

# ACGIH Workshop on Control Banding

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## COSHH Essentials: Technical Developments

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# COSHH Essentials

## Technical Developments

Selecting respiratory protective equipment

Improved advice for risk to skin and on  
selecting protective gloves

Proposals for hazardous gases

# COSHH Essentials

## Recap

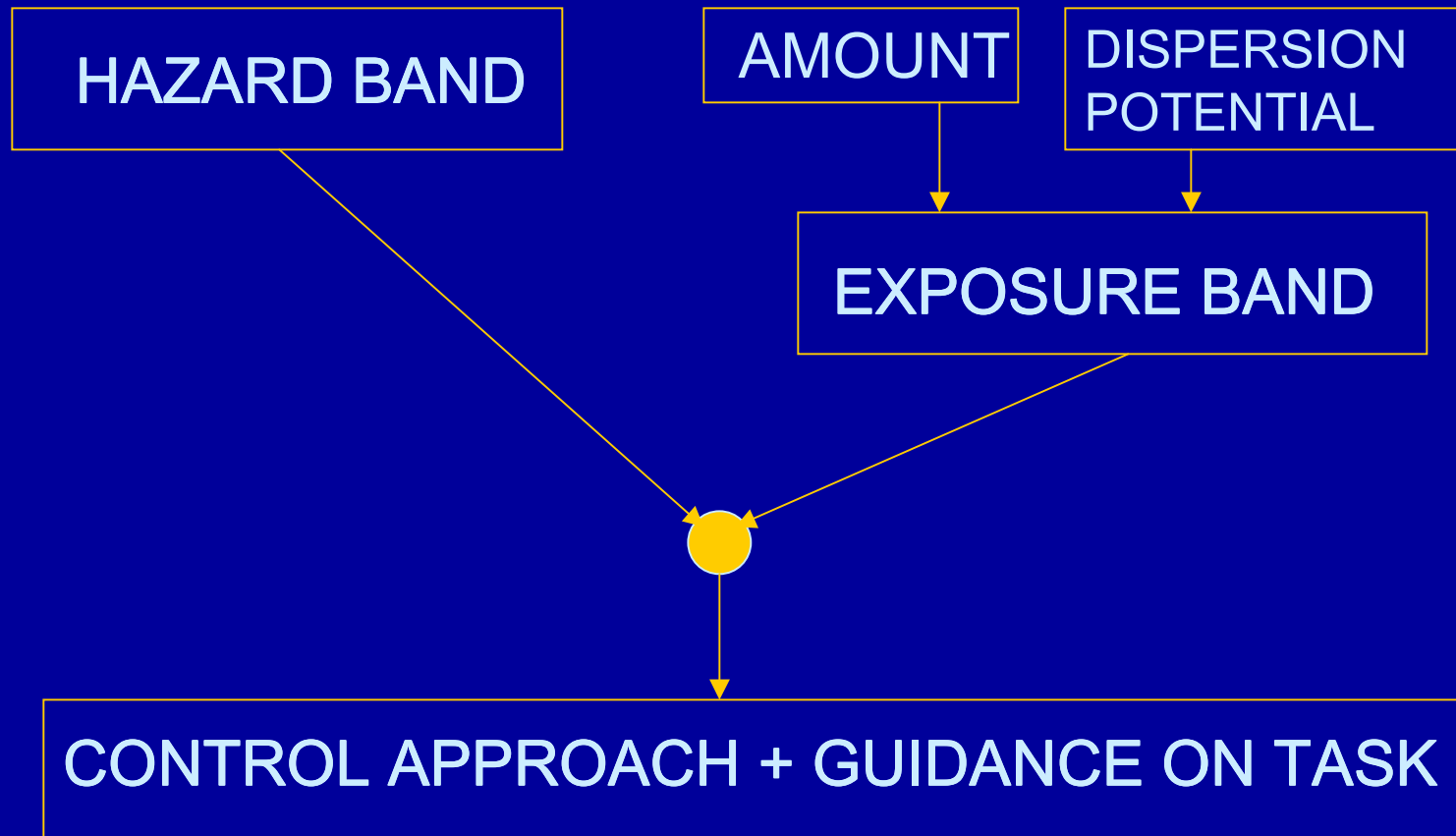
Most chemical control problems have been met, and solved, before.

There are only a few basic approaches to control. If we can band risk, we can associate risk with a control band.

Tackle the simpler scenarios first – liquids and dusts.

