Introduction to GHS

Technical elements, classification and labelling

Scaling-up Commitment for

Implementation of GHS in Pakistan - Inception Workshop

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GHS is the basis for safe use of chemicals

Successful hazard communication alerts the user to the presence of a hazard and the need to minimize exposures and the resulting risks.

Fundamental questions:

What is it?

Is it hazardous?

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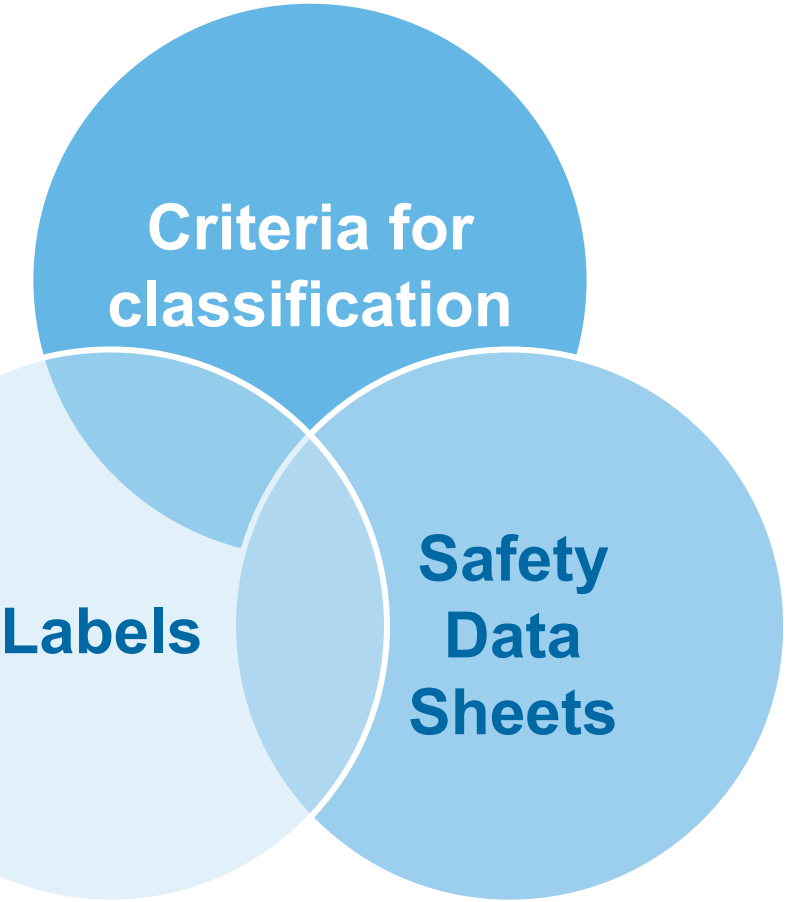
Elements of GHS

Hazard assessment

Is it hazardous? How hazardous is it?



How do you make people aware of the hazard?

Hazard communication

Hazard classification

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Topics

1. Hazard classes
2. Hazard categories
3. Classification of substances
4. Classification of mixtures

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Hazard classes

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Hazard classes

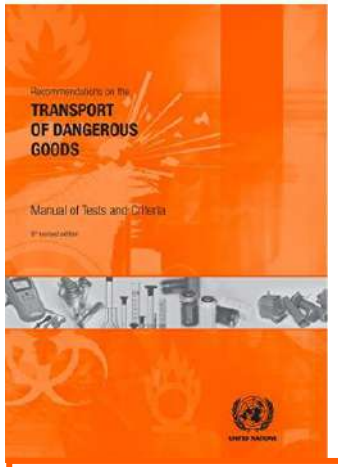
The hazard class describes the **type** of hazard

GHS includes:

- **17** Physical hazard classes *(GHS Chapters 2.1 – 2.17)*
- **10** Health hazard classes *(GHS Chapters 3.1 – 3.10)*
- **2** Environmental hazard classes *(GHS Chapters 4.1 – 4.2)*

Physical hazards

The physical hazard classes covers properties such as:



- Flammability
- Explosivity
- Oxidising potential
- Metal corrosion
- Gas under pressure

The GHS classification criteria for physical hazards are adopted from the UN Manual of Tests and Criteria

2.1	Explosives
2.2	Flammable gases
2.3	Aerosols and chemicals under pressure
2.4	Oxidising gases
2.5	Gases under pressure
2.6	Flammable liquids
2.7	Flammable solids
2.8	Self-reactive substances and mixtures
2.9	Pyrophoric liquids
2.10	Pyrophoric solids
2.11	Self-heating substances and mixtures
2.12	Substances and mixtures which, in contact with water, emit flammable gases
2.13	Oxidising liquids
2.14	Oxidising solids
2.15	Organic peroxides
2.16	Corrosive to metals
2.17	Desensitized explosives

