LEV LOCAL EXHAUST VENTILATION 2024

10th & 11th September 2024

Hosted by

BOHS British Occupational Hygiene Society

Practical demonstration on how to undertake a thorough examination and test of a typical portable welding fume LEV system

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LEV TExT Practical Demonstration

How to Undertake a Thorough Examination and Test of a Typical Portable Local Exhaust Ventilation Unit

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Director and LEV Specialist &

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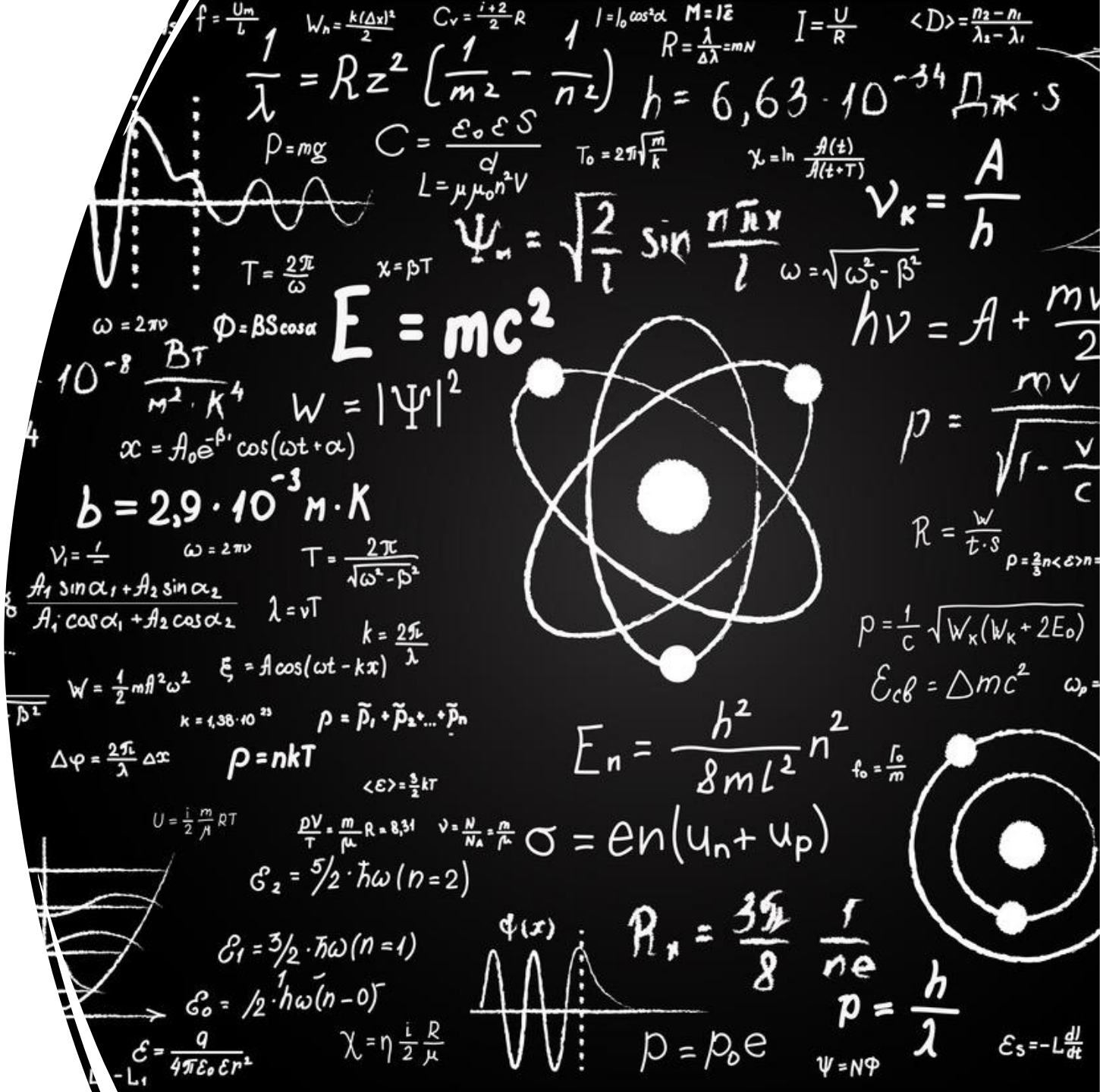
LEV Specialist

What to expect

- If you're hoping for complex scientific research on particle sizes and aerodynamics you've come to the wrong place.
- We'll cover the basics with regards to how we approach testing portable welding fume units.
- We can't cover all the different situations in 40 mins.
- We might leave you with more questions than answers!



Scenario for our LEV TExT

A Duty Holder phones to say they have a portable LEV unit that needs testing

- It has one hood.
- It’s in a welding bay.