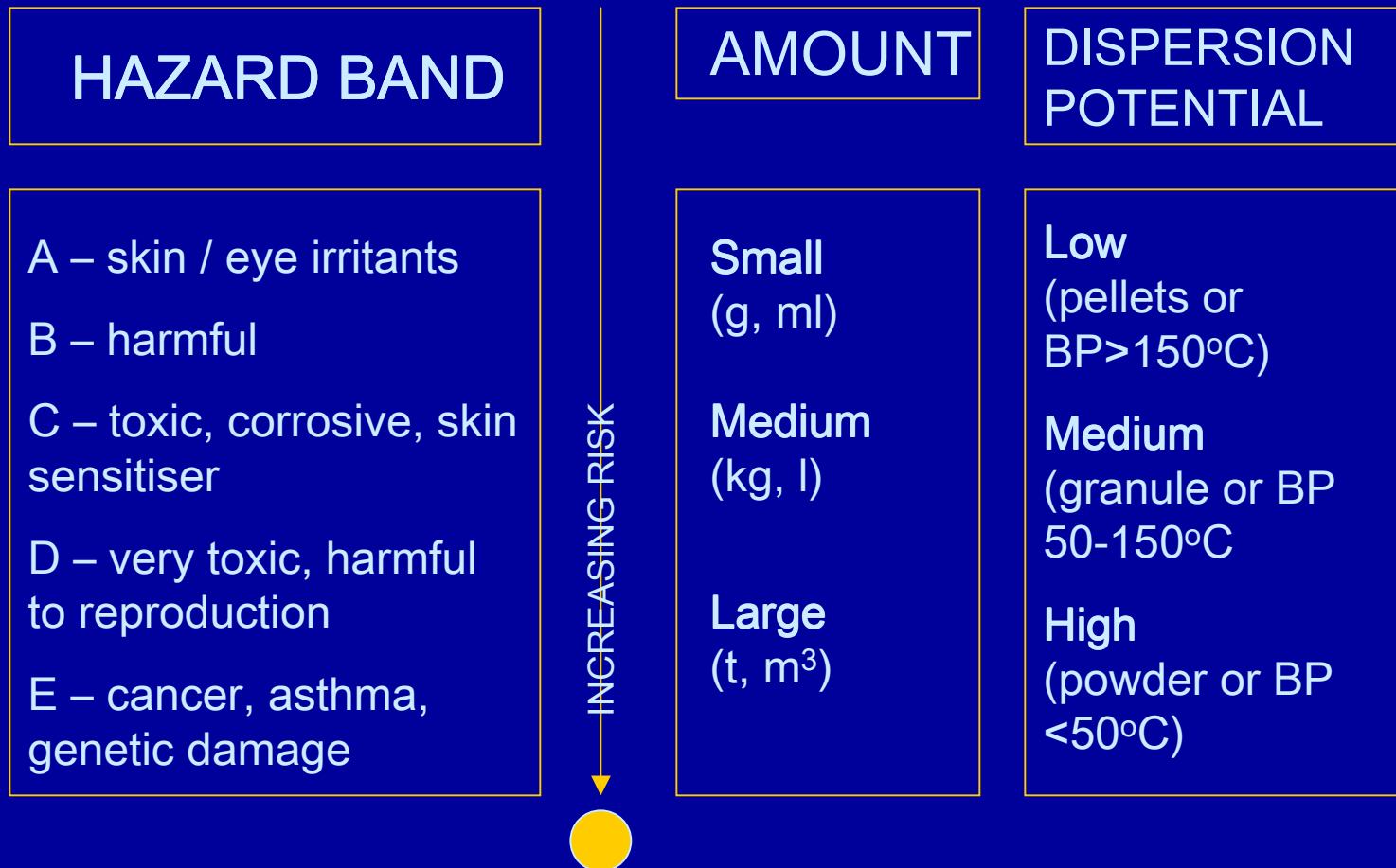
# COSHH Essentials

Banding inhalation hazard and exposure



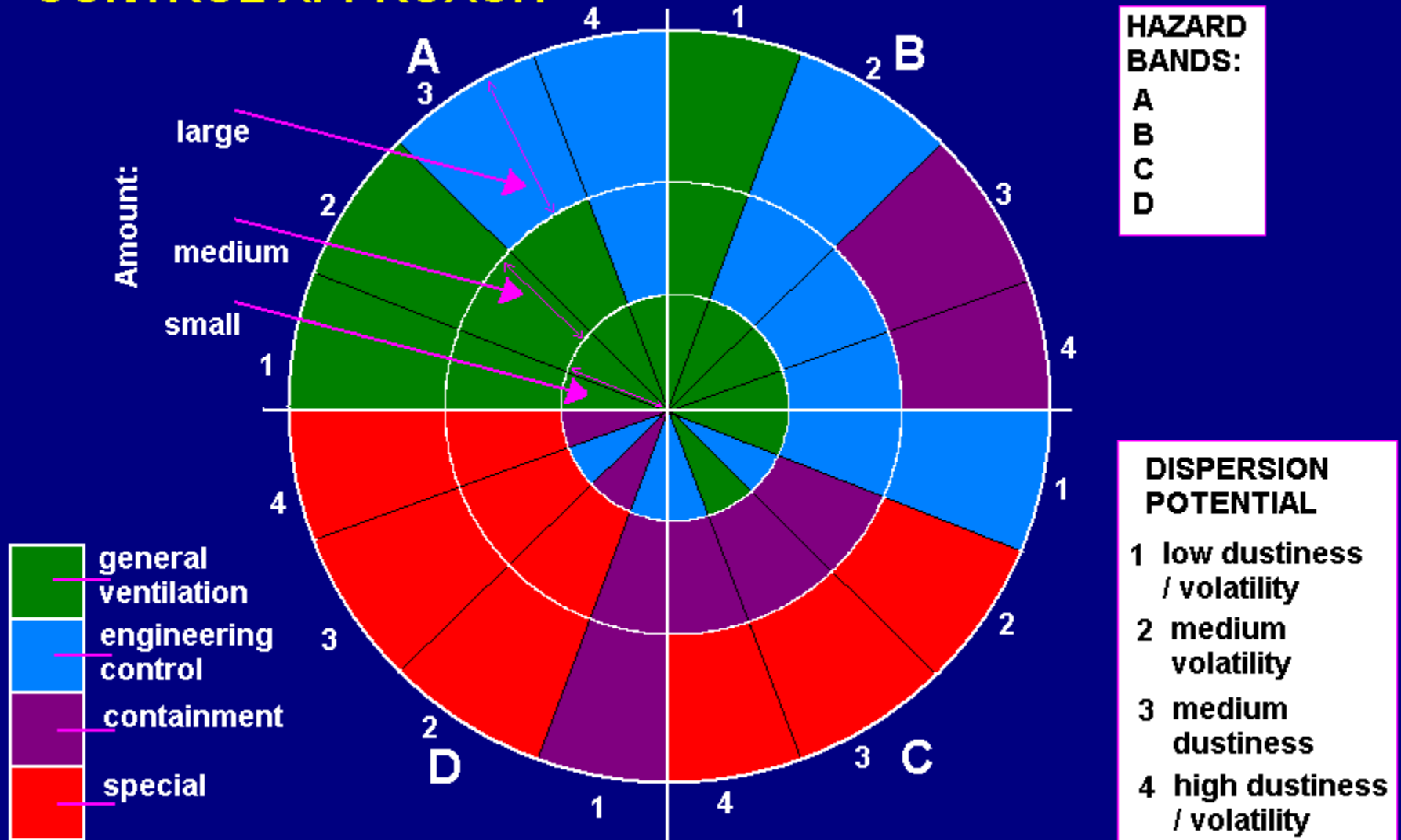
# COSHH Essentials

## Banding hazard and exposure



# COSHH Essentials

## CONTROL APPROACH



# COSHH Essentials

## Control Approaches

### 1. GENERAL VENTILATION

A good standard of general ventilation

Least  
reduction in  
exposure

### 2. ENGINEERING CONTROL

LEV eg single-point extractor close to source,  
ventilated partial enclosure.

### 3. CONTAINMENT

Enclose or contain – small breaches may be OK

Most reduction  
in exposure

### 4. SPECIAL

Expert advice is needed – seek help

Get advice

# COSHH Essentials (CE)

*“easy steps to control health risks from chemicals”*

Guidance on the Control of Substances Hazardous to Health Regulations 2002 (*COSHH*)

Practical – plain English – few technical terms

Provides solutions identifying ‘adequate control’, principally for exposure by inhalation

Points out when expert help is needed

# CE Technical Developments

## RPE

### Respiratory protective equipment

- for work of short duration
- for emergency escape and rescue
- for maintenance and emergency repair
- for control of residual risk, e.g. belt-sanding wood where LEV control can have limited effectiveness