Health hazard – Toxicity in humans

Acute toxicity	Chronic toxicity
Single exposure	Repeated exposure
High dose	Low dose
Clinical symptoms	No overt clinical symptoms
Treatment	Treatment not always possible
Recovery	Sustained/irreversible damage

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Health hazards

3.1	Acute toxicity
3.2	Skin corrosion/irritation
3.3	Serious eye damage/eye irritation
3.4	Respiratory or skin sensitization
3.5	Germ cell mutagenicity
3.6	Carcinogenicity
3.7	Reproductive toxicity
3.8	Specific target organ toxicity (STOT) — single exposure
3.9	Specific target organ toxicity (STOT) — repeated exposure
3.10	Aspiration hazard

Environmental hazards

4.1 Hazardous to the aquatic environment

Covers effects observed after both acute (short-term) and chronic (long-term) exposure.
The **persistency** (degradation rate) of a chemical in the environment and its **bioaccumulating potential** are important to consider in long-term hazard classification.

4.2 Hazardous to the atmospheric system

Chemicals covered by the Montreal protocol

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Hazard categories

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Hazard categories

Differentiation of the hazard within a hazard class according to:

- the **severity of the effect**

or

- **weight of the evidence.**

Example

1	2	3	4	5

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Physical hazard classes and categories

Hazard class	Hazard category						
2.1 Explosives	1	2					
		2A	2B	2C			
2.2 Flammable gases	1A			1B	2		
	Flammable	Pyrophoric	Chemically unstable		Flammable	Flammable	
			A	B			
2.3 Aerosols and chemicals under pressure	1	2	3				
2.4 Oxidising gases	1						
2.5 Gases under pressure	Compressed	Liquified	Refrigerated liquefied	Dissolved			
2.6 Flammable liquids	1	2	3	4			
2.7 Flammable solids	1	2					
2.8 Self-reactive substances and mixtures	Type A	Type B	Type C	Type D	Type E	Type F	Type G

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Physical hazard classes and categories (cont.)

Decrease in severity

Hazard class	Hazard caregory						
2.9 Pyrophoric liquids	1						
2.10 Pyrophoric solids	1						
2.11 Self-heating substances and mixtures	1			2			
2.12 Substances and mixtures which, in contact with water, emit flammable gases	1			2		3	
2.13 Oxidising liquids	1			2		3	
2.14 Oxidising solids	1			2		3	
2.15 Organic peroxides	Type A	Type B	Type C	Type D	Type E	Type F	Type G
2.16 Corrosive to Metals	1						
2.17 Desensitized Explosives	1		2		3		4

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Health hazard classes and categories

Decrease in severity →

Hazard class	Hazard category				
3.1 Acute toxicity					
Oral	1	2	3	4	5
Dermal	1	2	3	4	5
Inhalation	1	2	3	4	5
3.2 Skin corrosion/irritation	Corrosive			Irritant	
	1A	1B	1C	2	3
3.3 Serious eye damage	Corrosive			Irritant	
	1			2A	2B
3.4 Sensitization					
Respiratory	1A			1B	
Skin	1A			1B	

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Health hazard classes and categories (cont.)

Hazard class	Hazard category			
3.5 Germ cell mutagenicity	1A	1B	2	
3.6 Carcinogenicity	1A	1B	2	
3.7 Reproductive toxicity	1A	1B	2	Lactation
3.8 STOT – single exposure	1	2	3	
3.9 STOT – repeated exposure	1	2		
3.10 Aspiration toxicity	1	2		

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Environmental hazard classes and categories

Hazard class	Hazard category			
4.1 Hazardous to the aquatic environment				
Acute	1	2	3	
Long-term	1	2	3	4
4.2 Hazardous to the atmospheric system	Ozone layer	Global warming		
	1	1		

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Classification of substances

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Classification of substances

Data* generated in accordance with **test methods** (e.g. Test guidelines adopted by the Organisation for Economic Co-operation and Development (OECD), UN Manual for Transport of Dangerous Goods);

Epidemiological data and experience** on the effects on humans, such as occupational data and data from accident databases;

Other information (to fill data gaps) including Read across, Grouping of chemicals and Quantitative Structure Activity Relationship (QSAR)

