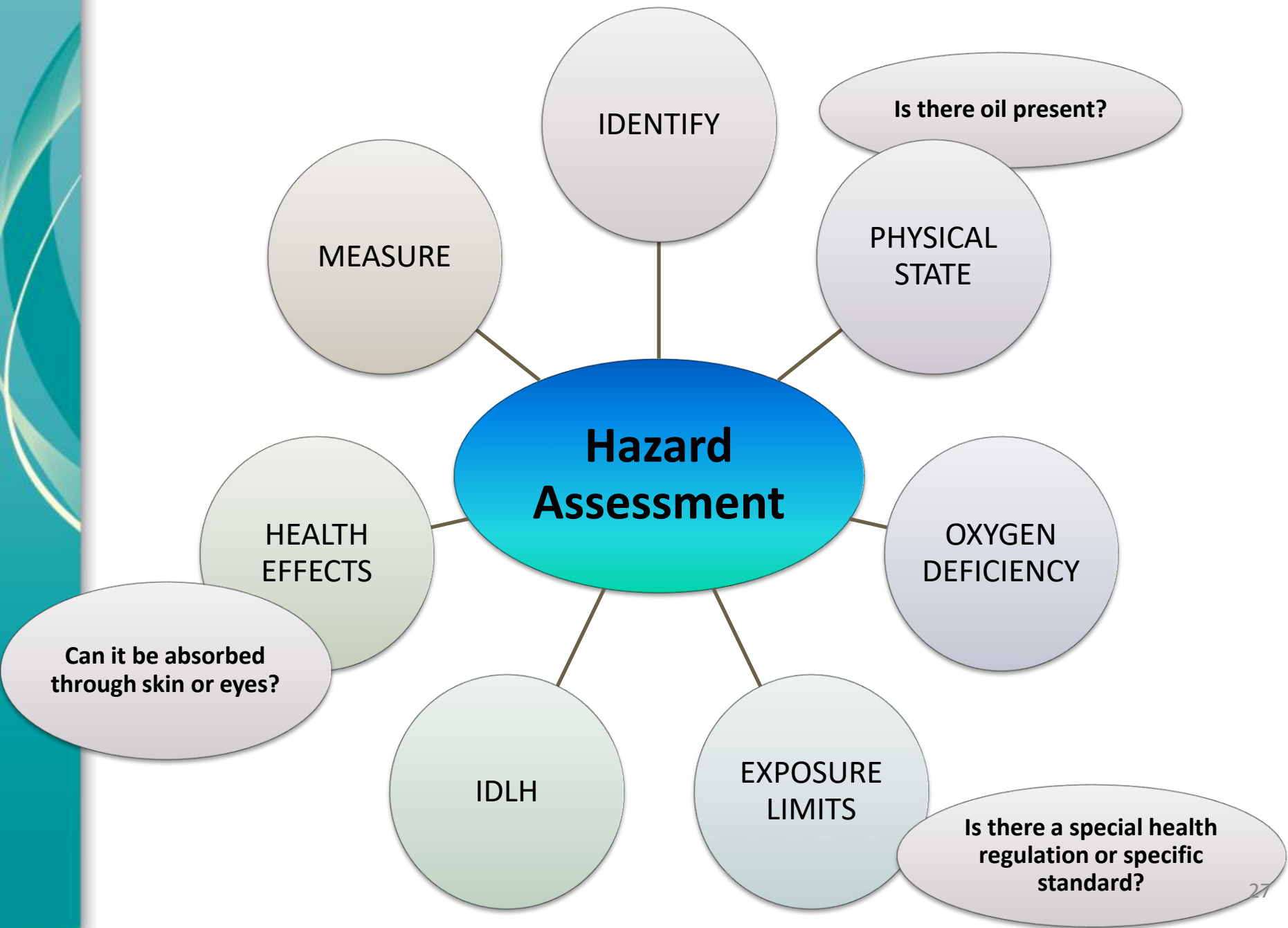


Threshold Limit Values



How much
is too
much?



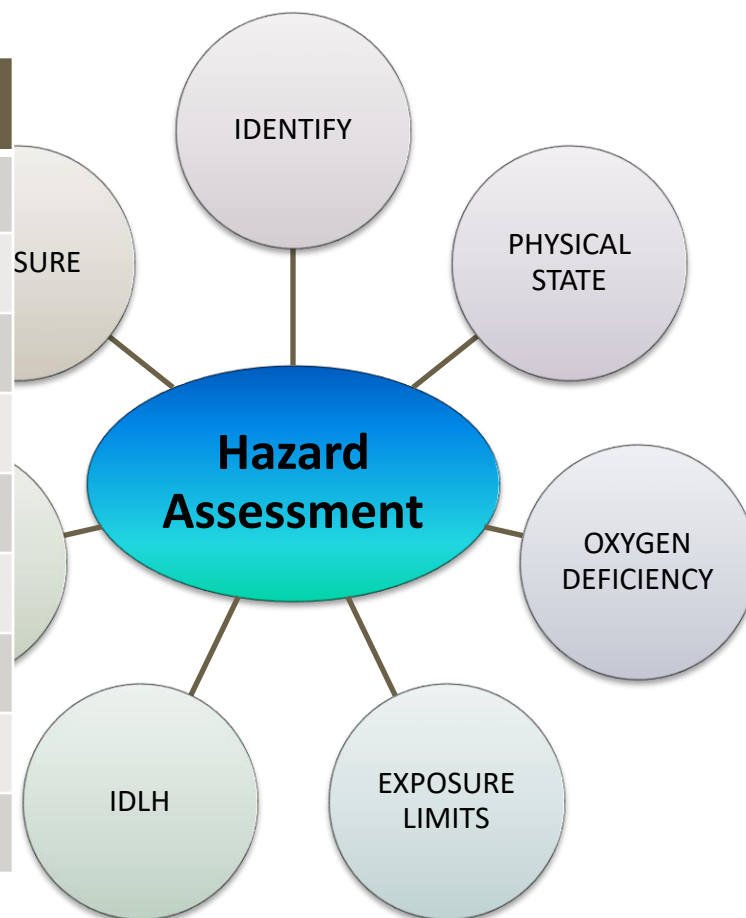


What information can you find in a SDS?