- where mandatory (eg pesticide use)

Not a substitute for engineering control.

RPE manufacturers consulted .....

# CE Technical Developments

## RPE and Assigned Protection Factors

Hazard Band	Amount in task with RPE	Dustiness & Volatility		
		Low	Medium	High
		Assigned Protection Factor (APF)		
<b>A</b> * 10 mg/m <sup>3</sup> / 500 ppm	Small	-	-	-
	Medium	-	4	10
	Large	4	10	20
<b>B</b> * 1 mg/m <sup>3</sup> / 50 ppm	Small	-	4	4
	Medium	-	10	20
	Large	10	20	40
<b>C</b> * 0.1 mg/m <sup>3</sup> / 5 ppm	Small	-	4	4
	Medium	10	10	20
	Large	20	20	40 BA
<b>D</b> * 0.01 mg/m <sup>3</sup> / 0.5 ppm	Small	10	20	40
	Medium	20	40	40 BA
	Large	20	40 BA	2000
<b>E</b> -	Small	10	20	40
	Medium	20	40 BA	40 BA
	Large	20	40 BA	2000

\* Upper concentration boundaries associated with the hazard band

# CE Technical Developments

## RPE selection – what to tell your supplier

- Task description
- Task duration
- Chemicals in product
- Amount handled
- Product's physical form
- If solid, dustiness?
- If liquid, Boiling Point?
- Solvent or water based
- Temperature of product
- Humidity
- Confined space
- Explosive / flammable in air
- Work rate
- Space to do task
- Mobility requirements
- Vision requirements
- Spoken communication
- Wearer's fitness, aspect
- Other PPE used