**Test data is required to assess physical hazard*
***Testing on humans solely for hazard identification purposes is generally not acceptable*

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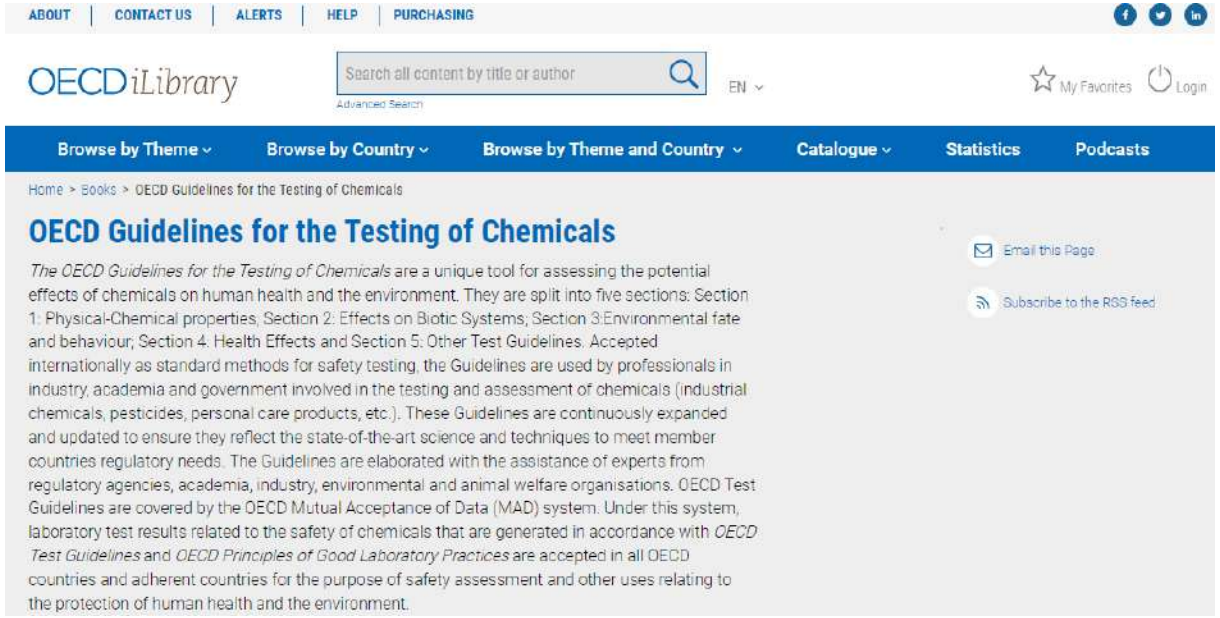
OECD Guidelines for Testing of Chemicals



Section 1	*Physical-Chemical properties*
Section 2	*Effects on Biotic Systems*
Section 3	*Environmental fate and behaviour*
Section 4	*Health effects*
Section 5	*Other Test Guidelines*

https://www.oecd-ilibrary.org/environment/oecd-guidelines-for-the-testing-of-chemicals_72d77764-en

Data based on testing in accordance with OECD test guidelines are available for a substantial number of substances.

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Classification of mixtures

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Mixtures

Identity of ingredient substances

↓

Hazard classification of ingredient substances

↓

Concentration of ingredient substances

The classification generally requires

- knowledge on the identity of the ingredient substances
- their individual classification
- their concentration in the mixture

Classification of the mixture for a specific hazard can be based on

- on testing (**mandatory for physical hazards**)
- by summation of the concentration of the classified ingredients
- by using cut-off values/concentration limits.

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Physical hazard classification of mixtures

Classification of mixtures for physical hazards is based on testing

Combining a flammable substance with an oxidising substance may form an explosive mixture

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Health hazard classification of mixtures

Health hazard classification of mixtures is generally based on the available information for the individual classified ingredients and their concentrations in the mixture. Classification is derived using either a calculation method or by applying cut-off values/concentration limits methods *(additive* or non-additive**).*

Hazard class	Mixture classification method
Acute toxity	Calculation
Skin corrosion/irritation	Cut-off value/concentration limit, additive
Serious eye damage/eye irritation	
Respiratory or skin sensitization	Cut-off value/concentration limit, non-additive
Germ cell mutagenicity	
Carcinogenicity	
Reproductive toxicity	
STOT – single exposure	
STOT – repeated exposure	
Aspiration toxicity	Cut-off value/concentration limit, additive

**E.g. Sum of classified ingredients ≥1%*
***E.g. One classified ingredient present at ≥0.1%*

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Environmental hazard classification of mixtures

Environmental hazard classification of mixtures is generally based on the available information for the individual classified ingredients and their concentrations in the mixture.