First things First

- This is a **Thorough** Examination and Test.
- Definition of thorough:
  - ***Complete with regards to every detail; not superficial or partial.***
  - ***The "LEV" tester takes pains to do something carefully and completely.***
- **The basic principles we will apply to this test apply to the majority of LEV systems!**
- Whilst LEV testing may appear straightforward, I'll demonstrate that it's more involved than people often assume.

LEV Route to Control

- At Armstrong Environmental we use a system called “**LEV Route to Control**”
- Based on the 3-stage approach laid out in paragraph 336 of HSG258 ”Controlling Airborne Contaminants at Work” from the HSE.

We begin by asking the duty holder for copies of any relevant information

- We start our assessment with a **Desk Top Study**

Desk Top Study

What information do you think the duty holder should provide us with here?

Desk Top Study

Commissioning Report - The unicorn of LEV testing!

Its not very often that the Duty Holder provide these.

It’s the LEV Commissioners job to determine if the equipment supplied provides adequate control of the contaminant.

The Commissioning report provides the benchmark against which to compare future performance.

Desk Top Study

Risk Assessment:

- This should clearly identify the **process and hazardous substances** under control.
- It defines **who is at risk of exposure** (primary & secondary exposures).
- The RA also puts the requirement for control into perspective ie is the LEV being used as part of a **wider strategy** eg to be used with RPE.

Desk Top Study

Log Book

- Details any repairs or servicing including filter changes.
- The commissioning report and previous reports should be detailed here.

User Manual – how to look after the system eg recommendations for service intervals

Technical Drawings – schematics showing the system parts and test points.

Desk Top Study

Workplace Exposure Assessment Report:

- This checks that relevant exposure limits have not been exceeded and that control measures are working adequately.
- They provide data to enable decisions on their **overall control strategy** and make any improvements where needed.

Filter Type:

- We're looking for any information on the filter type and any air sampling related to recirculating units.

Operator Training Records:

- Does the operator know how to use the system correctly?

What type of TExT?

The outcome of the Desk Top Study will determine if the Thorough Examination and Test (TExT) is a:

Commissioning TExT

(New System or Limited / No data available),

or a

Routine TExT

(System that has been previously commissioned, competently!)

Additional information required

- Next, we would arrange a suitable time for the site visit to test the system:

We'll ask the DH.

  - When is the system running? (**we will need to see it in operation**!)
  - What are the site-specific health and safety arrangements?

All being well we can now put together our Risk Assessment and Method Statement (RAM'S).

Arrival at Site

We’ve arrived on site, signed in, found the coffee machine, and reviewed our risk assessment.

We’ve put on our PPE.

We’re good to go

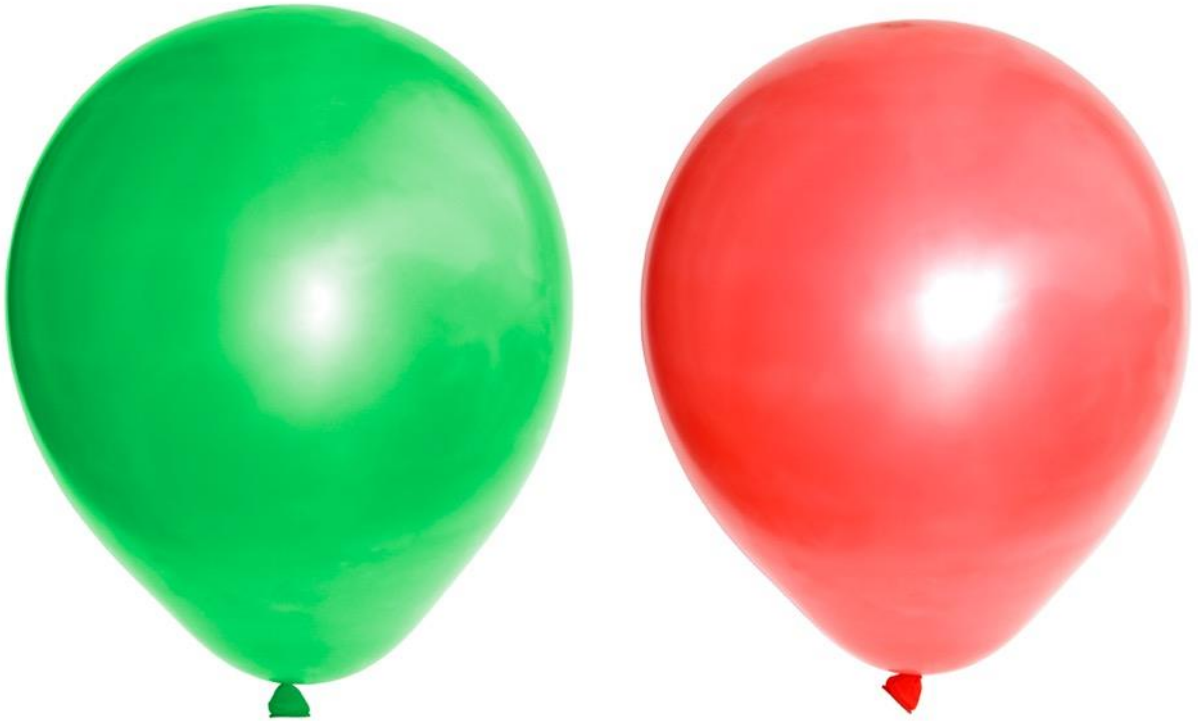
Stage One – **Visual Inspection**

- This is a critical and often overlooked part of the test.
- We do a thorough visual inspection of the unit and observe the operator using it.
- We take videos and photograph’s and save as a record.

