

Respiratory Protective Equipment 101



George Elliott

Northern Europe Region Application Engineering Supervisor
3M

What you breathe matters.
Choose wisely. 

Breathe Easy: Respiratory Protective
Equipment Fundamentals

Step Change

George Elliott

07/11/2024

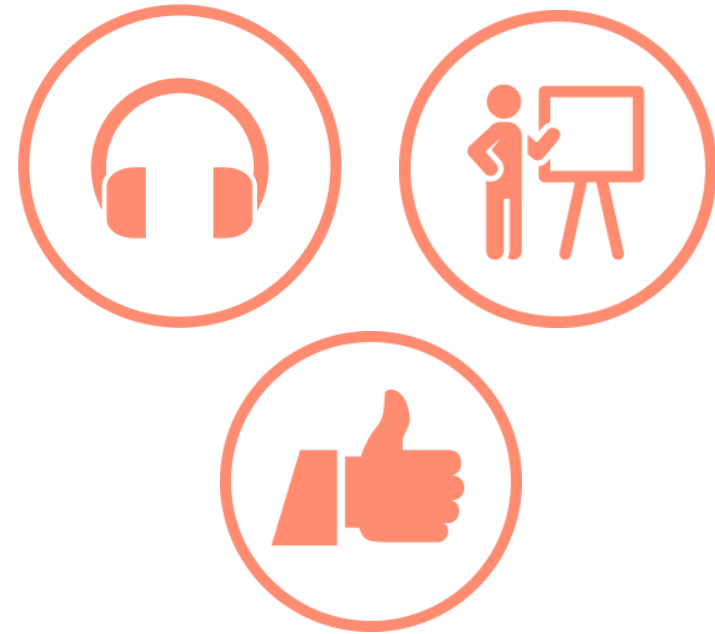


Thank you for joining me today

George Elliott



Senior Application Engineer
3M Personal Safety Division UK&I



Supporting customers with expert technical information and training at a local level.



Before I begin...

Thank you!

Respiratory Protection
Program

3

Steps

1. **Detect** hazards in the air
2. **Select** proper solution
3. **Protect** – how to protect properly



Detect

HSE COSHH Essentials

FD2 COSHH essentials for foundries
Molten metal fume: Melting

FD3 COSHH essentials for foundries
Molten metal fume: Pouring and casting

FD4 COSHH essentials for foundries: Silica
Sand plant

FD5 COSHH essentials for foundries: Silica
Coremaking and shell moulding (small scale)

FD6 COSHH essentials for foundries: Silica
Knock-out, shakeout, etc

FD8 COSHH essentials for foundries: Silica
Fettling large castings

FD11 COSHH essentials for foundries
Pattern assembly (investment casting)

FD12 COSHH essentials for foundries
Spray coating a large casting (open workshop)

FD14 COSHH essentials for foundries: Silica
Furnace relining

Health and Safety Executive

This information will help employers (including the self-employed) comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH), as amended, control exposure to metal and casting fume and protect workers' health. It is also useful for trade union safety representatives.

This sheet describes good practice using dust extraction.

It covers the points you need to follow to reduce exposure to an adequate level. It is important to follow all the points, or use equally effective measures.

Molten metal fume (heavy fumes) is hazardous to health. Fumes heavier than air can cause lung cancer.

Some metal fumes cause metal fume fever and lead to other health problems.

Casting fume is irritating to breathe; castings give off hazardous fumes for a considerable time.

Main points

- Keep exposure to fume as low as possible, using all the controls in this sheet.
- Make sure the controls work.
- Health monitoring is often needed. See sheet G401.

Hazard

- Handing sand can produce respirable crystalline silica (RCS).
- All RCS is hazardous, causing silicosis. This is a serious lung disease causing permanent disability and early death.
- Silicosis is made worse by smoking.
- 'Respirable' means that the dust can get to the deepest parts of the lung. Such fine dust is invisible under normal lighting.
- Keep inhalation of RCS as low as possible.
- When all controls are applied properly, less than 0.1 mg/m³ RCS is usually achievable (based on an 8-hour time-weighted average).
- Sand contains up to 100% crystalline silica.

Control approach 2 Engineering control

Access and premises

- Only allow access to authorized staff.

Equipment

- Stop dust spreading. If possible, segregate the sand plant from other operations.
- If you use a vehicle with the sand plant, can you enclose the cab and supply filtered air? Make sure the driver keeps the windows closed.
- Enclose the sand plant as much as possible. Use flexible strips at the openings.
- You need an air speed between 1 and 1.5 metres per second into the sand plant enclosure.
- Fit a manometer or pressure gauge near the extraction point, to show that the extraction is working properly.
- Always confirm the extraction is turned on and working at the start of work. Check the gauge.
- Discharge cleaned, extracted air to a safe place outside the building, away from doors, windows and air inlets.
- Have a supply of clean air coming into the workshop to replace extracted air.
- Shake down air filters four times a day.
- Fit an indicator or alarm to show if filters have blocked or failed.
- Consult a qualified ventilation engineer to design new control systems and to update current controls. See sheet G402.

Main points

- High dust levels result from sand handling.
- Keep exposure as low as possible using all the controls in this sheet.
- You need air sampling. See sheet G401.
- Health surveillance is usually needed. See sheet G402.

It is important to follow all the points, or use equally effective measures.

Make sure the controls work.

You need air sampling.

Health surveillance is usually needed.

See sheet G401.

