LEV and Exposure Control

Peter E J Baldwin CFMOH CPhys
Why bother?

Approx. 13,000 died from work related disease

99%

health

Slide from BOHS Breathe Freely campaign

148 workers died in accidents at work

1%
safety
Overview of talk

- Relevant legislation
- Examples of application of principles of good control
- Adequate control and LEV
Legal requirements

- HSWA
- MHSW
- COSHH
COSHH reg 7

Prevent exposure

Adequately control exposure

Apply hierarchy of control

Implement principles of good control practice

ALARP applies to certain substances

Control to below WEL
Summary of Schedule 2A

a) Designed to minimise emission of contaminant
b) Consider all routes of exposure
c) Choose controls proportionate to health risk
d) Ensure controls are effective, easy to use and reliable
e) Consider if PPE /RPE may also be needed to control risk
f) Regularly check controls work

g) Inform, train and instruct workers
h) Don’t increase other health and safety risks
Hierarchy of control

More effective and reliable

Less effective and reliable

Elimination
Substitution
Engineering controls
Admin. controls
PPE
Process change (1)

- Use Low silica stone
- Use guillotine
- Automate process
- Use dust controls
Process change (2) Enclose process
All routes of exposure
Control risk - Exposure control selection
Segregation
Ventilation

Displacement

General
DEEE - Procedural controls

• Turn off engines
• Run engines outside
• Maintenance of
  – engines
  – exposure controls
• Use exposure controls
• Minimise number exposed
Effective controls - Hierarchy of control

Primary prevention is key!
Can you eliminate the risk?

Engineering controls

Protect the individual:
PPE/RPE: provision, use of correct RPE, face fit testing etc.
Additional controls
Check controls work

• Audits

• Monitoring

• Supervision and management
Effect of Audits

Urinary nickel levels before and after audits for two platers.

- Initial levels:
  - Plater 1: 25
  - Plater 2: 20

- Follow-on levels:
  - Plater 1: 10
  - Plater 2: 15

The graph shows a significant decrease in urinary nickel levels for both platers after the audits.
Training

Risks and controls
• How to use controls
• How to check and report faults
• Consequences of no control
Overall risk not increased

LEV and control

• LEV may be part of adequate control
• Hierarchy of control should be followed
• COSHH Schedule 2A should be followed
Minimise emission

- Redesign work process
- Enclose process
- Design process for LEV
All routes of exposure

• How will exposure occur?

- Elimination
- Substitution
- Engineering controls
- Admin. controls
- PPE
Control the risk

Capture zone and working zone
Effective, easy to use and reliable

• Write specification
• Involve employees
• Think about ancillary tasks
  – Testing, maintenance and decommissioning LEV
  – Access to duct for cleaning
Will PPE /RPE be needed?

- MVR – LEV will control exposures to non-painters
- Painters still have high exposure
  – Need RPE
- Clearance time
- Integrity
Check controls work

- Use of LEV
  - Usability
- Maintenance
- Checks
  - flow indicators
Inform, train and instruct

- How does LEV work
- Position on hood
- Why LEV is needed
- User checks

HSE RR836
Overall H&S

- Elimination
- Substitution
- Engineering controls
- Admin. controls
- PPE
Sources of information

• HSE website

Controlling airborne contaminants at work
A guide to local exhaust ventilation

Control of substances hazardous to health
The Control of Substances Hazardous to Health Regulations 2002 (as amended)

Dust from mixing

Control approach 2

Engineering control
ANY QUESTIONS

Peter.baldwin@hsl.gsi.gov.uk
OCCUPATIONAL EXPOSURE MONITORING INSTRUMENTS
AND HOW THEY OPTIMISE LEV FILTRATION

Maxine Dolloway
Direct Sales Specialist, TSI Instruments
Agenda

+ Introduction to TSI
+ Reasons for air sampling
+ Typical particle sizes
+ Measurement techniques
+ Use of real time instruments with LEV filtration
+ Summary
Founded in 1961 by University of Minnesota graduates

Privately-held company as part of Churchill Industries holdings

Over 600 employees worldwide

Corporate headquarters based in Shoreview, MN with field offices throughout Europe and Asia

- Offices in Germany, United Kingdom, France, China, Singapore and India
TSI INSTRUMENTS... WHERE RESEARCH MEETS REALITY

+ Industry leader in the design and production of precision measurement instruments

+ Partnerships with research institutions and customers around the world to set the standard for measurements relating to aerosol science, air flow, health and safety, indoor air quality, environmental monitoring, fluid dynamics and biological detection.
OCCUPATIONAL HEALTH AND SAFETY
Why do we need to sample air?