Demonstration – Balloon Scenario

Green balloon represents the hoods capture zone

Red balloon represents the contaminant cloud.



Welding Scenario – Two Questions

Is the operator using the LEV?

What percentage of the contaminant do we think is being captured by the hood?

Question for Audience

Would it be sufficient to deem the system unsatisfactory at this point in the test?

YES / NO / It depends

I think it depends – some factors to consider.

Does it look like its normally tucked out of the way and never switched on or has the operator just had a momentary lapse and not used it?

Has the operator been trained how to use it correctly? – we can ask them the question.

What other control measures are in place? Are they wearing RPE?

What's the task duration? Is it high intensity or sporadic?

What type of welding is it?

Professional Judgement

- Using the information, we've collected we would make a professional judgement.

- We may deem it unsatisfactory eg:
  - No other control measures in place.
  - High intensity MIG welding on stainless steel.
  - Operator has had no training on the LEV use.

- We may deem it satisfactory eg:
  - We think it was a momentary lapse in concentration.
  - Operator was well trained.
  - Other control measures in place eg RPE

Earlier Re-Test Date

- If the unit is satisfactory but we have some minor concerns, then at this point we may decide to reduce the test date to 3 or 6 months to satisfy ourselves that any advice we give gets actioned within a reasonable timeframe.

- One such action might be refresher training for the operator and better supervision to ensure the system is used correctly.

- It is important to note that the 14-month test date is not set in stone and can be reduced based on the tester's professional judgement.

Physical inspection of the Unit

- COSHH Regulation 9 – Covers Maintenance

- Does the unit appear to be maintained in an efficient state, in efficient working order, in good condition and in a clean condition?

- Proper maintenance is a vital part of any control regime.

Visual inspection of the Unit

Hood

- Looking for any significant signs of damage.
- Is the hood the correct shape and size for welding being undertaken?

  e.g. If it’s a long seam weld and the welder has to keep moving it then its probably not suitable

Visual inspection of the Unit

Ducting

- Looking for signs of damage eg tears or holes (repaired with duct tape).
- Is the mechanical arm holding the hood in position?
- Is the ducting sufficiently long to allow the hood to be positioned correctly?

Visual Inspection of the Unit

Filter/s

- Confirm what filters are fitted:
  - Anti-spark mesh
  - Pre-filter
  - Main Filter (eg W3 or HEPA)
  - Are the filters suitable for particulate and gasses eg ozone if required?

- Record the Filter condition
  - New
  - Used
  - Damaged
  - Is there evidence of breakthrough?

Visual Inspection of the Unit

Exhaust Outlet

- Is there visible evidence of contaminant around the outlet, suggesting breakthrough?

Other items:

- Visual inspection of electric cables
- Are the wheels running freely?

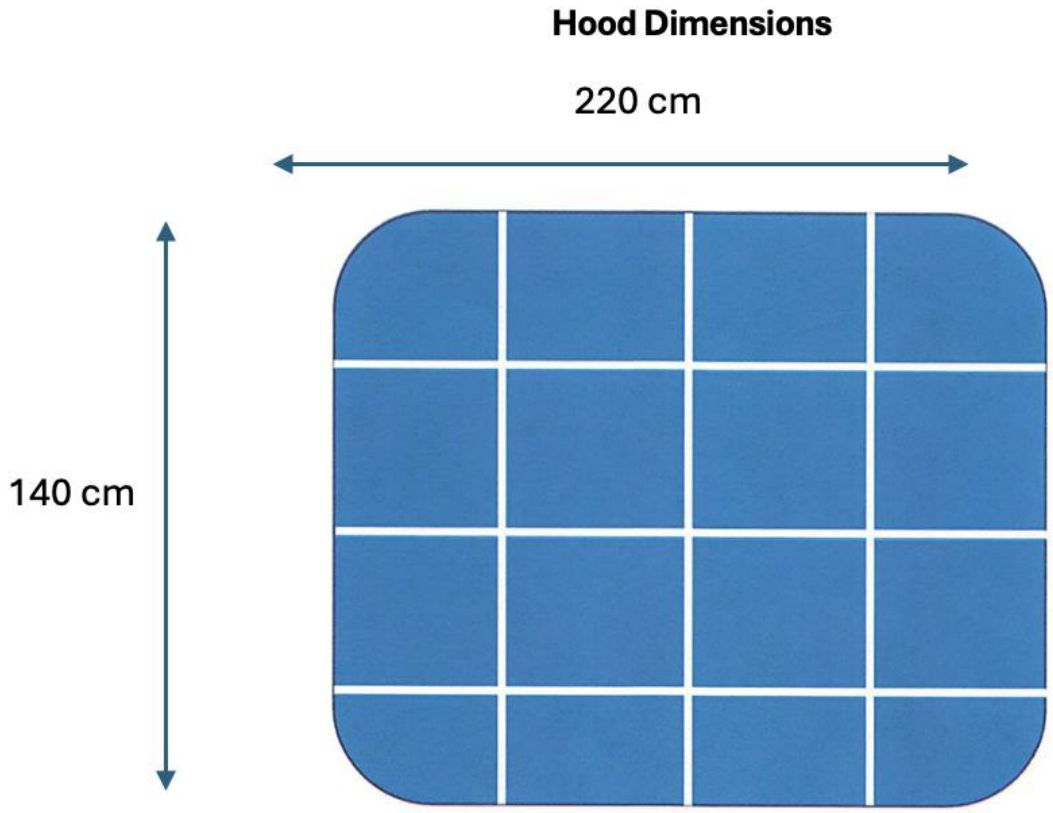
This stage is now complete.