Plus initial fit testing, training

# CE Technical Developments


## RPE advice produced (1)

<b>R<sub>100</sub></b>	Control Guidance Sheet - RPE <sup>1)</sup>	□
	Selection of respiratory protective equipment <sup>2)</sup>	<b>R100</b> □
<p><b>1)</b> The guidance in this sheet is aimed at employers, to help them comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH) by controlling exposure to chemicals and protecting workers' health.</p> <p>The sheet is part of the HSE Guidance: COSHH 6 controls, easy steps to control chemicals. It can be used alongside Control Approaches 1 to 4.</p> <p>It provides advice on selecting respiratory protective equipment (RPE).</p> <p>Respiratory Protective Equipment (RPE) is not a substitute for control. It is difficult to use, expensive, and always fails to 100%.</p> <p>If you are already using the right control, RPE should not be needed. If you are planning to roll out full control, then you may have to use RPE until this is done.</p> <p>If your task is cleaning up a spillage, routine maintenance, emergency escape, or a temporary use such as pressure cleaning, a short term one-off procedure, then RPE may be the correct choice.</p> <p>Take time to make plans for action in case of emergencies.</p> <p>☒</p>		
<p><b>2)</b> Respiratory Protective Equipment (RPE) is specially designed to help protect workers from dusts, fumes, vapours and gases. It is important to use the right sort of RPE. There are many different types, and they fall into two main groups.</p> <p>→ Ropes also (including dust masks) that filter contaminated air.</p> <p>→ Breathing apparatus (BA) that supplies clean air.</p> <p><b>3) Selection of RPE</b></p> <p>The factors that enable you to make a selection are listed on the second sheet. You must select the right type. Fill in the short questionnaire and short-cut with any Safety Data Sheets, to your RPE supplier.</p> <p><b>4) Using RPE - considerations</b></p> <p>→ All types of RPE restrict what the wearer can do.</p> <p>→ RPE is uncomfortable to wear, particularly for long periods of time.</p> <p>→ The RPE has to be worn all the time while doing the task, and until the wearer is away from the contaminated area.</p> <p>→ Workers must be medically fit to wear RPE – seek medical advice if you are not sure.</p> <p>→ The RPE needs to fit the person. If the RPE depends on a face seal, it won't work if the person has facial hair or stubble.</p> <p>→ Users should do a 'fit check' every time they put the RPE on.</p> <p>→ Change the filters on respirators regularly – your supplier may be able to advise you.</p> <p>→ Make sure the air supplied to breathing apparatus is fit to breathe, free of oil, water, carbon monoxide and other fumes.</p> <p>→ Face cans not to trip over BA or hoses.</p> <p><b>5) Maintenance</b></p> <p>→ Keep RPE clean and in good working order – follow the maker's instructions.</p> <p>→ Store RPE in a safe place, away from contamination.</p> <p>→ Check and replace inhalation and exhalation valves on respirators. The valves need changing frequently if your respiratory equipment has them.</p> <p>→ Don't forget to check the expiry dates on RPE and filters, etc.</p> <p>→ Keep a small stock of replaceable parts.</p> <p><b>6) Training</b></p> <p>→ Make sure that RPE users know how to check their equipment is working properly before they put it on, how to check face fit, how to replace worn or defective parts, and what the RPE's limitations are.</p> <p>→ Tell workers to stop work and leave the area if they think the RPE isn't working properly.</p> <p>→ Your RPE supplier may be able to advise you on training.</p> <p>→ Throw away disposable RPE after one use.</p> <p>☒</p>		


Control Guidance Sheet		APF 10 □
Selection of respiratory protective equipment (RPE) <sup>1)</sup>		<b>X102</b> □
Selection of RPE – information for RPE Supplier <sup>2)</sup>		Respiratory Protective Equipment (RPE) <sup>3)</sup>
Task / Job name <sup>4)</sup>	h	The RPE should have a British Standard Assigned Protection Factor (APF) of 10.
Chemicals used <sup>5)</sup>	h	One of the following types will be effective, based on the selection factors opposite.
(Section 2 of Safety Data Sheet) <sup>6)</sup>	Large / Medium / Small	→ Filtering half-mask, EN 149 or filtering half-mask with valve, EN 405, 4-1
Amount handled <sup>7)</sup>	Large / Medium / Small	→ Filtering half-mask without inhalation valves, EN 1327, 4-1
Physical form <sup>8)</sup>	Gas / Liquid / Sludge / Solid	→ Full face mask, EN 140 and 141, or full face mask, EN 128 and 146, 4-1
Particle diameter <sup>9)</sup>	High / Medium / Low	→ All filters – medium efficiency particulate P2, or gas, 4-1
→ Is legal breathing point? <sup>10)</sup>	____ %	→ Powered hood model FH1 EN 148 / EN 129, 4-1
→ Is liquid, in volume or weight? <sup>11)</sup>	White / Solvent / Not sure	→ Powered hood model FH1 EN 147 / EN 129, 4-1
→ Temperature the task is done at? <sup>12)</sup>	Room temperature / ____ °C	→ Fresh air hose BA, EN 1292, 4-1
→ Is the humidity high? <sup>13)</sup>	Yes / No / Not sure	→ Compressed air line BA, hood, helmet or vest, 4-1 EN 1285, 4-1
→ How long does the task take? <sup>14)</sup>	____ hours / ____ minutes	
→ Confined space? <sup>15)</sup>	Yes / No / Not sure	
→ Explosive / flammable in air? <sup>16)</sup>	Yes / No / Not sure	
Work rate <sup>17)</sup>	Heavy / Medium / Light	
Space to do task <sup>18)</sup>	Restricted / Unrestricted	
Amount of moving around <sup>19)</sup>	One place / many places	
Visual requirements <sup>20)</sup>	All round / not relevant	
Speech/communication <sup>21)</sup>	Necessary / not relevant	
Wearer's fitness <sup>22)</sup>	OK / Not sure – ask a doctor	
Wearer's speed <sup>23)</sup>	Fast / Not / Speedy / Not sure	
What other PPE worn? <sup>24)</sup>	Hard hat / Ear muffs / Vest / etc	
Make sure you get initial fit testing done for tight-fitting masks. 4-1 Ask the supplier for help in fit testing and arranging training.		
☒		
<b>Further information</b>		
The selection, use and maintenance of respiratory protective equipment – a practical guide. 4-1 HSG59/HSE Books 1998. ISBN 0-7176-1597-5		