- Odors
- Dusts
- Ventilation
- Mold
- Gases
- Temperature
- Viruses
- Chemicals
- Bacteria
- Particulates
- Humidity
- Pesticides
- Bioaerosols
- Radon
- Herbicides
- VOCs

The Air We Breathe
Reasons for Air Sampling

• Health Protection
• Environmental Protection
• Compliance with Government Legislation
• Product Protection
• Process Protection
• Protection from compensation claims
Particles Size Perspective

- Human Hair ± 150 µm
- Visible Airborne Debris 25 µm
- Heavy Atmospheric Dust 10 µm
- Avg. Atmospheric Dust 5-10 µm
- Metallic Fumes 0.3-1 µm
- Ultrafine Particles < 0.1 µm
Airborne Hazards

Gases & very small particles can reach the deepest areas of the lungs.
Typical Particle Sizes
Find and Control Pollutant Sources

You can’t solve a Problem you can’t find!
Measurement Methods

1. Gravimetric Sampling

2. Aerosol Mass Concentrations

3. Particle Counting
Gravimetric Sampling

HSE Standard **MDHS 14/3**

- Method for Determining Hazardous Substances
- Weight in mg/m$^3$ & analysis by laboratory
- 2-3 week turn-around time
Personal Monitoring

ALL Exposure limits are based on **PERSONAL SAMPLES** over an 8 Hour Period

**MUST** be taken in the Breathing Zone

**30 cm Sphere around the nose and mouth**

**SAMPLER (SAMPLING HEAD)**

**SAMPLING PUMP**
Sampling Results

- Laboratory identifies Amount of Hazard Collected (mg)
- Amount of Air Pumped is identified by the Pump (m$^3$)
- Occupational Hygienist can Calculate $\text{mg/m}^3$
- If amount is too high – Corrective Action is Mandatory!

But what happened?
Was it over the limit all of the time?
Or were there Peaks during the 8 hour sample?
Real Time Monitoring

Diagnostic Instruments find problems
Measurement Methods

1. Gravimetric Sampling

2. Aerosol Mass Concentrations

3. Particle Counting
Aerosol Monitor

- Mass Concentration
  Indicative measurement in mg/m$^3$

- Graphical representation

- Instantaneous readings

**DANGER ZONE**
- Oil fume/mist
- Airborne dust
- Viruses
- Tobacco smoke
- Colour pigment
- Bacteria
- Coal dust
- Hairs
- Carbon black
- Pollen
- Hairs
- Dust
- Tobacco smoke
- Carbon black
- Coal dust
- Pollen

Visible by electron microscope:
- 0 µm
- 0.01 µm

Visible by microscope:
- 0.1 µm
- 1 µm
- 10 µm
- 100 µm

Visible by eye (8,1 mm)
Revolution in Real-time Monitoring

The DustTraks are:

• Continuous
• Real-time
• Single Channel
• 90 degree light scattering photometers

They are used to determine the mass concentration of dust aerosols
DUSTRAK II

**Handheld Models**

- Lightweight
- Perfect for *Walkthrough Surveys*
- Single Point Data Collection
- Manual and Programmable Data Logging
- Rechargeable Li-Ion Battery
- Concentration up to 150mg/m\(^3\)
- Free TrakPro Download Software

**Desktop Models**

- Ideal for *Long Term Surveys*
- *Remote Monitoring* Applications
- Manual and Programmable Data Logging
- Rechargeable ‘Hot Swap’ Li-Ion Batteries
- Concentration up to 400mg/m\(^3\)
- Collects *Gravimetric Samples*
- Free TrakPro Download Software
DUSTRAK DRX