FD5 COSHH essentials for foundries: Silica
Coremaking and shell moulding (small scale)

FD6 COSHH essentials for foundries: Silica
Knock-out, shakeout, etc

FD8 COSHH essentials for foundries: Silica
Fettling large castings

Health and Safety Executive

This information will help employers (including the self-employed) comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH), as amended, control exposure to respirable crystalline silica (RCS) and protect workers' health. It is also useful for trade union safety representatives.

This sheet describes good practice using RPE with dust extraction.

It covers the points you need to follow to reduce exposure to an adequate level. It is important to follow all the points, or use equally effective measures.

Sand handling agents are also hazardous to health. This sheet does not cover these substances.

Look at safety data sheets for more information.

Main points

- High dust levels result from handling.
- Keep exposure as low as possible using all the controls in this sheet.
- You need air sampling. See sheet G401.
- Health surveillance is usually needed. See sheet G402.

Control approach R Respiratory protective equipment (RPE)

Access and premises

- Only allow access to authorized staff.

Equipment

- Can you remove residues by shotblasting? RPE is needed.
- Provide an extracted booth for fettling large castings.
- Provide a turntable to move the casting.
- You need an air speed between 1 and 1.5 metres per second into the booth, and between 0.5 and 10 metres per second at the extraction point.
- Fit a manometer or pressure gauge near the extraction point, to show that the extraction is working properly.
- Always confirm that the extraction is turned on and working at the start of work. Check the gauge.
- Discharge cleaned, extracted air to a safe place outside the building, away from doors, windows and air inlets.
- Have a supply of clean air coming into the workshop to replace extracted air.
- Shake down air filters four times a day.
- Fit an indicator or alarm to show if filters have blocked or failed.

Main points

- Fettling can produce high levels of dust.
- Keep exposure as low as possible using all the controls in this sheet.
- Make sure the controls work.
- You need air sampling. See sheet G401.
- Health surveillance is usually needed. See sheet G402.

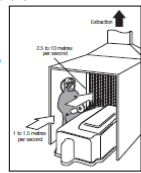
It is important to follow all the points, or use equally effective measures.

Make sure the controls work.

You need air sampling.

Health surveillance is usually needed.

See sheet G401.



FD11 COSHH essentials for foundries
Pattern assembly (investment casting)

FD12 COSHH essentials for foundries
Spray coating a large casting (open workshop)

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Furnace relining

Health and Safety Executive

This information will help employers (including the self-employed) comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH), as amended, control exposure to fume and protect workers' health. It is also useful for trade union safety representatives.

This sheet describes good practice using dust extraction.

It covers the points you need to follow to reduce exposure to an adequate level. It is important to follow all the points, or use equally effective measures.

Some casting wastes contain non-combustible, assembly and basic products 'volatilizing fumes' which cause asthma.

Control exposure to stop occupational asthma developing. If an individual develops occupational asthma, a levels in air can trigger an attack exposure to prevent this.

Main points

- Keep exposure as low as possible using all the controls in this sheet.
- Get safety data sheets - see 'Useful links'.
- Make sure the controls work.
- You may need health surveillance advice and monitoring. See sheet G402.

Control approach R Respiratory protective equipment (RPE)

Access and premises

- Provide a permit-to-work for access.
- Post a trained person outside, to act as lookout.
- Provide good access to enable safe waste removal.

Equipment

- RPE is normally needed to reduce exposures to an acceptable level.
- Provide a good standard of general ventilation.

Small furnaces

- Write a method statement for the job. Dust exposures can be high - specify what controls to use.
- Keep exposure as low as possible using all the controls in this sheet.
- Make sure the controls work.
- You may need health surveillance advice and monitoring. See sheet G402.

Large furnaces

- Use a permit-to-work system.
- For hot work, prepare a formal risk assessment. Seek expert advice - see 'Useful links'.
- Provide an air blower to get fresh air into restricted working places.
- Use a Type H vacuum cleaner fitted with a HEPA filter to remove dust residues. Never use dry brushing or compressed air.

Procedures

- Make sure that users check their RPE works properly every time they use it.

Main points

- Relining can produce airborne respirable crystalline silica (RCS).
- All RCS is hazardous, causing silicosis. This is a serious lung disease causing permanent disability and early death.
- Silicosis is made worse by smoking.
- 'Respirable' means that the dust can get to the deepest parts of the lung. Such fine dust is invisible under normal lighting.
- Keep inhalation of RCS as low as possible.
- When all controls are applied properly, less than 0.1 mg/m³ RCS is usually achievable (based on an 8-hour time-weighted average).
- Relining ceramic fibre (RCF) can degrade to silica.

Control approach R Respiratory protective equipment (RPE)

Access and premises

- Provide a permit-to-work for access.
- Post a trained person outside, to act as lookout.
- Provide good access to enable safe waste removal.

Equipment

- RPE is normally needed to reduce exposures to an acceptable level.
- Provide a good standard of general ventilation.

Small furnaces

- Write a method statement for the job. Dust exposures can be high - specify what controls to use.
- Keep exposure as low as possible using all the controls in this sheet.
- Make sure the controls work.
- You may need health surveillance advice and monitoring. See sheet G402.

Large furnaces

- Use a permit-to-work system.
- For hot work, prepare a formal risk assessment. Seek expert advice - see 'Useful links'.
- Provide an air blower to get fresh air into restricted working places.
- Use a Type H vacuum cleaner fitted with a HEPA filter to remove dust residues. Never use dry brushing or compressed air.

Procedures

- Make sure that users check their RPE works properly every time they use it.