We can now get the test kit out of the box out, progress to **Stage 2**, and start taking some measurements.

Stage 2 – **Technical Measurements**

Hood

- Measure the hood dimensions and work out the area of the face.
    - For our orange unit the hood face is 0.03 $m^{2.}$
- Split the hood into imaginary equidistant grids (we did 16 for this hood).



Stage 2 – Technical Measurements

- Using a hot wire anemometer take face velocity readings and work out the average.
    - We got **9.0 m/s Face Velocity.**
- We check with smoke release that there are no cross draughts eg from cooling fans or open shutter doors.

Stage 2 – Technical Measurements

Capture Distance

Let's assume we have an operator MIG welding mild steel, with continuous use throughout their shift.

One of the Questions Often Get Asked

- What Capture Velocity would you recommend?

  - 1.0 m/s

  - 0.5 m/s

Capture Velocity

Capture velocity is the velocity required at source to ‘capture’ the contaminant cloud and draw it into the hood.

HSG258 Table 9: Details recommended capture velocity range m/s.

- For welding fume the range is **0.5 to 1.0 m/s**

Paras 140 and 141 define which end of the range applies.

Lower end of the range of capture velocities

- Low toxicity, COSHH essentials Band A materials.
- Low usage.
- Intermittent use.
- Larger hoods.
- Some direction airflow towards hood.
- No draughts.

Upper end of the range of capture velocities

- Highly toxic, COSHH essentials Band D materials.
- High Usage.
- Continuous Uses.
- Small hoods.
- Airflows away from the hood.
- Draughts

Capture Velocity

On the basis of above we would typically be trying to achieve a capture velocity of 1.0 m/s.

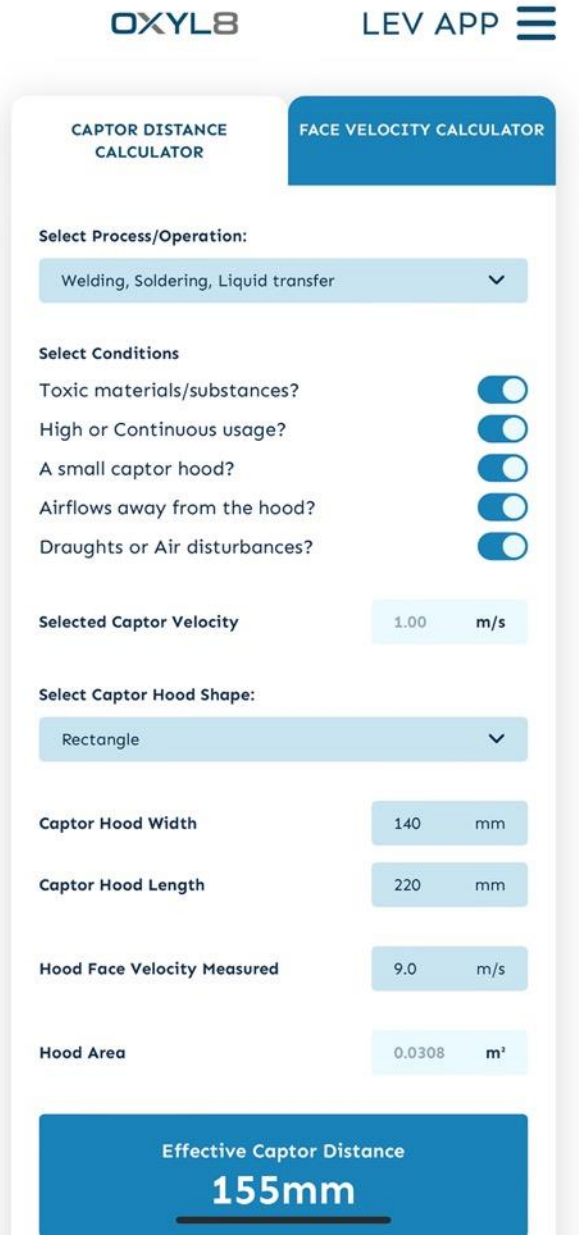
Work this out by measuring the hood dimensions and face velocity and then apply Fletcher's Equations.

