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Field Industrial Hygiene and Research

# Control Banding in the U.S.

## Simplified Occupational Risk Management Strategies

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South Lake Tahoe, Nevada

# Introduction to Control Banding

- CONTROL BANDING BASICS
- DEFINITION OF CONTROL BANDING TERMS
- INTRODUCTION TO CONTROL BANDING HISTORY
- IOHA & CONTROL BANDING INTERNATIONALLY
- COSHH ESSENTIALS TOOLKIT FOR CHEMICALS
- EXPANSION OF CONTROL BANDING'S RANGE
- CONTROL BANDING EFFORTS IN THE U.S.
- LITERATURE REVIEW & CRITICAL ANALYSIS

# Definition of Terms

- **CONTROL BANDING (CB);** A *Strategy* for Reducing IH-Related Exposures in the Workplace.
- **CB STRATEGIES;** Overarching concept of CB Model that is Evolutionary and not a Single Toolkit.
- **TOOLKIT;** Narrowly Defined Solutions Approach to Control Worker Exposures Within Toolkit's Parameters.
- **COSHH ESSENTIALS;** A CB Toolkit Developed by UK HSE to Assist SMEs in Addressing the UK 2002 COSHH Regulations - Perform Risk Assessments for all Chemicals.
- **TOOLBOX;** Wider Defined Solutions Approach to Control Worker Exposure; Many Toolkits May Fit Within a Toolbox.
- **OCCUPATIONAL RISK MANAGEMENT (ORM);** Banner Term as Part of Overall Function of IH Profession.

# Definition of Terms

- **CONTROL BANDING (CB);** A Qualitative or Semi-Quantitative Approach to Risk Assessment and Risk Management that Groups Occupational Risk Control Strategies in Bands Based on their Level of Hazard.
- **COSHH Essentials is an Example of a CB Toolkit.**

Occupational Risk Management (Parameter goes beyond CB and into traditional health and safety practice)

## Occupational Risk Management Toolbox

Chemical Control Toolkits						Physical hazard control toolkits (noise, radiation, etc.)	Ergonomic control toolkits	Other occupational hazard toolkits (workplace stress, injury reduction, environmental, etc.)	Non-toolbox approaches
Control Banding strategies			CB training strategies						
COSHH Essentials, PPE Essentials, Silica Essentials	Stoffenmanager, Solbase, Riskofderm Toolkit	OSH	GTZ, Process flow	Participatory, TTT	Others				

# Control Banding History

- **1946**; 1st ACGIH TLV Document Published
  - Significant Start for “Traditional Approach” to IH
- **1970’s**; Qualitative & Semi-Quantitative Risk Assessment
- **1988**; COSHH Regulations Released in UK; **Mandatory!**
- **1989**; Safety Risk Concepts Applied to Laboratories
  - (1) Categorizing Hazards with R-Phrases
  - (2) Estimate Exposures in Labs
  - (3) Workplace Matrix to Use (1) & (2) for Controls
- **1995**; Setting OELs & Occupational Exposure Bands (OEBs) for Pharmaceutical Agents
- **1999**; 1st Edition of COSHH Essentials

# Control Banding History; IOHA

- INTERNATIONAL OCCUPATIONAL HYGIENE ASSOCIATION - SINCE 1987
  - Striving to Contribute to the Standards and Programs Effecting Worker Protection
- 26 MEMBER ORGANIZATIONS
- 24 COUNTRIES
  - Australia, Belgium, Brazil, Canada, China (Hong Kong), Finland, France, Germany, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, South Africa, Sweden, Switzerland, Taiwan, United Kingdom, United States of America



# The World of IOHA 2005

- REPRESENTING OVER 20,000 OCCUPATIONAL HYGIENE PROFESSIONALS WORLDWIDE
  - <http://www.ioha.net>
- NGO IN OFFICIAL RELATION WITH WHO & ILO
  - NGO = Non-Governmental Organization
- FORMAL OCCUPATIONAL HEALTH LINKS WITH HEALTH/HYGIENE NGOS
  - Occupational Health Triad With IOHA &
  - ICOH – International Commission of Occ'l Health
  - IEA – International Ergonomics Association



# Control Banding History; IOHA

- **2001**; IOHA EXPERT GROUP ADAPTS COSHH ESSENTIALS FOR INTERNATIONAL USE
  - ILO Chemical Control Toolkit
- **2001**; 5th WHO COLLABORATING CENTRES MEETING
  - Develop Occupational Health Work Plan 2001 - 2005
- IOHA REPRESENTED THE IH PROFESSION
- GOAL: FOCUS ON PREVENTION
- OPPORTUNITY TO ELEVATE OUR PROFESSION'S VISIBILITY INTERNATIONALLY
  - Critical Juncture of the IH Profession
- **TF10**; PREVENTIVE TECHNOLOGIES
  - IOHA Co-Chair





# Control Banding History; IOHA

- **2001**; INTERNATIONAL CHEMICAL CONTROL TOOLKIT
- **2002**; {1st} INT'L CONTROL BANDING WORKSHOP (UK)
- **2002**; INTERNATIONAL TECHNICAL GROUP (ITG)
  - Develop Overarching Strategy, Tied to GHS 2008
  - Lead by WHO IPCS and ILO as Secretariat
  - ILO
  - WHO
  - NIOSH
  - UK HSE
  - GTZ
  - IOHA and Member Organizations


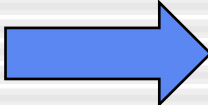


# Control Banding History; IOHA

- **2004;** 2nd INT'L CONTROL BANDING WORKSHOP (Ohio)
  - Leaders of NIOSH and OSHA as Keynote Speakers
  - International Implementation Strategy From ITG
- **2004;** CB PRACTICAL APPLICATIONS WORKSHOP
  - Netherlands; Develop Twinning Strategies & Training Protocol
  - India, Benin, South Africa, Brazil; Implementation of CB
- **2005;** NATIONAL CONTROL BANDING WORKSHOP (DC)
  - 50 Invited Participants Develop Coordinated National CB Plan
  - Discuss CB Literature Review & Critical Analysis Document
- **2005;** 3rd INT'L CONTROL BANDING WORKSHOP
  - IOHA 2005 South Africa, Pilanesberg National Park 21 Sept.
  - Introduction of CD Versions of COSHH & Silica Essentials
  - Outcome; WHO CC Work Plan 2006-2010

# Generic CB ORM Approach

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

Health Hazard + Exposure Potential 		Generic Risk Assessment 	Control Approach (Occ'l Risk Management)
Substances allocated to hazard group using R phrases	Substances allocated a dustiness or volatility band and a band for the scale of use	Combination of health hazard and exposure potential factors determine desired level of control	Type of approach needed to achieve adequate control

# COSHH Essentials Approach

- **COSHH ESSENTIALS RISK ASS'T APPROACH**
  - Identify Type of Task
  - Identify Assigned Chemical Hazard Band (A - E)
  - Determine Volatility (3 Levels) or Dustiness (3 Levels)
  - Amount of Chemical Used in the Task (3 Levels)
  - Control Solutions or IH Expertise Output as Necessary
- **CHEMICAL WORK WITH BULK LIQUIDS & DUSTS**
  - Not for Pesticides & Process Generated Hazards
  - E.g. Silica Dust, Wood Dust, Welding Fumes, Etc.
- **INTERMEDIATE EXPOSURE PREDICTION STEP**
- **CB STRATEGIES; SOLUTIONS APPROACH**
  - Task-Based; Database Inclusive of Exposures

# COSHH Essentials Approach

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

Hazard

Control

Assessment

## Collecting data:

For Selected Task

- chemical / product
- risk [R] phrases
- amount used
- volatility / dustiness
- process temperature
- task duration

## Produces:

For Selected Task

- control solutions
  - \* Control Guidance Sheets
- assessment log
  - \* evidence of assessment

# COSHH Essentials Approach

\* Paul Hewett; Exposure Assessment Solutions

Hazard Group (w/ examples)	Target airborne concentration range	
	Particulate	Vapors
<b>A</b> - Skin and eye irritants	>1-10 mg/m <sup>3</sup>	>50-500 ppm
<b>B</b> - Harmful on single exposure	>0.1-1 mg/m <sup>3</sup>	>5-50 ppm
<b>C</b> - Severely irritating & corrosive; skin sensitizers	>0.01-0.1 mg/m <sup>3</sup>	>0.5-5 ppm
<b>D</b> - Very toxic on single exposure; reproductive hazard	<0.01 mg/m <sup>3</sup>	<0.5 ppm
<b>E</b> - Carcinogens, asthmagens	Seek specialist advice	
S: skin and eye contact	Prevent or reduce skin and/or eye exposure	

# COSHH Essentials; Liquids

\* Paul Hewett; Exposure Assessment Solutions

Control Approach	Exposure Predictor Band (ppm)			
	ml – lo	ml – med,hi L, m <sup>3</sup> – lo	m <sup>3</sup> – med L – med,hi	m <sup>3</sup> – hi
General ventilation	<5	5-50	50-500	>500
Local Exhaust	<0.5	0.5-5	5-50	5-500
Containment	<0.05	0.05-0.5	0.5-5	0.5-5