Main points

- Relining can produce a great deal of dust.
- Keep exposure as low as possible using all the controls in this sheet.
- Make sure the controls work.
- You may need health surveillance advice and monitoring. See sheet G402.

It is important to follow all the points, or use equally effective measures.

Make sure the controls work.

You may need health surveillance advice and monitoring.

See sheet G402.

What makes the solution adequate?

TYPE
of the hazard

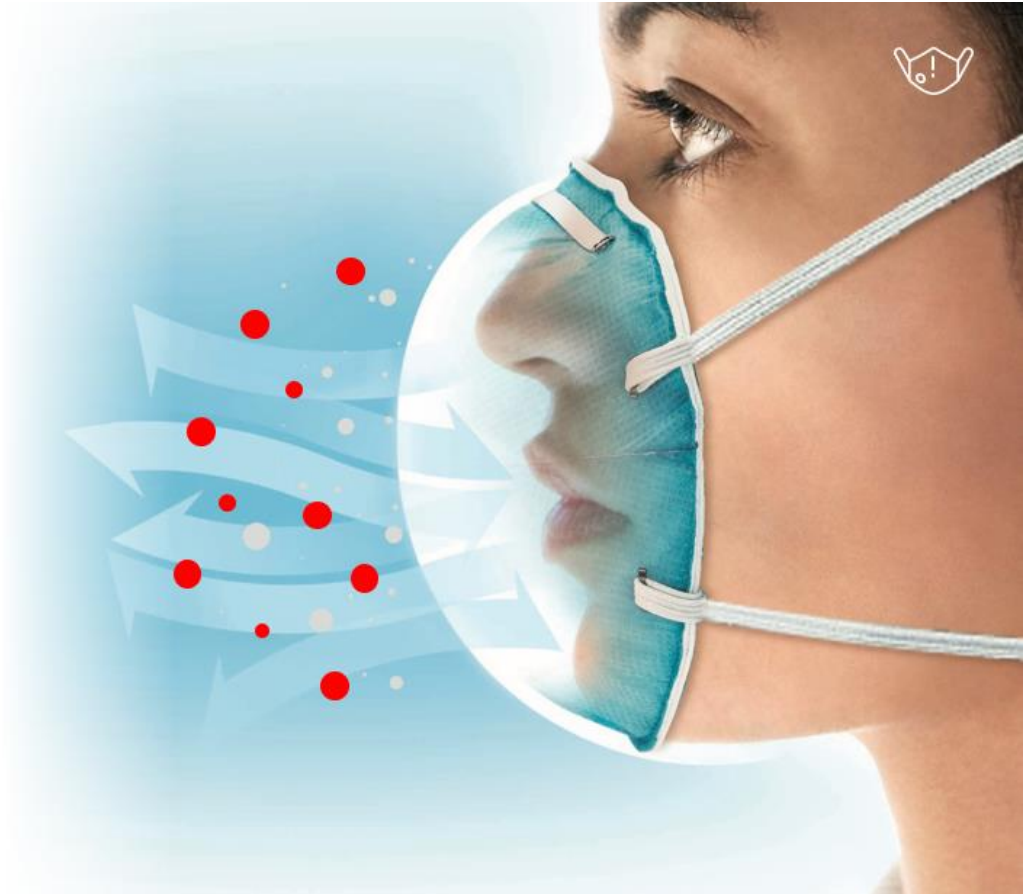
&

CONCENTRATION

Particulates

Gases &
Vapours

Oxygen
deficiency



Workplace Exposure Monitoring

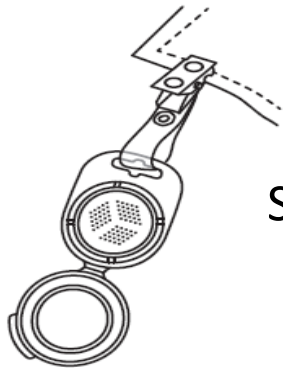
PREPARE

Identify contaminants
(e.g. MSDS) – N.B. Gases &
vapours only

Select appropriate
monitoring methods

Design a sampling strategy, e.g.
group workers with similar exposure, consider
number of samples needed

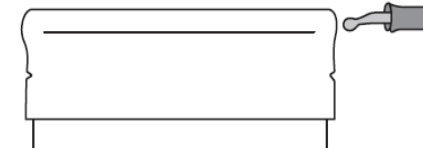
SAMPLE



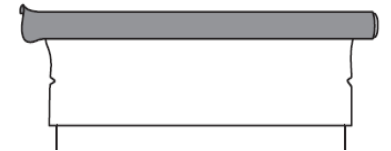
Sample



Stop



Pack



ANALYSE

Send to analytical services
provider

I have concentration
data, what can I now do
with it?

1 Set-up

Once you know what's in your air, 3M™ Select and Service Life Software helps you explore respirators and filter options, and select the one that's right for you. Then you can establish an effective gas/vapour filter-change schedule to help keep workers protected.

Select the results you are wanting to view.

1 Select respirators and filters for my contaminants

2 Estimate the service life for gas/vapour filters

Summary

Location



United Kingdom/Ireland - English

Contaminants

Filter



Resources

1  Set-up

2 **Contaminants**

3 Filter

4 Review

Select the contaminants in the workplace.

xylene



Show: All (2) Selected (1)

2-Methylpentane-2,4 diol
CAS# 107-41-5



Xylene (o-isomer)
CAS# 1330-20-7



Filter selection

Location



United Kingdom/Ireland - English

Contaminants

Filter

1 ✓ Set-up

2 ✓ Contaminants

3 Filter

4 Review

Below are the filter solutions for the contaminants that you previously entered. Select the solution(s) that work best for your workplace.

