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Real-time Worker Protection with Control Banding

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WorkSafeBC March 2023

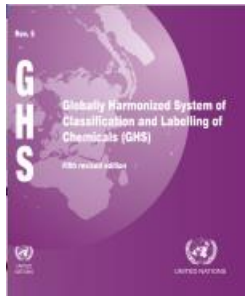
Control Banding

- A validated risk assessment method, commonly used to evaluate chemicals.
- 20-year history, starting with pharmaceuticals and chemicals then into nanotechnology and ergonomics.
- NIOSH acknowledges it can be a useful tool for small businesses.
- Offers a way to assess risk and determine relevant control measures to reduce exposures in workplaces when OELs or exposure measurements aren't available

HSE Health and Safety Executive

NIOSH

ILO



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Hazard Banding using GHS

Assign Hazard Band by using Hazard Class or Hazard Statement information from Section 2 of the SDS or Supplier Label.

Hazard Band	General Description	GHS Hazard Class	GHS Hazard Statements
E	**SPECIAL CASES** Proven Carcinogen Proven Respiratory Sensitizers	Carcinogenicity Category 1A, 1B Respiratory Sensitization Category 1A, 1B Germ Cell Mutagenicity Category 1A, 1B, 2	H334, H340, H341, H350
D	**MOST HAZARDOUS** Probable, Possible Carcinogen Reproductive Hazard Repeated Exposure	Acute Toxicity any route Category 1, 2 Carcinogenicity Category 2 STOT Repeated Exposure Category 1 Reproductive Toxicity Category 1, 2	H300, H310, H330, H351, H360, H361, H362, H372
C	**SOMEWHAT HAZARDOUS** Systematic toxins and corrosive agents	Acute Toxicity any route Category 3 Skin Corrosion Category 1A, 1B, 1C Serious eye damage Category 1 Acute Toxicity Inhalation Category 3 STOT single Respiratory Category 3 STOT single Skin Sensitivity Category 1 STOT repeated Any Route Category 2	H301, H311, H314, H317, H318, H331, H335, H370, H373
B	**SOMEWHAT LESS HAZARDOUS** Causes harm with single exposure	Acute Toxicity any route Category 4 STOT repeated Category 4	H302, H312, H332, H371
A	**LEAST HAZARDOUS** Reversible irritants	Acute Toxicity any route Category 5 Aspiration Hazard Category 1 Skin Irritation Category 2 Eye Irritation Category 2 STOT single Narcotic Effects	H303, H304, H305, H313, H315, H316, H319, H320, H333, H336
N	Not Hazardous by GHS	Not Hazardous by GHS	

Hazard Banding using GHS - cheat sheet

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C	SOMEWHAT HAZARDOUS Systematic toxins and corrosive agents	Acute Toxicity any route Category 3 Skin Corrosion Category 1A, 1B, 1C Serious Eye Damage Category 1 Acute Toxicity Inhalation Category 3 STOT single Respiratory Category 3 STOT single Skin Sensitivity Category 1 STOT repeated Any Route Category 2	H301, H311, H314, H317, H318, H331, H335, H370, H373
B	SOMEWHAT LESS HAZARDOUS Causes harm with single exposure	Acute Toxicity any route Category 4 Target Organ Category 3	H302, H312, H332, H371
A	LEAST HAZARDOUS Reversible irritants	Acute Toxicity any route Category 5 Aspiration Hazard Category 1 Skin Irritation Category 2 Eye Irritation Category 2 STOT single Narcotic Effects	H303, H304, H305, H313, H315, H316, H319, H320, H333, H336
N	Not Hazardous by GHS	Not Hazardous by GHS	

Starman (C1M), Respiratory Sensitizers

Starman (C2R), Acute Fatal

Corrosive, Acute Toxic, Skin Sensitizers, STOT

Harmful, Warning

Irritation, Aspiration Hazard

Controls Organized by Band

Control Band 4:
Expert Advice
plus containment

Control Band 3:
Containment

Control Band 2:
Local Exhaust
Ventilation

Control Band 1:
Natural/General
Ventilation

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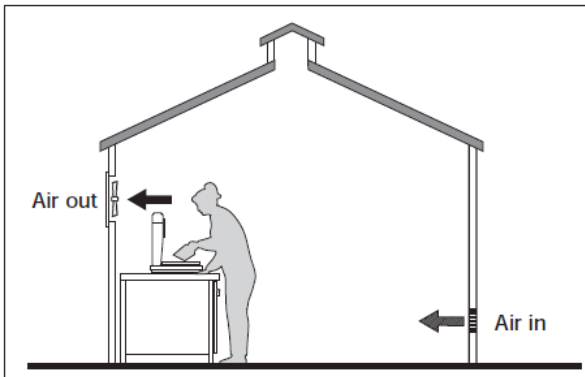
Natural Ventilation