# COSHH Essentials; Solids

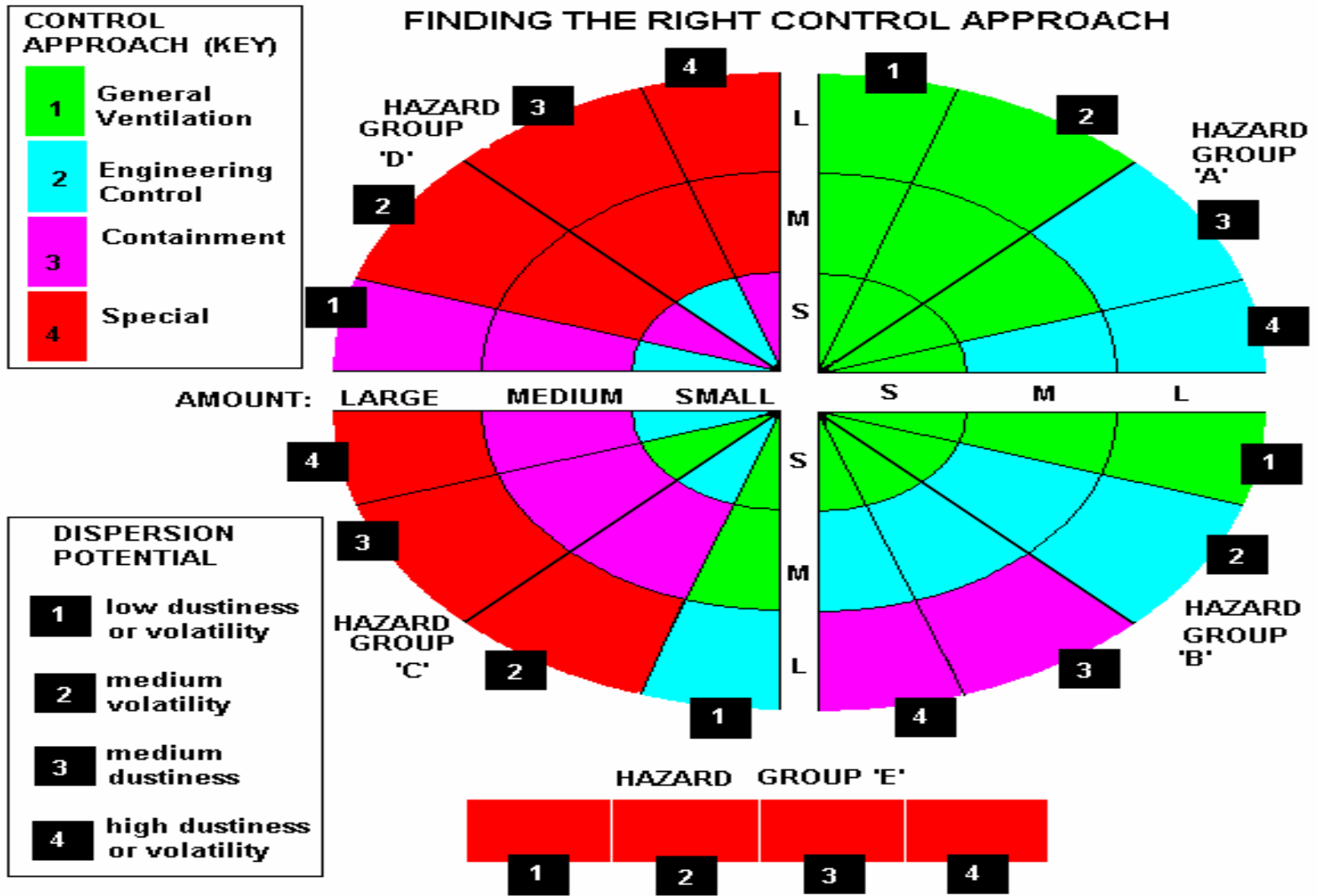
\* Paul Hewett; Exposure Assessment Solutions

Control Approach	Exposure Predictor Band (mg/m <sup>3</sup> )			
	g – lo,med	g – hi kg,tonne – lo	kg – med,hi	tonne – med,hi
General ventilation	0.01-0.1	0.1-1	1-10	>10
Local Exhaust	0.001-0.01	0.01-0.1	0.1-1	1-10
Containment	<0.001	0.001-0.01	0.01-0.1	0.1-1



# COSHH Essentials Approach

<http://www.coshh-essentials.org.uk>



# eCOSHH Essentials; Step 1

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## PROCESS AND TASKS

Please complete the following 2 sections, then click 'Go' at the bottom of the page :

1. You may find it helpful for your records to enter a [process name](#) here. This can be a simple description of the job you are doing, eg car spraying or anything that means something to you.

You may leave this blank.

2. You probably do one or more of the following [tasks](#) when carrying out this process. Please choose all those that apply from this list by clicking the box next to it. If none of these tasks apply, COSHH Essentials will still give you [general advice](#) to help you protect people from the ill effects of chemicals.

[Transferring](#)

[Screening](#)

[Weighing](#)

[Pelletising](#)

[Mixing](#)

[Storing](#)

[Surface coating](#)

[Laminating](#)

[Dust extraction](#)

[Dipping](#)

[Drying](#)

[Sieving](#)

# eCOSHH Essentials; Step 2

<http://www.coshh-essentials.org.uk>

Process → How Many → **Chemical Name** → Hazard → Form → How Much → Summary → Advice

## HOW MANY CHEMICALS ARE YOU USING ?

Assessment code	<b>RF12282656</b>
Process name	<a href="#">Lacquer making</a>
Task (1 of 1)	<a href="#">Transferring</a>

COSHH Essentials has given the assessment code **RF12282656** to this assessment. You or your firm cannot be identified in any way from this code. You should keep a copy of this code in case you want to return to the assessment within 30 days. It will be printed out at the end as part of your assessment summary.

You have two choices :

1. Please enter the number of [chemicals or products](#) you are using in this task

Go

2. Sometimes you may be using a mixture made by yourself **before** starting this task. If so, please enter the number of chemicals in the mixture

Go

# eCOSHH Essentials; Step 3

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## CHEMICAL OR PRODUCT NAME

Assessment code	RF12282656
Process name	<a href="#">Lacquer making</a>
Task (1 of 1)	<a href="#">Transferring</a>

Please enter the [chemical name](#) for each of the substances in the assessment or you may enter the name that appears on the [label](#). Then click on 'Go'. It is not important to COSHH Essentials to get the name exactly right. This is for your records only.

**Chemical or product name**

**Solid or Liquid**

1:

# eCOSHH Essentials; Step 4A

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## HOW HARMFUL ?

Assessment code	<b>RF12282656</b>
Process name	<u>Lacquer making</u>
Task (1 of 1)	<u>Transferring</u>
Chemical name (1 of 1)	citox
State	Liquid

You are using 1 chemical

# eCOSHH Essentials; Step 4B

<http://www.coshh-essentials.org.uk>

- |  |   |                                       |                                 |
|--|---|---------------------------------------|---------------------------------|
| <input type="checkbox"/> R20               | <input type="checkbox"/> R26/28               | <input type="checkbox"/> R42/43       | <input type="checkbox"/> R48/25 |
| <input type="checkbox"/> R20/21            | <input type="checkbox"/> R27                  | <input type="checkbox"/> R43          | <input type="checkbox"/> R49    |
| <input type="checkbox"/> R20/21/22         | <input type="checkbox"/> R27/28               | <input type="checkbox"/> R45          | <input type="checkbox"/> R60    |
| <input type="checkbox"/> R20/22            | <input type="checkbox"/> R28                  | <input type="checkbox"/> R46          | <input type="checkbox"/> R61    |
| <input type="checkbox"/> R21               | <input type="checkbox"/> R34                  | <input type="checkbox"/> R48/20       | <input type="checkbox"/> R62    |
| <input checked="" type="checkbox"/> R21/22 | <input type="checkbox"/> R35                  | <input type="checkbox"/> R48/20/21    | <input type="checkbox"/> R63    |
| <input type="checkbox"/> R22               | <input type="checkbox"/> R36                  | <input type="checkbox"/> R48/20/21/22 | <input type="checkbox"/> R64    |
| <input type="checkbox"/> R23               | <input type="checkbox"/> R36/37               | <input type="checkbox"/> R48/20/22    | <input type="checkbox"/> R65    |
| <input type="checkbox"/> R23/24            | <input checked="" type="checkbox"/> R36/37/38 | <input type="checkbox"/> R48/21       | <input type="checkbox"/> R66    |

Harmful in contact with skin (**R21**) and if swallowed (**R22**);

Irritating to eyes (**R36**), respiratory system (**R37**), and skin (**R38**).

# Examples of R phrases

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

Category	R-phrase	Description
Very toxic	R26	very toxic by inhalation
Toxic	R23	toxic by inhalation
Harmful	R20	harmful by inhalation
	R48	danger of serious damage to health by prolonged exposure
Corrosive	R35	causes severe burns
Irritant	R37	irritating to respiratory system
Sensitizing	R42	may cause sensitization by inhalation (e.g., asthmagens)
	R43	may cause sensitization by skin contact
Carcinogenic	R45	may cause cancer
Mutagenic	R46	may cause heritable genetic damage
Toxic to reproduction	R60	may impair fertility

# eCOSHH Essentials; R phrases

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

## Hazard Group vs. Target Exposure Range

Hazard group	Airborne concentration range	R phrases
A -Skin and eye irritants	>1-10 mg/m <sup>3</sup> dust >50-500 ppm vapor	R36, R38 All substances that do not have R phrases in groups B - E
B - Harmful on single exposure	>01-1 mg/m <sup>3</sup> dust >5-50 ppm vapor	R20/21/22, R40/20/21/22
C -Severely irritating & corrosive, skin sensitizers	>0.01-0.1 mg/m <sup>3</sup> dust >0.5-5 ppm vapor	R48/20/21/22, R23/24/25, R34, R35, R36/37, R37/38, R36/37/38, R37, R39/23/24/25, R41, R43
D -Very toxic on single exposure, reproductive hazard	< 0.01 mg/m <sup>3</sup> dust < 0 5 ppm vapor	R48/23/24/25, R28/27/28. R39/26/27/28, Carc Cat 3 R40, R60. R61, R62, R63
E - Carcinogen, occupational asthma	<i>Seek Specialist Advice</i>	Muta Cat 3 R40, R42, R42/43, R45, R46, R49
S: Skin and eye contact	<i>Prevention or reduction of skin and/or eye exposure</i>	R21, R24, R27, R34, R35, R36, R38, R41, R43, R48/21, R48/24, plus R -phrase combinations containing these. Skin <span style="float: right;">24</span>



# eCOSHH Essentials; R phrases

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

## Hazard groups A-E (chemicals causing harm when breathed in)

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
R36 R36/38 R38 <hr/> And all substances that don't have R-phrases in groups B-E	R20 R20/21 R20/21/22 R20/22 <hr/> R21 R21/22 <hr/> R22	R23 R23/24 R23/24/25 R23/25 <hr/> R24 R24/25 <hr/> R25 <hr/> R34 <hr/> R35 <hr/> R36/37 R36/37/38 <hr/> R37 R37/38 <hr/> R41 <hr/> R43 <hr/> R48/20 R48/20/21 R48/20/21/22 R48/20/22 R48/21 R48/21/22 R48/22	R26 R26/27 R26/27/28 R26/28 <hr/> R27 R27/28 <hr/> R28 <hr/> Carc cat 3 R40 <hr/> R48/23 R48/23/24 R48/23/24/25 R48/23/25 R48/24 R48/24/25 R48/25 <hr/> R60 R61 R62 R63	Muta cat 3 R40 <hr/> R42 R42/43 <hr/> R45 <hr/> R46 <hr/> R49

*Least hazardous substances*

*more hazardous substances*

*Special cases*

# eCOSHH Essentials; Step 4C

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → **Form** → How Much → Summary → Advice

## HAZARD GROUP

Assessment code	<b>RF12282656</b>
Process name	<a href="#">Lacquer making</a>
Task (1 of 1)	<a href="#">Transferring</a>
Chemical name (1 of 1)	citox
State	Liquid
R-phrases numbers	R21/22,R36/37/38
Hazard group	C

You are using 1 chemical

Please read this information and then click 'Go' at the bottom of the page.