# CE Technical Developments

## RPE advice produced (2)



Control approach R



This guidance sheet is for employers to help them comply with the requirements of the Control of Substances Hazardous to Health Regulations 2002 (COSHH) by controlling exposure to chemicals and protecting workers' health.

The sheet is part of HSE guidance COSHH essentials: easy steps to control chemicals. It describes the key points you need to follow to help reduce exposure to an adequate level. It is important to follow all the points, or use equally effective measures.

Thermal cutting and gouging creates a great deal of metal fume, silica dust and gases that are hazardous to health. Crystalline silica can cause serious respiratory diseases including cancer.

Control approach R (respiratory protective equipment) with control approach 2 (engineering control) is recommended to control fume and dust from the metal cutting and gouging.

You need also to control exposure to noise.

For environmental advice see further information on the back page.

For more control guidance sheet **FD10**

### Dust and fume when thermal cutting and gouging

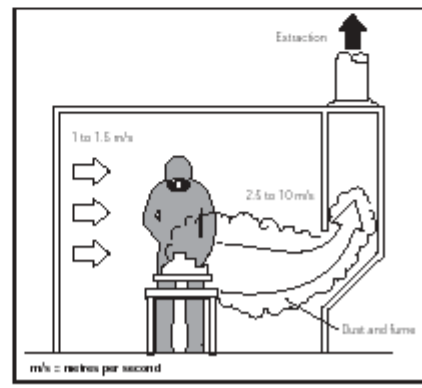
Respiratory protective equipment **FD10**

**Access**

- ✓ Restricted access to those staff who need to be there.

**Design and equipment**

- ✓ Thermal cutting and gouging produce large amounts of dust and fume. Always use an extracted booth.
- ✓ Respiratory protective equipment (RPE) is required.
- ✓ You need an air speed between 1 and 1.5 metres per second into the booth, and between 2.5 and 10 metres per second at the extraction point.
- ✓ Ensure a manometer or pressure gauge is fitted 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.
- ✓ Position the workplace so that it is as close as possible to the extraction point.
- ✓ Provide a trolley to move the casting.
- ✗ Workers should not stand between the casting and the extraction point.
- ✓ Good lighting will help you see escapes of fume.
- ✓ Consult a qualified ventilation engineer to design near control systems (see Control guidance sheet FDI 4).



# CE Technical Developments

## SKIN

Classification (R-phrases) for skin is uneven

Three routes for skin exposure

Skin uptake – reservoir effects and time-line

Protective gloves – belief and performance

Potential and actual dermal exposure

Effects on skin, uptake via skin and interplays

All chemicals - risk to / via skin?

# CE Technical Developments

## Skin hazard and exposure bands

### HAZARD BAND

#### 'Toxic'

CE groups A, B and C  
except R34, 35, 37, 43  
- 500 mg dust / 10 mg liquid \*

#### 'Very toxic'

CE group D + R34, 35  
- 50 mg dust / 1 mg liquid \*

Special CE group E

#### Sensitiser

R43 (>0.1%)

### EXPOSURE BAND

#### Deposit on skin

- immersion (hands)
- deposit of splash, aerosol
- contact with surface residues

#### Duration

Splash, immediate wipe off  
All other scenarios

#### Amount?

#### Mitigation?

\* Quantity of concern on the skin.

# CE Technical Developments

## Skin exposure

'Toxic': 500 mg dust / 10 mg liquid.

'Very toxic': 50 mg dust / 1 mg liquid.

### Protective clothing

75<sup>th</sup> percentile data (not hands),  
potential dermal exposure

Dipping window frames  
11 g product / hour

Airless (paint) spraying  
15 g product / hour

Penetration and permeation  
2% through 2 clothing layers.

+

### Protective gloves

Contamination inside protective  
gloves is almost inevitable.