Element of Hazard Assessment

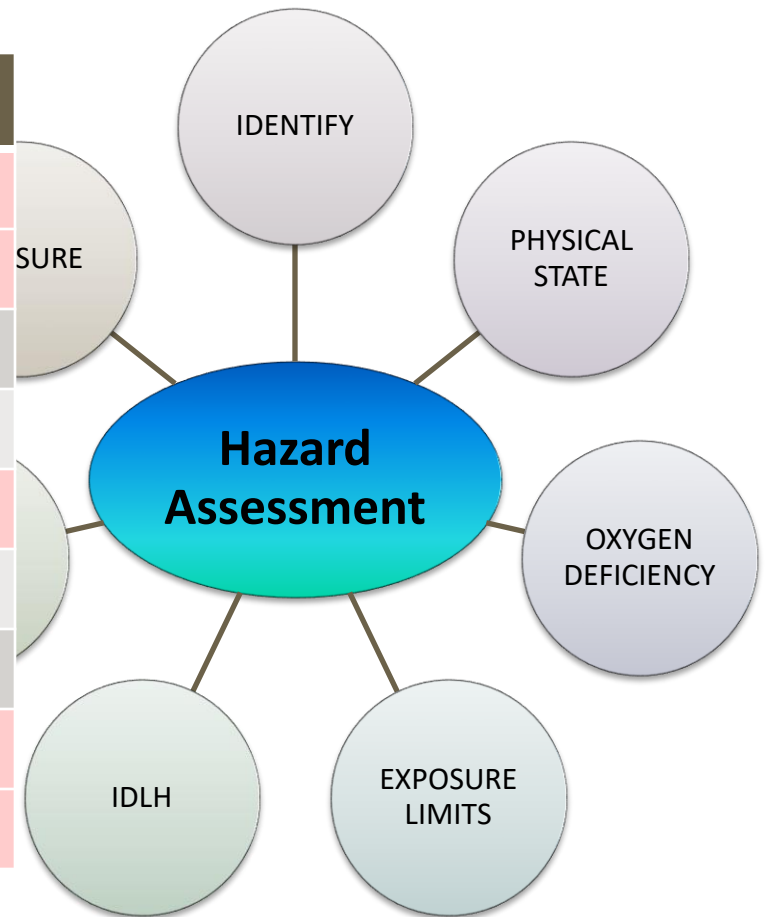
A	Identify the contaminant(s)
B	Identify physical state
C	Measure (estimate) concentrations
D	Determine oxygen deficiency
E	Exposure Limits
F	Determine if an IDLH
G	Health regulation or guideline?
H	Is oil present?
I	Health effects (including skin, eye)



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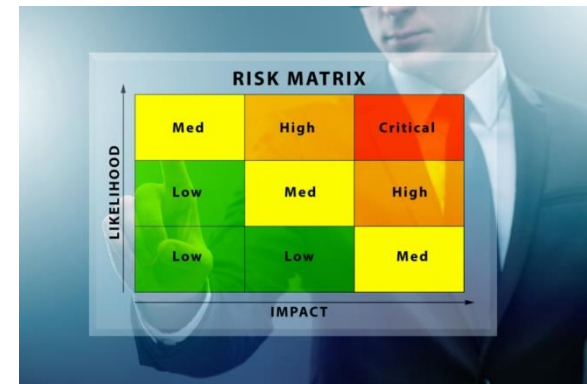
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H	Is oil present?
I	Health effects (including skin, eye)



Hazard Assessment

- Type of task (e.g., mixing liquid)
- How often the task will be performed.
- How long it takes to complete the task.
- The amount of product used.
- The hazard classification and the risk/hazard phrases.
- The volatility or dustiness of the chemical or product (e.g., how much of the product can enter the air).



Hazard Assessment

- Control Banding HSE UK tool:
<http://coshh-tool.hse.gov.uk/>
- CSA standard - Description of assessment for bioaerosols
<https://www.csagroup.org/store/standards-support-tools/>
- PEI Asbestos Legislation and Guideline
- BC Construction Safety Association – Silica Exposure Control Tool

Air Sampling

- Industrial hygiene sampling should happen when there is:
- Uncertainty about exposure
- A higher risk contaminant
- To verify engineering control
- **To verify appropriate respirator selection**

Air Sampling

Breathing zone



Air Sampling

Who

- Worker(s) exposed
- Similar groups

What

- Contaminant(s)

When

- During full shift
- Representative of all task(s)



Air Sampling



Where

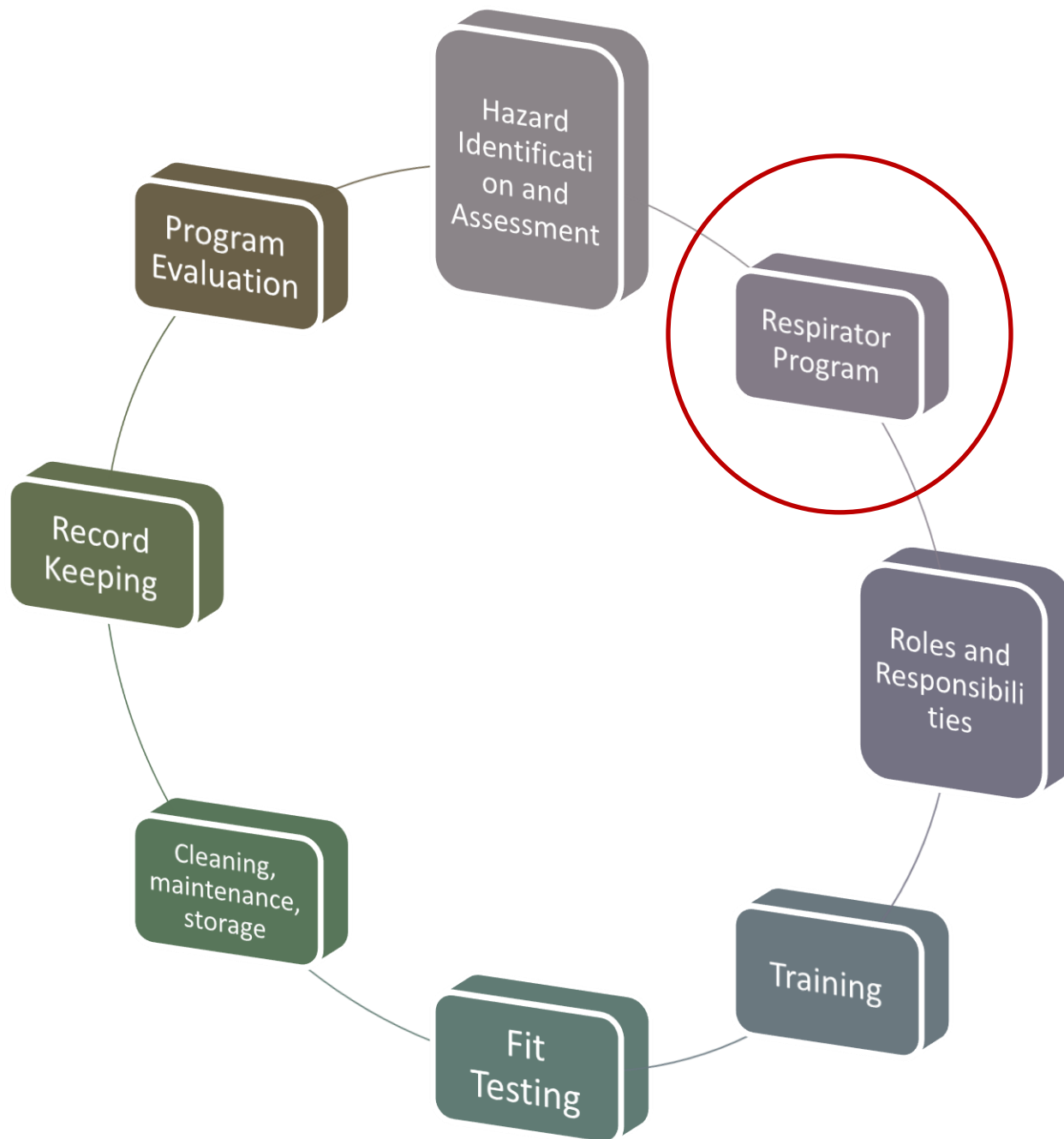
- Breathing Zone

How

- Competent person
- Sampling test method
- Accredited lab

Why

- Understand worker exposure
- Assess exposure to compare with Threshold Limit Value





Respirator Types

What are the two classes of respirator protection?

