Disclaimer: The information and opinions expressed in the upcoming presentation are those of the author/presenter and not necessarily those of the Institution of Occupational Safety and Health (IOSH).
IOSH – A Guide to Respiratory Protection In Construction

Gary Pharo
AGENDA

Part 1 – 27th September

➢ Common Challenges
➢ Cold Hard Facts
➢ ERICP – Hierarchy of Controls
➢ Legislation & Reasons For Respiratory Protective Devices
➢ What Is A Respiratory Protection Programme?
➢ Correctly Selecting Mask Based on Hazard/Task/Person
➢ Exposure Levels & Protection Factors
➢ Facial Hair & Face Fit Testing

Part 2 – 21st November

➢ Respiratory Protective Devices
   Working Principles
   Types Of R.P.D.
➢ Types of Filters Available
➢ Correct Fitting And Usage
➢ Pre Use Checks
➢ Aftercare, Cleaning & Storage
➢ Counterfeit Products
➢ The future
   Product innovation
   Other countries approaches
HUMAN NATURE

This year thousands of men will die from stubbornness.

NO WE WON'T

DO NOT CLIMB, PLAY ON, AND AROUND PIPE
MOST COMMON CHALLENGES TO OVERCOME WITH RPE COMPLIANCE

Feel claustrophobic
Can’t breathe in a mask
I don’t want to shave
I didn’t have to wear a mask at xxx company

Mask is uncomfortable
Makes glasses steam up
Only a quick job
It won’t affect me/ it’s too late, I’ve never worn a mask
PARTICLE SIZES

Visibility limit 17 µm

- Tobacco Smoke
- Sawdust
- Metal Dust
- Welding Smoke
- Bacteria
- Pollen
- Fibreglass
- Car Soot
- Asbestos
- Corn Dust
- Coal Dust
- Flour Dust
- Textile Dust
- Cement Dust
- Biocides in sprayform

≤ 0.001 µm
0.01 µm
0.1 µm
1 µm
10 µm
100 µm
1 000 µm
10 000 µm
PARTICLE SIZE GROUPS

Inhalable dust (100 μm)

Thoracic dust (10 μm)

Respirable dust (4 μm)

= Total dust

Hairs in the nose & throat (cilia) along with mucous membranes in the nose, mouth and throat capture most particles larger than 10 μm.
MOST DAMAGING PARTICLE SIZE

The total active surface area of the 600 million alveoli in our lungs is 75 - 100 m²

That's the size of a typical 3 bed house
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The percentage of work related deaths attributed to poor safety</td>
</tr>
<tr>
<td>99</td>
<td>The percentage of work related deaths attributed to ill health</td>
</tr>
<tr>
<td>100</td>
<td>Times construction workers are more likely to die from an occupational disease than a workplace accident.</td>
</tr>
</tbody>
</table>
Estimated 18,000 new cases of “breathing and lung problems” each year caused or made worse by work

- approximately 20% caused by dusts from stone, cement, brick or concrete
- A further 13% thought that “Airborne materials from spray painting or manufacturing foam product” had contributed to their ill health
- a further 10% thought that “Airborne materials while welding, soldering or cutting/grinding metals” had contributed to their ill health.
Silicosis is a long-term lung disease caused by inhaling large amounts of crystalline silica dust, usually over many years.

Asbestosis is a chronic (long-term) lung disease caused by breathing in tiny asbestos fibres.

Mesothelioma is a type of cancer that begins to grow in the pleural membrane. Less commonly, mesothelioma can affect a similar lining around the abdomen or heart.

Silicosis kills around 800 people per year.

Asbestosis kills around 600 people per year.

