Local Exhaust Ventilation

Practical Applications
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LEV Issues

- Size of the Problem.
- Engineering Controls.
- The standards that apply.
- Important Design Features.
- Case Studies.
- Legal Requirements.

A Salesman Approaches!

One size fits all or does it?

Source:shponline.com

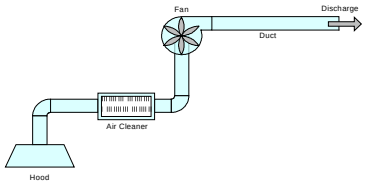
Why is LEV important?

- It removes harmful, dusts, fumes vapours, and gases from the breathing zone of the operator.
- It is a legal requirement under the COSHH Regulations.
- The equipment is often not properly understood by employers.

What is it supposed to do?

- Collect or contain the airborne contaminant.
- Carry it away from workers for treatment or discharge to a safe place.
- Ensure adequate control of exposure and, below relevant Workplace Exposure Limits (WEL).
- Note that loss of LEV control can lead to ill health.

What comprises an LEV system?

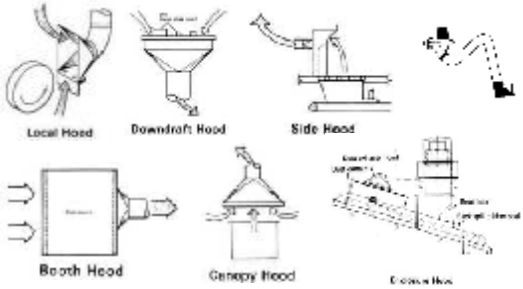


Source: Adrian Hirst

Which contaminants is LEV suitable for?

- Dusts and Fumes
- Mists and Fogs
- Vapours and Gases
- Aerosols and Smoke.
- These might be classified as harmful, irritants, or corrosive.
- LEV is not suitable for highly toxic materials as it is not 100% efficient.

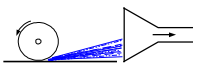
What are the types of hood?



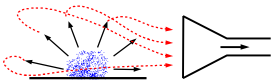
The three basic types of LEV hood

Enclosing (Contain and separate)

Receiving (Receive, contain & empty)



Capturing (Capture)



Source: HSE

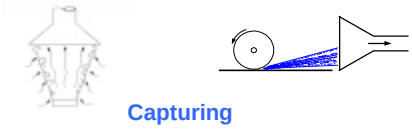
LEV hood classification expanded

Enclosures

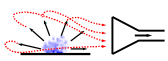
Full **Partial, large** **Partial, small** **Room**

LEV hood classification expanded

Receiving



Capturing



Source: HSE

LEV system design, the most critical element is the hood

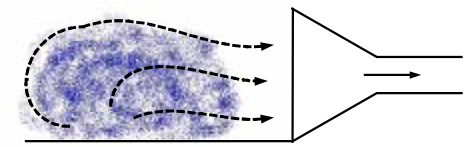
Main reasons why systems fail to protect:

- Incorrect type of hood is chosen (and could never provide sufficient protection)
- The airborne contaminant isn't contained or captured.
- LEV hood design doesn't match the process and source(s)
- Insufficient airflow (various reasons).

Source: Adrian Hirst

How efficient is an LEV system?

Capturing Hoods

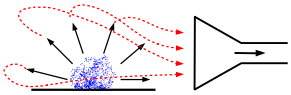


Side-draught captor hood

Source: HSE

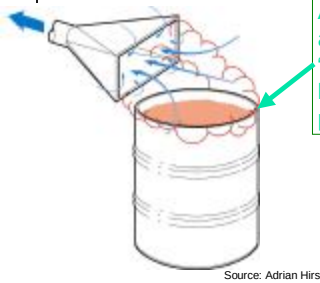
Capturing Hoods

Hood has to generate sufficient airflow at and around the source to 'capture' and draw in the contaminant-laden air



Source: HSE

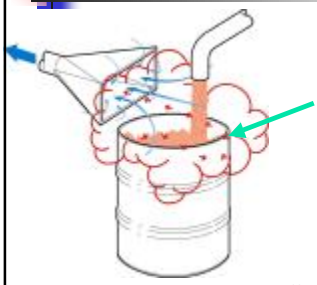
Capture of vapour-laden air: evaporation



Air velocity required at this point to "capture" vapour-laden air ~0.5 metres per second (m/s)

Source: Adrian Hirst

Capture of vapour-laden air: drum filling

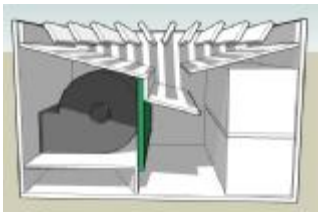


Air velocity required at this point to "capture" vapour-laden air ~2.5 metres per second (m/s)

Source: Adrian Hirst

Downdraught Table

"go with the flow" and entrain pollutants as nature intended

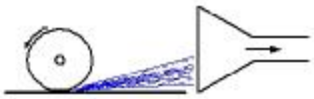


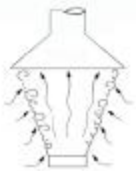
Source: Airbench.com, Lumberjocks.com and Axminster UK Ltd.