Respirator Types

Two Classes of Respirator Protection

Air Purifying

- Breathing air source

is from the work environment.

- Cleaned/filtered air from the work environment.

Atmosphere Supplying

- Breathing air source

is not from the work environment.

- Canister, cylinder, compressed breathing air system.

Respirator Examples

Disposable Particulate Respirators (P95 or N95)

- Filters 95% of particles 0.3 μm in diameter and greater.



Respirator Examples

Half-face

- With filter/cartridge, can remove particulates, gases, vapour.
- Assigned protection factor (APF):
 - APF 10
 - Concentration no more than 10 times the TLV



Respirator Examples

Full-face

- Same atmospheres as the half-face (filter/cartridge).
- Provides eye protection.
 - APF 50 (quantitative fit-test)
 - *APF 10 (qualitative fit-test)*



Respirator Examples

Power Air Purifying Respirator

- Same atmospheres as the half-face (filter/cartridge).
 - APF 25 to 1000 (depends on manufacturers test and face piece versus hood with shroud)



Respirator Examples

Supplied Air

- Separate breathing source from compressed breathable air system or canisters.
- Requires breathable air line.
- Governed by a different CSA Standard.
 - APF 1000
 - Not escape



Respirator Examples

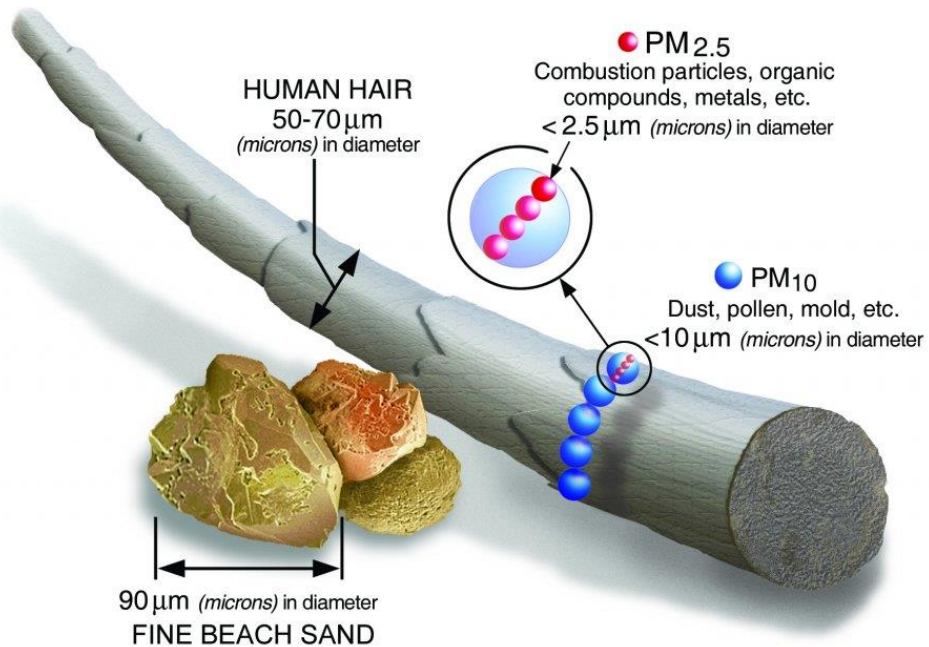
Self Contained Breathing Apparatus (SCBA)

- Cylinder or canister of breathable air.
 - APF 1000 to 10 000 (if in positive pressure mode)
 - Designed for escape
 - Can be used in IDLH environments