Handheld Models

- Lightweight
- Perfect for Walkthrough Surveys
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Desktop Models

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- Concentration up to 400mg/m³
- Collects Gravimetric Samples
- Free TrakPro Download Software
Personal Aerosol Monitor

+ TSI SidePak AM520
+ Wear like a Sampling Pump
+ 50 cc/min to 3 Ltr flow range.
+ Particle sizes 0.8, 1.0, 2.5, 4.0, & 10 µm
+ Static & personal monitor
+ TrakPro 5 software
Ultrafine Particle Counter

+ TSI P-Trak

+ New concept for air monitoring

+ Particles sizes <1µm

+ Measured in particles / cc
P-Trak in the Workplace

Measurements can be used to find sources in the workplace of

• Ultra-fine Particles

• Nanoparticles

This helps evaluate the effectiveness of corrective actions or engineering controls.
TRAKPRO™

- Programming a logging instrument.
- Receiving and managing test data.
- Graphing test data.
- Printing reports.
TRAKPRO™

Choose from several presentation styles and curve fitting choices
Real time monitoring in LEV commissioning

Used in 3 stages:

1. Before commissioning
2. At commissioning
3. After installation
Real time monitoring in LEV commissioning

Before commissioning:

+ Identify baseline (indoors vs outdoors)
+ Walk through survey identify sources of particulate (real time peaks)
+ Helps in design and installation stage of LEV
+ Makes sure LEV system captures particulate at source
+ Using workplace and personal monitoring
Real time monitoring in LEV commissioning

At commissioning stage:

+ Check filters are undamaged
+ Check fitting of filters has been done correctly
+ Check no particulate is passing through
+ Particularly important if system recirculates air
Real time monitoring in LEV commissioning

After installation:

+ Check filters are still fitted correctly
+ Check for damage
+ Workplace and personal monitoring
+ Continuous monitoring?
Summary

+ Importance of particulate monitoring
+ Real time vs gravimetric
+ TSI range of real time dust monitors
+ Personal (breathing zone) vs workplace
+ Aids all three stages of commissioning LEV
+ Helps to maintain a healthy environment for workers
QUESTIONS ?
RECIRCULATING LEV SYSTEMS
THE PROS AND CONS

Richard Topliss – Croft Occupational Hygiene Ltd
Types of recirculating systems
Particulates
Types of recirculating systems
Particulates
Types of recirculating systems
Gases and vapour
What do HSE say?

- COSHH ACOP: Examples of the information which should be available in respect of the main components of the LEV system include (for) systems which return exhaust air to the workplace: filter efficiency; and concentration of contaminant in returned air.

- HSG258: **Controlling airborne contaminants at work**
  
  *Recirculating extracted air is a way to save energy and reduce heating or cooling costs. It also reduces the need to consider make-up air. Recirculation is easier with:*
  
  - contaminants which are particles;
  - low concentrations of airborne contaminant compared with the ‘benchmark’ value (Chapter 3);
  - relatively small LEV systems; and
  - lower toxicity materials.
What do HSE say?

- The air cleaner is the most important part of a recirculation system. It must match the contaminant and its concentration. Recirculation is acceptable as long as the air is thoroughly cleaned. Recirculation may be inappropriate when failure of a component, such as an air cleaner, could result in dangerous conditions. Under these circumstances, any recirculation system should incorporate monitoring and alerts, for example:
  - an alarm for a blocked or failed filter, eg a pressure gauge for continuous monitoring;
  - an advanced detection system connected to alarms and a system to divert recirculated air out of the workplace.
So what are the pros and cons

Pros
- Easy to install (& move)
- No replacement air needed
- Lower energy use - heated / cooled air not thrown away
- Often lower initial cost
- “No” environmental emissions

Cons
- “Dangerous” air emitted
- No clear standards to test against
- High cost of filters
- Often higher maintenance
- Noise
Acceptable concentrations in returned air?