Control Approach 1 for:

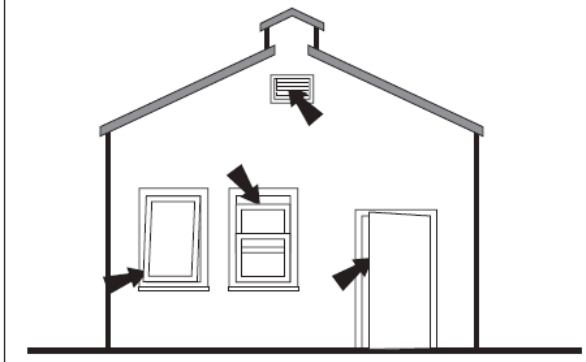
- **Low Risk**
- **Risk Level 1**

Rx:

- **Natural Ventilation, good IH practices and PPE**



Controlled ventilation from a fan


Natural ventilation

HSE, COSHH Essentials Control Guidance Sheet G100, October 2003, http://coshh-tool.hse.gov.uk/assets/live/G100.pdf

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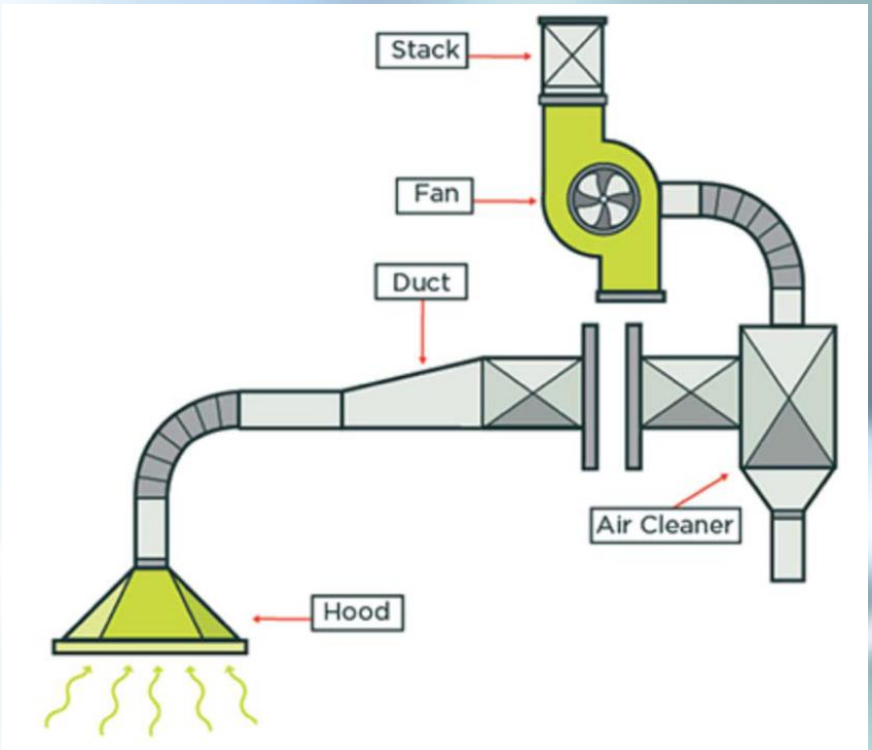
Engineering Controls

Control Approach 2 for:

- **Medium Risk**
- **Risk Level 2**

Rx:

- **Local Exhaust Ventilation**
- **Validation**



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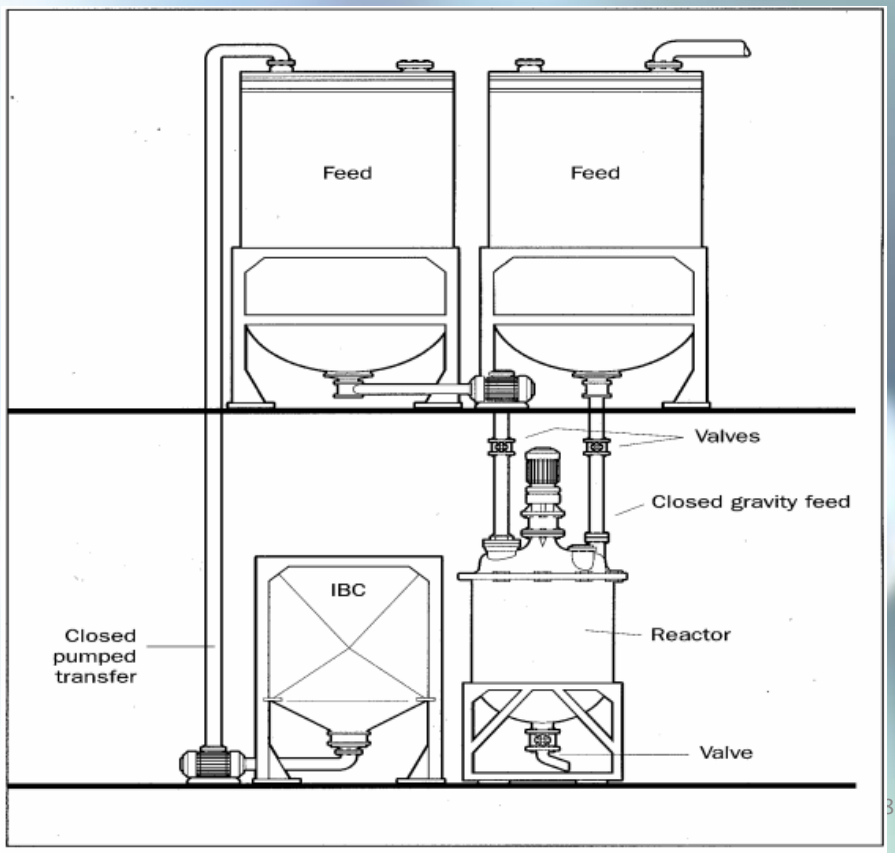
Containment

Control Approach 3 for:

- **High Risk**
- **Risk Level 3**

Rx:

- **Isolation**
- **Safety systems**
- **Process design**



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Seek Expert Advice

Control Approach 4 for:

- **Extreme Risk**
- **Risk Level 4**

Rx:

- **Multiple control strategies,**
- **Exposure control plans,**
- **Medical fitness/surveillance,**
- **Preventative maintenance program, etc.**

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Controls by Type of Hazard

Simplified Risk Matrix			
Hazard Group E Proven cancer and reproductive effects; respiratory sensitizer	**Extreme Risk** Eliminate or substitute if possible; implement exposure control plan (ECP)		
Hazard Group D Very toxic on single exposure; possible cancer & reproductive effects	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**High Risk** Contain using Engineering Controls	**Extreme Risk** Eliminate if possible; do process hazard analysis;implement control plan (ECP)
Hazard Group C Corrosive to skin; Severely irritating; skin sensitizer	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**High Risk** Contain using Engineering Controls
Hazard Group B Harmful on single exposure	**Low Risk** Use Natural Ventilation with ample airflow to remove dusts and vapors	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**Medium Risk** Use Local Exhaust Ventilation (LEV)
Hazard Group A Mild and reversible skin and eye irritants	**Low Risk** Use Natural Ventilation with ample airflow to remove dusts and vapors		
	Exposure Potential 1 Quantity – Small Dustiness – low Volatility - low	Exposure Potential 2 Quantity – medium Dustiness – medium/high Volatility – medium/high	Exposure Potential 3 Quantity – high Dustiness – medium/high Volatility – high (gases are grouped here)