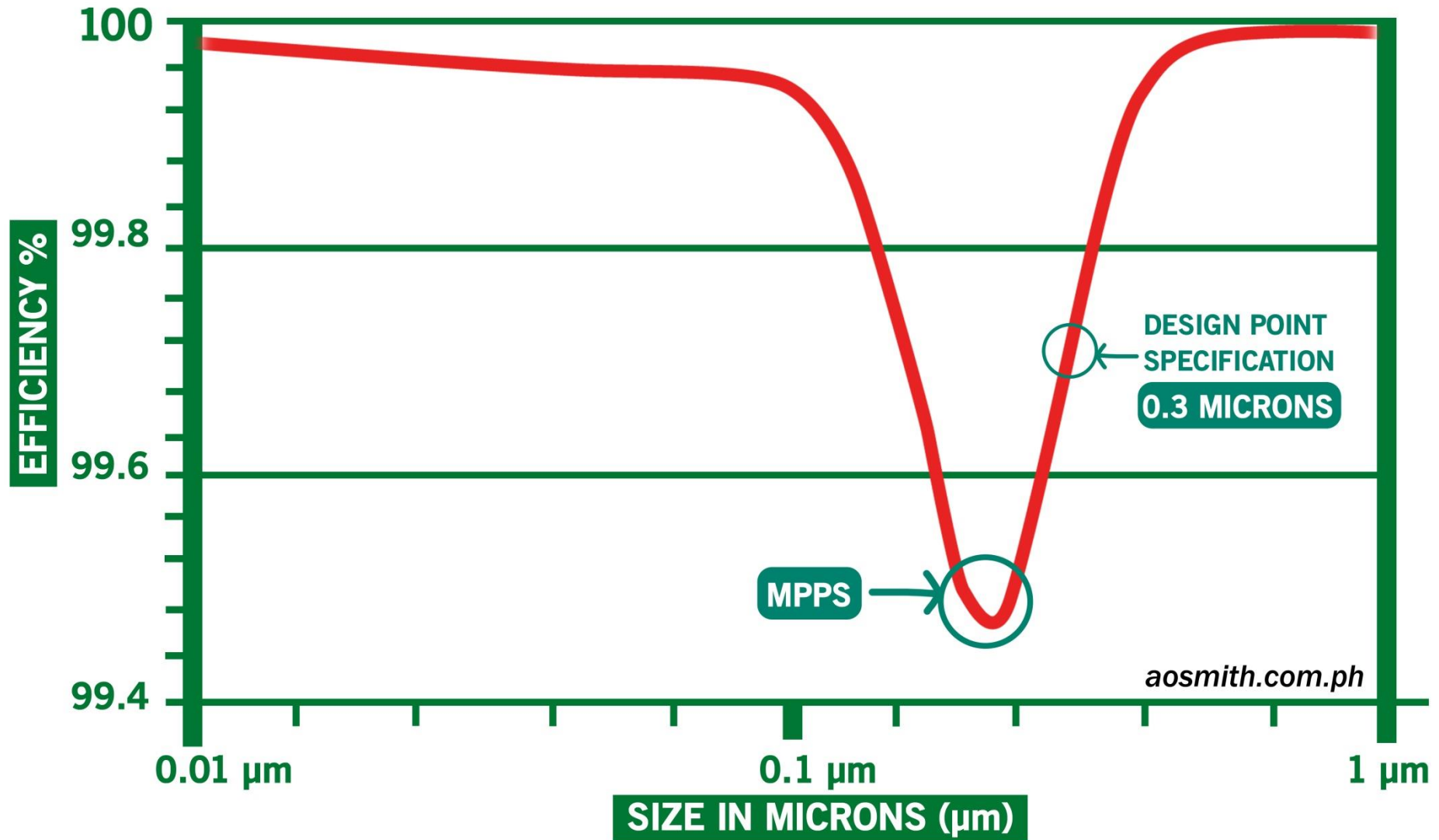


Filter Protection

Particulates



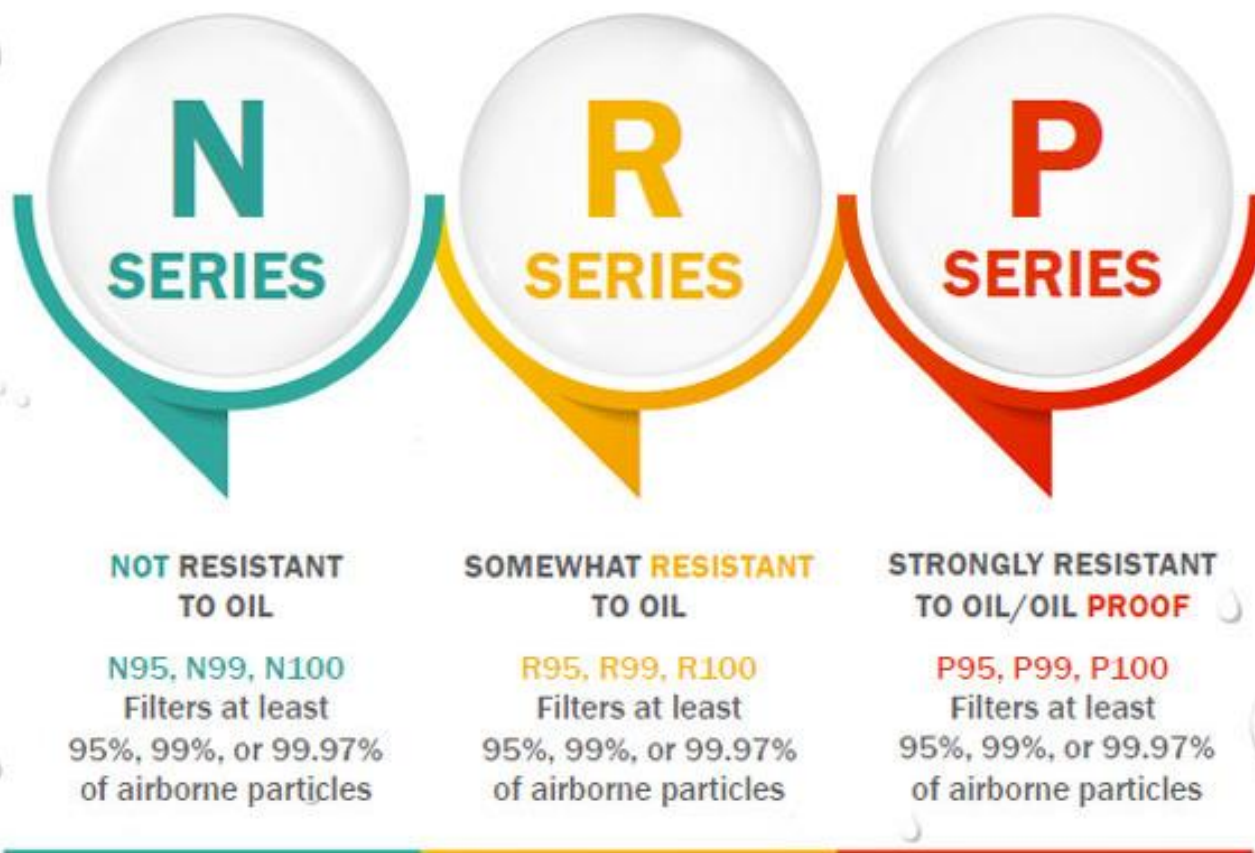
MOST PENETRATING PARTICLE SIZE (MPPS)



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NIOSH RESPIRATOR FILTER CLASSES

NIOSH classifies the filtering media in respirators based on its resistance to oil and its particle filtering efficiency. The resistance to oil is designated as "N", "R", or "P". Particle filtering efficiency is designated "95", "99", or "99.97".



OILS

When products containing oil (like fuel, lubricating or hydraulic oils, solvents, paints, and pesticides) are sprayed or used in processes producing aerosols or droplets, the oil component may become airborne.

Cartridge Protection

Examples of Gases

A gas is a state of matter with no fixed volume or shape.