- Carcinogens
- Respiratory sensitisers
- Flammable vapours
- No contaminant detectable?
- Contaminant below WEL?
Case Study

Recirculating fume cupboards introduced into oil field laboratories
Case Study

Recirculating air from welding fume extraction in a fabrication shop
Case Study

Recirculating air from soldering process extraction into the workplace
Case Study

Recirculating air from wood dust extraction
Recirculation – pros and cons

■ Sometimes it might be the best option BUT
■ Consider the whole cost throughout the lifetime of the equipment
■ Consider whether you can be assured that it is always going to control the health risk
CONTACT:

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Croft Occupational Hygiene Limited
Mobile: +44 (0)7803 721424
Email: richard@croftoh.co.uk
Who can make fans...

So here’s what you should look out for.....

.....Anyone!
Applied National & Harmonized Standards

- Machinery Directive (2006/42/EC)
- Low Voltage Directive (2006/95/EC)
- ISO9001:2015
- ATEX Directive 2014/34/EU
Selecting the correct Fan Supplier

Who can you talk too?

Engineers
Designers
Today’s topics to help you understand your requirements and enable the fan supplier to select a suitable fan.

• Information relevant to basic fan selections.
• Installation required to avoid system effects.
• ATEX-Certified fans.
Basic info required to select a fan

- **Flow Rate** – Actual, Standard and Normal
  Units (m³/s, m³/hr, cfm, l/s)

- **Fan Pressure**
  Units: Pa, kPa, mbar, mmWg, insWg

- **Static Pressure?**
  Is the temperature related to the specified pressure
  Pressure split between fan inlet and discharge
Basic info required to select a fan
More things to think about...

Operating Conditions

- Power supply (Voltage/Phase and Frequency)
- Maximum operating temperature
  - Requirement for cold start would also need to be known.
- Minimum fan efficiency?
- Climatic condition high ambient conditions.
- Is the fan handling corrosive, erosive, explosive gas/dust?
- Material handling
  - Type and size of material
  - Concentration
- Is the fan to be driven by inverter?
1) Choosing the correct fan/impeller

- Clean air only
- Product handling
Air enters and exits axially
Generally suited for moving large volumes of **clean** air at low pressures.
Generally low efficiencies- 50%-60%.

Clean air
Maximum temp 50°C

Clean air
Maximum temp 50°C

Clean air
Maximum temp 250°C
Example of Axial fan performance curve
Example of Axial fan performance curve
Centrifugal

Air enters axially & exits at 90°.
Can be used for **Clean** air or **Dirty** air
Single inlet-all air is drawn in through one inlet
Double Inlet Air is drawn from both sides
Velocity profile through a centrifugal fan.
Centrifugal Impeller Types

- Backward Bladed
- Paddle Bladed
- Forward curved

[Graphs showing performance characteristics for different impeller types]
Variable Speed Drive (Inverter) control
Ensuring your fan is free from System Effects

– Fans will only meet the duty point shown on the performance curve under “ideal” installation conditions.

– Ideal conditions are seldom obtainable in practice consequently there will always be some “SYSTEM EFFECT”.

A number of steps can be taken ensure the correct fan is installed correctly for your customer!
2) Avoid duct system design faults

Factors that influence system effect on fan:

- Elbow or bend too close to fan inlet or outlet
- Abrupt duct transition before/after fan
- Pre swirl of the incoming air due to duct design (Swirl in same direction as rotation)
- System dampers not fully open
- Damper location
- Fan inlet or outlet too close to wall or bulkhead
- Bend orientations at fan discharge
Abrupt inlet installations
Inlet duct bends
Inlet swirl due to inlet direction
Effects on duty with fan inlet swirl
Fan orientation and duct outlet direction

- **Good Discharge Duct**
- **Poor Discharge Duct**
- **Acceptable Discharge Duct**
3) Bad flexible connection installation effects fan performance
Ideal fan installation – AV mounts with Flexible connections
In summary, what a bad installation means for you and your customer...

- Fan Performance Problems
- Fan Starting Problems
- Fan Mechanical System Problems
- Fan running inefficiently causing additional noise & running costs!
- Unlikely repeat business
Final chapter: Is the fan you’re installing legally suitable?