We don't measure capture distance using smoke release. Why?

- Because smoke releases can usually be controlled at velocities well below 0.5 m/s, (*typically down to 0.2 m/s*).
- Smoke on its own would therefore overestimate the capabilities of the hood's performance.

Working out the Capture Distance

- We use the **OXYL8** App which is free to download.
- We got a capture distance of **155mm, or 15 cm**



Capture Velocities

OK – we're good to go……Not quite.

Porosity

- When you test enough welding systems this is a word you come to hear fairly regularly.

The ACGIH manual states that "*Hood location too close to the weld or velocities above 0.75 m/s at the point of weld may disturb the shield gas.*"

So…what the heck is Porosity?

Porosity

- Porosity in welds result from bubbles of gas being trapped in the welding pool as it solidifies.
- It’s caused by the shielding gas not reaching the weld.
- The results is the little holes we can see evident in the photo.
- In a nutshell this is a poor weld which would probably need grinding out and re-doing.

Porosity – what to do if you get it

- Speak to the welder – this might be why they haven’t been using a hood!
  - Word of caution this tends to be the default response from all welders!
- Porosity could be down to the welder's technique.
- Its important to work with the welder to find a solution.
- If this system doesn’t work, alternative control solutions will be required.

Capture Distance

- Once we have determined the capture distance, we mark this on the hood so the operator can see what it is.

Duct

The ducting is polyester hose, PVC coated with welded steel wire spiral.

To determine the transport velocities - we don't drill holes in the side of the hose – this is not good practice!

Two schools of thought here.

- Estimate the duct velocities using the hood readings.
- Carry out a visual inspection from the hood.

We don’t think its necessary to estimate the duct velocity. It doesn’t add a lot of value to the test.

An inspection can be made from the hood, using your torch.

If it’s a long section of duct you could estimate the duct velocities.

Use your professional judgement to decide what to do.

Filters

Aluminium pre-filter (spark guard)	Pre-filter (Polyester) Class Typically G4 Coarse Particles >10µm	Main Filter (Non-woven fibre) W3 E12 Filter efficiency >**99.5%** Filters Particle < 1 µm
HEPA Filter (Non-woven fibre) H13 Filter efficiency >**99.95%** Filters Particle < 1 µm	HEPA Filter (Non-woven fibre) H14 Filter efficiency >99.995% Filters Particle < 1 µm	Active Carbon Filters (solvents and gasses)

How long will the filter last?

- It depends.
  - How often its used.
  - How well the operator uses the LEV.

- As dust accumulation in the filter increases, its flow resistance increases and the extraction performance of the unit decreases.

- The signal horn on our unit indicates that a filter change is required.

- Good practice would be to check capture distances prior to filter change to confirm what **worst case** would be.

Question

- Our unit is fitted with a **W3 E12** rated filter.
  - Efficiency of >99.5%.
  - Filters particulates less than 1 µm in size.

Is this type of filter OK for welding fume (eg MIG welding Stainless Steel)?

HSG258 – Special Filters

HSG 258 Para 363 states:

“Filtration of “toxic” particles requires a **high performance** filter,

for example high efficiency particulate air ‘HEPA’ or ‘absolute’ filters.