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Application of Controls

Simplified Risk Matrix			
Hazard Group E Proven cancer and reproductive effects; respiratory sensitizer	**Extreme Risk** Eliminate or substitute if possible; implement exposure control plan (ECP)		
Hazard Group D Very toxic on single exposure; possible cancer & reproductive effects	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**High Risk** Contain using Engineering Controls	**Extreme Risk** Eliminate if possible; do process hazard analysis;implement control plan (ECP)
Hazard Group C Corrosive to skin; Severely irritating; skin sensitizer	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**High Risk** Contain using Engineering Controls
Hazard Group B Harmful on single exposure	**Low Risk** Use Natural Ventilation with ample airflow to remove dusts and vapors	**Medium Risk** Use Local Exhaust Ventilation (LEV)	**Medium Risk** Use Local Exhaust Ventilation (LEV)
Hazard Group A Mild and reversible skin and eye irritants	**Low Risk** Use Natural Ventilation with ample airflow to remove dusts and vapors		
	Exposure Potential 1 Quantity – Small Dustiness – low Volatility - low	Exposure Potential 2 Quantity – medium Dustiness – medium/high Volatility – medium/high	Exposure Potential 3 Quantity – high Dustiness – medium/high Volatility – high (gases are grouped here)

Corporate HSE

Corporate HSE

Field HSE

Corporate HSE

Field HSE

Field HSE

Supervisor

Supervisor

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Welding Construction, Fabrication & Repair Industry

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Highly Variable Exposure Profiles

- Process & task
- Base metal
- Filler metals & flux
- Human factors (body position, eyesight, habits, experience)
- Work environment (size, configuration, dimensions, ventilation, confined, moisture, SimOps)

Air Contaminants of Concern

- Iron oxide fumes
- Manganese, nickel, chrome VI fumes
- Ozone
- Carbon monoxide
- Nitrogen oxides
- Fluorides
- Decomposition products or residues - isocyanates, aldehydes, VOCs
- Argon, helium or carbon dioxide shielding gases

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Short-term exposure	Long-term exposure
Eye, nose and throat irritation	Occupational asthma
Dizziness	Pneumonia
Nausea	Metal fume fever
	Reduced lung function
	Stomach ulcers
	Kidney damage
	Nervous system damage
	Prolonged manganese exposure can cause Parkinson's-like symptoms
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Control Band 1 – Natural Ventilation

- Current state of affairs
- We must do better
- Not appropriate for carcinogens

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Control Band 2 – LEV

- Natural/dilution ventilation (CB1) is not appropriate for carcinogenic nature of welding or thermal cutting fume.
- LEV can reduce fume exposures if used correctly (<1 to 1.5 hood diameters from arc) and routinely measured for effectiveness.
- LEV part of the solution, not the basis of a control approach.
- LEV can enhance natural ventilation for coworkers in the shop/immediate vicinity.

Welding table where the welding fume is captured and extracted by the airflow at the back

Welding, hot work and allied processes - WL3 - Welding fume control, Health and Safety Executive, 04/21, Welding fume control (hse.gov.uk)

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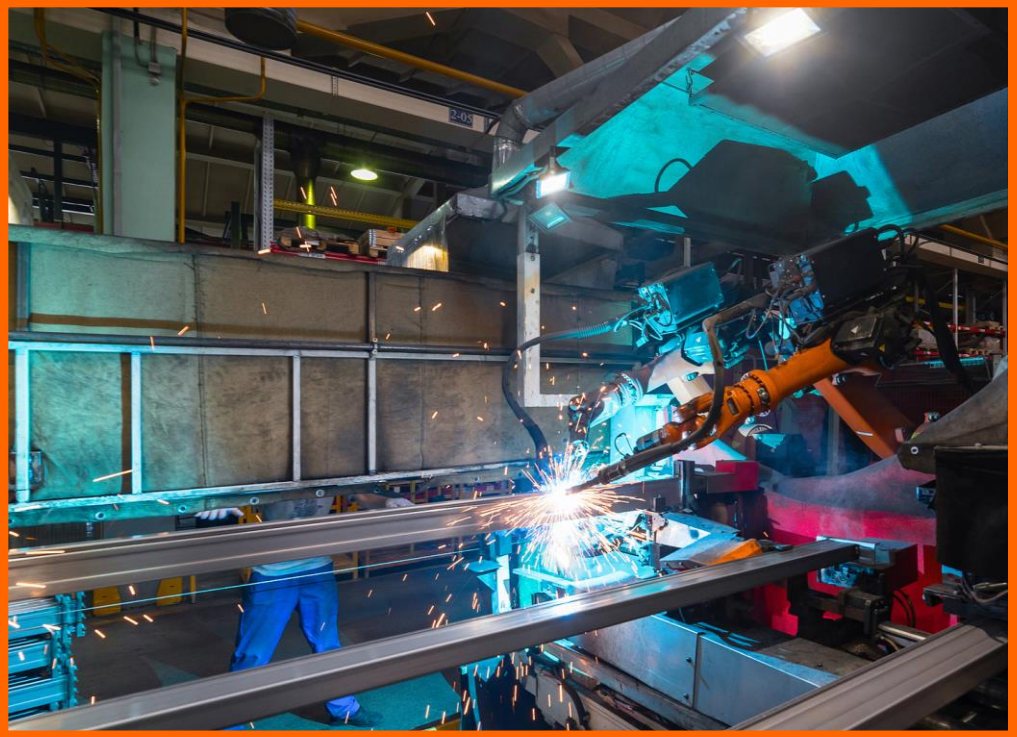
Control Band 3 - Containment

