Overview of Occupational Hygiene in Practice

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2007-2008 Sydney Adventist Hospital, Exercise Physiologist

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What is Occupational Hygiene?

- 'The discipline of **anticipation**, **recognition**, **Evaluation, Communication** and **Control** health hazards in, or arising from the workplace with the objective of protecting the wel-being of workers and members of the community.'

Source: AIOH

Health Hazards

Chemical agents	Gases, vapours, solids, fibres, liquids, dusts, mists, fumes, etc.
Physical agents	Noise and vibration Heat and cold Electromagnetic fields, lighting etc.
Biological agents	Bacteria, fungi, etc.
Ergonomic factors	Lifting, stretching, and repetitive motion
Psychosocial factors	Stress, workload and work organisation

Source: AIOH

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ANTICIPATION – this involves identifying potential hazards that may result from work processes, operations and equipment.

RECOGNITION - involves understaning the potential hazard that a chemical, physical or biological agent - or an adverse ergonomic situation - poses to health.

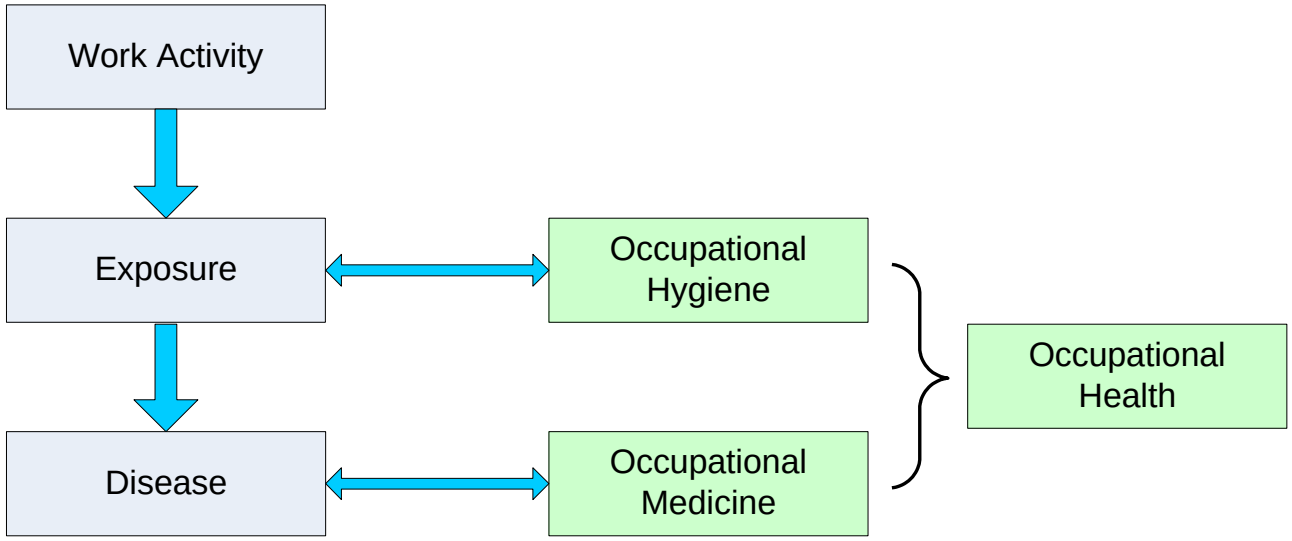
What is Occupational Hygiene?

- **EVALUATION** of the extent of exposure to the chemical hazards, physical or biological agents (or adverse ergonomic situation) in the workplace, with a view to eliminating exposures, or reducing them to acceptable levels.

What is Occupational Hygiene?

- **CONTROL** design, recommend for adoption, and evaluate the effectiveness of control strategies - by procedural, engineering or other means where the evaluation indicates that this is necessary.