☰ Refine results

Search by Name



4251+
3M™ Maintenance Free Half Mask,
FFA1P2 R D Filters, 4251+



4255+
3M™ Maintenance Free Half Mask,
FFA2P3 R D Filters, 4255+



4277+
3M™ Maintenance Free Half Mask,
FFABE1P3 R D Filters, 4277+



4279+
3M™ Maintenance Free Half Mask,
FFABEK1P3 R D Filters, 4279+



6051
3M™ A1 Gas and Vapour Filters
6051



6055
3M™ A2 Gas and Vapour Filters
6055



6057
3M™ ABE1 Gas and Vapour Filters
6057



6059
3M™ ABEK1 Gas and Vapour
Filters 6059



6075
3M™ Formaldehyde + A1 Gas and
Vapour Filters 6075



D8051

D8055

D8059



Filter selection

Location



United Kingdom/Ireland - English

Contaminants

Xylene (o-isomer)

Filter

Resources

www.3M.com/SLS



1 ✓ Set-up

2 ✓ Contaminants

3 ✓ Filter

4 **Environment**

5 Review

Describe the environmental conditions in the workplace

relative humidity

Atmospheric pressure

 ATM range 0.8-1.2 ATM

Temperature

 Celsius Fahrenheit

Work rate

Service Life estimate

Location

United Kingdom/Ireland - English

Contaminants

Xylene (o-isomer) 20ppm

Filter

3M™ A2 Gas and Vapour Filters 6055



Resources

- 1 ✓ Set-up
- 2 ✓ Contaminants
- 3 ✓ Filter
- 4 ✓ Environment
- 5 Review

Review your selections



3M™ A2 Gas and Vapour Filters 6055

3M™ A2 Gas and Vapour Filters 6055 protect against organic vapours with boiling points above 65°C. Suitable for use with all 3M half and full face masks.



155 hours

Service Life estimate

Service Life estimate: 155 hours until breakthrough to 10 ppm
Based on environmental conditions: relative humidity <65%, 1 ATM, 20°C, Moderate Work , Xylene (o-isomer) (20ppm)

* The values generated by the software are estimates only. For example, the math model used to estimate organic vapor service life at <65% RH may have uncertainty of ± 50%.

Warnings

- Your estimated service life is greater than 8 hours. Please see information on contaminant migration through the filter in the Help document.
- The selected chemical is a mixture. Calculations are based on its primary component.
- Service life is based on an organic vapour which can migrate through the filter during storage. Please consider the estimated service life as time from first use.

Selected contaminants

Xylene (o-isomer)
CAS 1326-20-7

Exposure Entered: 20ppm

Service Life estimate

Location



United Kingdom/Ireland - English

Contaminants

Xylene (o-isomer) 20ppm

Filter

3M™ A2 Gas and Vapour Filters 6055

Environment

relative humidity <65%
 Atmospheric pressure 1
 Temperature 20 Celsius
 Work rate Medium

Generate PDF



Select

Respiratory Selection

Adequate

It is right for the hazard and reduces exposure to the level required to help protect the wearer's health



Suitable

It is right for the wearer, task and environment





Select adequate respirator



What makes the solution adequate?