- Containment of the process.
- Emissions captured at the source.
- Negative pressure so that clean air moves into the contaminated work zone.
- Practical or available outside of dedicated, state-of-the-art manufacturing facilities?



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Containment of Welder

- Powered, air-purifying respirator (PAPR) can create a containment level of protection during welding and thermal cutting processes.
- Not true containment of the contaminant.
- Increased ventilation or LEV, restricted work areas, decontamination practices, and PPE are also part of the control scheme.

The 3M™ Adflo™ Powered Air Purifying Respirator System

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Control Band 4 – Expert Advise

- Multiple control strategies,
- Exposure control plans,
- Medical fitness/surveillance,
- Preventative maintenance program, etc.
- RPE Strategy for Welding Activities

Welding/Thermal Cutting Process	Welder and Helper	Bystander/Co-worker
High Fume (SMAW/MMA, FCAW, GMAW)	 PAPR + cape, HEPA filter	 Half face, air-purifying respirator + P100
Low Fume (GTAW/TIG, SAW, RW)	 Half face, air-purifying respirator + P100	 N95, air-purifying Respirator

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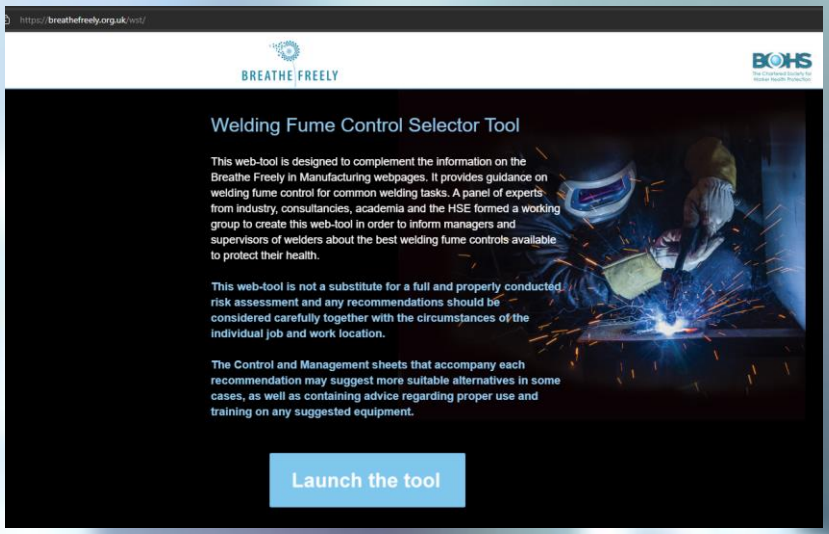
https://breathefreely.org.uk/wst/

What the selector tool does:

- Takes 4 simple task-related questions
- Produces a guidance sheet with the optimum control solution based on the responses.
- Offers alternative acceptable control solutions.
- Ranks the control solutions using a familiar 5-star rating, based on the overall likely effectiveness of fume control.



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Welding Health and Safety

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2nd Edition

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By Michael K. Harris, PhD, CIH and Michael R. Phibbs, CIH, ROH

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Hazard Band Chart
https://www.chemscape.com/resources/chemical-management/fundamentals

COSHH Essentials eTool & Advice Sheets
https://www.hse.gov.uk/coshh/essentials/index.htm

Breathe Freely Welding online tool
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