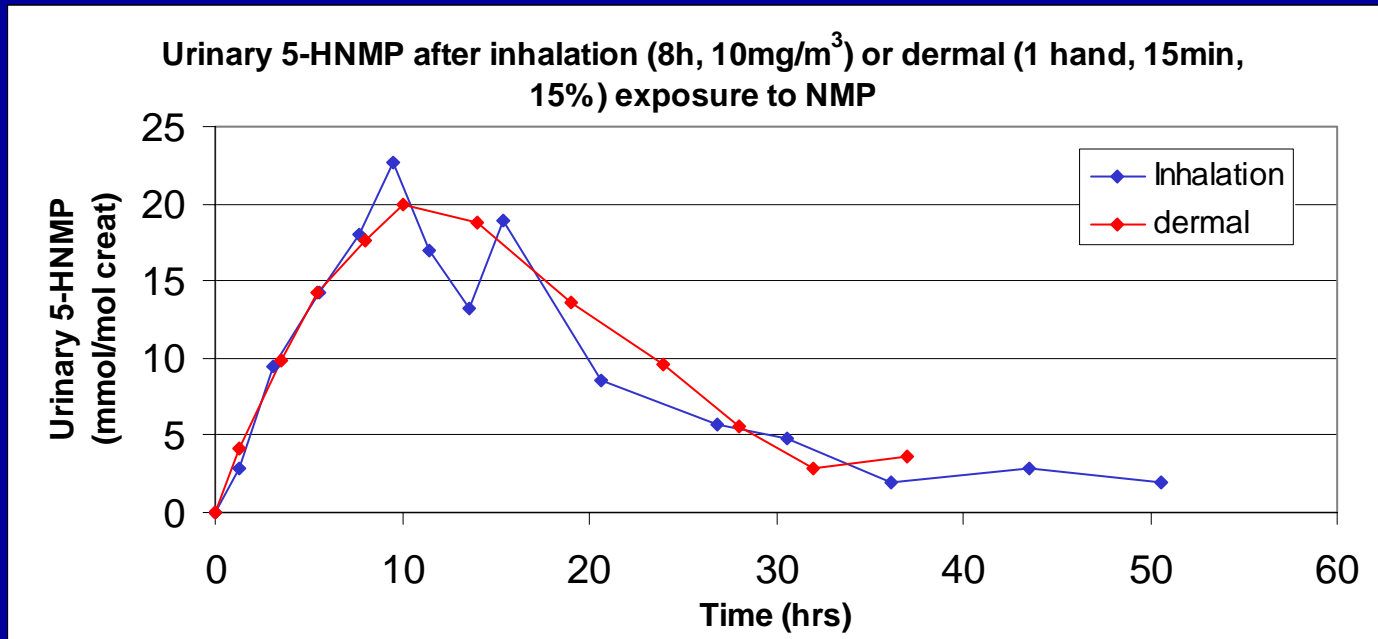
Contamination 2<sup>nd</sup> time they are  
put on.

Washing gloves helps a bit, and  
disposables are often best.

75<sup>th</sup> percentile (190 data) at 250  
mg product / hour.

# CE Technical Developments

## Skin uptake



Comparing inhalation with dermal uptake and elimination  
(biomonitoring)

# CE Technical Developments

## Skin exposure

Skin exposure - complex and often significant  
(plus effects of water)