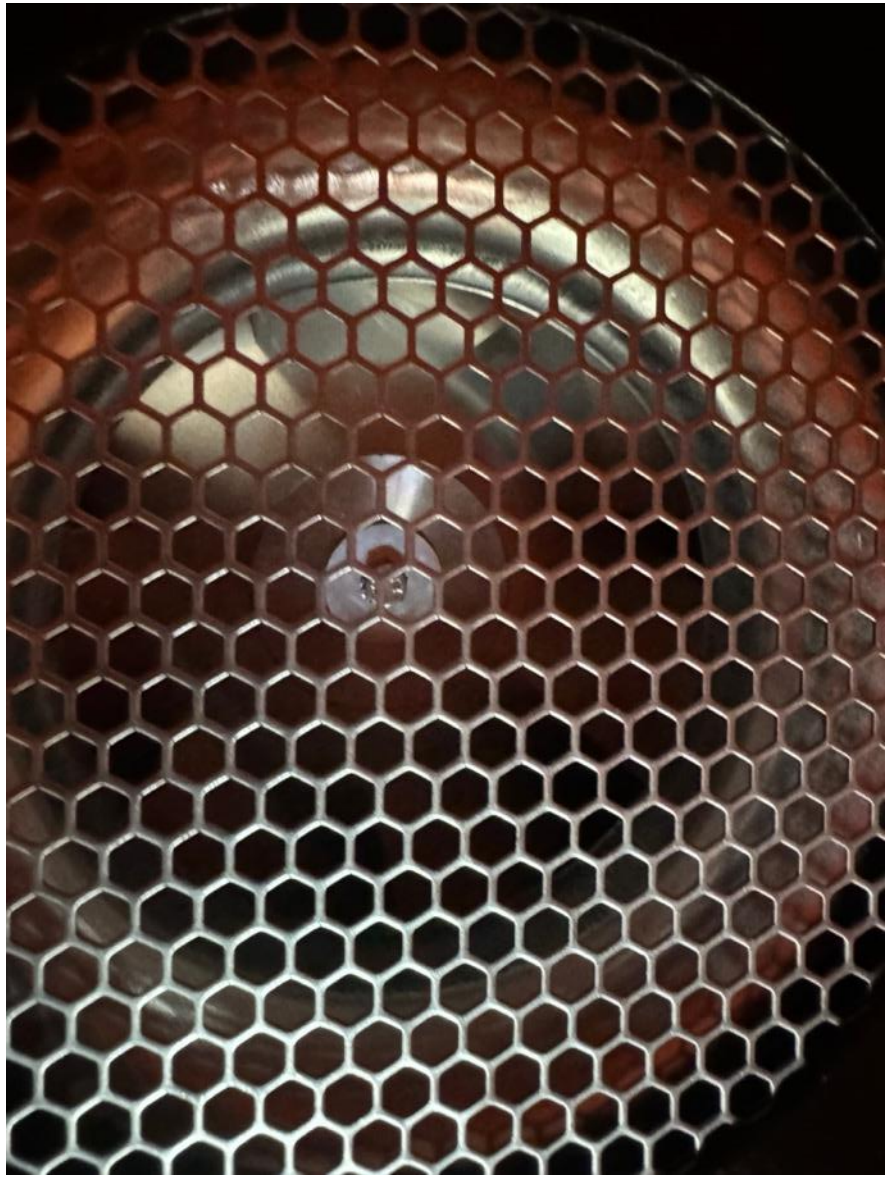
ALARP (As low As Is Reasonably Practicable)

- This involves the duty-holder weighing a risk against the trouble, time and money needed to control it?
- We can recommend that the duty-holder fits the best filtration available but ultimately its for them to decide what to fit, taking into account ALARP.
- These hoods as we have seen can capture anywhere between **0% up to 100%** of the welding fume generated.
- Whilst we would recommend HEPA - Focusing too much on filters that are either 99.5% or 99.95% efficient (difference of **0.45%**) probably isn't the best use of resources.

Fan

I don’t think there is a lot we can do on these units as part of the thorough examination and test:

- Try and visually inspect to see if there are any contaminants building up on the blades
- listen for unusual noises that indicate there may be a problem.



Exhaust Outlet

Using a real-time hand-held device enables us to take readings of airborne fumes, at the exhaust outlet.

We use a CEL-712 Microdust Pro

- range 0.001 mg/m^3 to 250 g/m^3).

Exhaust Outlet

We suggest that you take a number of readings, as follows:

1. Measure the background airborne concentration at the outlet with the LEV unit switched off.
2. Switch the unit on and repeat the first measurement (this result should be lower than the first as the air is now going through the filters).
3. Final reading …. we now ask the operator to undertake the process (or a simulation of the process).

Exhaust Outlet

- These readings are great for checking quickly if:
  - There is a filters fitted correctly!
  - The filter is working correctly.
  - Are the seals OK?

- We have found units with filters that appear to be fake copies (these typically do not have any labels or markings on them). This is a good way to identify them.

Exhaust Outlet

Fixed Point Air Samples

- We could also run some fixed-point / static air samples at the outlet and send these off to the laboratory for analysis for the specific metals.

Advantage of this is that we can achieve low detection levels.

Disadvantage is that it takes time (potentially weeks) to get results.