Mesothelioma kills around 2,500 people per year.
WORK-RELATED & OCCUPATIONAL RESPIRATORY HEALTH: MESOTHELIOMA

1 in 5 Work related deaths are caused by mesothelioma

20 Tradespeople die EVERY WEEK from mesothelioma; of which:

8 Joiners
6 Electricians
4 Plumbers
DISEASES ATTRIBUTABLE TO COMMON CONSTRUCTION HAZARDS SUCH AS ISOCYANATE, WOOD DUST, MOLD, WELDING FUME, METAL DUST ETC

**Asthma** is the most common lung disease; many chemicals, types of dust and moulds can cause asthma.

**COPD** covers a number of conditions including emphysema & chronic bronchitis. Occupational exposures to various dusts, fumes and vapours have contributed to causing a substantial proportion of current cases.

**Asthma** affects some 8m people and kills around 1200 people per year

**COPD** affects some 1m people and kills around 30,000 people per year – some 4,000 of which are work related.
WORK-RELATED & OCCUPATIONAL RESPIRATORY HEALTH
THE POSITIVE OUTLOOK

The good news is that we can protect workers’ health and actually prevent most of these deaths by:

- Recognising the hazards
- Evaluating the risks
- Controlling exposures
HIERARCHY OF CONTROLS

The laws governing the control of harmful substances in the workplace, and their supporting ACOP, say that you should only use RPE after you have taken all other reasonably practicable measures to prevent or control exposure.
**HIERARCHY OF CONTROLS**

- **Elimination**: Eliminate the hazard
- **Substitution**: Replace the hazard
- **Engineering Controls**: Isolate people from the hazard
- **Administrative Controls**: Change the way people work
- **PPE**: Protect the worker with PPE

Most effective to least effective.
E  ELIMINATE
R REPLACE

Isocyanate containing products

Non-isocyanate products
ISOLATE PEOPLE FROM THE HAZARD

Water

Water damps down dust clouds. However, it needs to be used correctly. This means enough water supplied at the right levels for the whole time that the work is being done.

On-tool extraction

removes dust as it is being produced. It is a type of local exhaust ventilation (LEV) system that fits directly onto the tool.

Local Exhaust Ventilation

Effective LEV or dust/fume extraction can carry away airborne contaminants before they can be breathed in – but it must be used correctly and placed as close to source as possible.
C

CHANGE THE WAY PEOPLE WORK

Reduce time exposed

Reduce number of people exposed/ rotate tasks

Sundström
The Health and Safety at Work etc Act 1974
COSHH - Control of Substances Hazardous to Health Regulations 2002
CLAW - Control of Lead at Work Regulations 2002
CA - Control of Asbestos Regulations
HSG 53 - Respiratory protective equipment at work: A practical guide
OC 282/28 - Fit Testing of Respiratory Protective Equipment - a guide for users and testers
WHAT DOES LEGISLATION REQUIRE?

Where respiratory protective equipment (RPE) is used as a control measure under Health and Safety Legislation, it is vital that the selected RPE is adequate and suitable.

RPE must reduce exposure to as low as reasonably practicable, and in any case to an acceptable level (e.g. below any applicable Workplace Exposure Limits or Control Limits).
ON CONSTRUCTION SITES HSE GUIDANCE STATES ‘YOU WILL NEED TO MAKE SURE THAT THE RPE IS’:

- Adequate for the amount and type of dust – RPE has an assigned protection factor (APF) which shows how much protection it gives the wearer. The general level for construction dust is an APF of 20

- Suitable for the work – disposable masks or half masks can become uncomfortable to wear for long periods. Powered RPE helps minimise this. Consider it when people are working for more than an hour without a break

- Compatible with other items of protective equipment

- Fits the user & is worn correctly

- Face fit testing is needed for tight-fitting masks; anyone using tight-fitting masks also needs to be clean shaven.
EMPLOYER’S OBLIGATIONS

• To have the expertise to create and pursue a respiratory path protection programme
• To provide respiratory protection equipment suitable for both users and their tasks
• To provide training in use, fit and maintenance
• To monitor compliance with the programme
• To produce documentation
EMPLOYEE’S OBLIGATIONS

• To comply with the programme
• To report any problems occurring when using the equipment
• To use respiratory protection equipments in the prescribed manner
  