Air



Helium



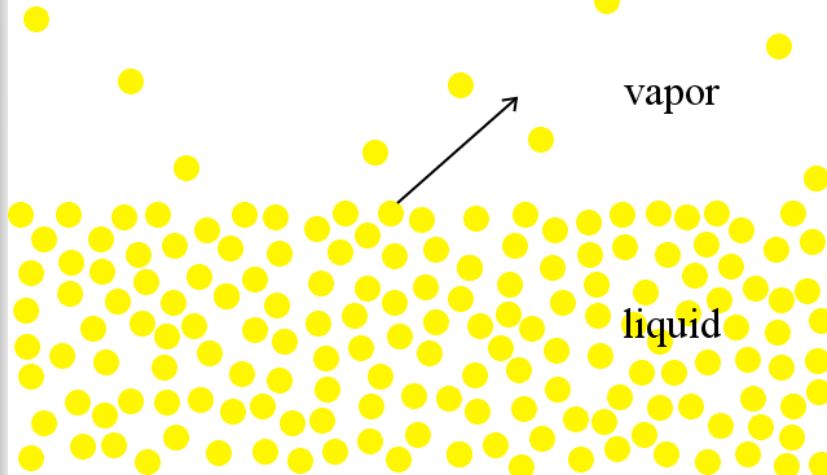
Ozone



Carbon Dioxide

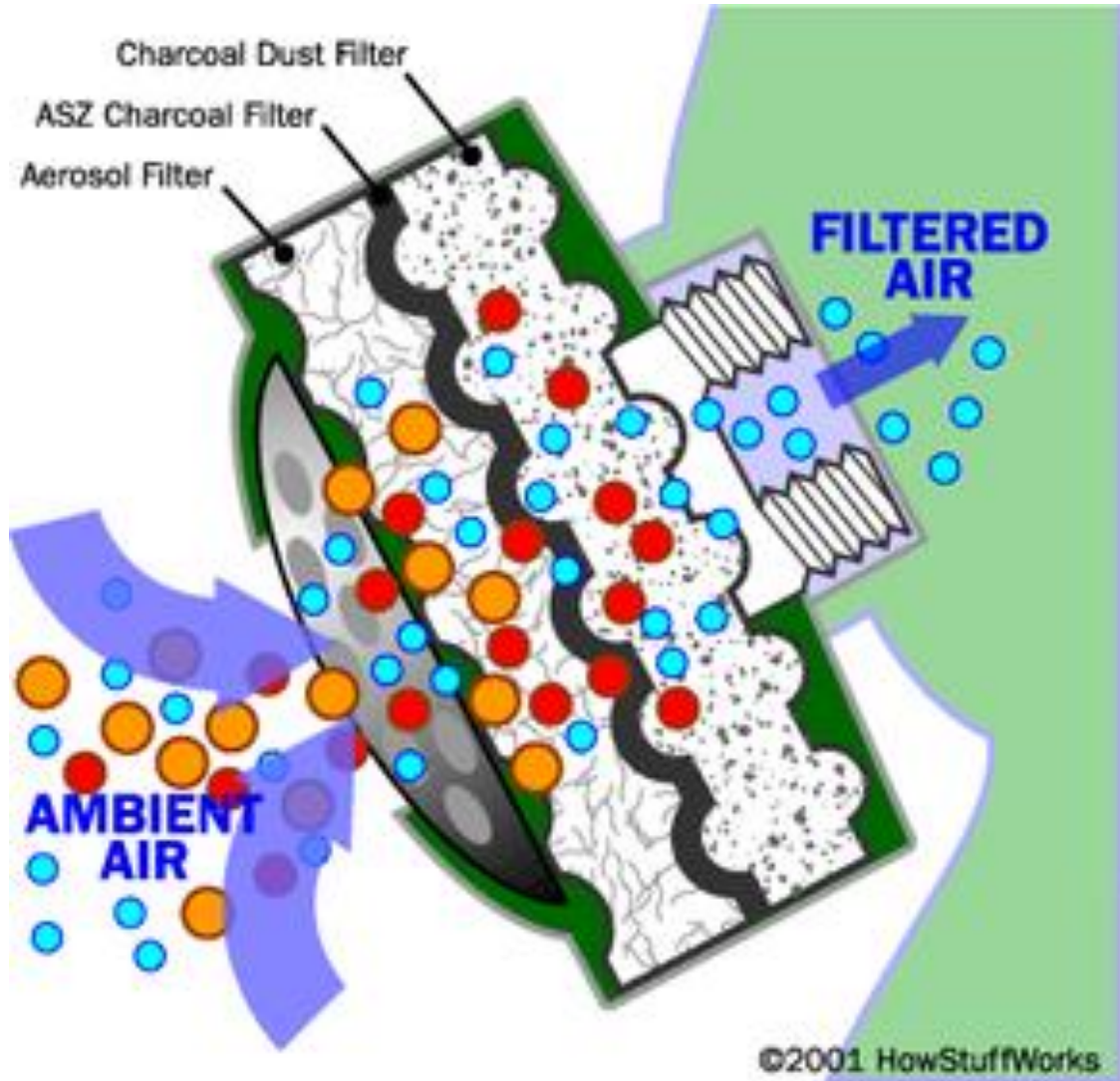


Water Vapor



Cartridge Protection

Gas / Vapour



Color Coding for 3M™ Chemical Cartridges

6001	Organic Vapor	Black	
6002	Acid Gases	White	
6003	Organic Vapor/Acid Gases	Yellow	
6004	Ammonia/Methylamine	Green	
6005	Formaldehyde/Organic Vapor	Olive/Black	
6006	Multi-Gas/Vapor	Olive	
6009	Mercury Vapor/Chlorine Gas	Orange	

Limitations of Air Purifying Respirators

- Not for use in atmospheres <19.5% oxygen
- Not for use in IDLH conditions
- Not for use when concentrations exceed APF x OEL
- Not for use with facial hair



IDLH – Immediately Dangerous to Life and Health Atmosphere

- An IDLH atmosphere shall be assumed in any of the following situations:
 - Structural fire fighting
 - Untested confined space
 - Known hazardous contaminant above IDLH
 - Reduced O₂
 - Qualified person opinion that the conditions presents IDLH atmosphere



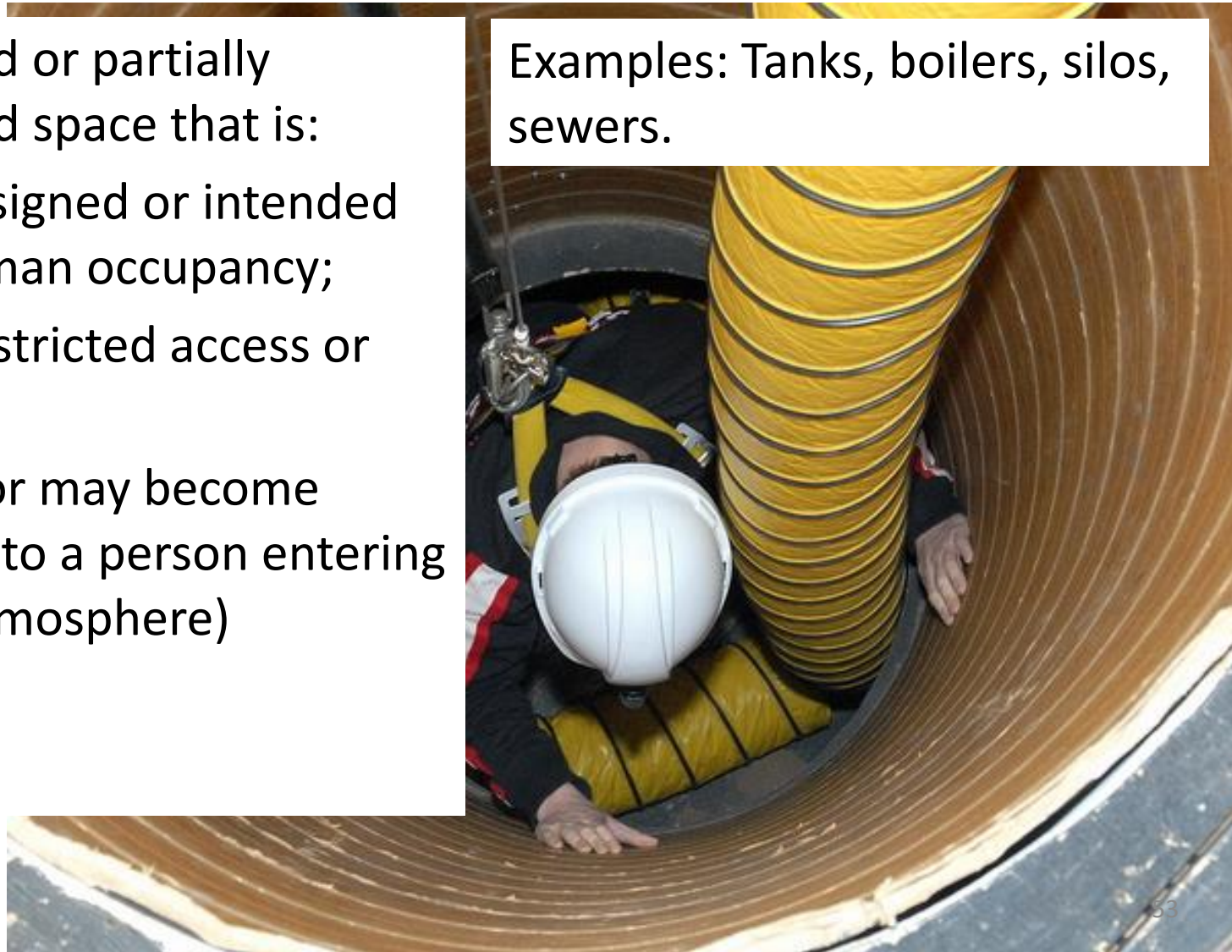
An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects or would impair an individual's ability to escape.