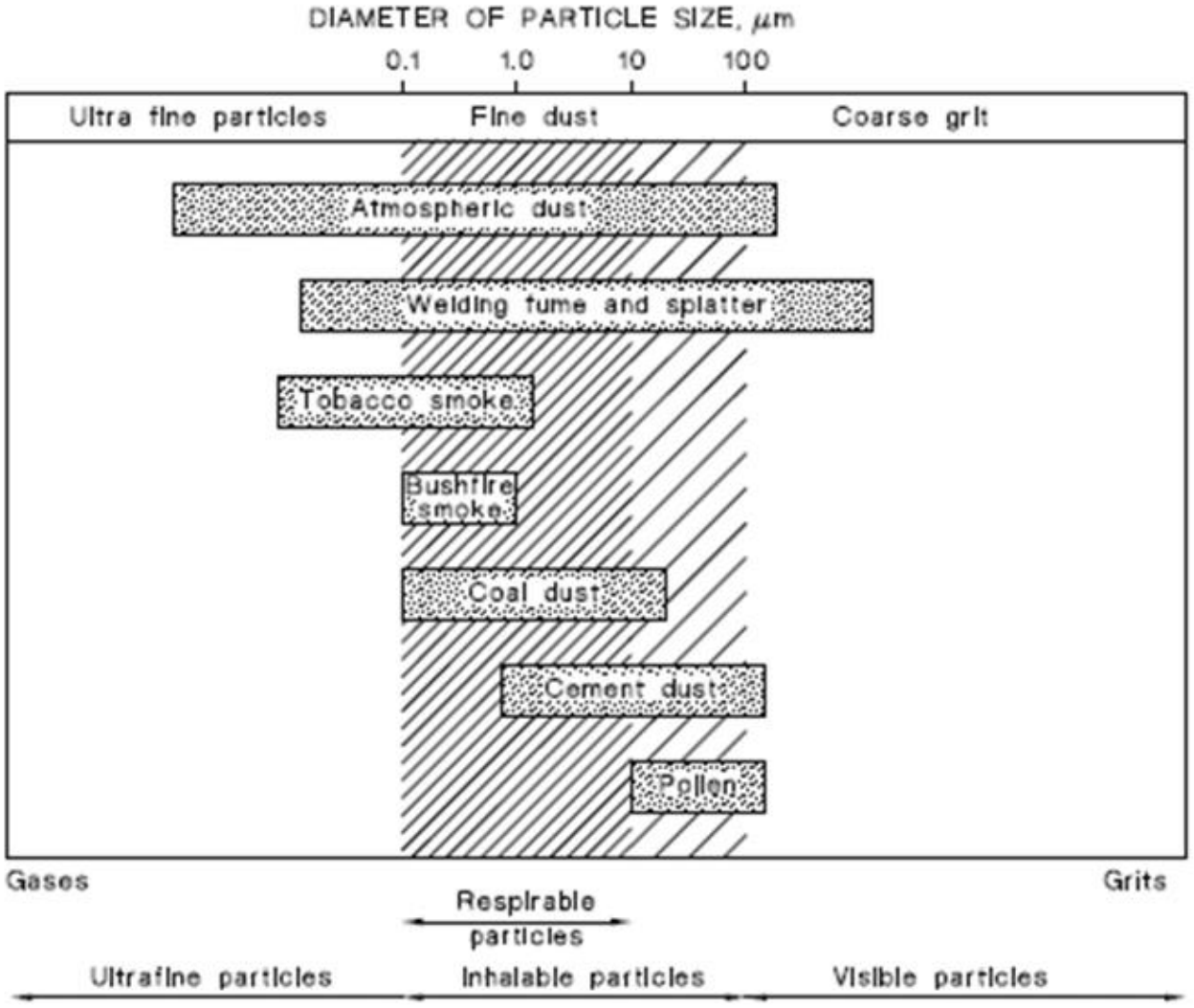
Occupational Health



Source: OH Learning

Chemical Hazards

Particle Size



Source: AS 1715

Physical States

- **Vapour –** gaseous materials generated from the evaporation of substances that are liquids or solids at room temperature.
- **Mist** - liquid particles, large size generally produced by bubbling, splashing or boiling of a liquid.
- **Fume –** Vaporised metal that contains particles smaller than <1 micron (µm) diameter.
- **Dust -** particles of solid material in the broad size range of 1 micron to 1 millimetre diameter. Anything of a larger particle size is considered to be grit and will be too heavy to remain airborne.
- **Nanoparticle** – Very small particles, smaller than 0.1 micron (µm) in diameter or 100 nanometres (a 1000^{th} part of a micrometre)
- **Fibre** – Solid particulate which are longer than they are wide by a ratio of 3:1.

Types of Sampling

- Grab
- Short term
- Long term
- Continuous

Dust

- **Total inhalable dust** is the fraction of airborne material which enters the nose and mouth during breathing and is therefore liable to deposition anywhere in the respiratory tract. The particle sizes of total inhalable dust are up to 100 microns.
- **Respirable dust** is that fraction that penetrates to the deep lung where gas exchange takes place. The particle sizes of respirable dust are up to 10 microns.