ATEX

“Design of fans working in potentially explosive atmospheres”
BS EN 14986 : 2007

This is the foundation for any fan being produced to comply with the ATEX 2014/34/EU Directive
2014/34/EU

The updated ATEX standard was introduced in April 2016

Please remember you are responsible for the equipment you install

Do you have all the technical documentation with the fan?
• Manuals, Equipment Category Marking on Fan & Motor.
• Is CE marking shown.
• How is it certified? 3rd party tested with certificates?
Check the next ATEX fan you purchase for a hazardous application is... 

• 2014/34/EU compliant 
• 14986:2007 compliant (14986:2017) 
• Independently certified for ATEX compliance 
• And that the fan is not 94/9/EC 

Otherwise you and your customer may be at risk?
Thank you for listening, I hope it has been interesting
Do you have any questions?
LEV – EXTRACTING BEST PRACTICE'S

LEV FOR BULK MATERIAL HANDLING EQUIPMENT

Southdowne Solutions Ltd
LEV FOR BULK MATERIAL HANDLING EQUIPMENT

Introduction

LEV and COSHH

LEV and DSEAR

Review available guidance

Comment on shortfall in the guidance with relation to BMH Equipment
LEV FOR BULK MATERIAL HANDLING EQUIPMENT

Large scale biomass handling system at Lynemouth Power Station
Large scale biomass handling system at Drax Power Station
Large scale biomass handling system at Port of Tyne/Immingham Etc
These large scale biomass handling system all incorporate LEV systems throughout.

They also all utilise belt conveyors for transfer.

Belt conveyors tend to present the biggest challenge.

Review problem areas and suggest some solutions...
FACTORS THAT INFLUENCE THE LEV DESIGN

Chute design and transfer height

Conveyor containment

Transfer rate and belt speed

Material dustiness and dust return systems...
CHUTE DESIGN - IDEAL CHUTE GEOMETRY

- Transfer height <3M
- Straight not twisted transfer
- Hood and Spoon type geometry
- Minimise openings especially at the top of the transfer
- Matched velocity, top and bottom
- Various guidelines that will help the chute designer...
Transfer height 20m

Twisted transfer

Hood and Spoon geometry not possible

Air induction via diverter valves

High velocity at impact

Very little guidance available for the LEV engineer to compensate for this...
CONVEYOR CONTAINMENT

IMPORTANT ELEMENTS:

Rear seal and side skirt boards and seals

Transfer point location
(Avoid flat to trough transition)

Impact plates in chute to avoid heavy contact with skirt seals

Skirt joints should be eliminated if possible

Impact rollers or sliding bed plates required

Settling chamber dimensions and hood locations

Good guidance in the conveyor guides...
BELT SPEED

LEV flow rate proportional to throughput

The faster the belt the higher the LEV flow rate needs to be
But how much higher?

Dust lift off after transfer points at high speeds

Roller ‘Patter’

Variable rate
  Variable speed
  or variable burden?

Intermediate LEV between transfers...
MATERIAL DUSTINESS

The dustier the material, the more extraction is needed
But how much more?

2800TPH wood pellets
5% dust
140TPH fine dust

Dust Collection:

Spot filter that drops dust back on top of the pile?

Local extraction that returns the dust under the pellets

Central extraction with dust removal...
LEV GUIDANCE IN RELATION TO BMH

ACGIH INDUSTRIAL VENTILLATION GUIDE
CEMA BELT CONVEYOR GUIDE
MARTIN BELT CONVEYOR GUIDE
NIOSH DUST CONTROL HANDBOOK
MHEA TROUGH CONVEYOR GUIDE...
FACTORS THAT INFLUENCE LEV DESIGN

- Chute design and transfer height
- Conveyor containment
- Belt speed
- Material dustiness and dust return
- Systems...
FACTORS THAT INFLUENCE LEV DESIGN

Chute design and transfer height

All recognise the benefit of good chute design and recommend “hood and spoon” approach

ACGIH adds extraction at the top of transfers over 3m but does not differentiate between 3m or 30m

CEMA/NIOSH/MARTIN allows a calculation for actual transfer height

MHEA makes no allowance...
FACTORS THAT INFLUENCE LEV DESIGN

Chute design and transfer height

Conveyor containment

All recognise the importance of good Containment

But only CEMA/NIOSH/MARTIN account for increased extraction airflow by calculating induced air through defined openings...
FACTORS THAT INFLUENCE LEV DESIGN