Confined Space

- Enclosed or partially enclosed space that is:
 - (a) not designed or intended for human occupancy;
 - (b) with restricted access or exit;
 - (c) that is or may become hazardous to a person entering (design, atmosphere)

Examples: Tanks, boilers, silos, sewers.



Acceptable level						Air-purifying options	APF	Atmosphere-supplying options
0	1	2	3	4	5			
					5	No air-purifying option available	10000	SCBA (pressure-demand) full-facepiece SCBA (pressure-demand) tight-fitting hood Multi-functional SCBA/airline
					4 to 5	Powered air-purifying full-facepiece Powered air-purifying helmet/hood with SWPF study	1000	Airline (continuous-flow) full-facepiece Airline (pressure-demand) full-facepiece Airline (continuous-flow) helmet/hood with SWPF study
					3 to 5	Powered air-purifying half-facepiece Air-purifying (negative-pressure) full-facepiece	50	Airline (pressure-demand) half-facepiece Airline (continuous-flow) half-facepiece
					2 to 5	Powered air-purifying loose-fitting facepiece/visor Powered air-purifying helmet/hood without SWPF study	25	Airline (continuous-flow) loose-fitting facepiece/visor Airline (continuous-flow) helmet/hood without SWPF study
					1 to 5	Air-purifying (negative-pressure) half-facepiece (including filtering facepieces)	10	No atmosphere-supplying option available
					No respiratory protection required			

Hazard Ratio

Hazard Ratio

- The estimated/measured airborne concentration of a substance divided by the occupational exposure limit.
- This ratio is calculated for each gas, vapour, and/or particulate component that poses a respiratory hazard.

Hazard Ratio

=

Airborne Concentration

÷

Occupational Exposure Limit

Grinding Concrete with grinding tool (4 to 8 hrs)



**NO Engineering
Control**

2.173 mg/m^3

**Hazard Ratio
Example**

2.173 mg/m^3

÷

0.025 mg/m^3

= 86.92

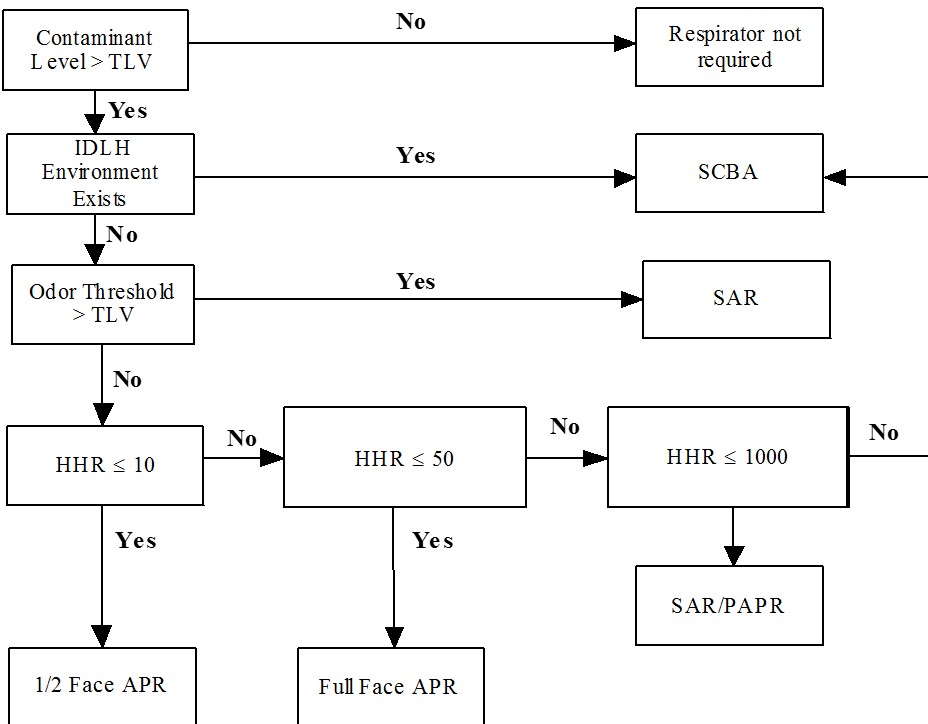
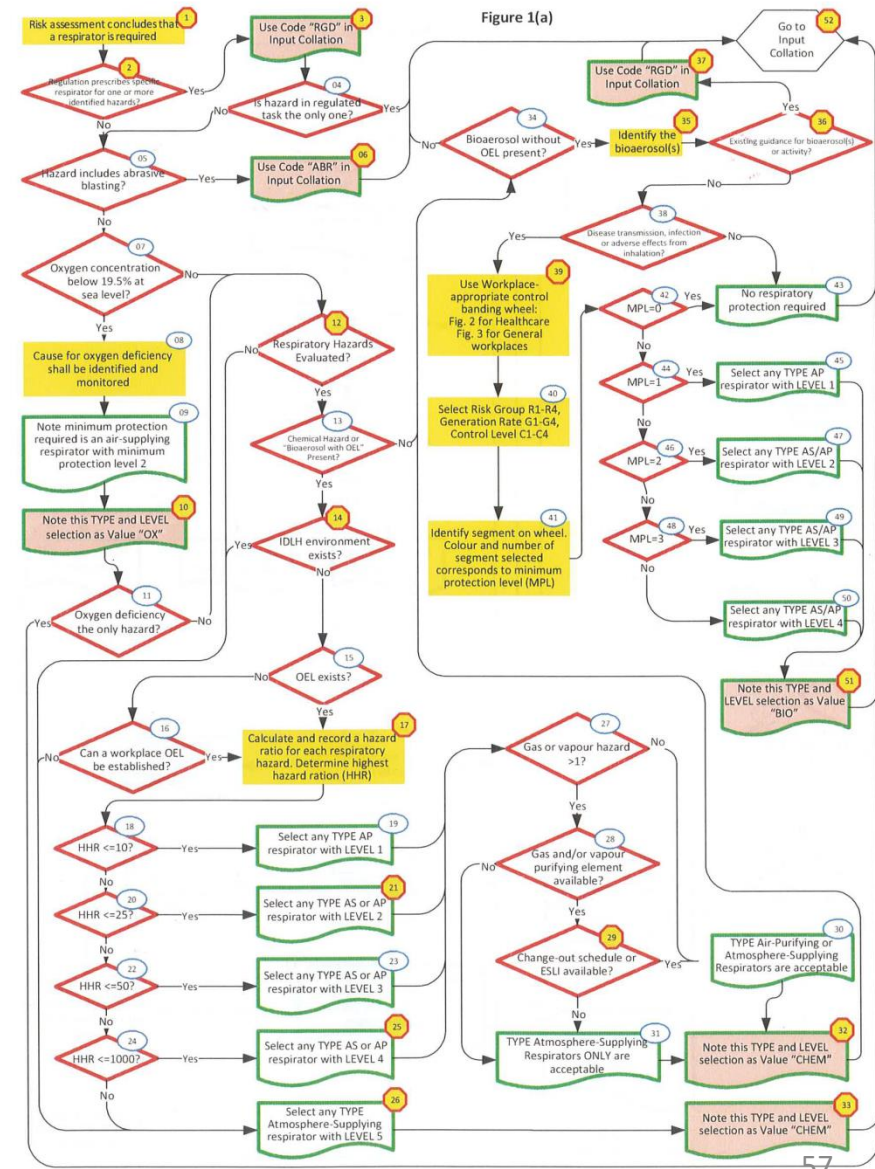
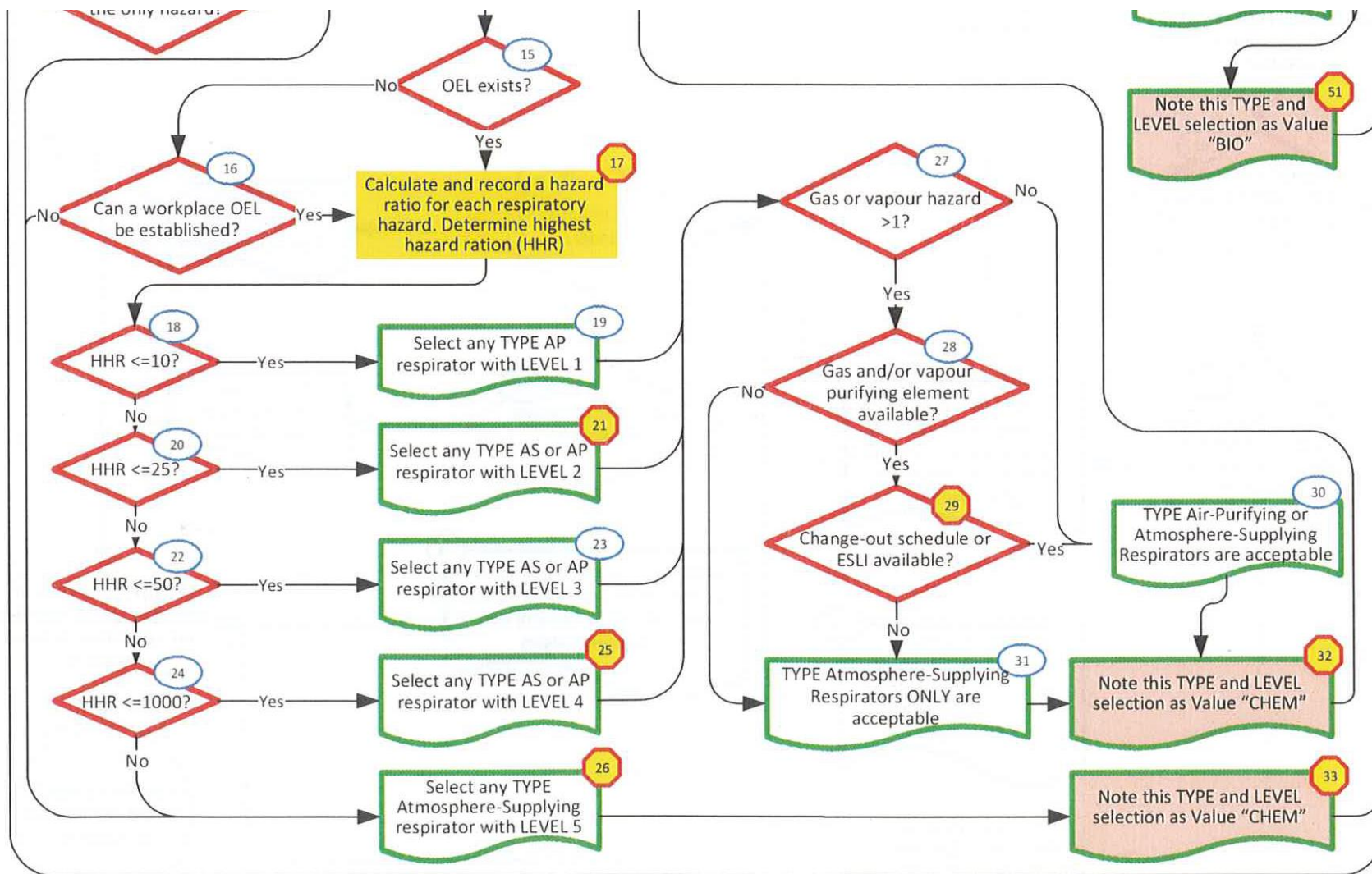