Sampling Head / Size Seperator

IOM Head
Total Inhalable Dust

Cyclone
Respirable Dust

Source: SKC

Respirable Asbestos Fibre Sampling

Source: Capitol Scientific

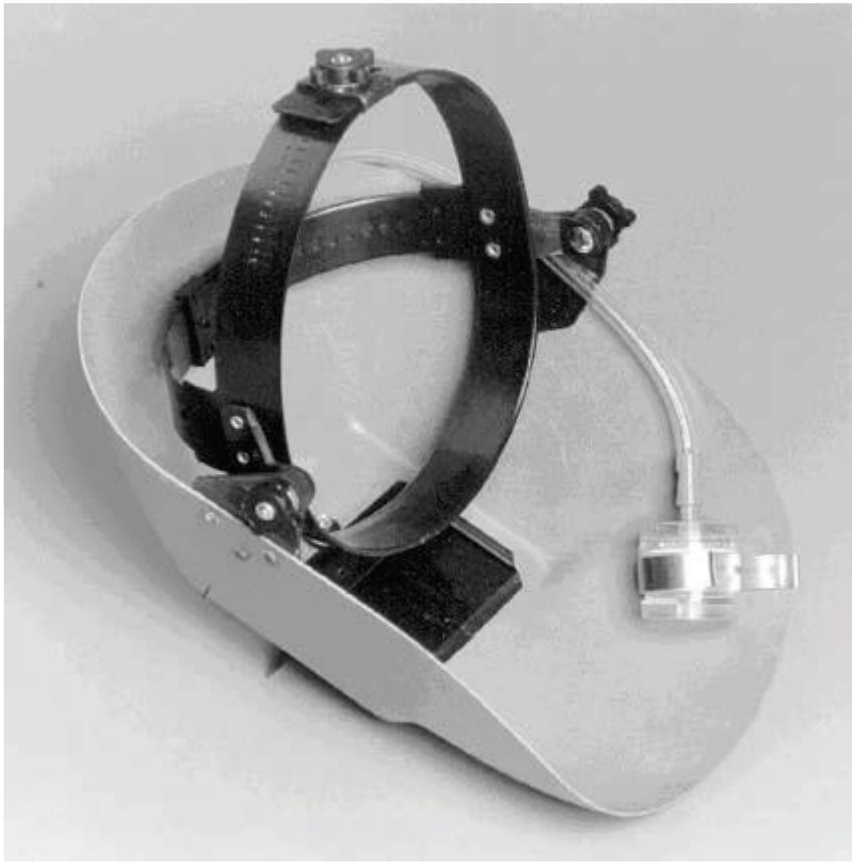
Source: NIOSH

Real Time Dust Monitor

SKC Real Time Dust Monitor: data-logging, light-scattering laser photometer that gives you real-time aerosol mass readings

Source: TSI

Welding Fume



Welder's face shield with a sampler attached by means of a removable clip

Source: AS 3853.1

Sampling for Gases and Vapours

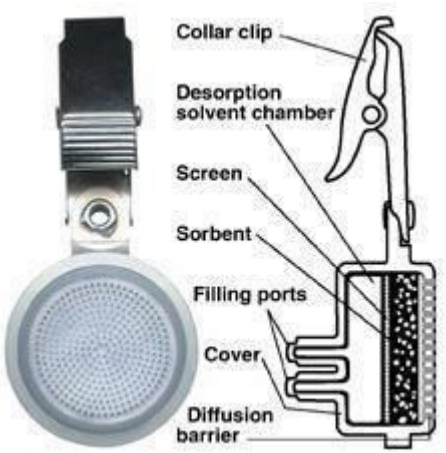
- Active Sampling - i.e. by means of a mechanic/sampling pump method.
  - Sorbent Tubes
- Passive Sampling

Sorbent Tubes

Source: SKC

Passive Samplers

Source: 3M



Source: SKC

Colorimetric Tubes

Source: Drager

Containers

Source: SKC

Direct Reading Instruments

- Direct reading, simple, lightweight. Can be used to measure a range of gases and vapours.