  Putting the RPE on correctly
  
  Fit checking the RPE before entering the hazardous area
  
  Storing it as instructed
  
  Carrying out any simple maintenance
  
  Where necessary, logging maintenance records or defects noted during use
REQUIREMENTS OF AN RPE PROGRAMME

An RPE programme encapsulates all the elements of RPE use you need to ensure that your RPE is effective in protecting the wearers. To have an effective RPE programme you need to:

- Correctly select RPE
- Train for correct use
- Ensure correct use (including supervision)
- Check to ensure RPE is working correctly before each use
- Maintain RPE in accordance with manufacturer's instructions and law
- Keep records as required by law
- Correctly store RPE
- Correctly dispose of RPE

Any shortcomings in one of the steps in the programme could result in wearers not receiving adequate protection.
CHOOSING RESPIRATORY PROTECTIVE EQUIPMENT

1. Adequate
Right for the hazard & reduces exposure to a level required to protect the wearer’s health

2. Suitable
Right for the wearer, task and environment, such that the wearer can work freely and without additional risks due to the RPE.

To ensure RPE is **suitable & adequate** it should be:

- Right for the Hazard
- Right for the Task
- Right for the Person

- Climate, temperature?
- Communication?
- Visibility requirements?
- Mobility?
- Work rate?
- Duration of wear?
- Oxygen deficiency or IDLH?
- Workplace measurements?
- Adequate protection factor?
- Health effects?
- Occupational exposure limit?
- Which hazardous substance?
RIGHT FOR THE HAZARD

Two types of contaminants – three risk areas

- Gas / Vapours
- Lack of Oxygen
- Particles
A substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid)

A substance diffused or suspended in the air; normally from the heating or evaporation of a liquid or solid
PARTICLES COME IN MANY FORMS

**Inorganic Particles**
- Wood Dust
- Silica Dust
- Asbestos

**Organic Particles**
- Bacteria
- Mites
- Fungal Spores

**Mist, Fume & Spray**
- Chemical Spray
- Paint Mist
- Welding Fume
# Workplace Exposure Limit (WEL)

**Substance** | **CAS number** | **Workplace exposure limit** | **Comments**
--- | --- | --- | ---
| | | Long-term exposure limit (8-hr TWA reference period) | Short-term exposure limit (15-minute reference period) | The Carc, Sen and Sk notations are not exhaustive. Notations have been applied to substances identified in IOELV Directives

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS number</th>
<th>ppm</th>
<th>mg.m⁻³</th>
<th>ppm</th>
<th>mg.m⁻³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>75-07-0</td>
<td>20</td>
<td>37</td>
<td>50</td>
<td>92</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>64-19-7</td>
<td>10</td>
<td>25</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Acetic anhydride</td>
<td>108-24-7</td>
<td>0.5</td>
<td>2.5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Acetone</td>
<td>67-64-1</td>
<td>500</td>
<td>1210</td>
<td>1500</td>
<td>3620</td>
</tr>
<tr>
<td>Acetonitrile</td>
<td>75-05-8</td>
<td>40</td>
<td>68</td>
<td>60</td>
<td>102</td>
</tr>
<tr>
<td>α-Acetylaminocetic acid</td>
<td>50-78-2</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Acrylaldheyde (Acrolein)</td>
<td>107-02-8</td>
<td>0.02</td>
<td>0.05</td>
<td>0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>Acrylamide</td>
<td>79-06-1</td>
<td>-</td>
<td>0.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Acrylic acid</td>
<td>10</td>
<td>29</td>
<td>20*</td>
<td>59*</td>
<td></td>
</tr>
<tr>
<td>Acrylonitrile</td>
<td>107-13-1</td>
<td>2</td>
<td>4.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Allyl alcohol</td>
<td>107-18-6</td>
<td>2</td>
<td>4.8</td>
<td>4</td>
<td>9.7</td>
</tr>
<tr>
<td>Aluminium alkyl compounds</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Aluminium metal inhalable dust respirable dust</td>
<td>7429-90-5</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Aluminium oxides inhalable dust respirable dust</td>
<td>1344-28-1</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:** STEL in relation to a 1-minute reference period

**Source:** EH40/2005 Workplace exposure limits (Third edition, published 2018)
The Assigned Protection Factor should be used to determine which protection is needed at the workplace. It represents the difference in the cleanliness of the air inside and outside of the protection equipment e.g. APF of 20 means the air inside the mask is 20 times cleaner than that outside.