Downdraught applications

Use of Angle Grinders in Workshops

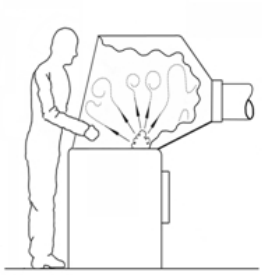
Receptor Hoods





Source: HSE

Enclosing Hood



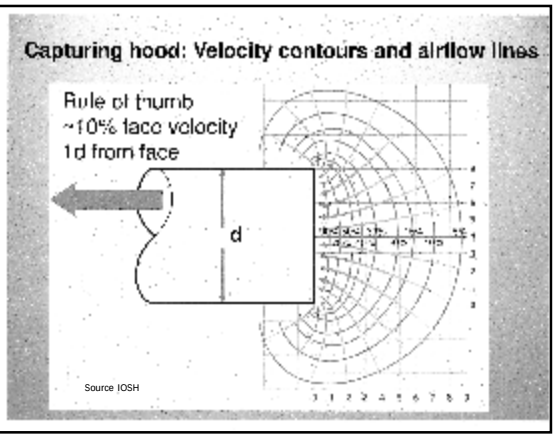
Source: HSE

Types of LEV used for various processes

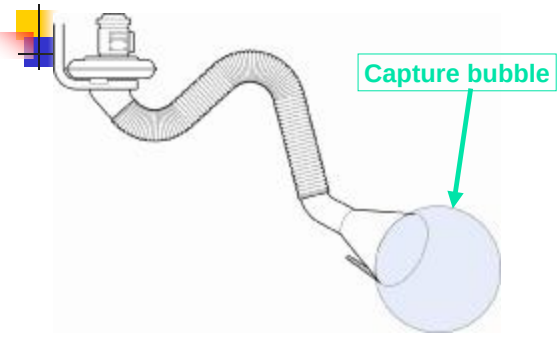
Industrial process	Nature of hazardous substance	Types of LEV
Welding	Welding fume: fine particulate with some natural buoyancy	Capture hood positioned close to the welding activity; or Tip extraction fitted to the end of the welding gun
Paint spraying	Mist and solvent vapours released in controlled direction with velocity	Walk in paint spray booth Down flow booth
Polishing	Metal and polishing dust released in controlled direction with high velocity	Receptor hood and enclosure around the polishing wheel
Shot blasting	Steel shot and metal dust from components released at high velocity in variable direction	Fully enclosed glove box type cabinet with airflow managed to compensate for compressed air input and shot recycling system
Hand held orbital Sander	Wood dust released in variable directions	Extraction integrated into the sander disc
Paint curing Ovens	Hot air and curing vapours with strong thermal buoyancy	Extract/vent from top of oven combined with a receptor hood over the doorway
Laboratory analysis	Acid and solvent vapours released with low velocity and little direction	Partial enclosure and extraction within a fume cupboard

What is the capture area of a hood?

- The face velocity one diameter from the the face of the hood is less than 10%.

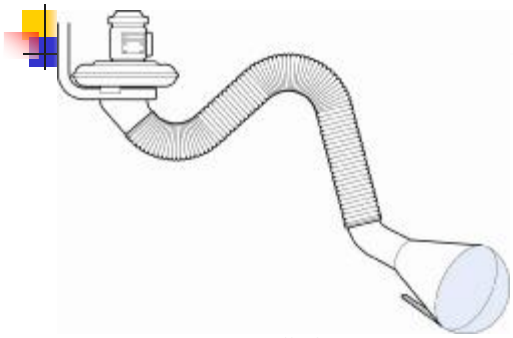


Movable capturing hood – capture 'bubble'



Source: Adrian Hirst

Capture 'bubble' varies in size

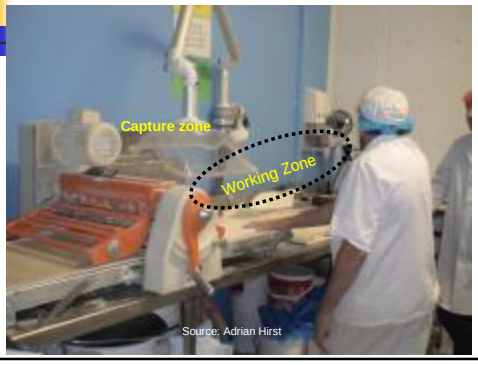


Source: Adrian Hirst

Capturing hood capture 'bubble'