Hazard class	Mixture classification method
Hazardous to the aquatic environment	Summation of the concentrations of the classified ingredients
Hazardous to the atmospheric system	Cut-off value/concentration limit (at least one classified ingredient listed in the Annexes to the Montreal Protocol present in the mixture at a concentration ≥0.1%)

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Hazard communication

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Topics

1. Communicating hazard information
2. What constitutes a GHS label?
3. GHS and FAO/WHO labelling of pesticides
4. What is a Safety Data Sheet (SDS)?
5. The content of the SDS

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Communicating hazard information

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How do you make users aware of the hazard?

Right to know –
right to comprehend

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Hazard Communication in GHS

Labelling

- Chapter 1.4
- Annex 1
- Annex 3
- Annex 5
- Annex 7

Note: *Annex 2 found in GHS Rev.4 has been removed in later revisions*

Safety Data Sheets (SDS)

- Chapter 1.5
- Annex 4

Annex 6 - Comprehensibility testing

(**Annex 11** – Other hazards not resulting in classification)

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What constitutes a GHS label?

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Labelling

GHS hazard communication elements

- Pictograms
- Signal words
- Hazard statements
- Precautionary statements

Additional information on label

- *Product identifier*
- *Supplier identifier*
- *Supplemental information*

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GHS pictograms

Gas under pressure

Explosive

Oxidiser

Corrosive

Serious health hazard

Hazardous to the environment

Harmful

Toxic

Flammable

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Signal words

Danger – severe hazard

Warning – less severe hazard

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Hazard statements

- **H2xx** – Physical hazard
  - *e.g. H240 – Heating may cause an explosion*

- **H3xx** – Health hazard
  - *e.g. H331 – Toxic if inhaled*

- **H4xx** – Environmental hazards
  - *e.g. H410 – Very toxic to aquatic life with long lasting effects*

Combination hazard statements possible, for instance
Fatal if swallowed, in contact with skin or if inhaled (H300, H310, H330)

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Hazard information Example 1:
Acute toxicity

Higher

Severity

Lower

Classification			Labelling		
Hazard class	Hazard category		Pictogram	Signal word	Hazard statement
Acute toxicity	1	Oral		Danger	Fatal if swallowed
		Dermal			Fatal in contact with skin
		Inhalation			Fatal if inhaled
	2	Oral		Danger	Fatal if swallowed
		Dermal			Fatal in contact with skin
		Inhalation			Fatal if inhaled
	3	Oral		Danger	Toxic if swallowed
		Dermal			Toxic in contact with skin
		Inhalation			Toxic if inhaled
	4	Oral		Warning	Harmful if swallowed
		Dermal			Harmful in contact with skin
		Inhalation			Harmful if inhaled
	5	Oral	No pictogram	Warning	May be harmful if swallowed
		Dermal			May be harmful in contact with skin
		Inhalation			May be harmful if inhaled

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Hazard information Example 2:
Flammable gases

Classification				Labelling		
Hazard class	**Hazard category**			**Pictogram**	**Signal word**	**Hazard statement**
Flammable gases	1A	Flammable gas			Danger	Extremely flammable gas
		Pyrophoric gas			Danger	Extremely flammable gas May ignite spontaneously if exposed to air
		Chemically unstable gas	A		Danger	Extremely flammable gas May react explosively even in the absence of air
			B		Danger	Extremely flammable gas May react explosively even in the absence of air at elevated pressure and/or temperature
	1B				Danger	Flammable gas
	2			No pictogram	Warning	Flammable gas

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Precautionary statements

- **P1xx** – General precautionary statements
  - *e.g. P102 - Keep out of reach of children*
- **P2xx** – Prevention precautionary statements
  - *e.g. P260 – Do not breathe dust/fume/gas/mist/vapour/spray*
- **P3xx** – Response precautionary statements
  - *e.g.P316 – Get emergency medical help immediately*
- **P4xx** – Storage precautionary statements
  - *e.g. P405 – Store locked up*
- **P5xx** – Disposal precautionary statements
  - *e.g. P501 - Dispose of contents/container to…*

Combination precautionary statements possible, for instance
IF ON SKIN: Wash with plenty of water/…

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GHS and FAO/WHO labelling of pesticides