Chute design and transfer height

Conveyor containment

Belt speed

All link extraction airflow to belt speed

But all only on the basis of above or Below 1M/S...
FACTORS THAT INFLUENCE LEV DESIGN

Chute design and transfer height

Conveyor containment

Belt speed

Material dustiness and dust return systems

ACGIH adjusts airflow for dusty materials
But does so fairly subjectively

CEMA/NIOSH/MARTIN calculate airflow based on mean particle size
But is this adequate?
### COMPARISON OF LEV CALCULATIONS

<table>
<thead>
<tr>
<th>AIRFLOW RATES IN M3/Hour</th>
<th>CEMA</th>
<th>ACGIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOP AIRFLOW</td>
<td>4600</td>
<td>5600</td>
</tr>
<tr>
<td>BOTTOM REAR AIRFLOW</td>
<td>3500</td>
<td>2400</td>
</tr>
<tr>
<td>BOTTOM FRONT AIRFLOW</td>
<td>10400</td>
<td>5600</td>
</tr>
<tr>
<td>TOTAL AIRFLOW</td>
<td>18500</td>
<td>13600</td>
</tr>
</tbody>
</table>

**CEMA 36% Higher**

**APPLICATION:** 2500 TPH PELLET 3M TRANSFER 3M/S BELT SPEED

Southdowne Solutions Ltd
## EFFECT OF BELT SPEED

<table>
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</tr>
<tr>
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<td>10400</td>
<td>5600</td>
</tr>
<tr>
<td>TOTAL AIRFLOW</td>
<td>18500</td>
<td>13600</td>
</tr>
</tbody>
</table>

**APPLICATION:** 2500 TPH PELLET 3M TRANSFER 1.5M/S BELT SPEED

No Change  No Change
## EFFECT OF HIGH DUST CONTENT

<table>
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<tr>
<td>TOP AIRFLOW</td>
<td>5500</td>
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<td>BOTTOM REAR AIRFLOW</td>
<td>4200</td>
<td>4800</td>
</tr>
<tr>
<td>BOTTOM FRONT AIRFLOW</td>
<td>12400</td>
<td>11200</td>
</tr>
<tr>
<td>TOTAL AIRFLOW</td>
<td>22100</td>
<td>27200</td>
</tr>
</tbody>
</table>

120% Increase  200% Increase

**APPLICATION:** 2500 TPH PELLET
- 3M TRANSFER
- 3M/S BELT SPEED
- 70% Broken pellets 10mm long
- 30% Fines <3.0mm
- 5% Dust >0.1mm
### EFFECT OF 6M TRANSFER

<table>
<thead>
<tr>
<th>AIRFLOW RATES IN M3/Hour</th>
<th>CEMA</th>
<th>ACGIH</th>
</tr>
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<tbody>
<tr>
<td>TOP AIRFLOW</td>
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<td>5600</td>
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<tr>
<td>BOTTOM REAR AIRFLOW</td>
<td>5100</td>
<td>2400</td>
</tr>
<tr>
<td>BOTTOM FRONT AIRFLOW</td>
<td>15300</td>
<td>5600</td>
</tr>
<tr>
<td>TOTAL AIRFLOW</td>
<td>27200</td>
<td>13600</td>
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</tbody>
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**APPLICATION:** 2500 TPH PELLET

**6M TRANSFER**

**3M/S BELT SPEED**
## MODIFIED ACGIH

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<tr>
<td>TOP AIRFLOW</td>
<td>8200</td>
<td>11200</td>
</tr>
<tr>
<td>BOTTOM REAR AIRFLOW</td>
<td>6200</td>
<td>4800</td>
</tr>
<tr>
<td>BOTTOM FRONT AIRFLOW</td>
<td>18500</td>
<td>18000</td>
</tr>
<tr>
<td>TOTAL AIRFLOW</td>
<td>28900</td>
<td>34000</td>
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**APPLICATION:** 2500 TPH PELLET
- 6M TRANSFER
- 3M/S BELT SPEED
- 70% Broken pellets 10mm long
- 30% Fines <3.0mm
- 5% Dust >0.1mm
FACTORS THAT INFLUENCE THE LEV DESIGN

Chute design and transfer height

Conveyor containment

Belt speed and throughput

Material dustiness and dust return systems

The affect of these parameters isn't covered in much detail

DSEAR

This isn’t covered at all...
As we have seen, the performance of a dust control system depends heavily on both containment and LEV.