This is the level of protection that can realistically be expected to be achieved in the workplace by 95% of adequately trained & supervised wearers using a properly functioning & correctly fitted respirator.

RPE must reduce exposure to as low as reasonably practicable, and in any case to an acceptable level (e.g. below any applicable Workplace Exposure Limits or Control Limits).
CALCULATING ASSIGNED PROTECTION FACTOR (APF)

Contaminant Concentration \( \frac{200}{\text{Workplace Exposure Limit} \times \text{Selected APF}} = 20 \text{ Required Assigned Protection Factor} \)

\( 10 \times 20 = 200 \)
## ASSIGNED PROTECTION FACTOR (APF)

### DISPOSABLE MASKS
Filtering Facepieces
- FFP1...........4
- FFP2...........10
- FFP3...........20

### REUSABLE MASKS
- P1............4
- P2...........10
- P3...........20

### HALF MASKS
- with P3 filter.................20
- with Gas or Gas + P3........10

### FULL FACE MASKS
- with P3 filter....................20
- with Gas or Gas + P3........20

### POWERED AIR PURIFYING RESPIRATOR

<table>
<thead>
<tr>
<th>HOOD/ VISOR/ HELMET</th>
<th>POWERED MASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH1........10</td>
<td>TM1........10</td>
</tr>
<tr>
<td>TH2........20</td>
<td>TM2........20</td>
</tr>
<tr>
<td>TH3........40</td>
<td>TM3........40</td>
</tr>
</tbody>
</table>

### CONSTANT FLOW AIR LINE

<table>
<thead>
<tr>
<th>WITH A MASK</th>
<th>WITH A HOOD/ HELMET</th>
<th>WITH A FULL SUIT HELMET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A/1B........10</td>
<td>1A/1B........10</td>
<td>1A/1B........10</td>
</tr>
<tr>
<td>2A/2B........20</td>
<td>2A/2B........20</td>
<td>2A/2B........20</td>
</tr>
<tr>
<td>3A/3B........20</td>
<td>3A/3B........20</td>
<td>3A/3B........20</td>
</tr>
<tr>
<td>4A*...........40</td>
<td>4A/4B........20</td>
<td>4B...........40</td>
</tr>
<tr>
<td>* (full facemask only)</td>
<td>CLASSES 1,2,3,4 &amp; 5........200</td>
<td>CLASSES 1C........200</td>
</tr>
</tbody>
</table>

### DEMAND VALVE BREATHING APPARATUS
Positive pressure demand airline
- full face mask..................2000

Positive pressure self-contained demand
- full face mask ....................2000

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* Source: Sundström®
RIGHT FOR THE TASK

Things you need to consider include:

- Work rate
- Wear time
- Abnormal temperature or humidity
- Flammable or explosive atmospheres
- Lack of oxygen
- Vision
- Communication
- Mobility
- Other PPE
Things you need to consider include:

- Contact lenses/ Spectacles
- Facial hair and markings
- Pre-existing Health conditions
FACIAL HAIR AND PROTECTION FACTOR

- Clean shaven: > 10% remains
- Stubble: > 1% remains
- Beard: > 1% remains
WHAT CONSTITUTES FACIAL HAIR?