TYPE
of the hazard

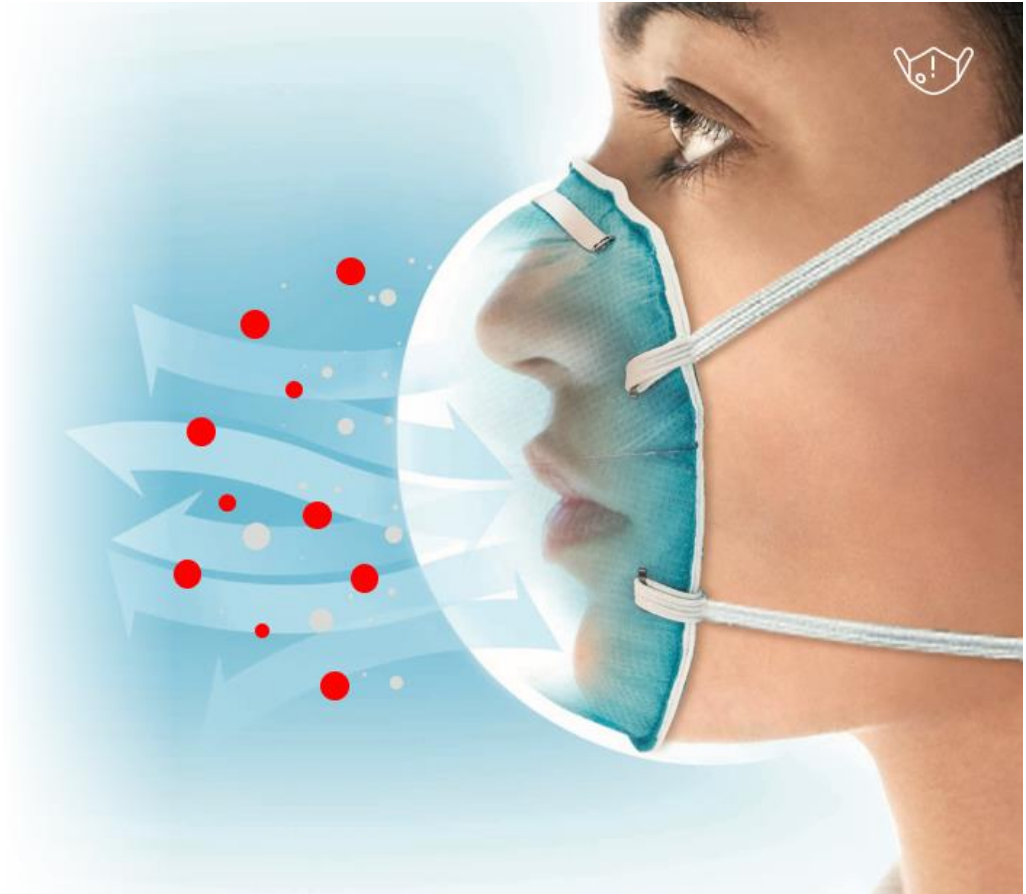
&

CONCENTRATION

Particulates

Gases &
Vapours

Oxygen
deficiency



Adequate to the type of hazard

Particulates
Particulate filter



Gases & Vapours
Gas filter



Oxygen deficiency
NO filtration - SCBA & Fire



UK Assigned Protection Factors (HSG 53)



APF 2000	Pressure demand valve breathing apparatus
APF 40	PAPR and Supplied air hoods, helmets and full facepieces (TM3/TH3)
APF 40*	Negative demand full facepieces +P3
APF 20*	Negative demand half facepieces +P3
APF 20*	Filtering facepieces FFP3



*Focuses on maximum particulate protection only, APFs may vary for Gas & Vapour protection

Tight Fitting Respiratory Protection

Disposable respirators



Particulate hazards
FFP1, FFP2, FFP3
Short tasks < 1 hour
Face fit testing and wearers clean shaven

Half / Full face mask



Particulates, gas & vapours
Short tasks < 1 hour
Face fit testing and wearers clean shaven
Selection of models and sizes
Maintenance/record keeping

Powered and Supplied Air Respiratory Protection

P&SA with with headtops



Particulates, gas & vapours
Longer tasks > 1 hour
Selection of headtops and hoods
No face fit test required
Maintenance/record keeping



P&SA with face masks



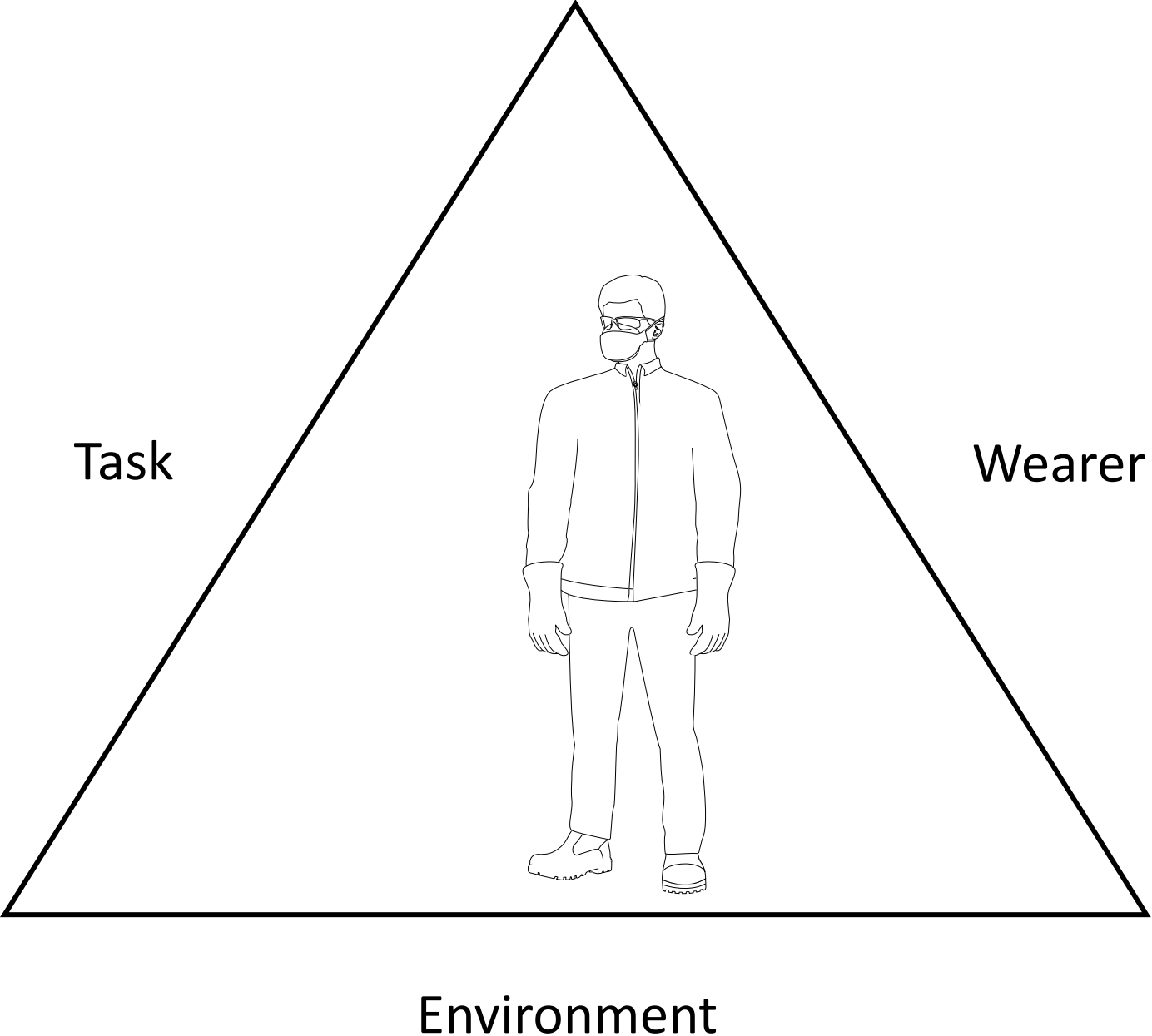
Particulates, gas & vapours
Longer tasks > 1 hour
Full face and half mask
Facefit testing required
Maintenance/record keeping