The chemical **citox** belongs to the hazard group : **C**

A

B

**C**

D

E

*Least hazardous substances*

*more hazardous substances*

*Special cases*

The chemical **citox** may also cause harm if in contact with skin or eyes.

**Warning** : The chemical you are using has been given the high hazard group of **C**. Before carrying on you may want to consider using a less harmful chemical.

# eCOSHH Essentials; Step 5A

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## FORM : HOW MUCH OF THE CHEMICAL CAN GET INTO THE AIR ?

Assessment code	RF12282656
Process name	<a href="#">Lacquer making</a>
Task (1 of 1)	<a href="#">Transferring</a>
Chemical name (1 of 1)	citox
State	Liquid
R-phrase numbers	R21/22,R36/37/38
Hazard group	C

You are using 1 chemical

# eCOSHH Essentials; Step 5B

<http://www.coshh-essentials.org.uk>

Operating temperature

 °  ▾

You now have two options :

1. Boiling point

 °  ▾

If a range is given enter the lowest figure

OR, if you prefer, you may enter

2. Vapour pressure

  ▾

Reference temperature

 °  ▾

# eCOSHH Essentials; Step 6

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## HOW MUCH ARE YOU USING AND HOW OFTEN ?

Assessment code	<b>RF12282656</b>
Process name	<a href="#">Lacquer making</a>
Task (1 of 1)	<a href="#">Transferring</a>
Chemical name (1 of 1)	citox
State	Liquid
R-pharse numbers	R21/22,R36/37/38
Hazard group	C

You are using 1 chemical

Choose the [quantity used](#) :

- Small - millilitres
- Medium - litres
- Large - cubic metres

[How many times a day](#) do you carry out this transferring task?

[How long in minutes](#) does the transferring task take?

# Step 6; How much is being used?

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

<b>AMOUNT</b>	<b>SOLID</b>	<b>LIQUID</b>
<i>Small</i>	Grams	Milliliters
<i>Medium</i>	Kilograms	Liters
<i>Large</i>	Tons	Cubic meters

# Step 6; Dustiness of solid used?

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

<b>LOW</b>	pellet-like solids that don't break up little dust is seen during use, e.g., PVC pellets, waxed flakes, prills
<b>MEDIUM</b>	crystalline, granular solids dust settles quickly, e.g., soap powder
<b>HIGH</b>	fine, light powders dust clouds remain in air for several minutes e.g., cement, carbon black, chalk dust

# eCOSHH Essentials; Summary

<http://www.coshh-essentials.org.uk>

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## SUMMARY OF USER INPUT

**Your assessment code** : RF12282656  
**Process name** : Lacquer making  
**Task** : Transferring

Congratulations! You have completed the COSHH Essentials risk assessment for 1 chemical. Below is a summary of the information you have input.

If you think you have made a mistake or you wish to change any of the information, please click [here](#) to edit the information on this task.

To obtain more details on the summary, click on any of the terms below.

<b>Chemical or product name :</b>	<b>citox</b>
<a href="#">R-phrases :</a>	R21/22, R36/37/38
State :	Liquid
<a href="#">Operating temperature :</a>	25 °C
<a href="#">Boiling point :</a>	134 °C
Hazard group :	C
Skin hazard :	Yes
<a href="#">Quantity used :</a>	Medium
<a href="#">How many times a day ?</a>	2 times a day
<a href="#">How long does the task take ?</a>	120 minutes



# eCOSHH Essentials; Guidance

<http://www.coshh-essentials.org.uk>

## Recommended control approach : Containment

Task Name	Guidance Sheet Title	Number	Download
General tasks	Containment	G300	
Transferring	Drum filling	G305	
Transferring	Drum emptying	G306	
Transferring	Transferring liquid by pump	G312	
Transferring	Bottle filling	G314	

Your task involves **Chemicals causing harm via skin contact**. Hence the following Guidance Sheets are also recommended

Task Name	Guidance Sheet Title	Number	Download
General	General advice	S100	
General	Selection of personal protective equipment	S101	

# eCOSHH Essentials; Guidance

<http://www.coshh-essentials.org.uk>

Home

Help

Worked Example

Back to Demo Menu



Single Liquid,  
Single Task



Control guidance sheet

## Local exhaust ventilation

Engineering control

200



This guidance sheet is aimed at employers to help them comply with the requirements of the Control of Substances Hazardous to Health Regulations 1999 (COSHH) by controlling exposure to chemicals and protecting workers' health.

The sheet is part of the HSE guidance pack *COSHH essentials: easy steps to control chemicals*. It can be used where the guide recommends control approach 2 - engineering control - as the suitable approach for your chemical(s) and task(s).

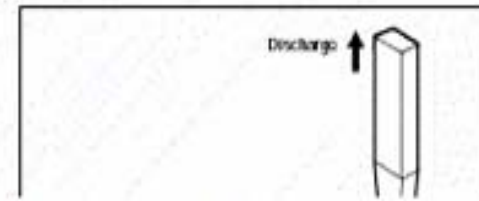
This sheet provides good practice

### Access

- ✓ Restrict access to the working area to authorised staff only.

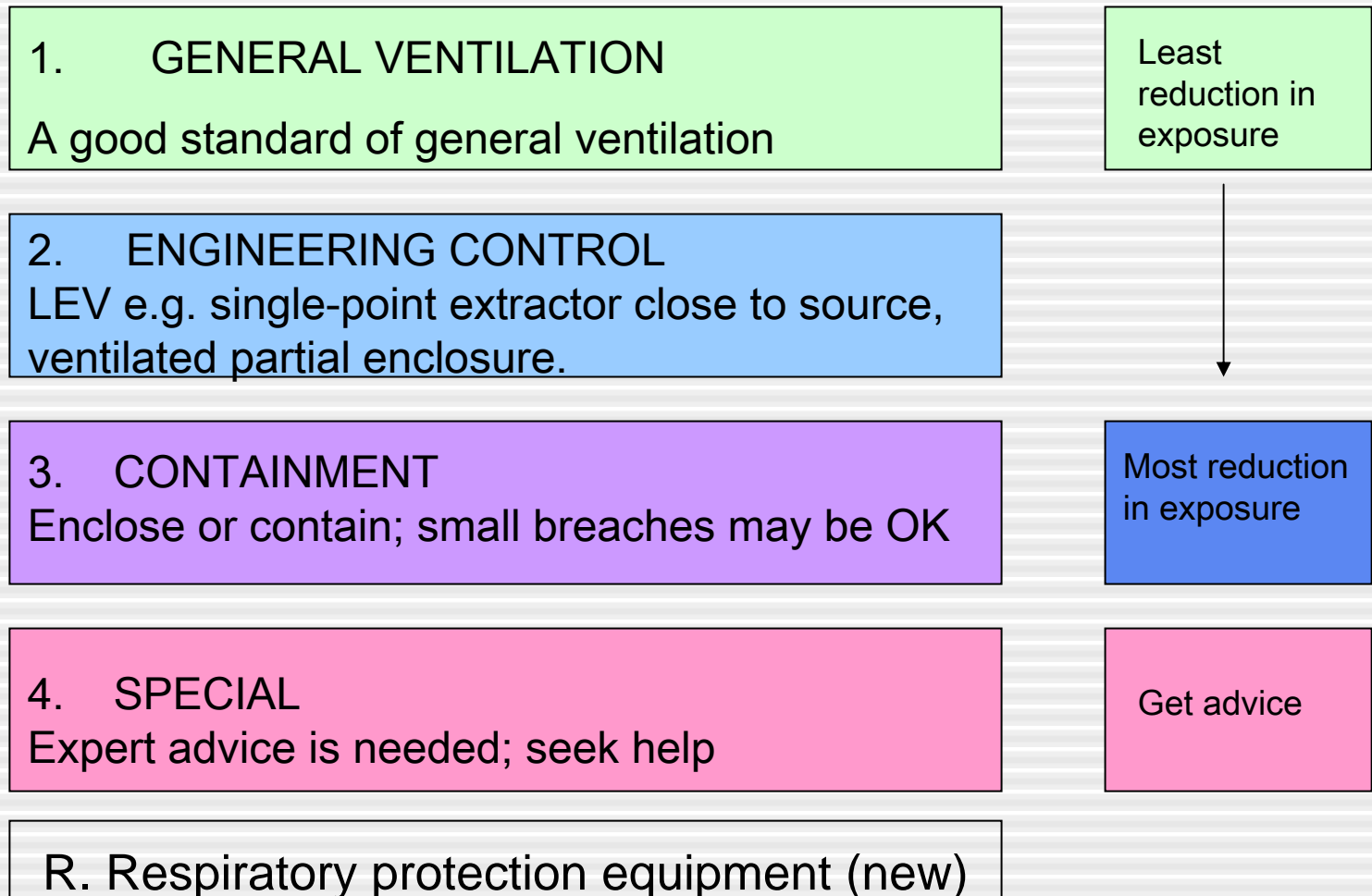
### Design and equipment

- ✓ Apply local exhaust ventilation (LEV) at the source of exposure to capture the dust or vapour.
- ✓ Enclose the source of dust or vapour as much as possible to help stop it spreading.
- ✓ Don't allow the worker to get between the source of exposure and the LEV, otherwise they'll be directly in the path of the contaminated air flow.
- ✓ Where possible, site the work area away from doors.



# eCOSHH Essentials; Guidance

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis



# eCOSHH Essentials; Guidance

<http://www.coshh-essentials.org.uk>

Control Guidance Grouping Assigned for Level of Risk				
Amount Used	Low Dustiness or Volatility	Medium Volatility	Medium Dustiness	High Dustiness or Volatility
<b>Hazard Group A</b>				
SMALL	1	1	1	1
MEDIUM	1	1	1	2
LARGE	1	1	2	2
<b>Hazard Group B</b>				
SMALL	1	1	1	1
MEDIUM	1	2	2	2
LARGE	1	2	3	3
<b>Hazard Group C</b>				
SMALL	1	2	1	2
MEDIUM	2	3	3	3
LARGE	2	4	4	4
<b>Hazard Group D</b>				
SMALL	2	3	2	3
MEDIUM	3	4	4	4
LARGE	3	4	4	4
<b>Hazard Group E</b>				
<b>For all hazard group E substances, choose control approach 4</b>				



## Control approach 2



This guidance sheet is aimed at employers to help them comply with the requirements of

the Control of Substances Hazardous to Health Regulations 1999 (COSHH) by controlling exposure to chemicals and protecting workers' health.

The sheet is part of the HSE guidance pack *COSHH essentials: easy steps to control chemicals*. It can be used where the guide recommends control approach 2 - engineering control - as the suitable approach for your chemical(s) and task(s).

This sheet provides good practice advice on mixing medium and large quantities of liquids with other liquids or solids. It describes the key points you need to follow to help reduce exposure to an adequate level.