The guides we have reviewed suggest containment should be the first line of attack and suggest full enclosure for toxic materials.

It might be tempting to fully enclose both strands of a belt conveyor handling wood pellets.

But not a great idea if the product is potentially explosive.

Something I’ve heard called “Doing an Imperial Sugar” in the BMH industry.

(CSB Safety Video-Imperial Sugar)
User Directive (ATEX 137/DSEAR): The employer must implement the regulations of the user directive

Equipment Directive (ATEX 100A) The equipment manufacturer / importer must implement the regulations of the equipment directive
IDENTIFICATION OF FLAMMABLE ATMOSPHERES

**Equipment** directive - identifies flammable atmospheres inside the equipment.

**User** directive - identifies flammable atmospheres outside of equipment.

The user and manufacturer / importer need to exchange information so the zones and equipment can be prescribed accordingly.
WHEN CAN AN EXPLOSION OCCUR?

FIRE TRIANGLE

EXPLOSION PENTAGON

Note: oxidant is most commonly air which contains 21% oxygen
HAZARD ZONES – DEFINITIONS (DUST)

Zone 20
An area in which there is either always, for long periods or often the presence of an explosive atmosphere in the form of a cloud of flammable dust

Zone 21
...during normal operation, likely that an explosive atmosphere in the form of a cloud of flammable dust exists

Zone 22
...unlikely to exist. If, however an explosive atmosphere does occur, it will exist for a short period only
HAZARD ZONES IN CHUTES AND CONVEYORS

Enclosure of the top strand is common

With conventional roller supported conveyors this is achieved by adding covers and a deck plate between the top and bottom strands

Build-up will occur internally in chutes and on deck plates and if product is potentially explosive these internal areas (at least) must be hazard zoned

Air supporting the top strand on a continuous plate is a successful way of eliminating the problem (between transfers!)...
CONTROL OF IGNITION SOURCE

With this type of plant, elimination of Oxygen is not really practical

   Either control the ignition sources

Or prevent formation of viable explosive atmospheres

Elimination of ignition source is also extremely difficult

   Mechanical and electrical ignition sources – Use ATEX certified equipment

But ATEX certification for mechanical equipment usually relies on elimination of foreign bodies, which again is usually impossible

   Ignition sources such as embers being transferred from one zone to another can be impractical to eliminate and difficult to control

Control of the hazard zone is therefore more practical and this is where LEV can play its part...
CONTROL OF FLAMMABLE ATMOSPHERE

Installation of a well designed LEV system can reduce a zone 20 atmosphere in a transfer chute to a zone 21

This significantly reduces the probability of an explosion

The belt conveyor between transfer points might typically classified as zone 22

A 3mm dust layer on the deck plate of a 2m wide conveyor will reach 50gms/m3 is raised into a cloud and this is above the LEL for wood dust

It might be possible to eliminate such internal dust layers with well designed dust extraction system at the transfer points that avoids returning the dust to the belt

But belt speed must be low enough to prevent any dust present being lifted off during conveying

(Or intermediate dust extraction between transfers could be provided)...
SUMMARY

On new plant, a design which can satisfy the requirements of both COSHH and DSEAR will require close co-ordination of the chute designer, the conveyor designer and the LEV supplier.

On existing plant it will usually fall to the LEV Engineer to provide a dust extraction system that can compensate, as far as is possible, for the chute design installed.

There is relatively little guidance on LEV for sub-optimal transfer point geometries.

It’s the same with the conveyor containment, although this is usually easier to upgrade than the transfer point geometry.

Leaks cannot be compensated by LEV!

LEV has an important part to play in reducing hazard zones and therefore reducing the probability of an explosion.

Either way, new or existing, I hope this presentation will have identified some points to look out for...
Any Questions?