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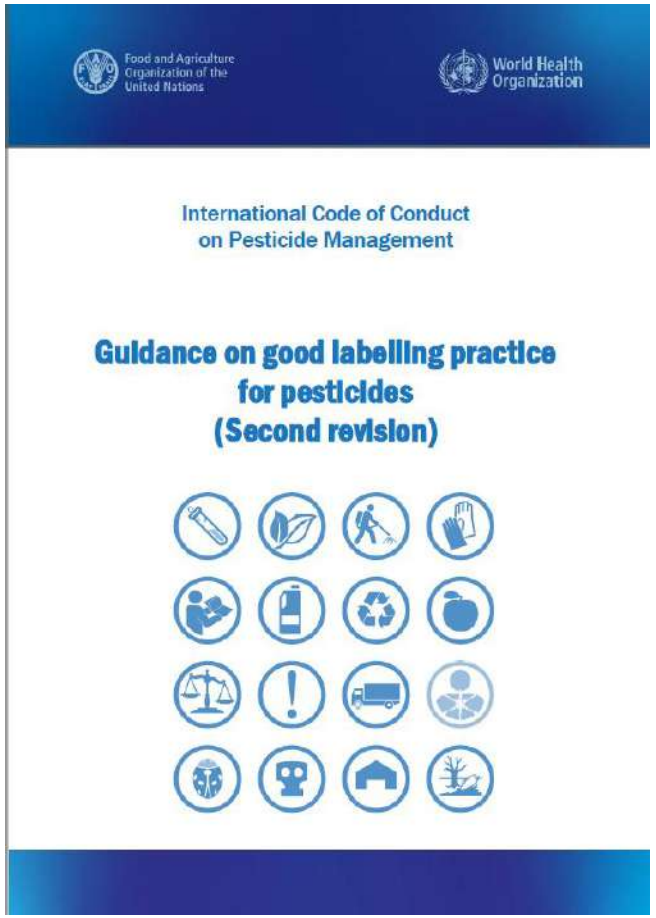
FAO/WHO Guidance on Good Labelling Practice for Pesticides



- The **FAO/WHO guidance** recommends that the GHS should be the only classification scheme used for labelling health hazards of pesticides.
- Hazard colour bands could be added to pesticide labels to take into account both acute and severe chronic health hazards, using the GHS criteria for carcinogenicity, mutagenicity and reproductive toxicity.

https://www.who.int/publications/i/item/9789240053014

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Labelling of pesticides and colour banding

i) GHS – Acute toxicity

	Hazard category					
	Category 1	Category 2	Category 3	Category 4	Category 5	Not classified i.e. toxicity lower than Cat 5
Pictogram/ Symbol					*No pictogram*	*No pictogram*
Signal Word	Danger	Danger	Danger	Warning	Warning	*No signal word*
Hazard Statement						
Oral	Fatal if swallowed	Fatal if swallowed	Toxic if swallowed	Harmful if swallowed	May be harmful if swallowed	
Dermal	Fatal in contact with skin	Fatal in contact with skin	Toxic in contact with skin	Harmful in contact with skin	May be harmful in contact with skin	
Inhalation	Fatal if inhaled	Fatal if inhaled	Toxic if inhaled	Harmful if inhaled	May be harmful if inhaled	
Colour band	PMS red 199 C	PMS red 199 C	PMS Yellow C	PMS Blue 293 C	PMS Blue 293 C	PMS Cool Grey 7C

Note: The GHS pictograms (above and below) should only be used if the classification is according to the GHS criteria.

ii) GHS – Severe chronic toxicity

	Hazard category	
	Category 1	Category 2
Pictogram/ Symbol		
Signal Word	Danger	Warning
Hazard Statement		
Carcinogenicity	May cause cancer	Suspected of causing cancer
Germ cell Mutagenicity	May cause genetic defects	Suspected of causing genetic defects
Reproductive toxicity	May damage fertility or the unborn child	Suspected of damaging fertility or the unborn child
Colour band	PMS red 199 C	PMS red 199 C

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What is a safety data sheet (SDS)?

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The role of the Safety Data Sheet (SDS)

- To provide comprehensive information about a substance or mixture for use in workplace chemical control regulatory frameworks.
- To be a source of information about hazards
- To provide advice on safety precautions
- To act as a reference source for the management of hazardous chemicals in the workplace
- Enables the employer
  - *to develop an active programme of worker protection measures, including training, which is specific to the individual workplace*
  - *to consider any measures which may be necessary to protect the environment.*

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The content of the SDS

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The 16 sections of the SDS

1. Identification
2. Hazard identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

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