It is important that all the points are followed.

Some chemicals can also be flammable or corrosive. Where they are, your controls must be suitable for those hazards too. Look at the safety data sheet for more information.

For certain processes your local authority or the Environment Agencies will impose emission limits under the Environmental Protection Act 1990. Air cleaning equipment may therefore be necessary before discharging some emissions into the atmosphere.

# Mixing liquids with other liquids or solids

217

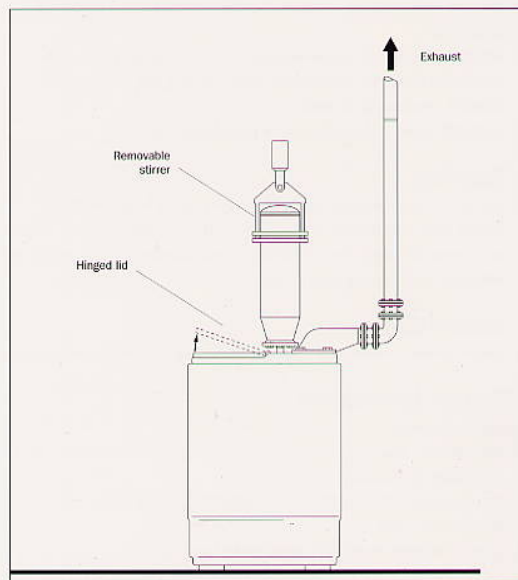
## Engineering control

### Access

- ✓ Restrict access to the work area to authorised staff only.

### Design and equipment

- ✓ Position the local exhaust ventilation (LEV) hood as near to the source of the vapour as possible.
- ✓ Enclose the top of the mixer as much as possible.
- ✓ Air flow across the whole mixer top towards the LEV should be at least 0.5 metre per second. If solids are mixed, it may be necessary to increase the airflow to 1.0 metre per second.
- ✓ Where possible, site the work area away from doors, windows and walkways to stop draughts interfering with the ventilation and spreading vapours.
- ✓ Provide an air supply to the workroom to replace extracted air.
- ✓ Keep ducts short and simple, and avoid long sections of flexible duct.
- ✓ Provide an easy way of checking the control is working, eg a manometer, pressure gauge or tell-tale.
- ✓ Discharge extracted air to a safe place away from doors, windows and air inlets.
- ✗ With vapours, air re-circulation is not recommended.



### Maintenance

- ✓ Maintain the equipment as advised by the supplier/installer in effective and efficient working order.

### Examination and testing

- ✓ Get information on the design performance of the ventilation equipment from the supplier. Keep this information to compare with future test results.
- ✓ Visually check ventilation equipment at least once a week for signs of damage.
- ✓ Ensure the ventilation equipment is examined and tested against its performance standard. This is generally at least every 14 months (see HSE publication HSG54). Keep records of all examinations and tests for at least five years.
- ✓ Keep records of all examinations and tests for at least five years.

### Cleaning and housekeeping

- ✓ Clean work equipment and the work area daily. Clean other equipment and the workroom regularly - once a week is recommended.
- ✓ Deal with spills immediately.
- ✓ Store containers in a safe place and dispose of empty containers safely (see CGS 101).
- ✓ Put lids on containers immediately after use.

### Personal protective equipment (PPE)

- ✓ Chemicals in **hazard group S** can damage the skin and eyes, or enter the body through the skin and cause harm. See CGS S100 and S101 for more specific advice. Check the safety data sheets to see what personal protective equipment is necessary.
- ✓ Ask your safety clothing supplier to help you select suitable protective equipment.
- ✓ Respiratory protective equipment should not be necessary for routine operations. It may be necessary for some cleaning and maintenance activities, eg cleaning up spills.
- ✓ Keep PPE clean, and replace it at recommended intervals.

### Training

- ✓ Give your workers information on the harmful nature of the substance.
- ✓ Provide them with training on: handling chemicals safely; checking controls are working and using them; when and how to use any PPE you provide; and what to do if something goes wrong.

### Supervision

- ✓ Have a system to check that control measures are in place and being followed.

### Further information

- Safety data sheets.
- *Maintenance, examination and testing of local exhaust ventilation* HSG54 HSE Books 1998 ISBN 0 7176 1485 9.
- *An introduction to local exhaust ventilation* HSG37 HSE Books 1993 ISBN 0 7176 1001 2.
- Control guidance sheets 101, S100 and S101.

### Employee checklist for making the best use of the controls

- Make sure the ventilation system is switched on and is working.
- Make sure it is running properly; check the manometer, pressure gauge or tell-tale.
- Make sure the air movement is across or away from your face.
- Look for signs of damage, wear or poor operation of any equipment used. If you find any problems, tell your supervisor. Do not carry on working if you think there is a problem.
- Make sure that paper bags and other waste material aren't drawn into the ventilation duct.
- Wash your hands before and after eating, drinking or using the lavatory.
- Do not use solvents to clean your skin.
- Clear up spills straight away. Contain or absorb liquids with granules or mats. Dispose of spills safely.
- Use, maintain and store any PPE provided in accordance with instructions.





## Control approach 3



This guidance sheet is aimed at employers to help them comply with the requirements of the Control of Substances Hazardous to Health Regulations 1999 (COSHH) by controlling exposure to chemicals and protecting workers' health.

The sheet is part of the HSE guidance pack *COSHH essentials: easy steps to control chemicals*. It can be used where the guide recommends control approach 3 - containment - as the suitable approach for your chemical(s) and task(s).

This sheet provides good practice advice on sack emptying, and can be applied to tasks involving medium quantities of solids. It describes the key points you need to follow to reduce exposure to an adequate level.

It is important that all the points are followed.

Some chemicals can also be flammable or corrosive. Where they are, your controls must be suitable for those hazards too. Look at the safety data sheet for more information.

For certain processes your local authority or the Environment Agencies will impose emission limits under the Environmental Protection Act 1990. Air cleaning equipment may therefore be necessary before discharging some emissions into the atmosphere.

# Sack emptying

304

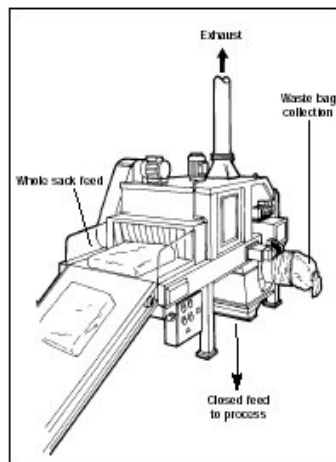
## Containment

### Access

- ✓ Control staff entry to the work area.
- ✓ The work area and equipment should be clearly labelled.

### Design and equipment

- ✓ Provide arrangements to strip and vacuum or wet clean the conveyor belt.
- ✓ Enclose the slitter as much as possible - see diagram.
- ✓ Ensure an inward airflow of 1.0 metre per second at any opening into the enclosure.
- ✓ Keep all openings as small as possible - while allowing enough room for safe working. Use see-through panels and plastic strips to reduce the open area.
- ✓ Consider additional ventilation at the bag disposal point.
- ✓ Provide good lighting. Select lighting equipment suitable for the nature of the substances and processes, eg dust tight or flameproof, if needed.
- ✓ Design the system to allow easy maintenance.
- ✓ Where operational factors permit, keep the process equipment under negative pressure to prevent leakage.
- ✓ Discharge extracted air to a safe place away from doors, windows and air inlets.



### Maintenance

- ✓ Ensure all equipment used in the task is maintained as advised by the supplier/installer, in effective and efficient working order and good repair.
- ✓ Adopt a 'permit to work' system for maintenance work.
- ✓ Follow any special procedures that are needed before the system is opened or entered, eg purging and washing.

### Examination and testing (if a ventilation system is provided)

- ✓ Get information from the supplier on all parameters needed to safely operate the system.
- ✓ Visually check equipment at least once a week for signs of damage.
- ✓ Ensure any extraction equipment is thoroughly examined and tested against its performance standard. This is generally at least every 14 months (see HSE publication HSG54).
- ✓ Keep records of all examinations and tests for at least five years.

### Cleaning and housekeeping

- ✓ Thoroughly clean work equipment and the work area daily. Clean other equipment and the workroom regularly - once a week is recommended.
- ✓ Store packages/containers in a safe place (see CGS 101).
- ✓ Dispose of empty packages/containers safely.
- ✓ Put lids on containers immediately after use.
- ✓ Deal with spills immediately.
- ✗ Don't clean up with a dry brush or compressed air, use a vacuum system or wet cleaning.

### Personal protective equipment (PPE)

- ✓ Chemicals in hazard group 5 can damage the skin and eyes, or enter the body through the skin and cause harm. See CGS S100 and S101 for more specific advice. Check the safety data sheets to see what PPE equipment is necessary.
- ✓ Ask your safety clothing supplier to help you select suitable protective equipment.
- ✓ Respiratory protective equipment (RPE) shouldn't be needed for routine tasks. It may be necessary for some cleaning and maintenance activities, eg cleaning up spills. Be aware that some maintenance activity may involve entry into confined spaces. Decide if supplied air is needed when RPE is used.
- ✓ Ensure PPE is kept in a clean condition and replaced when necessary.

### Training

- ✓ Give your workers information on the harmful nature of the chemicals.
- ✓ Provide them with training on: operating the process; following maintenance procedures; when and how to use PPE; and how to detect and deal with leaks.

### Supervision

- ✓ Have a system to check that control measures are in place and being followed.

### Further information

- Safety data sheets.
- *Maintenance, examination and testing of local exhaust ventilation* HSG54 HSE Books 1998 ISBN 0 7176 1485 9.
- *An introduction to local exhaust ventilation* HSG37 HSE Books 1993 ISBN 0 7176 1001 2.
- Control guidance sheets 101, 204, 302, S100 and S101.

### Employee checklist for making the best use of the controls

- Make sure any ventilation system is switched on and is working.
- Look for signs of leaks, wear or damage of any equipment used. If you find any problems, tell your supervisor. Do not carry on working if you think there is a problem.
- Avoid manual handling - use handling aids.
- Any damaged or leaking bags should be repacked away from the main storage area or disposed of safely. A responsible person should be involved to ensure this process is carried out safely.
- Wash your hands before and after eating, drinking or using the lavatory.
- Do not use solvents to clean your skin.
- Clear up spills straight away. For solids, use vacuum cleaning or wet mopping. Dispose of spills safely.
- Use, maintain and store any PPE provided in accordance with instructions.