**Select
suitable
respirator**



Suitability



PPE Compatibility – another factor of suitability



+

=





Bump cap head protection

Eye + Face protection

Impact protection

Respiratory protection

Integrated PPE
The connection between eye, face, head and respiratory protection

Suitability Considerations

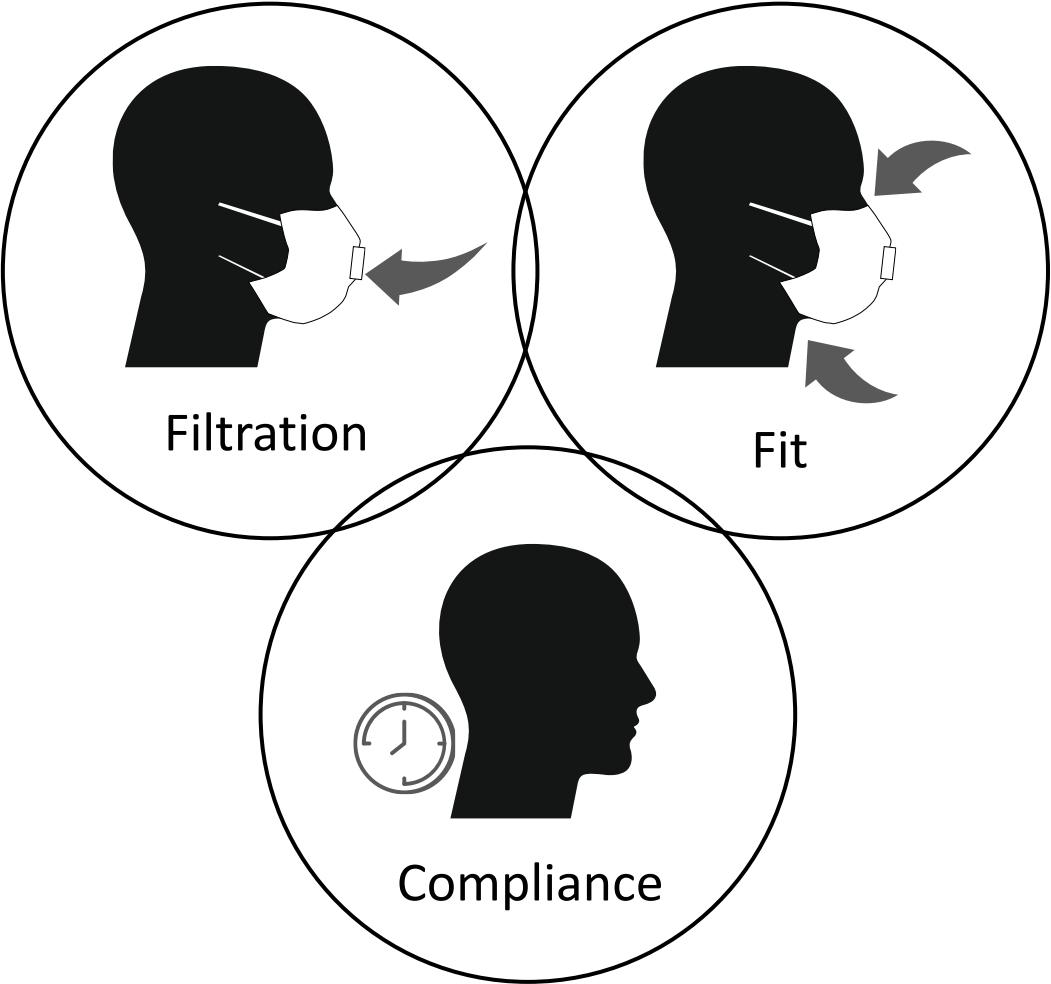
- Their health: medical evaluation and surveillance
- Facial hair
- Need for corrective spectacles
- Comfort
- Suitable fit
- Additional requirements e.g. headwear
- Their work-rate
- The time they may have to wear the PPE
- Requirements for communication
- Mobility





Protection

Tight-fitting RPE performance



Any tight-fitting
facepiece should be
fit tested



Any tight-fitting
facepiece should be
fit tested



Any tight-fitting facepiece should be fit tested

Including powered devices



Any tight-fitting
facepiece should be
fit tested

Including SCBA



Filters and cartridges



When should they
be changed?