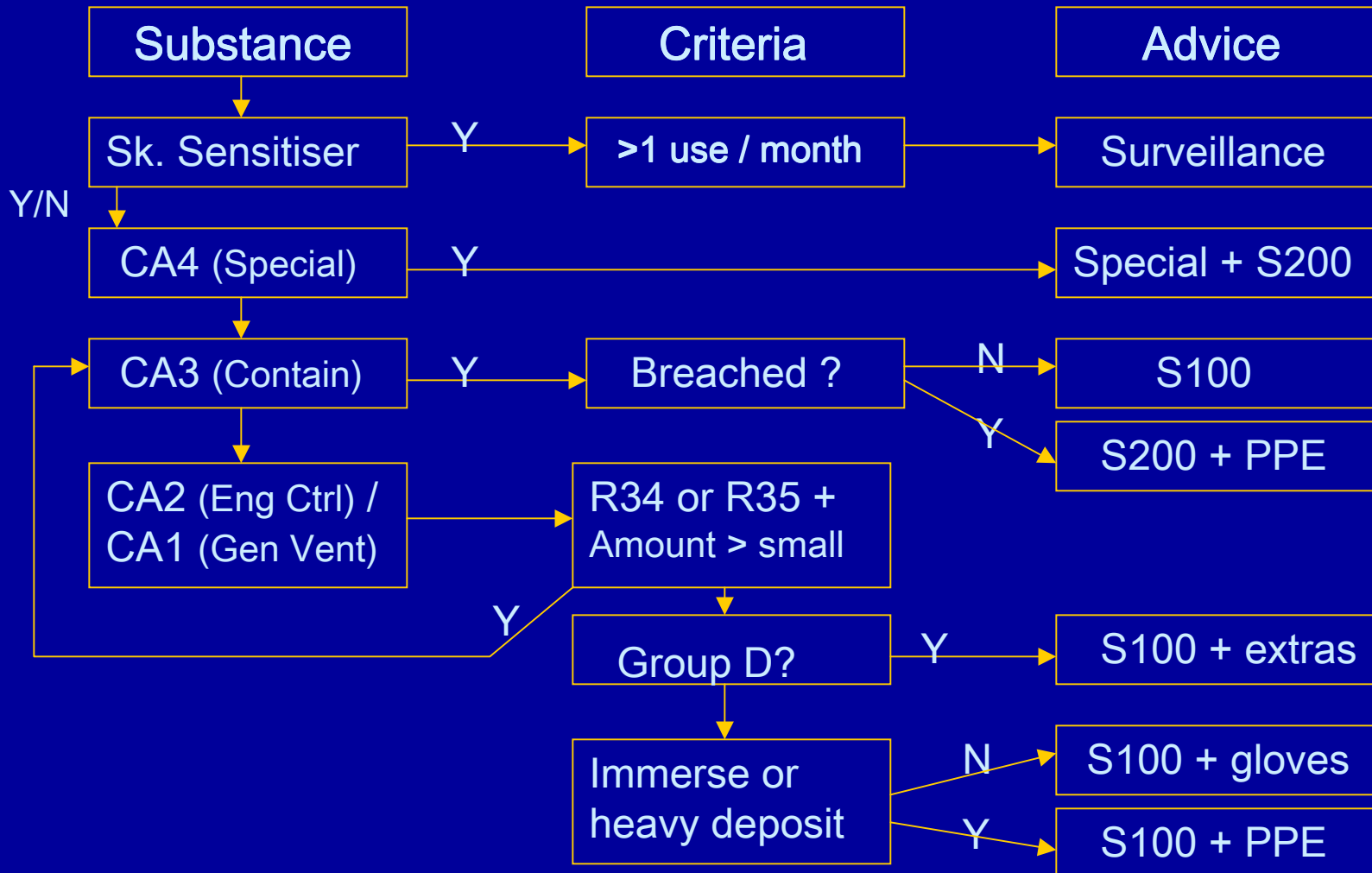
Hazard bands – feasible

Insufficient current knowledge to band skin exposure

Control options are limited  
(but can arrange in a hierarchy according to risk)

# CE Technical Developments

## Skin advice from CE Control Bands



# CE Technical Developments

## Skin exposure advice topics

### 'Toxic' (S100)

modify process  
substitute physical form  
segregate clean and dirty areas  
cleaning routines  
hygiene procedures  
skin care  
training

use PPE (S101, S102)

### 'Very Toxic' (S200)

as medium, plus full containment,  
or  
permit to work  
Biological monitoring (appropriate)

### Sensitisers (G403)

as for toxic or very toxic  
skin surveillance

# CE Technical Developments

## Personal Protective Equipment (PPE)

head	(hood, helmet)
face / eyes	(visor / goggles)
body	(coverall, apron)
hands	(gloves, skin cream)
feet	(boots)

Selection ....

# CE Technical Developments

## selecting protective clothing and gloves

### Clothing

penetration versus run-off.  
impervious fabrics – ‘bellows’  
effect.

25% breakthrough for cotton-poly-  
ester, microporous polypropylene  
(75<sup>th</sup> %)

2% breakthrough for work clothing  
beneath coveralls (75<sup>th</sup> %)

Laundry

### Gloves

select according to challenge

contamination inside – discard  
single-use gloves after use.

latex – low protein powder free

Cost.

# CE Technical Developments

## Glove selection – what to tell your supplier

Task description

Task duration

Chemicals in product

Product's physical form

If solid, dustiness?

If liquid, Boiling Point?

Temperature

What extent of hand contact

Product spread up arms

What other hazards

Range of glove sizes

Sensitivity / dexterity needs

Disposal

Has the worker any skin condition that would affect his wearing protective gloves?

# CE Technical Developments

## Glove advice produced

<h1>S10</h1>	Control Guidance Sheet	§
	§101 Selecting chemical-protective-gloves	§101a
Hand exposure to chemicals		
<p>The guidance in this sheet is aimed at employers, to help them comply with the Control of Substances Hazardous to Health Regulations 2002 (COSHH) by controlling skin exposure to chemicals and protecting employees' health.</p> <p>This sheet is part of the HSE Guidance COSHH Good Practice, easy steps to control chemicals. It can be used alongside Control Approaches 1 to 9.</p> <p>This sheet provides advice on the factors you need to consider when selecting protective gloves.</p> <p>It describes the key points you need to follow to provide adequate control, and to help assess that exposure is reduced to an acceptable level.</p>	<p><b>§101a Skin contact and dermal exposure</b></p> <p>Chemical substances can damage the skin and/or eyes, or enter the body through the skin and cause harm. This is additional to the harm caused by breathing them in. The chemical can be liquid, solid, gas, vapour, spray, mist, fume or dust.</p> <p>§101a Skin contact occurs in the following ways:</p> <ul style="list-style-type: none"> <li>→ Direct contact – handling, immersion.</li> <li>→ Splashes, dust or spray settling on the skin.</li> <li>→ Touching contaminated surfaces, including work clothing.</li> </ul> <p>Once the hands are contaminated, touching or scratching skin will spread the around. Hand-mouth contact is likely, and lead to swallowing the chemical.</p> <p><b>§101a Selection of chemical-protective-gloves</b></p> <p>Selecting the right gloves is a complex job and you need expert advice from your PPE supplier, manufacturer or a health and safety professional. Incorrect selection or misuse of gloves can:</p> <ul style="list-style-type: none"> <li>→ Lead to skin disease including dermatitis, burns or serious ill health.</li> <li>→ Result in legal action being taken against you or your company.</li> <li>→ Waste your money.</li> </ul> <p>All the information you will need to help select the right gloves is set out in the questionnaire on the next page. You will also need the product Safety Data Sheet to help in completing the questionnaire. Fill in a separate questionnaire for each task.</p> <p>Show the information to your protective gloves supplier, manufacturer or a health and safety professional, who will then be able to help you choose the most suitable gloves. The gloves may need to protect hands against other hazards such as heat or handling rough objects.</p> <p>§101a Select gloves that are CE marked as complex, (category III) PPE, and comply with EN387.</p> <p><b>Main maintenance of chemical-protective-gloves</b></p> <p>In general, gloves cannot be 'maintained'. They nearly always become contaminated inside. Single use gloves might offer better protection:</p> <ul style="list-style-type: none"> <li>→ Throw away 'single use' gloves when they are taken off.</li> <li>→ No glove is tested to give more than 3 hours' protection against chemical permeation. Remember also that wear and tear, stretching and abrasion are not part of the test.</li> <li>→ Gloves always become contaminated inside, the second time they are put on.</li> <li>→ If there is any chemical present (e.g. on the inside of the shirt), they may look clean inside, and undamaged – but they won't be.</li> </ul>	