COSHH essentials:  
easy steps to control chemicals  
HSG103 May 1999

Printed and published by  
the Health and Safety Executive

# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005

- Mixture made up in the factory
  - 30% MEK, BP 70 °C, R11 R36/38
  - 10% IPA, BP 82 °C, R11 R36/38
  - 50% toluene, BP 110 °C, R11, R20
- Sprayed at room temperature
- Small amount (750 ml)
- 90 minutes per task, several times daily

# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005



Easy steps to control health risks from chemicals

hsedirect

Help

new Feedback

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About COSHH Essentials

Help

Worked Example

HSE

hsedirect

DTI Small Business Service

Environment Agencies

## GETTING STARTED

You have 4 choices:

1. Find out what the law says and how COSHH Essentials works (we recommend that you choose this option first if you have not used COSHH Essentials before).

Go

2. Start a new assessment (to provide this information you will need a safety data sheet for each chemical to supply details such as risk phrases (R-phrases)).

Go

3. Return to an assessment you have completed during the last 30 days. Please enter here the assessment code that was generated by COSHH Essentials.

Go

4. **NEW** Direct advice topics

Go





# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005

The screenshot shows a web browser window with a help window open on the left and the main task page on the right. The help window, titled 'COSHH ESSENTIALS Help - Microsoft Internet Ex...', contains the following text:

**Surface coating**

Surface coatings include paints, varnishes, lacquers, adhesives, glazes and powders which either dry in air or set through heating.

**Liquid coatings**

Small-scale spray coating uses liquid in an aerosol can. Medium-scale uses a spray gun with a liquid paint reservoir, or lines to a larger paint drum and these are often powered by compressed air. Car spraying is an example. Production lines can carry sprayed articles to a drying oven and that task is continuous drying. Large-scale use involves airless spraying at over 1000 psi. It is used for very large surfaces, such as ships' bilges, and personal protective equipment is vital.

**Solid coatings**

These are powders. They are often sprayed in a booth using an electrostatic spray gun.

[Close](#)

The main page, titled 'In chemicals hsedirect Help', has a navigation bar: [How Many](#) → [Chemical Name](#) → [Hazard](#) → [Form](#) → [How Much](#) → [Summary](#) → [Advice](#). Below this is the heading 'PROCESS AND TASKS' and the instruction: 'complete the following 2 sections, then click 'Go' at the bottom of the page :'. There are two sections: 'You may find it helpful for your records to enter a [process name](#) here. This can be a description of the job you are doing, eg car spraying or anything that means something you may leave this blank.' with a text input field containing 'Gnome - line 17', and 'You probably do one or more of the following [tasks](#) when carrying out this process. Choose all those that apply from this list by clicking the box next to it. If none of them apply, COSHH Essentials will still give you [general advice](#) to help you protect people from the effects of chemicals.' Below this is a list of tasks with checkboxes: [Transferring](#) , [Screening](#) , [Weighing](#) , [Pelletising](#) , [Mixing](#) , [Storing](#) , [Surface coating](#) , [Laminating](#) , [Dust extraction](#) , [Dipping](#) , [Drying](#) , [Sieving](#) , and [None of the above](#) . A 'Go' button is at the bottom.

# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005

Home

Help

Worked Example

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## HOW MANY CHEMICALS ARE YOU USING ?

Assessment code	1058679538
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>

COSHH Essentials has given the assessment code **1058679538** to this assessment. You or your firm cannot be identified in any way from this code. You should keep a copy of this code in case you want to return to the assessment within 30 days. It will be printed out at the end as part of your assessment summary.

You have two choices :

1. Please enter the number of [chemicals or products](#) you are using in this task
2. Sometimes you may be using a mixture made by yourself **before** starting this task. If so, please enter the number of chemicals in the mixture

<<Back

# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

Home

Help

Worked Example

## CHEMICAL OR PRODUCT NAME

Assessment code **IO58679538**  
Process name [Gnome - line 17](#)  
Task (1 of 1) [Surface coating](#)

Please enter the [chemical name](#) for each of the substances in the assessment or you may enter the name that appears on the [label](#). Then click on 'Go'. It is not important to COSHH Essentials to get the name exactly right. This is for your records only.

	Chemical or product name	Solid or Liquid	Maximum Concentration
1:	<input type="text" value="MEK - butanone"/>	<input type="text" value="Liquid"/>	<input type="text" value="30"/> %
2:	<input type="text" value="IPA - isopropanol"/>	<input type="text" value="Liquid"/>	<input type="text" value="10"/> %
3:	<input type="text" value="Toluene + pigment"/>	<input type="text" value="Liquid"/>	<input type="text" value="50"/> %

Please select one...  
Solid  
**Liquid**  
Solid in Liquid

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Help

Worked Example

## HOW HARMFUL ?

Assessment code	<b>IO58679538</b>
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
Chemical name (1 of 3)	MEK - butanone
State	Liquid

You are using a mixture you made yourself

You now need to enter the [risk phrase](#) (R-phrase) numbers that appear at section 15 of your safety data sheet. Then click 'Go' at the bottom of the screen. **It is very important that you enter the numbers shown and in the right groupings.**

**Important note** : You may have R-phrases on your safety data sheet, which do not appear below. This is because COSHH Essentials only deals with risks to health. Other R-phrases deal with safety or environmental risks. Simply choose from your data sheet those R-phrases which do appear on the list so COSHH Essentials can work out a hazard group for the chemical. If none of the numbers appear on the list, click in the last

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Help

Worked Example

## FORM : HOW MUCH OF THE CHEMICAL CAN GET INTO THE AIR ?

Assessment code	<b>IO58679538</b>
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
Chemical name (1 of 3)	MEK - butanone
State	Liquid
R-phrase numbers	R36/38
Hazard group	A

You are using a mixture you made yourself

What you have to do to protect yourself and others from the ill effects of chemicals, depends on how easily they get into the air. In other words, for liquids, how volatile they are. COSHH Essentials calculates volatility from your operating temperature and either the chemical's boiling point or vapour pressure.

Please enter the information on your chemical's volatility from section 9 of your safety data sheet, then click 'Go'.

[Operating temperature](#)  °C

You now have two options :

1. [Boiling point](#)  °C

If a range is given enter the lowest figure

R48/25

**R36/38**

**Group A**

## HOW HARMFUL ?

Assessment code	<b>IO58679538</b>
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
Chemical name (2 of 3)	IPA - isopropanol
State	Liquid

You are using a mixture you made yourself

You now need to enter the [risk phrase](#) (R-phrase) numbers that appear at section 15 of your data sheet. Then click 'Go' at the bottom of the screen. **It is very important that you enter the numbers shown and in the right groupings.**

**Important note :** You may have R-phrases on your safety data sheet, which do not appear in the list below. This is because COSHH Essentials only deals with risks to health. Other R-phrases deal with safety or environmental risks. Simply choose from your data sheet those R-phrases which do appear on the list so COSHH Essentials can work out a hazard group for the chemical. If none of the numbers in the list apply to your chemical, please click in the last box.

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Help

Worked Example

## FORM : HOW MUCH OF THE CHEMICAL CAN GET INTO THE AIR ?

Assessment code	<b>IO58679538</b>
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
Chemical name (2 of 3)	IPA - isopropanol
State	Liquid
R-phrase numbers	R36/37
Hazard group	C

You are using a mixture you made yourself

R48/25

What you have to do to protect yourself and others from the ill effects of chemicals, depends on how easily they get into the air. In other words, for liquids, how volatile they are. COSHH Essentials calculates volatility from your operating temperature and either the chemical's boiling point or vapour pressure.

Please enter the information on your chemical's volatility from section 9 of your safety data sheet, then click 'Go'.

[Operating temperature](#)  °

You now have two options :

1. [Boiling point](#)  °  

If a range is given enter the lowest figure

R36/37

Group C

Home

Help

Worked Example

### HOW HARMFUL ?

Assessment code	<b>IO58679538</b>
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
Chemical name (3 of 3)	Toluene + pigment
State	Liquid

You are using a mixture you made yourself

You now need to enter the [risk phrase](#) (R-phrase) numbers that appear at section 15 of your safety data sheet. Then click 'Go' at the bottom of the screen. **It is very important that you enter the numbers shown and in the right groupings.**

**Important note** : You may have R-phrases on your safety data sheet, which do not appear below. This is because COSHH Essentials only deals with risks to health. Other R-phrases which do not relate to health are not included. If none of the numbers shown are applicable, click in the last box.

### FORM : HOW MUCH OF THE CHEMICAL CAN GET INTO THE AIR ?

- Home
- Help
- Worked Example

Assessment code	<b>IO58679538</b>
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
Chemical name (3 of 3)	Toluene + pigment
State	Liquid
R-phrase numbers	R20
Hazard group	B

You are using a mixture you made yourself

What you have to do to protect yourself and others from the ill effects of chemicals, depends on how easily they get into the air. In other words, for liquids, how volatile they are. COSHH Essentials calculates volatility from your operating temperature and either the chemical's boiling point or vapour pressure.

Please enter the information on your chemical's volatility from section 9 of your safety data sheet, then click 'Go'.

[Operating temperature](#)    25 °C

You now have two options :

1. [Boiling point](#)    110 °C   

If a range is given enter the lowest figure

Help on R20

Harmful by inhalation

# R20 Group B

R48/25

# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005

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Help

Worked Example

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice

## HOW MUCH ARE YOU USING AND HOW OFTEN ?

Assessment code	IO58679538
Process name	<a href="#">Gnome - line 17</a>
Task (1 of 1)	<a href="#">Surface coating</a>
State	Liquid

Choose the [quantity used](#) :

- Small - millilitres
- Medium - litres
- Large - cubic metres

[How many times a day](#) do you carry out this surface coating task?

[How long in minutes](#) does the surface coating task take?

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# eCOSHH Task: Surface coating

\* Paul Evans; COSHH Essentials, NCBW March 2005

Home

Help

Worked Example

Process → How Many → Chemical Name → Hazard → Form → How Much → Summary → Advice


### ADVICE ON HOW TO PROTECT YOURSELF AND OTHERS

Your assessment code : IO58679538  
Process name : Gnome - line 17  
Task : Surface coating

Having assessed the mixture of 3 chemicals used in this task, COSHH Essentials has calculated that you need to use control approach "[Engineering Control](#)". This is based on the highest hazard found.

The guidance sheets listed below give you advice on areas such as design and equipment, maintenance, examination and testing, cleaning and housekeeping, personal protective equipment, training and supervision.

You should now print off the guidance sheets and also print off the summary of your assessment for your records. The summary will also give you important information about what you should do to put the advice into practice and other action you may need to take.