FACIAL HAIR STYLES

- Clean Shaven
- Stubble
- Long Stubble
- Full Beard
- French Fork
- Ducktail
- Verdi
- Garibaldi
- Bandholz
- Soul Patch
- Goatee (Careful! Chin hair may easily cross the seal)
- Chin Curtain
- Extended Goatee
- Circle Beard
- Anchor (Careful! Chin hair may easily cross the seal)
- Balbo
- Van Dyke
- Imperial
- Side Whiskers
- Mutton Chops
- Hulihee (Careful not to cross the seal)
- Horseshoe
- Zappa
- Walrus
- Painter's Brush
- Chevron
- Handlebar
- Pencil
- Toothbrush
- Lampshade
- Zorro (Careful not to cross the seal)
- Villain
- Fu Manchu
- English
- Dali
FACIAL HAIR – THE OPTIONS

❖ Remove the person from the hazardous environment
   This isn’t always possible or realistic

❖ Introduce a clean shaven requirement into your health and safety policy. Requires a good management system to be in place, requires constant monitoring and supervision, and actions taken when breaches with the policy occur. It can prove challenging to enforce, but establishes a level playing field for all staff.

❖ Supply alternative RPE that does not rely on a tight seal
   A clean shaven policy may not be possible to enforce in certain circumstances such as where beards are worn for religious reasons, or someone has a genuine skin complaint that makes it impractical to shave every day. In these instances you’ll be required to supply alternative RPE that does not rely on a tight seal.
The right to have facial hair is often cited as a reason for not being clean-shaven at work.

However, this needs to be balanced against the requirement under the Health and Safety at Work Act 1974. This requires employees to follow the training they have received, take care of their own health and safety and co-operate with their employer on health and safety.

Many businesses will also balance the cost of a Powered Respirator against the loss of a skilled employee who resists being clean shaven.

It's also worth bearing in mind that, aside from respiratory protection, if correctly chosen, a Powered Respirator can also provide protection to head, face, eyes & neck reducing the cost of other types of PPE, reducing any incompatibility of other PPE & ensuring compliance at a glance.
This link will take you to a great video on youtube that clearly shows the difference being clean shaven makes.

It is Australian, so has some small variants on UK

https://m.youtube.com/watch?v=dCWo6hgZB5Y
FACE FIT TESTING

The ACoPs supporting COSHH, CAR and CLAW stipulate that all tight-fitting RPE must be fit tested as part of the selection process.

Recent research indicates that up to 50% of all RPE used does not offer the wearer the level of protection assumed and one of the major reasons is that it simply does not fit!

This is the level of protection that can realistically be expected to be achieved in the workplace by 95% of adequately trained & supervised wearers using a properly functioning & correctly fitted respirator.

The British Safety Industry Federation, along with the HSE and other industry stakeholders have developed a competency scheme for Fit Test Providers. The Fit2Fit RPE Fit Test Providers Accreditation Scheme is designed to confirm the competency of any person performing face piece fit testing.
The qualitative test can only be carried out on filtering face pieces and half masks.

The test takes around 20 minutes and involves wearing a hood over the head and shoulders.

The tester sprays a bitter (or sweet) tasting solution into the hood whilst the delegate carries out a series of exercises, i.e. turning head from side to side.

If the wearer can taste the solution then the mask does not fit correctly.
FACE FIT TESTING

There are 2 methods:

The quantitative test can be carried out on any type of mask.

There are several variations for this test, but the most common method involves attaching the mask to a machine (a Portacount), which can detect whether airborne particles are passing into the mask through the seal.

Again the test takes around 20 minutes and at the end of the test the machine gives a 'pass' or 'fail'.
FIT CHECK

Should be performed every time you don a mask

Generally shows if you have a reasonable fit

It isn’t a replication of typical work, so to be very clear…it is…

NOT A FACE FIT TEST
CHOOSING RESPIRATORY PROTECTIVE EQUIPMENT

To ensure RPE is **suitable & adequate** it should be:

- Right for the Hazard
- Right for the Task
- Right for the Person
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Part 2 – 21st November

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- Counterfeit Products
- The future
  - Product innovation
  - Other countries approaches
SILICA DUST IS ONE OF THE WORLD’S MOST SIGNIFICANT CAUSES OF OCCUPATIONAL DISEASE

Use our free resources to find out more about silica dust and how to control it – go to www.notimetolose.org.uk.

#silicasafe

JOIN US AND BE PART OF THE SOLUTION
www.breathefreely.org.uk