Source: SKC

Monitoring Strategies

- Most sampling done to assess personal exposure, but also done to:
  - Identification of airborne contaminants
  - Identify leaks and spillages
  - Assessment of the Effectiveness of Control Measures

Monitoring Strategies

- Whenever possible personal monitoring should be carried out, in the breathing zone of the worker.
- Fixed Position Samples useful to
  - Provide information about contamination from fixed sources
  - Assess effectiveness of control measures e.g. local exhaust ventilation.
- **Fixed position samples cannot be used to establish personal exposures or be compared to hygiene standards.**

Sampling Methods

- Validated methods of sampling and analysis should be used e.g. HSE, NIOSH
- National Standards may specify particular methods.

- E.g. http://www.skcinc.com/catalog/osha-niosh.php

Methods of Analysis

- Organic Vapours - gas chromatograph (GC) complete with a flame ionisation detection (FID).
- Oil Mists – Gravimetric, Fluorescent Spectroscopy
- Pharmaceuticals - high pressure liquid chromatography (HPLC)
- Metals/ Fume– ICP, Atomic Absorption Spectroscopy (AAS).
- Mineral Dusts/ Fibres – Microscopy, gravimetric, x-ray diffraction, Infrared

Dermal

Source: 3M

Source: SKC

Biological Hazards

Monitoring Bio-aerosols

- **Risk Group 1** –Unlikely to cause human diseases
- **Risk Group 2** –Unlikely to be a significant risk to laboratory worker, the community or the environment.
- **Risk Group 3** –Usually causes serious human disease and may present a significant risk to laboratory workers.
- **Risk Group 4** –Usually produces life threatening human disease, represents a significant risk to laboratory workers

Monitoring Bio-aerosols

- Assess viable or culturable total microorganism load
- No consensus on permissible exposure levels
- Concentrations above 100 CFU m-3 may be unhealthy for immunosuppressed

Monitoring Bio-aerosols

Air-O-Cell Mould Sampling Cassettes

Bio Tape Surface Samplers

Source: Mould Lab

Physical Hazards

Noise

Table 1 Equivalent Noise Exposures $L_{Aeq,8h}$ = 85 dB(A)	
Noise Level dB(A)	Exposure Time
80	16 hours[1]
82	12hours[1]
85	8 hours
88	4 hours
91	2 hours
94	1 hour
97	30 minutes
100	15 minutes
103	7.5 minutes
106	3.8 minutes
109	1.9 minutes
112	57 seconds
115	28.8 seconds
118	14.4 seconds
121	7.2 seconds
124	3.6 seconds
127	1.8 seconds
130	0.9 seconds

Source:Managing noise and preventing Hearing loss at work Code of practice (Safe Work Australia)

Assessment of Workplace Noise

Source: B&K Noise Meter

Source: Casella Noise Dosimeter

Source: Wikmedia Commons

Vibration

Whole Body Vibbration

Hand Arm Vibration

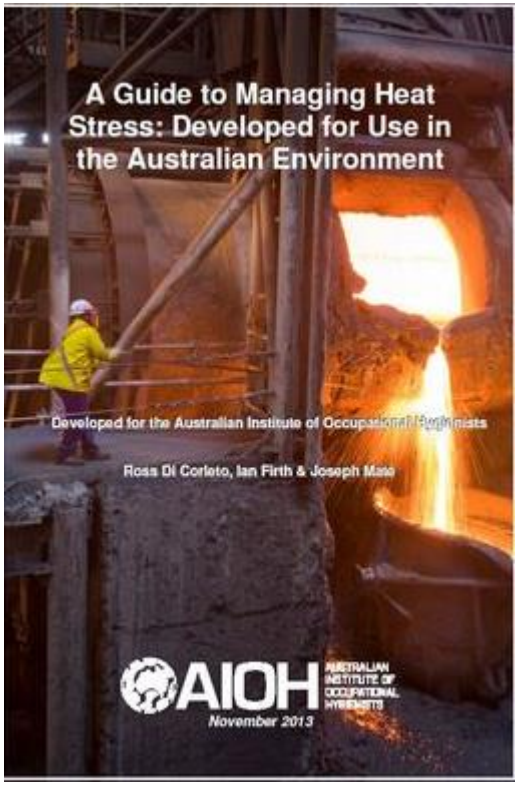
Source: Safe Environments

EU 2002/44/EC Physical Agents (Vibration) Directive

- Hand-Arm Vibration
  - Exposure Action Value: If daily vibration exposure is likely to exceed an A(8) of 2.5 m/s^2 action should be taken to reduce exposure to below this value.
  - Exposure Limit Value: 5 m/s^2
- Whole-Body Vibration
  - Exposure Action Value: 0.5 m/s^2
  - Exposure Limit Value: 1.15 m/s^2

Heat and Cold

Source: 3M



Source: AIOH

Heat Stress Assessment

- Stage 1: Basic Thermal Risk Assessment
  - AIOH Questionnaire
- Stage 2: Detailed assessment
  - Predicted Heat Strain (PHS)
- Stage 3: Physiological Assessment

Lighting

- Australian Standards for Lighting AS/NZS 1680
- Light meter (often termed a 'Lux' meter).
- Corrected to respond to the human eye.