**Please note :** The summary and guidance sheets provided below are [PDF files](#). To view these files, you have to have Adobe® Acrobat Reader installed. If you do not have Acrobat Reader installed, click the  button to download and install the latest version. THIS SOFTWARE HAS BEEN CHECKED FOR

Download the summary of your assessment here :



#### Recommended control approach : **Engineering Control**

Task Name	Guidance Sheet Title	Number	Download
General tasks	Local exhaust ventilation	G200	
General tasks	Fume cupboard	G201	
General tasks	Ventilated Workbench	G203	
Surface coating	Spray painting	G220	

Your task involves **Chemicals causing harm via skin contact**. Hence the following Guidance Sheets are also recommended

Task Name	Guidance Sheet Title	Number	Download
General	General advice	S100	
General	Selection of personal protective equipment	S101	

<<Back    **New assessment** >>



# COSHH Essentials; Respirators

<http://www.coshh-essentials.org.uk>

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

# COSHH Essentials Validation






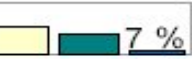

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis


- EU risk phrases and Globally Harmonised System (GHS)
- Hazard classification and labelling scheme (GHS 2008)
  - Chapter IX, UNCED Agenda 21
- IOHA/ILO testing International Chemical Control Toolkit using GHS categories, based upon COSHH Essentials.
- Concerns and Limitations
  - Method (predicting an appropriate level of control)
  - Engineering Controls (verify effectiveness of particular engineering controls installed to control exposures)
- German BauA field studies (1991-2001) – over 1000 personal measurements in 18 industrial applications:
  - Tischer et al., 2003

# Tischer et al 2004; Validation

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

## Measured data vs model predictions: lower, within or higher?

Control strategy	Exposure potential (solids)	
	tonnes, medium /high dusty	kilogram, medium /high dusty
general ventilation	rubber production 	plastics processing 
		textile industry 
		grinding wheel production 
local exhaust ventilation		chemical industry 
		chemical industry (TRK) 
		textile industry 















lower  
 within  
 higher

# Tischer et al 2004; Validation

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

## Measured data vs model predictions: lower, within or higher?

Control strategy	Exposure potential (liquids)			
	litre, medium /high volatil.	m l, medium /high volatil.; m <sup>3</sup> /litre, low volatil.		
general ventilation	furniture industry		carpenters workshop	 12%
	textile industry		optician workshop	 5%
	offset printing		glueing activities	 22%
	screen printing		screen printing	
local exhaust ventilation	paint production	 5%		
closed systems	chemical industry			
	chemical industry (TRK)			



lower  
within  
higher

# Brooke 1998; Validation

\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

## Validation Results for COSHH Essentials

<i>Level of Control</i>	<i>Number of Substances (%)</i>
scheme equivalent to OEL	52
scheme more stringent than OEL	46
scheme less stringent than OEL	2
scheme equivalent or more stringent than OEL	98

# COSHH Essentials; Limitations

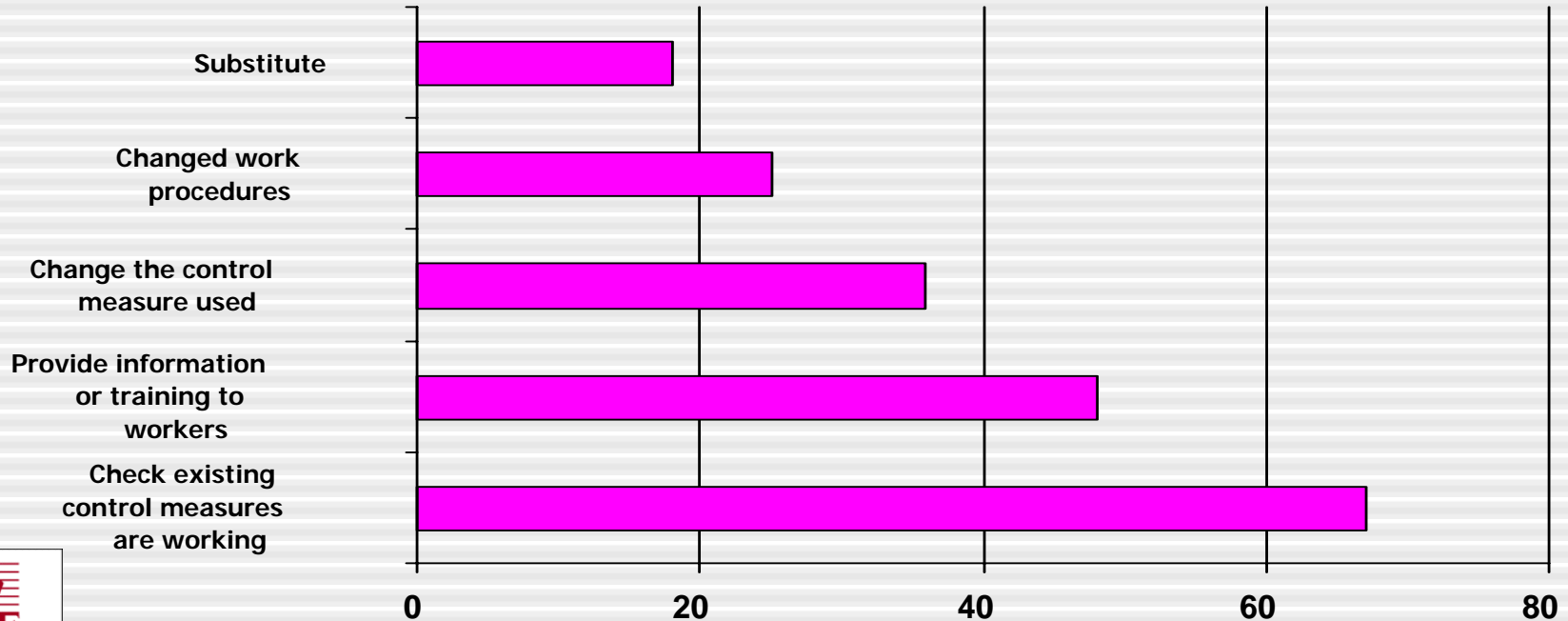
\* Deborah Nelson; Co-Author Control Banding Literature Review & Critical Analysis

- Scheme is semi-quantitative exposure assessment
- COSHH Essentials is not yet appropriate for:
  - Process generated fume/dust, “hot” processes, spray applications, pesticides, lead, asbestos, gases, chemicals without R-phrases, safety or environmental hazards, skin hazards, *and more that experienced IHs can readily list!*
- Critical role of R-phrases, set by manufacturer or supplier
  - GHS 2008 seeks to standardize setting process & terminology
- Dusts: respirable, total, or inhalable units?
- Can owner of SME really understand without training?
  - Requires “expert advice” for high toxicity &/or large quantities
- Possible to over-/under- estimate the exposure of a substance in a mixture (solvent mixture, inorganic solutions)
- Validation of effectiveness of engineering controls

# COSHH Essentials; In the U.K.

\* Paul Evans; COSHH Essentials, NCBW March 2005

- Telephone survey of 500 purchasers who have used COSHH Essentials; Do they like it?
  - 80% had used it
  - 75% had taken action
  - 5% difficult to use
  - 95% recommend it



# COSHH Essentials; In the U.S.?

- Compliance strategy vs. regulatory scheme
- R-phrases
- Validation of effectiveness
- Shift in thinking from “exposure assessment” to “exposure control”
- How to handle mixtures? Other gaps?
- Role of sampling / analysis?
- OSHA?
  - Would OSHA consider CB as “de facto” compliance?
  - Could their IHs use CB as “sampling screen”?



# COSHH Essentials; In the U.S.?

- Compliance strategy vs. regulatory scheme
- R-phrases
- Validation of effectiveness
- Shift in thinking from “exposure assessment” to “exposure control”
- How to handle mixtures? Other gaps?
- Role of sampling / analysis?
- OSHA?
  - Would OSHA consider CB as “de facto” compliance?
  - Could their IHs use CB as “sampling screen”?

# Expand CB Range; Silica

\* Paul Evans; COSHH Essentials, NCBW March 2005

## **Silica Essentials: Existing Exposure/Control Data**

- Quarries
- Stonemasonry
- Foundries
- Silica Flour
- Rock Drilling
- Screening
- Sand Drying
- Bagging/Transfer
- Slate Making
- Ceramics & Tilemaking
- Construction
- Brickmaking
- Excavating & Ripping
- Milling
- Silica Flour Transfer & Weigh
- Baghouse Cleaning

# Expand CB Range; Ergonomics

- MSDs = 40% WORLD'S HEALTH COSTS (ILO, 1999)
  - Occupational and Work-Related Diseases
- 37% WORLD'S BACK PAIN - OH RISKS (WHO, 2002)

<b>DISEASES</b>	<b>COST</b>
Tumours	2%
Skin Diseases	3%
Mental Disorders	7%
CNS	8%
Respiratory Dis.	10%
Accidents	14%
Heart Disease	16%
Musculoskeletal	40%

# Expand CB Range; Ergonomics

- MSD RISK FACTORS~CHEMICAL HAZARD GROUPS
  - Awkward Postures, Hand Force, Repetitive Motions
  - Heavy, Frequent, or Awkward Lifting
- RELATIVELY EASIER FOR ERGONOMICS
  - MSD Risks for Procedures by Profession More Finite
  - Compare to Ever-Growing Hazardous Chemicals List
- ERGONOMISTS ANALYZE COMMON RISK FACTORS
  - Risks: **Red** = High; **Yellow** = Moderate; **Green** = Lower
- HIGHEST RISK PROFESSIONS GET MORE FOCUS
  - Higher Level of Assessment, Training, Intervention
- IMPLEMENTATION CREATES ERGO PROGRAMS
  - Proven Prevention of Work-Related MSDs

# Expand CB Range; Ergonomics

## SUGGESTED IMPLEMENTATION PROTOCOL FOR MULTIPLE TOOLKITS BY TRADE

$$\text{CBE} = \text{PE} + \text{EA} + \text{CT}$$

- CBE = Control Banding in Ergonomics
- PE = Participatory Ergonomics
- EA = Exposure Assessment
- CT = Creation of Training

# Expand CB Range; Toolbox

- **ORM CONSTRUCTION TOOLBOX WITH CB STRATEGIES**
  - Focus on Given Worksite Task
  - Break Down ES&H Considerations by Task
- **JACKHAMMERING EXAMPLE**
  - Measured Silica Exposure Potential With Established Controls
  - Available Noise Databases for Appropriate Potential Ranges
  - Vibration Dynamics Well Understood & Communicable
  - Musculoskeletal Disorders Known - Specific Ergonomics Toolkit
  - Safety Parameters (Barrier Banding?) Already as Checklists
  - Environmental Considerations Addressed; e.g. Wet Methods
- **CREATE A SINGLE, PRIMARILY PICTORIAL, TRAINING**

# Expand CB Range; Reproductive

\* Anne Bracker; AIHce May 2005

- **REPRODUCTIVE HAZARD ISSUES IN THE U.S.**
  - >20 MILLION U.S. workers exposed to occupational hazards (annual estimate)
  - Over 75% of workers (male and female) are of reproductive age
  - Women compose almost 50% of U.S. workforce
  - The number of women under age of 44 having a child while working has increased (38% → 54%) since 1960
  - Many women do not realize they are pregnant until after 1st trimester
- **REPRODUCTIVE HAZARD ISSUES INTERNATIONALLY\***
  - Women = ½ the world's workforce
  - Women supply the main financial support for 30% of households
  - By 2010, 70% of women employed during childbearing years