Thanks to Gexcon Ltd, Shepherd Construction and NIOSH for some of the images

John@southdownesolutions.co.uk
HSE Steps to Supporting LEV Good Practice

Research, Guidance, Communications & Enforcement
A few words about me

You are at risk if the dust you breathe in over a full shift contains more RCS than the amount shown next to the penny.
Why occupational health?

There were 1,610 new cases of work related ill health per 100,000 workers in 2014/15.

1.2 million people who worked during the last year were suffering from a work-related illness.

0.8 million former workers (who last worked over 12 months ago) were suffering from a work-related illness.

2,538 mesothelioma deaths due to past asbestos exposures.

27.6 million working days were lost due to ill health and injury in 2014/15.

New cases of ill health and injury cost Britain £14.3 billion in 2014/15.

#HelpGBWorkWell Source: RIDDOR
Communication challenges around LEV…

• Has a hood or enclosure that captures or contains the harmful substances;
• Uses duct work and fans to remove the harmful substances;
• Requires regular maintenance especially when filters are used to clean the air
Good practice example

Moving from a capture hood to an enclosed hood
LEV Systems: problems

Employers sold inappropriate and expensive LEV systems that don’t work
Health Intervention Initiative

• Proactive inspections in industries with known health risks
• Inspections leading to increased enforcement and intelligence on exposure control
• Development of support materials highlighting poor control in key industries
• Specialist inspector occupational hygiene support for enforcement on control
• Re-focus away from risk assessment to control of risk
Health Interventions Initiative – enforcement on LEV

• No LEV!
• No thorough examination and test
• No records of maintenance
• Capture hoods without any means of extraction
• Hoods too small
• Duct work damaged
• Poor extraction
HSE Guidance
LEV visits and downloads May 2016

LEV Website Statistics May 2016

Visitors
Visits
Page requests

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<th>Series</th>
<th>Visitors</th>
<th>Faqs</th>
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This website provides practical advice for employers and employees on buying and using LEV and what to do to comply with the law. It will help designers, installers and examiners work with their customers to control airborne contaminants effectively.

LEV calculations - Conversions, Air density, Air velocity
Common processes - Processes and the dust sources they create
FAQ – Air flow measurement, TExT, Examiners
Resources – HSE guidance and ILEVE
Research in progress or recently completed

1. Development of a quantitative test to measure LEV capture efficiency
2. Review of European Standards to address shortcomings in relation to spray booths
3. Design specification for extraction enclosure hoods for small and medium sized bakeries
4. Efficiency of controls for silica dusts in stone-working
Measuring Capture Efficiency

% Loss

Point A

Point M

Point B

Capture zone
Benefits and Issues

**Benefits (potential)**
- Influence better design
- Regulatory checks
- Duty holder confidence
- Energy savings
- REACH demonstration of control
- Occupational hygiene routine check

**Issues**
- Cost
- Analytical technique
  - Infra red
  - Light scattering
- Source
  - SF6
  - Freon 22
  - Arizona dust No 3
- Method errors in comparison with process
Improving LEV in Local Metropolitan Areas project

• Working with Chambers of Commerce and LEV suppliers

• Aimed at devising information and messages for employers, supervisor and purchasing departments

• Helping industry identify and locate trusted and competent designers and suppliers of LEV
Objectives

1. Identify three Metropolitan Areas that have sufficient industry to benefit from an LEV campaign.

2. Produce communications information and case studies to provide:
   - Awareness of hazard and risk in tasks that can be effectively controlled through LEV
   - Information on how to locate LEV suppliers and assess supplier competence that can be used by employers to help purchase effective LEV systems
   - Operational knowledge to commission LEV and maintain effectiveness
Objectives (cont)

3. Devise a plan and funding to deliver three campaigns including:
   • Breakfast events
   • Magazine articles
   • Direct e-mails

4. Consolidate campaign communications with an on-line resource of information and case studies.

5. Seek assistance in delivering the information by identifying health orientated non-government organisations and LEV suppliers and their representative organisations.
Challenges

• LEV provided that does not control the risks
• Developments in LEV design
• The need to change dutyholders so they are intelligent customers
• Some consultants providing expensive advice which doesn’t really assist dutyholders
Questions?

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