Stage 4 – Provision of a Comprehensive Report

- The report is based on requirements laid out in HSG258 and the ACOP L5.
- Using professional judgement based on all of the quantitative and qualitative data the tester makes a judgement on the effectiveness of the system.
- **Does the system provide adequate control**?
  - Yes
  - No
  - Not determined – insufficient information to make an informed decision.

armstrong environmental

LEV – COMMISSIONING THOROUGH EXAMINATION AND TEST (TExT)	Project number: P24-2345 Client system number: LEV 01
Client: Welding Inc	
Address: Stockley Shed Durham DH1 1MA	
Building Name: Hanger **Building Number:** 01 **Floor level:** Ground Floor **Room name:** Engineering	
System description: Kemper ProfiMaster - Portable Unit.	
Previous test date: Not Applicable. **Current test date:** 23/07/2024	**Retest before:** 23/07/2025
Examiners & report author Peter Surtees *LFOH(S) TFAAM CoC (Control)* Project Manager & LEV Specialist	**Signature:** **Date:** 23/07/2024
Report checked by: Ross Macauley *BSc (hons) LFOH(S) CoC (Control)* Project Manager & LEV Specialist	**Signature:** **Date:** 23/07/2024
Authorised by: Mark Armstrong *MSC BSC(Hons) CMIOSH LFOH(S) CoC (Control)* Director & LEV Specialist	**Signature:** **Date:** 23/07/2024
Client representative accepting report: Mr D. Holder	**Signature:** **Date:** 01/08/2024

Assessment Level of Control:

ADEQUATE

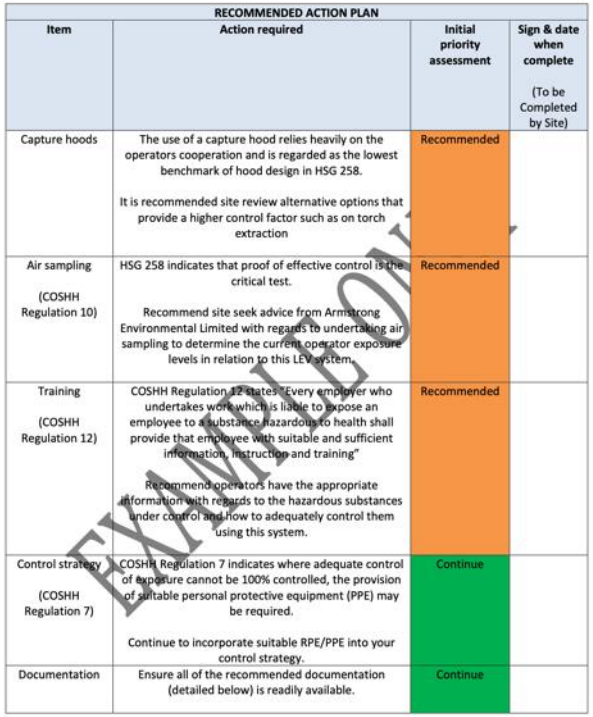
Please note that this system may not always achieve 100% control of the contaminants. Consequently, site must use this LEV in conjunction with a wider control strategy, including suitable RPE as per the risk assessment

EXAMPLE

Head Office: Stockley Lodge, Stockley Lane, Oakenshaw, Crook, DL15 0TL
Regional Office Locations: Edinburgh, Leeds and Cheltenham
Tel: 0191 3782164
www.armstrongenvironmental.co.uk
Armstrong Environmental Limited a company incorporated and registered in England and Wales.
Company registration number **06317253 and** VAT Registration Number: 916 0437 40

Provision of a Comprehensive Report

- Even for a single hood system ours is around 13 pages long.
- If your report is 1 or 2 pages, I would question its validity!
- Report should clearly state the process and hazardous substances and if adequate control is provided.