\* ILO: Healthy Beginnings: Guidance on Safe Maternity at Work (2004)

# Expand CB Range; Reproductive

\* Anne Bracker; AIHce May 2005

- ANNE BRACKER; UNIV CONN HEALTH CENTER (UCHC)
  - Research Methods; Retrospective Chart Review of Patients Referred to UCHC Reproductive Hazards Clinic
- FOR EACH PATIENT'S TASKS:
  - Identify potential chemical exposures
  - Assign chemicals to a "hazard group" using "R phrases"
  - Define inhalation exposure potential
  - Assign task a control band
  - Using COSHH Essentials exposure control strategies
- COMPARE TO CONTROL APPROACH RECOMMENDED BY UCHC INDUSTRIAL HYGIENIST



# Expand CB Range; Reproductive

\* Anne Bracker; AIHce May 2005

- Of the 78 patients, 69 (88%) had tasks involving chemical exposures
- COSHH applied to 59 (60%) of these patients' 99 tasks.
- COSHH could not be applied for the remaining 40 tasks because the workers' were exposed to:

▪ Gases	14	(35%)
▪ Process emissions	9	(22.5%)
▪ Multiple chemicals (>20)	7	(17.5%)
▪ Chemicals w/o "R-values"	4	(10%)
▪ Chemical classes not covered by CB	6	(15%)
• Pesticides, lead, pharmaceuticals		

# Expand CB Range; Reproductive

\* Anne Bracker; AIHce May 2005

- DID COSHH ESSENTIALS COMPARE WITH DOEM?\***

	Frequency	Percent
<b>Models the Same</b>		54
DOEM recommended/existing controls = CB	14	
CB: “seek specialist advice”	11	
CB: “seek specialist advice”/DOEM task restriction	7	
<b>DOEM &gt; COSHH Essentials</b>		39
DOEM recommended/existing controls > CB	9	
DOEM task restriction	14	
<b>COSHH Essentials &gt; DOEM</b>	4	7
	59	100

For the 59 tasks where the model could be applied, the COSHH Essentials model and the DOEM information assigned the same band for the task 54% of the time.

# Control Banding U.S. Efforts

- NATIONAL CONTROL BANDING WORKSHOP (3/05)
  - Task; Develop Coordinated National CB Strategies
  - Focus on Needs of Stakeholder Groups
- NIOSH CB CRITICAL REVIEW DOCUMENT
  - Review Literature Review & Critical Analysis Document
  - Critique and Modify Recommendations Section
- EXISTING MODELS REQUIRE FURTHER RESEARCH
  - Adaptation for US Application & Overall Validation
- WE ALL MUST WORK TOGETHER
  - Professional Organizations, Governmental Agencies, Disciplines, Health and Safety Professionals, Trade Associations, Academic Institutions, Private Industry, Labor Organizations, ANSI Z10 Committee, and Others?

# Literature Review & Critical Analysis

- **INTRODUCTION AND EXECUTIVE SUMMARY**
  - Definitions and Background
  - Key Findings of the Literature Review
- **LITERATURE REVIEW**
  - COSHH Essentials Strategy
  - Validation and Verification of CB Strategies
  - Specific Issues and Variations of the Model
- **CRITICAL ANALYSIS OF CB STRATEGIES**
  - Direct Comparison of CB Strengths and Weaknesses
  - Determining Barriers and Utilities for Implementation
  - Specific Industries, New Application, Partnerships
- **RECOMMENDATIONS**
- **OVER 250 REFERENCES**

# Control Banding Terminology

- **CONTROL BANDING (CB);** A *Strategy* for Reducing IH-Related Exposures in the Workplace.
- **CB STRATEGIES;** Overarching concept of CB Model that is Evolutionary and not a Single Toolkit.
- **TOOLKIT;** Narrowly Defined Solutions Approach to Control Worker Exposures Within Toolkit's Parameters.
- **COSHH ESSENTIALS;** A CB Toolkit Developed by UK HSE to Assist SMEs in Addressing the UK 2002 COSHH Regulations - Perform Risk Assessments for all Chemicals.
- **TOOLBOX;** Wider Defined Solutions Approach to Control Worker Exposure; Many Toolkits May Fit Within a Toolbox.
- **OCCUPATIONAL RISK MANAGEMENT (ORM);** Banner Term as Part of Overall Function of IH Profession.

# Control Banding Literature Review

- DEVELOPMENT OF THE MODEL
  - Over-Protective Strategy Would Lack Credibility
  - Under-Protective Strategy Would Not Protect Workers
  - Under-Control; Vapor Degreasing/Bag Filling {Jones & Nicas 2004}
  - Small Scale Solvent/Powder Handling {Tischer 2003, ABPI 1995}
  - More Protective of Dusts vs Vapors (ppm & mg/m<sup>3</sup>) {Brooke 1998}
  - Certain Exposure Routes Not Included (Dermal) {Guest 1998}
  - Only 111 Chemical Compared to UK Hazard Bands {Brooke 1998}
  - Point Source Exposure Exclusion (Silica, Asbestos, Welding)
  - Dustiness Levels Difficult for SMEs {Jones & Nicas 2004}
  - Need: Asthmagens (HSE/NIOSH/OSHA), Silica (HSE/NIOH)
  - Validation of Existing Dermal Efforts
    - RISKOFDERM Toolkit; Predictive Dermal Risk Assessment
    - DREAM; Semi-Quantitative Dermal Exposure Assessment

# Control Banding Literature Review

- **DEVELOPMENT OF DATABASES**
  - Accuracy of Toxicological Ratings
  - Consistency of Hazard Band Classification
  - Need to Reconsider and Standardize R-Phrases {Brooke 1998}
  - Accuracy of EU Chemical Classifications {Ruden and Hansson 2003}
  - Some Vapors Require Higher Bands {Jones & Nicas 2004, Guest 1998}
  - COSHH vs ILO Toolkit Hazard Bands {Jones & Nicas 2004}
  - Maintenance of Classifications With More Data {Guest 1998}
- **IMPLEMENTATION OF CONTROL BANDING**
  - Primary Consideration of Substitution or Safer Processes
  - COSHH Essentials Objective to Achieve Exposure Levels Within Anywhere in the Exposure Band
  - Chemical Industries Association Recommends Exposures “As Low As Reasonably Practicable” {Guest 1998, CIA 1997}

# Control Banding Literature Review

- **VALIDATION OF THE MODEL**

- Lack of Good Data {Tischer 2003, Swuste 2003, Money 2003, Kromhout 2002}
- Limited Range Exposure Situations for Prediction {Tischer 2003}
- “Purity” of UK Control Strategies Reported {Maidment 1998}
- Retrospective Accuracy for Comparisons {Jones & Nicas 2004}
- Model Validation vs Verification of Effectiveness & Controls
- Include Health Surveillance Evaluation {Russell 1998, Maidment 1998}
- Personal Sampling for Effectiveness Over Time {Naumann 1996}
- Seek to Test Hypotheses for Degree of Accuracy & Confidence
- Validate Each CB Strategy Step Independently:
  - Exposure Prediction
  - Hazard Prediction
  - Control Recommendations and Implementation
  - Training
- CB Hazard Classification Errors Known; What is Tolerable?



# Control Banding Critical Analysis

## COMPARING CB STRENGTHS & WEAKNESSES

<b>CB Strategy Issues</b>	<b>Weakness Summary</b>	<b>Strength Summary</b>
<b>Perception of CB Being the same as the COSHH Essentials</b>	Highlighting COSHH Essentials within CB presentations led to improper understanding they are the same. Research critical of COSHH is therefore critical of CB.	Current CB publications and events are clarifying that CB is an overarching strategy and not a single Toolkit. COSHH Essentials critique led to improved revisions.
<b>Replacing Good Science with Vague Controls</b>	As IH practice in the U.S. is based on solid scientific protocols, why replace with potentially under- protective CB outcomes?	Traditional IH practice is expensive and options are necessary to protect most U.S. workers. CB strategies reduce costs and seek IH expertise.

# Control Banding Critical Analysis

## COMPARING CB STRENGTHS & WEAKNESSES

CB Strategy Issues	Weakness Summary	Strength Summary
<b>Affecting Professional Industrial Hygienists</b>	Implementation of CB strategies will reduce the need for IH consultants and move profession toward ES&H generalists.	CB strategy indicates thresholds that require IH expertise. With CB implementation employers will be educated about the IH profession.
<b>CB Will Replace OELs</b>	Some professionals believe that moving CB forward in the absence of OELs will strengthen the argument to eliminate them.	CB strategies will not serve as a replacement for OELs in the U.S. CB validation protocol will include personal monitoring for OEL use.
<b>Exposure Assessment vs. Exposure Control</b>	Traditional exposure assessment relies heavily on personal IH monitoring. Some perceive CB as eliminating this crucial step.	CB requires IH personal monitoring for validation and maintenance. Task-based control solutions are appropriate with historical data.

# Control Banding Critical Analysis

## COMPARING CB STRENGTHS & WEAKNESSES

<b>CB Strategy Issues</b>	<b>Weakness Summary</b>	<b>Strength Summary</b>
<b>Predicting Exposures and Implementing Controls</b>	COSHH Essential's interim step of predicting exposures is an area estimate, offering controls in the absence of workplace variations.	COSHH Essentials criticisms are assisting in perfecting the model. Task-based point source models do not require exposure prediction.
<b>Validation and Maintenance of Implemented Controls</b>	Current CB strategies implement static controls. Validation needs to include dynamic aspects of initial accuracy, process change, and control degradation.	CB validation protocol will include evaluating dynamic implementation strategies. The database resulting from this process will offer a useful task-based CB solutions database.