When to change particle filters

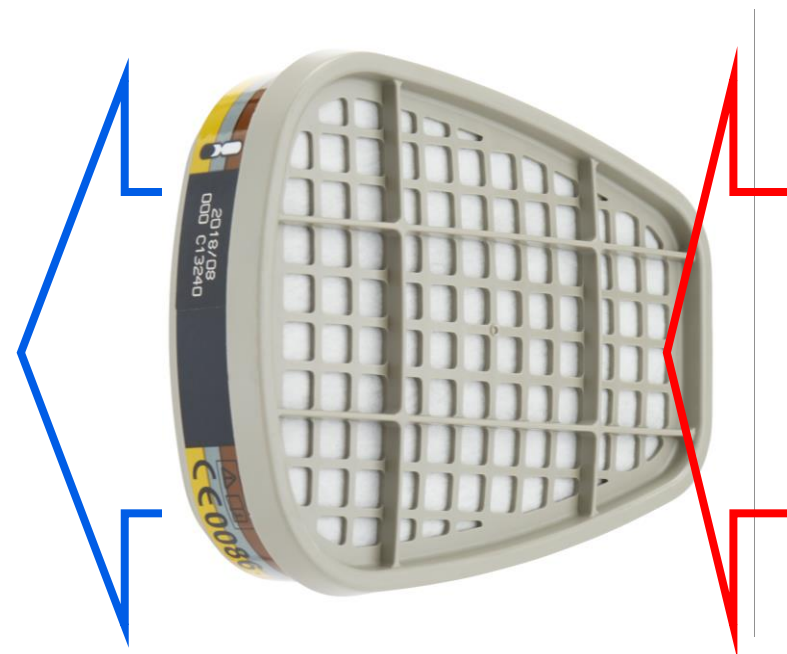
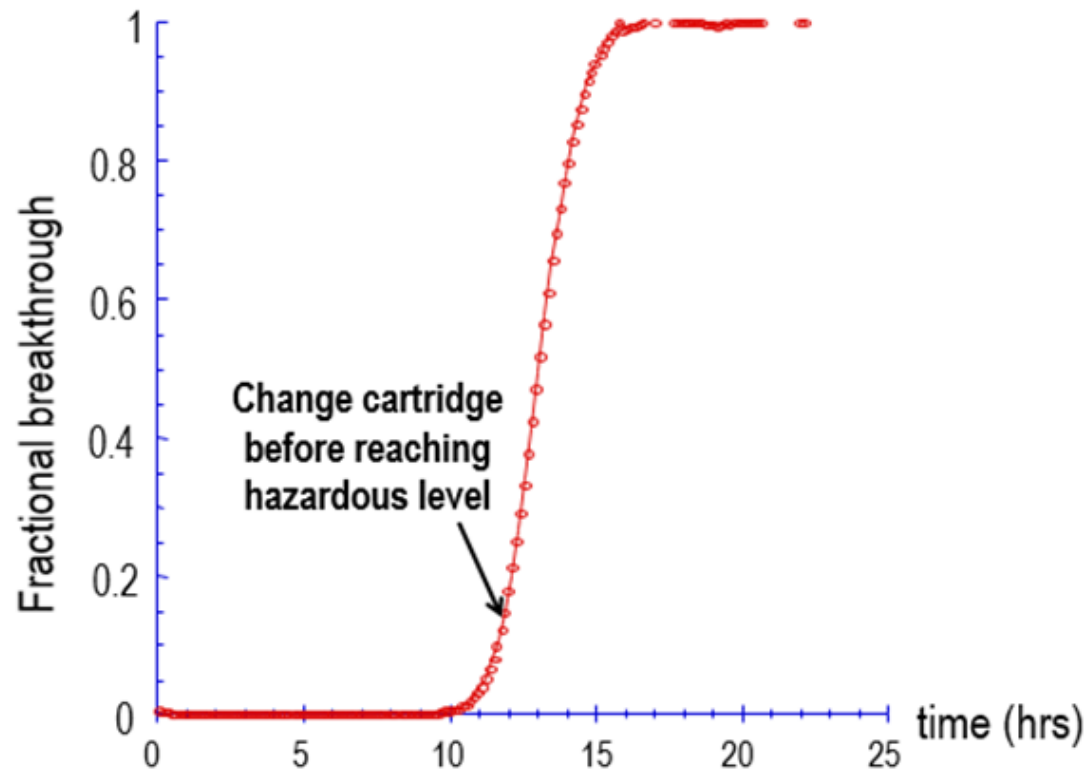
Change filter if:

- Dirty
- Damaged
- Increased breathing resistance
- PAPR failing flow rate check
- If EN single use: maximum 8 hours



How Long Do They Last?

Typical Gas/Vapor Breakthrough Curve



Cartridge Service Life

Depends on several factors, such as:

- Carbon characteristics
- Contaminant(s)
- Concentration
- Airflow (breathing rate)
- Temperature
- Relative humidity
- Migration



Service Life Software



Select and Service Life

Select the Country or Region of Regulation

Americas

-  Argentina (Español)
-  Brasil (Português)
-  Canada (English)
-  Chile (Español)
-  Colombia (Español)
-  Mexico (Español)
-  Peru (Español)
-  United States (English)

Asia Pacific

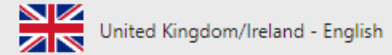
-  Australia/New Zealand (English)
-  China (中国) - 简体中文
-  Japan (日本) - 日本語
-  South Korea (대한민국) - 한국어
-  South Korea (English)
-  Taiwan (臺灣) - 繁體中文

Europe

-  Belgium (België) - Nederlands
-  Belgium (Belgique) - Français
-  Denmark (Danmark) - Dansk
-  France - Français
-  Germany - Deutsch
-  Italy - Italiano
-  Netherlands - Nederland
-  Spain (España) - Español
-  Turkey (Türkiye) - Türkçe
-  United Kingdom/Ireland - English

Summary

Location



Contaminants

Filter

Resources

www.3M.com/SLS

Care and Maintenance



Care and Maintenance

3M™ Versaflo™ TR-600 Powered Air-Respirator

To maintain protection levels, optimise the effective lifetime of the system and avoid the additional cost of replacement, it is extremely important to carry out regular checks and maintenance on Powered and Supplied Air Respirators.