Lighting

Class of task		Recommended maintained illuminance lx	Characteristics of the activity/interior	Representative activities/interiors
Movement and orientation*		40	Interiors rarely visited with visual tasks limited to movement and orientation	Corridors; cable tunnels; indoor storage tanks; walkways.
Rough intermittent*		80	Interiors requiring intermittent use with visual tasks limited to movement, orientation and coarse detail.	Staff change rooms; live storage of bulky materials; dead storage of materials needing care; locker rooms; loading bays.
Normal range of tasks and work places	Simple	160	Any continuously occupied interior where there are no tasks requiring perception of other than coarse detail. Occasional reading of clearly printed documents for short periods.	Waiting rooms; staff canteens; rough checking of stock; rough bench and machine work; entrance halls; general fabrication of structural steel; casting concrete; automated process monitoring; turbine halls.
	Ordinary or moderately easy	240	Continuously occupied interiors with moderately easy visual tasks with high contrasts or large detail (>10 min arc).	School chalkboards and charts; medium woodworking; food preparation; counters for transactions.
	Moderately difficult	320	Areas where visual tasks are moderately difficult with moderate detail (5-10 min arc or tolerances to 125μm) or with low contrasts.	Routine office tasks, e.g. reading, writing, typing, enquiry desks.
		400		Inspection of medium work; fine woodwork; car assembly.
	Difficult	600	Areas where visual tasks are difficult with small detail (3-5 min arc or tolerances to 25μm) or with low contrast.	Drawing boards; most inspection tasks; proofreading; fine machine work; fine painting and finishing; colour matching.
	Very difficult	800	Areas where visual tasks are very difficult with very small detail (2-3 min arc) or with very low contrast.	Fine inspection; paint retouching; fine manufacture; grading of dark materials; colour matching of dyes.
Extremely difficult		1200	Areas where visual tasks are extremely difficult with extremely small detail (1-2 min arc or tolerances below 25μm) or of low contrast. Visual aids may assist.	Graphic arts inspection; hand tailoring; fine die sinking; inspection of dark goods; extra-fine bench work.
Exceptionally difficult		1600	Areas where visual tasks are exceptionally difficult with exceptionally small detail (<1 min arc)or with very low contrasts. Visual aids will be of advantage.	Finished fabric inspection; assembly of minute mechanisms, jewellery and watchmaking.

Source: AS/NZS 1680

Radiation Hazards

Ionising **Non-Ionising**

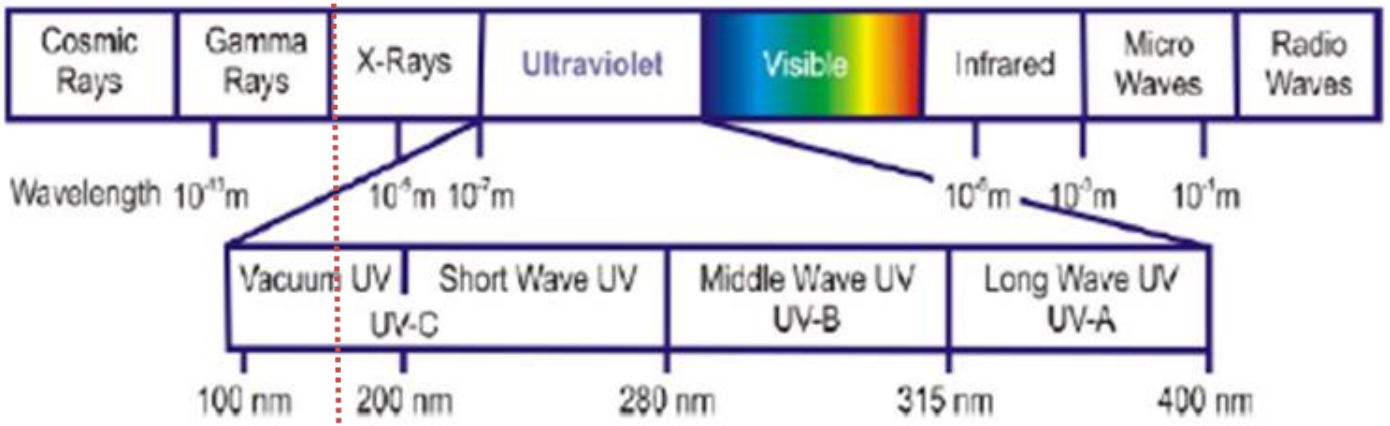


Figure 1. Electromagnetic Spectrum and Wavelength Bands (ICINRP, 2007)