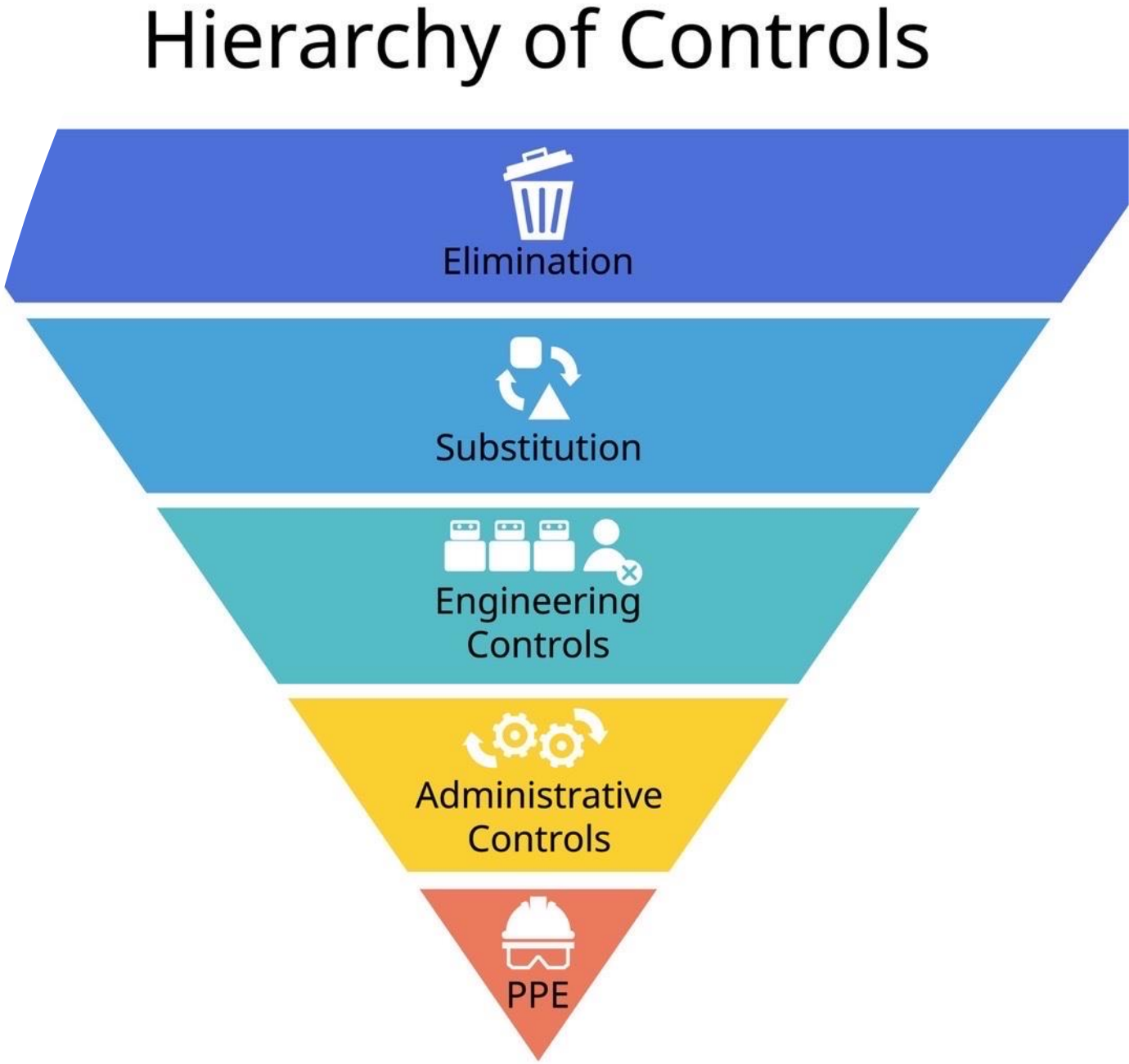
RECOMMENDED ACTION PLAN			
Item	**Action required**	**Initial priority assessment**	**Sign & date when complete** (To be Completed by Site)
Capture hoods	The use of a capture hood relies heavily on the operators cooperation and is regarded as the lowest benchmark of hood design in HSG 258. It is recommended site review alternative options that provide a higher control factor such as on torch extraction	Recommended	
Air sampling (COSHH Regulation 10)	HSG 258 indicates that proof of effective control is the critical test. Recommend site seek advice from Armstrong Environmental Limited with regards to undertaking air sampling to determine the current operator exposure levels in relation to this LEV system.	Recommended	
Training (COSHH Regulation 12)	COSHH Regulation 12 states "Every employer who undertakes work which is liable to expose an employee to a substance hazardous to health shall provide that employee with suitable and sufficient information, instruction and training" Recommend operators have the appropriate information with regards to the hazardous substances under control and how to adequately control them using this system.	Recommended	
Control strategy (COSHH Regulation 7)	COSHH Regulation 7 indicates where adequate control of exposure cannot be 100% controlled, the provision of suitable personal protective equipment (PPE) may be required. Continue to incorporate suitable RPE/PPE into your control strategy.	Continue	
Documentation	Ensure all of the recommended documentation (detailed below) is readily available.	Continue	

Provision of a Comprehensive Report

- There should be recommended action plan.
- The DH would then need to satisfy the Regulator that they have complied, or that they have a sound action plan going forwards.

Wider Control Strategy

- The duty holder should be using LEV as part of a wider control strategy.
- LEV forms one part of the hierarchy of controls.
- The LEV TExT report needs to define how it fits into this wider strategy eg it must be used in conjunction with suitable RPE.



Re-test / Routine TExT

- Does the system continue to provide control?

- Is it being maintained?

Timeframe for testing will be dependent on the conditions found at the time of the assessment and how confident the tester is that control could be maintained up to 14 months time!

Workpalce Exposure Assessments

- We’re huge fans of collecting data.

- Workplace exposure assessments tell us how well the control strategy is working and if the control measures are adequate enough to ensure operator exposures are sufficiently below specific workplace exposure limits (WELs)
- Workplace exposure assessments should always be carried out as part of the commissioning and followed up at suitable intervals.

Summary

- A thorough examination and test is more involved than many people realise.
- Professional judgement, based on experience and qualifications, is very important when determining if a system provides adequate control, or not.
- LEV should be judged on the effective capture of the welding fume, not just on the airflow measurements.
- If done incorrectly people's lives are at risk.
- Choosing competent testers, such as LEV Specialists listed in the Professional Standards Authority Accredited Register, is vital.

Thank you