Battery

- Should be immediately charged after receipt of product

Before use

- Ensure Battery is fully charged
- Ensure Turbo is undamaged
- Ensure Turbo is correctly secured to its belt
- Ensure Filter is correctly fitted
- Perform airflow check -insert Airflow Indicator Tube. Refer to Turbo user instructions for information
- Perform alarm check. Refer to Turbo user instructions for information

Monthly

- Carry out all the 'Before Use' inspections and create a record of this monthly check for the turbo

After use

- Clean with cloth dampened with a mild solution of water and liquid household soap
- Turbo may also be worn through a shower to remove further contaminant
- Turbo can also be immersed for cleaning or put in respirator washer for cleaning (using TR-653 Cleaning & Storage Kit)
- Battery can be immersed for cleaning
- Refer to user instructions for cleaning information
- Charge Battery (if required)
- Change Spark Arrestor, Pre-Filter and/or Filter (if required)
- Store in a dry, clean area/locker away from direct sunlight, high temperature and solvents

Every filter change

- Inspect Filter and inner seal and replace if damaged
- Always properly install the Filter into the Turbo

Ordering consumables, repair parts and accessories

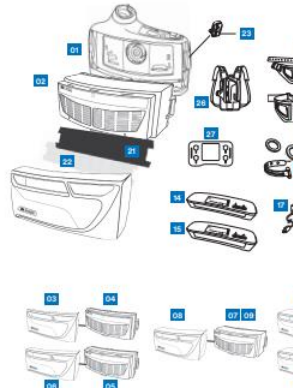
To request a quote or place an order for these items, please contact your 3M Approved Distributor.

Further information and advice

If you require additional guidance on the Care and Maintenance of your 3M Powered and Supplied Air Equipment, please contact the Helpline or your local 3M representative.

3M Personal Safety Division
3M United Kingdom plc
3M Centre, Cain Road
Bracknell, Berkshire RG12 8HT
United Kingdom
Tel: 0870 60 800 60
www.3M.co.uk/safety

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Replace all damaged parts immediately to ensure correct levels of protection.



To download this poster please visit www.3M.co.uk/maintenancepack



Care and Maintenance

3M™ Versaflo™ M-400 Series Helmets

To maintain protection levels, optimise the effective lifetime of the system and avoid the additional cost of replacement, it is extremely important to carry out regular checks and maintenance.

Before Use

- Inspect for damage and replace if necessary:
 - Outer shroud – ensure it is free from tears and its gasket is inserted properly
 - Inner collar
 - Visor frame to jaw gasket
 - Visor - surround and gasket
 - Helmet shell
 - Forehead seal
 - Head harness
 - Comfort pad/s
- Replace Peel Off visor covers (if used).

Monthly

- Carry out all the 'Before Use' inspections and create record of this monthly check.

After Use

- Clean with cloth dampened with a mild solution of water and liquid household soap.
- Disinfect with 3M 105 Wipes.
- Store in a dry, clean area / locker away from direct sunlight, high temperatures and solvents.

Ordering Consumables, Repair Parts and Accessories

To request a quote or place an order for these items, please contact your 3M Approved Distributor.

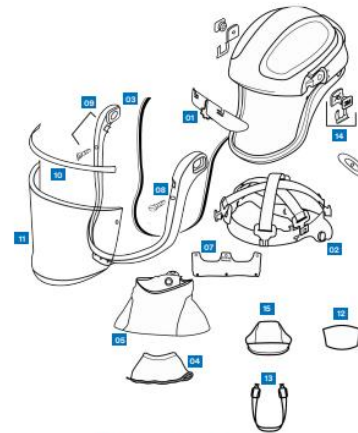
Further Information and Advice

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3M Personal Safety Division
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Replace all damaged parts immediately to ensure correct levels of protection.



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Description	Part No.
Versaflo M-406 Respiratory Helmet, with Coated Visor and High Durability Shroud	M-406
Versaflo M-407 Respiratory Helmet, with Coated Visor and Flame Resistant Shroud	M-407
Accessories and spare parts	
01 Replacement Airflow Deflector	M-316
02 Head Suspension	M-350
03 Jaw Gasket	M-441
04 Inner Collar	M-444
05 Flame Resistant Outer Shroud (M-407)	M-447
06 High Durability Outer Shroud (M-406)	M-448
06 Size Reducing Ratchet Comfort Pad	M-956
07 Forehead Comfort Pad	M-957
08 Visor Frame Buttons	M-919
09 Visor Frame Assembly	M-920
10 Visor Gasket	M-921
11 Molten Metal Visor	M-925
11 Coated Visor	M-927
12 Peel-Off Visor Covers	M-928
13 Chin Strap	M-958
14 Visor Pivot Kit	M-960
15 Flame Resistant Headtop Cover	M-972

3M Health & Safety Helpline
Monday - Friday 9 to 5
0870 60 800 60 - UK
1800 320 500 - IRELAND

Contact Us

Health & Safety Helpline

Available Monday to Friday - 9.00am until 5.00pm

Telephone

0870 60 800 60 (United Kingdom) 1 800 320 500 (Ireland)

George Elliott

Linked 

Thank you!

Any questions?