# Control Banding Critical Analysis

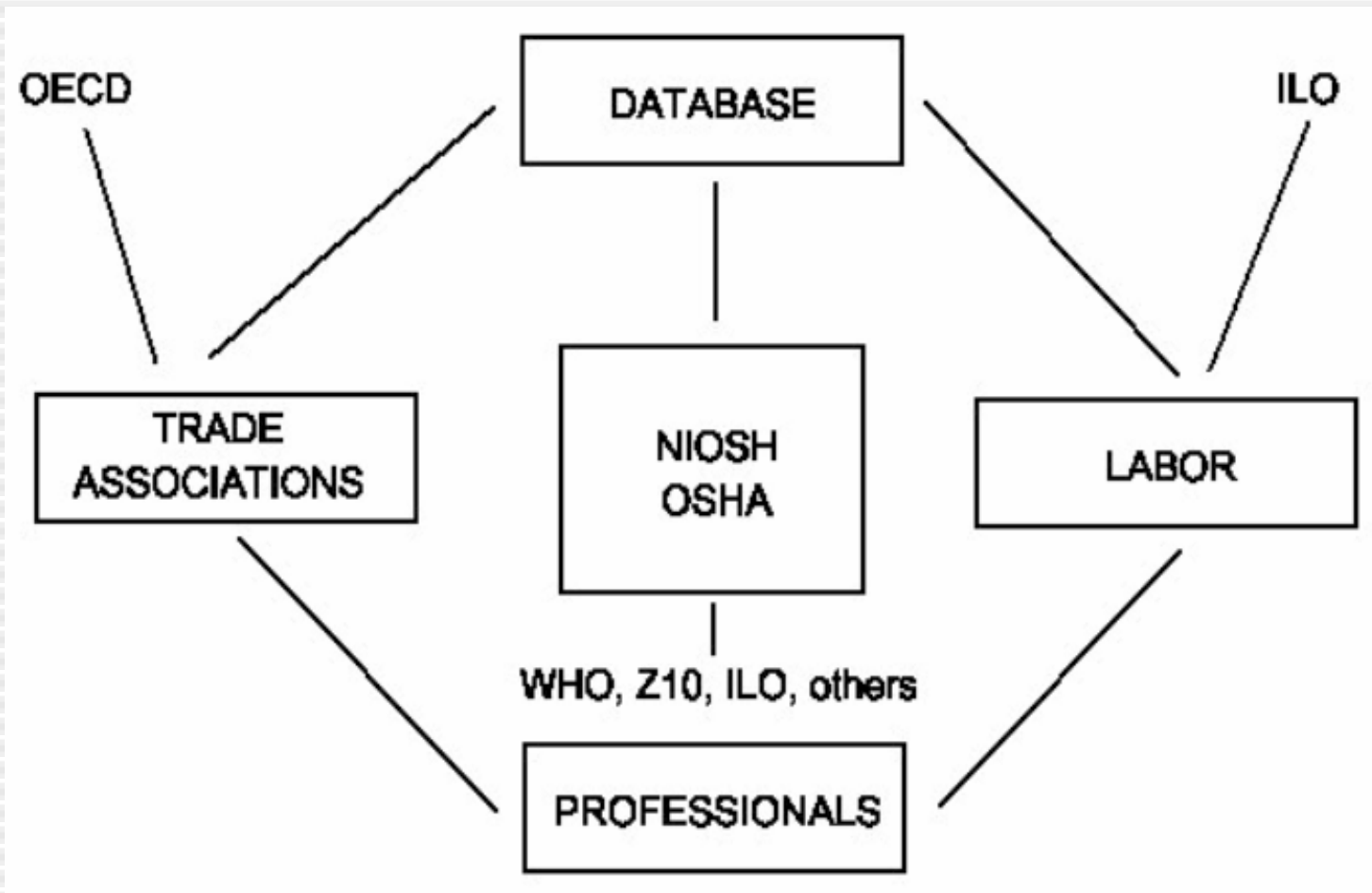
- BARRIERS TO IMPLEMENTING CONTROL BANDING
  - Legal Implications
    - Protecting Those Offering Technical Advice, Economically Viable?
    - What Happens When CB Outcome Fails to Implement Controls?
    - Under-Control Will Expose Workers {Money 2003, Kromhout 2002}
  - Devaluation of Worker Protection
    - Good System Protecting Most is Still Not Perfect, But Better?
    - Creating a Minimal Level of Protection?
    - Would We be Satisfied With the Control Outcome for Ourselves?
  - Use of Standardized Hazard Statements in Control Banding
    - OSHA Hazard Communication Standard vs EU R-Phrases
    - R-Phrases for Some Chemicals Not Appropriate Under US Law
    - US Adoption of GHS Harmonized Classification Approach?
    - International Chemical Safety Cards to GHS = 1500+ Chemicals

# Control Banding Critical Analysis

- UTILITIES FOR IMPLEMENTING CONTROL BANDING
  - Dynamic Process to Ensure Implementation & Maintenance
    - Avoid Current Static Approach, Does Not Encompass Change
    - Maintain Controls Implemented and Managerial Oversight
    - Create With Input and Approval of Managers and Workers
    - Create Quantifiable Level of Success & Exposure Reduction
    - ANSI Z10; “Use of Occupational Risk Management Processes”
  - OSHA Voluntary Consultative Services and VPP
    - Small Businesses Consultation Program; 30 Yrs Old / 912 Strong
    - Government Assisting Business Toward Cooperative Solutions
    - Trade Organizations and Labor Unions Part of Development
    - Validation Protocol Can be Linked to Process Development
    - Create Centralized Databases by Profession & Individual Tasks
    - Offer of Tax Incentives and Worker Compensation Fee Reductions

# Control Banding Critical Analysis

## NCBW Suggested Global/National CB Partnerships



# Control Banding Critical Analysis

- **NEW CONTROL BANDING APPLICATIONS**
  - Create a National CB in Ergonomics Committee Quickly
  - Need to Encompass ES&H Multidisciplinary Concepts
    - Environmental Toolkits Can Benefit Waste Minimization
    - Safety Control Guidance Sheet System; Traumatic Injury Focus
    - Problem With Avoiding IIPP Statistics as Trailing Indicators
    - Creation of Trainings; Participatory Methods & Pictograms
- **PARTNERSHIPS TO IMPLEMENT CONTROL BANDING**
  - Twinning Developed & Developing Countries for Databases
  - WHO, ILO, IPCS, & OSHA Already Together With GHS and ITG
- **INDUSTRIES TARGETTED FOR IMPLEMENTATION**
  - Construction is a Perfect Target for an ORM Toolbox
  - NIOSH Targeted Small Businesses: Pallet Manufacturing, Concrete Products, Roofing, Siding, HVAC, and Plumbing

# Other Control Banding Strategies

- GERMANY; 3rd Largest Producer, 1st Exporter {Adellman 2001}
  - Convention Project on Chemical Safety (GTZ) {Tischer 2002}
  - GTZ Chemical Management Guide Trainings, 130 Countries
- NETHERLANDS
  - Stoffenmanager; Web-based Tool for SMEs With Chemicals
  - Calculates a Risk Score and Relative Risk Ranking
- FRANCE
  - System to Prioritize Chemical Risk Assessment
    - Considers Hazard and Exposure Factors {Vincent & Bonthoux 2000}
- BELGIUM
  - Regetox; 2-Stage Risk Assessment Strategy
  - Uses French Ranking of Risk, Medium/High Use COSHH Essentials
- NORWAY; KjemiRisk; Chemical Health Risk, From Oil Industry
- SINGAPORE; Developing Semi-Quantitative Risk Assessment (SQRA)



# CB LRCA Recommendations

- IMPLEMENTATION OF THE MODEL IN THE U.S.
  - Coordinate Terminology to a Singular CB Vocabulary
  - Consider Circumstances and Tasks Requiring Personal Monitoring to Ensure the Building of Databases
  - Adopt GHS to Standardize Protocol and Educate ES&H Community on the Pending Changes
  - US Regulatory System May Require That Some Chemicals be Placed in Higher Hazard Bands
  - “Seek Professional Advise” Needed in Control Strategy 3
  - Link Control Guidance Sheets to Professional Association Listserves and Consultant Contacts
  - Develop and Offer Training for Professionals and SME Operators on CB Strategies and Available Toolkits
  - Emphasize Role of CB in the Context of Tiered Risk Assessment and the Concurrent Need for Professional IHs

# Control Banding Critical Analysis

- **SHORT TERM FOCUS**

- **Validate**, Assess, and Offer Alternative Approaches for Avoiding Degradation of Established Controls Over Time
- Reevaluate Risk Acceptability in Occupational Settings
- Test Hypotheses; Focus on Degree of Accuracy & Confidence
- Review Vapor/Dust Margins of Safety, Compare to OELs
- Compare Hazard Banding with Health-Based OELs
- Prospective Comparison of COSHH with OEL Measurements
- Link CB Strategy With ANSI Z10 for Management Oversight
- **Expand CB Model** to Ergonomics Quickly for Comparisons
- Include Dermal and Address Multiple Chemical Use
- **Disseminate CB** Strategies to Public and Private Sector
- Include Regulatory, Consultative, Professional & Trade Assoc.
- Marketing Tool for CB Incentives, Promotion & Integration

# Control Banding Critical Analysis

- LONG TERM FOCUS (Should Proceed Immediately)
  - **Formulate a System of Incentives** with Existing Programs
  - Voluntary Protection Program Participants Association
  - Bolster OSHA Voluntary Consultative Services to Embrace CB in Cooperation With Investigators' Risk Evaluation
  - Economic Incentives; Insurance Savings, Small Business Loans & Tax Incentives With Long Term Successes
  - Dynamic System for Controls Implemented Over Time
  - **Legal Implications**; Investigate Employer Liability
  - Consider Belgium Regetox Approach for US Companies to Assess and Manage Chemical Risks in the Workplace
  - Require Training of "Prevention Advisors" and a Strategy for a Tripartite Approach to Collect Risk Assessment Information
  - Multi-Stage Approach Best Model for a CB Strategy Approach in the US and for Comparison to Legalities

# Control Banding Critical Analysis

- **COORDINATION AND COLLABORATIONS**
  - **Nationally**, Encourage NIOSH and OSHA Cooperation Focusing on Already Prioritized Small-Scale Trades
  - Create a National CB Program Committee
  - Develop Task-Based CB Toolkits for Point Source Exposures
  - Emphasize Worker Involvement in a Participatory Process
  - Afford a Feedback Loop for Medical Surveillance Inclusion
  - Coordinate Resources and Curricula for Training Protocol
  - **Internationally**, Create Integrated Database Systems
  - Embrace ITG Implementation Strategy to Coordinate ORM Toolbox Concepts for Economical, Timely, Best Product
  - Link CB With Occupational Safety and Health Management Systems to Oversee Toolkit and Toolbox Implementations
  - US Product Stewardship Can Benefit With Involvement of US Trade Commission & World Trade Organization With CB

# Control Banding Key Points

- CONTROL BANDING BASICS
- DEFINITION OF CONTROL BANDING TERMS
- INTRODUCTION TO CONTROL BANDING HISTORY
- IOHA & CONTROL BANDING INTERNATIONALLY
- COSHH ESSENTIALS TOOLKIT FOR CHEMICALS
- EXPANSION OF CONTROL BANDING'S RANGE
- CONTROL BANDING EFFORTS IN THE U.S.
- LITERATURE REVIEW & CRITICAL ANALYSIS
- ROOM FOR *NEW* CONTROL BANDING APPROACHES