Figure 1. RESPIRATOR SELECTION LOGIC TREE
 HR = Hazard Ratio; HHR = Highest Hazard Ratio

Figure 1
Respirator selection flow chart
 (See Clauses 7.3.2, 7.3.3, 7.3.4.2, 7.3.5.1, 7.3.5.5, 7.3.5.7, and 8.1.2 and Table 1.)





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Grinding Concrete with grinding tool (4 to 8 hrs)



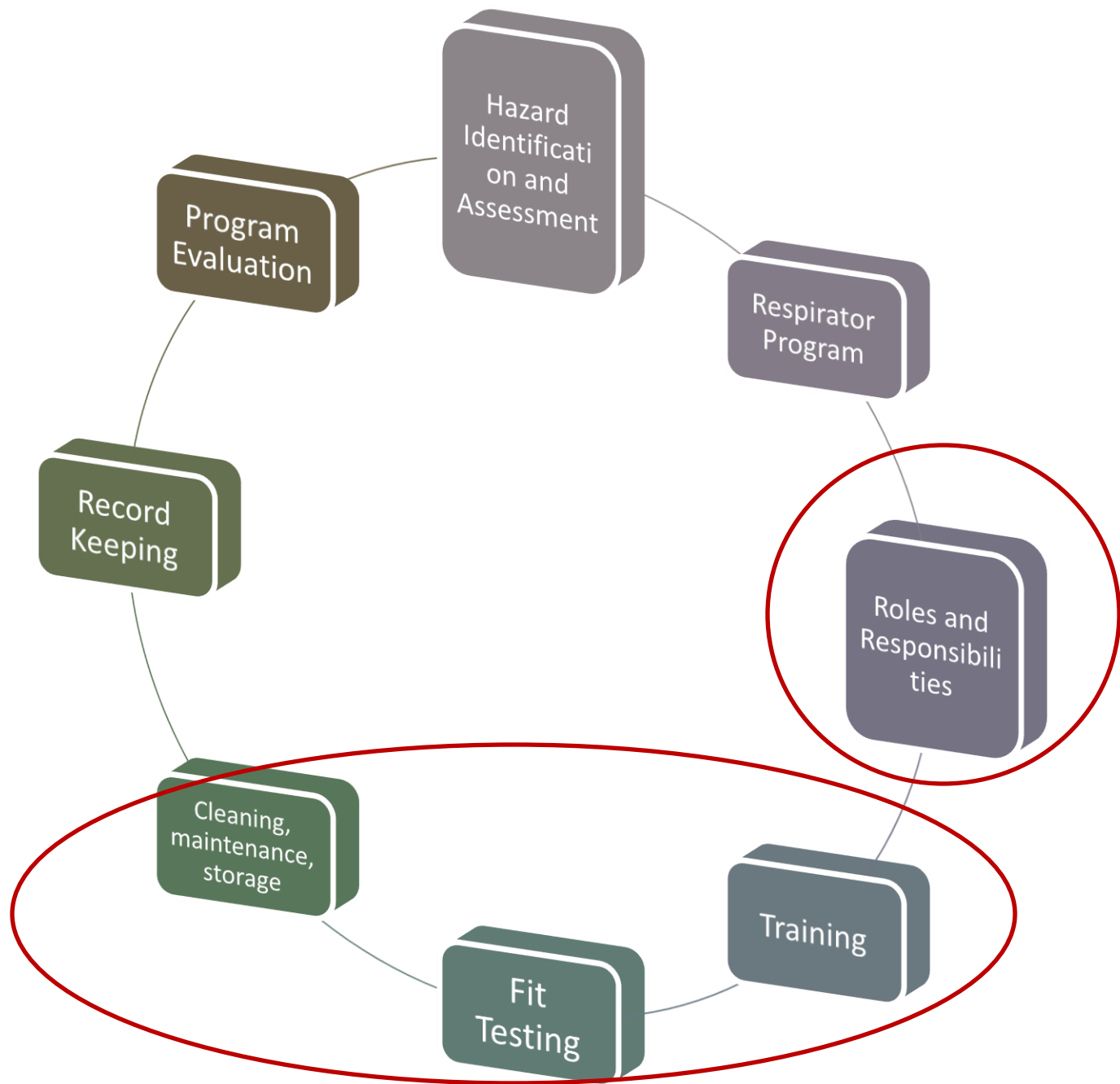
NO Engineering Control

2.173 mg/m³

HR 86.92 or 8692%

Full Face PAPR
N100/P100 with a
protection factor **greater
than 50.**

Loose-fitting PAPR not
adequate (APF of 25).



Roles & Responsibilities

Employer Program Administrator

**Respirator
User**

Supervisor

**Person
Selecting
Respirator**

Fit Tester

Issuer

**Respirator
Maintenance
Personnel**

**Health
Professional**

Respirator User Screening

Respirator User Screening Form (Annex E of CSA)

Questions:

- a) Do you have or do you experience any condition(s) that could affect respirator use?
- b) Have you had difficulty while using a respirator?
- c) Do you have any concerns about your future ability to use a respirator safely?
- d) Have you ever had a severe adverse health reaction or condition while undergoing a fit-test?



Respirator User Screening

Respirator User Screening Form (Annex E of CSA)

A “YES” answer to a), b), c), or d) indicates further assessment by a health care professional is required prior to respirator use.

- **Health Care Professional Assessment**





Respirator Fit Tests

Quantitative









Qualitative



Respirator Fit Test

- Shall be carried out
 - After user screening
 - After of during training
 - Prior to initial use
 - Change to user's physical condition
 - Change to make model size
 - Continued discomfort
 - At least every 2 year



<p>E. Soul patch that will interfere with the respirator seal in the chin area on elastomeric facepieces</p> <p>Facial hair and sideburns that will interfere with the sealing surface</p>	
<p>F. This facial "shadow" (not clean-shaven) will interfere with the sealing surface of a half or full facepiece. It will also compromise a secondary seal inside a tight-fitting hood-style respirator.</p> <p>Degradation of fit can occur during cumulative work hours when an individual grows this amount of facial hair.</p>	
<p>G. Moustache is too thick and too long (down around edge of mouth); <u>will contact</u> a sealing surface and interfere with exhalation valve.</p> <p>Sideburns and/or heavy hair under the chin will prevent a good seal.</p>	
<p>H. Moustache is too thick and too long (down around edge of mouth); <u>will contact</u> a sealing surface and could get stuck in an exhalation valve.</p> <p>The hair on the rest of the face will interfere with a sealing surface.</p>	
<p>I. Hair is in sealing region and under the chin.</p> <p>Hair is in chin cup sealing region and on the side of the face.</p>	
<p>J. Moustache is too thick and too long; will contact a sealing surface and interfere with <u>exhalation</u> valve.</p>	

A. Clean-shaven, ideal for a good seal



B. Amount of facial hair that will typically allow a good seal



C. Moustache that does not interfere with the sealing surface, valves, or respirator function



D. Soul patch that does not interfere with the sealing surface, valves, or respirator function



Training in the Care & Practical Use

- Instruction and practice
- Donning, doffing
- User seal checks
- End of service
- Change out
- Replacement
- Identification of problems
- Maintenance
- As per manufacturers instructions
- <https://www.youtube.com/watch?v=DzIDhYGnDIM&t=2s>

Change-Out Schedule

R Series - every shift

P Series

- According to manufacturer
- 3M recommends 30 days of 40 hours use, whichever comes first



N Series

- Physically damaged
- Unhygienic
- Increased breathing resistance
- Employer's change out schedule

PAPR

- Air flow check

Change-Out Schedule



Service Life Calculator

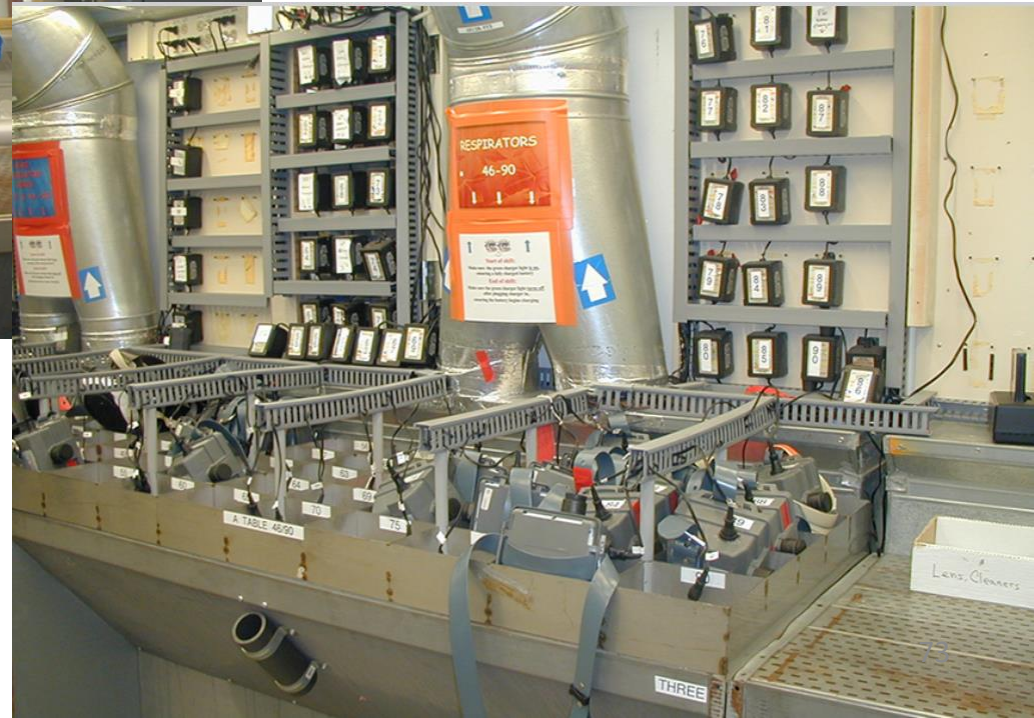
<https://sls.3m.com/login?en-ca>

Cleaning & Sanitizing

- <https://www.youtube.com/watch?v=ScvkveNQqMc>



Cleaning & Sanitizing





Safety Matters@Work

Workers Compensation Board of PEI