Source: Adrian Hirst

Capture zone must encompass working zone



Source: Adrian Hirst

Ductwork

- Velocity Important
- Should be sufficiently strong
- Well supported and capable of withstanding normal wear and tear
- The number of changes of directions should be kept to a minimum
- Should be made smoothly
- Access to ducting may be required

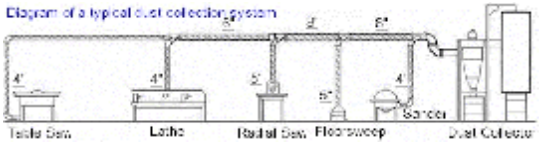
Duct Velocity

Type of contaminant	Duct velocity (m sec-1)
Gases (non-condensing)	No minimum limit
Vapours, smoke, fume	10
Light/medium density dust (e.g. sawdust, plastic dust)	15
Average industrial dusts (e.g. grinding dust, wood shavings, asbestos, silica)	20
Heavy dusts, (e.g. lead, metal turnings and dusts which are damp or that tend to agglomerate)	25

What is the best type of ducting?

Steel tube gradual curves

How should ducting be designed?



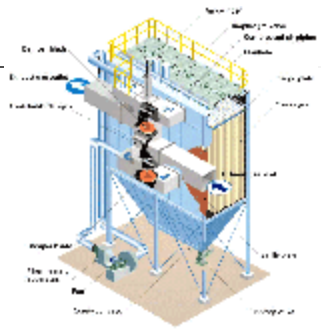
Do different fans make a difference?

The fan type and capacity need to be individually specified for each ventilation system design. Centrifugal fans are generally best for high pressures and axial fans are more suitable for low pressure, high volume applications.

Why are filters necessary?

Filters and Collection Devices:
The type and specification of filtration and collection equipment will depend on various factors relating to the contaminant, the process and environmental considerations.

Appropriate cleaning/maintenance Procedures, including permits must be devised and strictly implemented.



Source: www.envirotreat.net.

Where should cyclones and bag filters be located?

Source: Adrian Hirst

How must it be maintained?

- The system must perform to its design specification.
- The LEV user manual should set out the frequency of checks.
- If you have no user manual then you must hire a competent person, to prepare a suitable document.

Checks and Maintenance Cover Four Types of Parts:

- Moving parts that wear e.g. fan bearings, filter shakers.
- Hoods, duct work and seals that can get damaged.
- Parts that deteriorate with use e.g. filters, flexible ducting.
- Items needing regular attention e.g. filter bins, sludge collectors.

Maintenance other factors

- COSHH Assessments for cleaning and maintenance must be carried out;
- Everyone must know who is responsible for what checks.
- Permit to Work procedures may be needed to carry out this work.

Thorough Examination and Test:

- Most LEV needs a statutory test at least once every fourteen months.
- The test must be done by a competent person, tested against minimum legal standards.

Future Actions

- Implement the report recommendations.
- Keep records of all examinations for at least five years.
- A long list of actions arising from this test shows that your maintenance is not thorough enough.

What training does the operator need?

- Training should cover how the LEV system works.
- How to use the LEV to get the best out of it.
- How to check that the LEV is working.
- What to do if something goes wrong.
- Note – you must keep training records.
- Changes to the work process and LEV means that staff may need re-training.

Buying New LEV Systems

- Use a reputable LEV supplier with experience of the controls you need.
- Ask LEV suppliers how they will prove that their system will control exposure adequately.
- LEV is rarely straightforward and mistakes are costly.

You must specify your LEV.

- You must describe the process, the contaminant, its hazards and the sources to be controlled, and how stringent the control needs to be.
- You must require indicators to be fitted to show that the system is working properly.
- You must require the LEV to be easy to use, check, maintain and clean.
- You must specify that the supplier provides training in how to use, check and maintain the LEV system.

You must specify your LEV.

- You must require the supplier to provide a user manual that describes and explains the LEV system, how to use, check, maintain and test it, along with performance benchmarks and schedules for replacing parts.
- You must require the supplier to provide a logbook for the system to record the results of checks and maintenance.
- See HSE Guidance Leaflet: indg408.

What guidance is available from the HSE?

- Controlling airborne contaminants at work: A guide to local exhaust ventilation (LEV) HSG258 HSE Books 2008 ISBN 978 0 7176 6298 2
- Time to clear the air! A workers' pocket guide to local exhaust ventilation (LEV) Pocket card INDG409 HSE Books 2008 (Single copy free or priced packs of 25 ISBN 978 0 7176 6300 2)

Case Studies

- Grinding in a Forge
- Food factory
- Powder Coating
- Gluing Process
- Die head ventilation
- Ceramics

Practical LEV

- Our Thanks to Dr Adrian Hirst for his permission to use his diagrams and illustrations in this talk.
- Thanks to you for listening.
- Are there any Questions?