Control Guidance Sheet	
§101a - Selecting chemical-protective-gloves	
<p><b>General information</b></p> <ul style="list-style-type: none"> <li>→ Chemicals are likely to 'leak' through coated gloves with a knitted liner and those with knitted cuffs onto exposed skin within seconds of chemical exposure – these gloves can only provide splash protection.</li> <li>→ If you select latex gloves, then use only 'low protein' powdered latex gloves.</li> <li>→ Had the worst of any skin condition that would affect the wearing of protective gloves? If so, consult a medical professional.</li> </ul> <p>Information you need to provide to the PPE supplier/manufacturer to help you pick the right glove often specific task.</p> <p>You also need the Safety Data Sheet – attach it to the questionnaire.</p>	<p><b>Training workers to use chemical-protective-gloves</b></p> <p>Chemical protective gloves nearly always get contaminated inside. This happens the second time the gloves are put on.</p> <p>Most workers do not know how to take off or put on contaminated gloves safely.</p> <ul style="list-style-type: none"> <li>→ Ask the glove supplier for training on how to put on and take off protective gloves safely.</li> <li>→ Consider having a designated area for putting on and taking off gloves. Clean this area regularly.</li> </ul> <p><b>Tell employees to:</b></p> <ul style="list-style-type: none"> <li>→ Where possible, clean gloves before taking them off.</li> <li>→ Use 'single use' gloves once only.</li> <li>→ Store clean gloves in a plastic 'free from contamination'.</li> <li>→ Wash hands after taking off protective gloves.</li> <li>→ Try not to spread chemical contamination around.</li> <li>→ Dispose contaminated gloves safely as chemically contaminated waste.</li> </ul>
<p>Task description (use activity only - e.g. cleaning out sludge)</p> <p>Chemicals in product?</p> <p>See List in Section 2 of Safety Data Sheet</p> <p>Physical form of product?</p> <p>Pressure - duration?</p> <p>Pressure - boiling point?</p> <p>Temperature the product is used at?</p> <p>How long does the task take?</p> <p>How much hand contact with chemical?</p> <p>How fast does the contamination get?</p> <p>Are there other hazards?</p> <p>Impacts - What range of glove sizes?</p> <p>In special sensitivity or disability needed to the job?</p> <p>Other information:</p>	<p>Gas   Liquid   Solid   Paste   Other</p> <p>High   Medium   Low</p> <p>Room temperature   _____</p> <p>_____ type   _____ minutes</p> <p>A little   Quite a lot</p> <p>Hands   Forearms   Above elbow</p> <p>Hot   Cold   Sharp   Abrasive   Electric shock   Other _____</p> <p>Yes   No</p> <p>Other information:</p>

# CE Technical Developments

## GASES

Substances with boiling point below room temperature deemed 'gases'.

Supplied compressed or refrigerated  
Generated from reactions

Dispersed as fumigant, extinguishant  
Others eg non-aqueous solvent, supercritical solvent.

# CE Technical Developments

## BANDING FOR SUPPLIED GASES

Compressed gases (contained use)

R-phrases ... or some other hazard selector?

Banding by UN hazard class?

Concentrations of concern – eg leaks

- toxicity (eg <50 ppm toxic / very toxic) UN 2.3
- fire (eg 5,000 ppm flammable – 25% LEL) UN 2.1
- asphxia (eg 50,000 ppm inert – 19.5% O<sub>2</sub>) UN 2.2

But some flammable gases 2.1 have toxic hazards

Alarms?

# CE Technical Developments

## COMMON GASES

‘Arising’ gases (usual or unusual conditions)

Industry sector link with named gas  
‘Event’ conditions – permits-to-work

Possible gases requiring specific guidance:

ammonia

carbon dioxide

carbon monoxide (exhaust fumes)

chloramines

hydrogen chloride

hydrogen cyanide

hydrogen sulphide

oxides of nitrogen (combustion fume etc.)

ozone

phosphine etc from foundry slag / dross

sulphur dioxide

# COSHH Essentials

## Technical Developments

[www.coshh-essentials.org.uk](http://www.coshh-essentials.org.uk)

RPE plug-in simple to integrate

Skin and PPE plug-ins - rule amendments

Gases require more work