Controls

Ventilation

- Supply or extract air
- Should be regularly examined
- The velocity on the open face for most situations should be within a range 0.5-2.5 m/s
- Smoke tests, anemometer

AFC International

Respiratory Protection

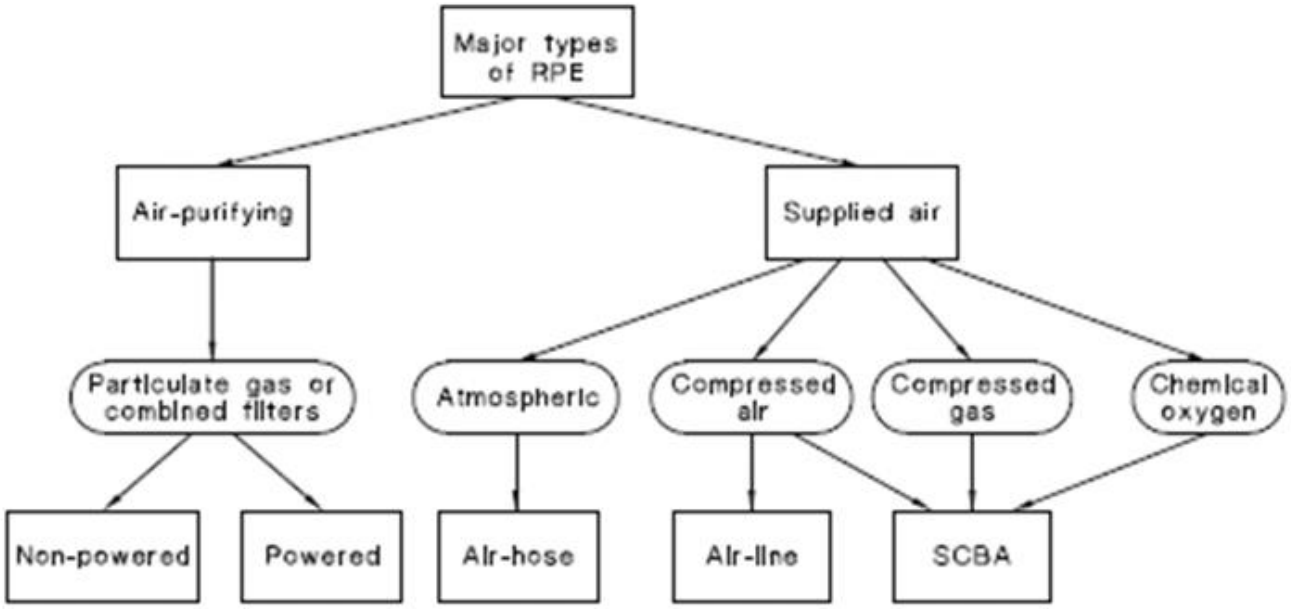


FIGURE 5.1 MAJOR TYPES OF RPE

Source: AS 1715

Respirator Fit

- AS/NZS 1715 requires that all persons provided with RPE undergo fit tests
  - Qualitative
  - Quantitative

Source: RPA

AIOH 2017 Seminar Series

- APRIL | **Occupational Hygiene & Ergonomics** with Katrina James, CPE
- MAY | **Human Vibration** with Marion Burgess AM
- JUNE | **Asbestos in Soil** with Linda Apthorpe & Michael Fisher
- JULY | **Gloves: What hygienists need to know** with Dr Sue Reed & Dr David Bromwich
- AUGUST | **Health Monitoring** with Ass. Prof Jacques Oosthuizen
- SEPTEMBER | **Thermal Environment** with Dr Vinod Gopaldasani & John Henderson

AIOH
Basic Principles of Occupational Hygiene

- The AIOH is an approved training provider under the Occupational Hygiene Training Association (OHTA).
- Keep an eye out at https://www.aioh.org.au/education-training-careers/basic-principles-of-occupational-hygiene

Thank You