

Training materials:

GHS and chemical hazards for beginners

Classification – the language to talk about chemicals

This document is part of *the International Chemicals Management Toolkit for the Toy Supply Chain* developed by the United Nations Environment Programme (UNEP) in collaboration with the Baltic Environmental Forum (BEF) within the framework of the Global Environment Facility (GEF) project ID: 9771 on Global Best Practices on Emerging Chemical Policy Issues of Concern under the Strategic Approach to International Chemicals Management (SAICM).

What is GHS?

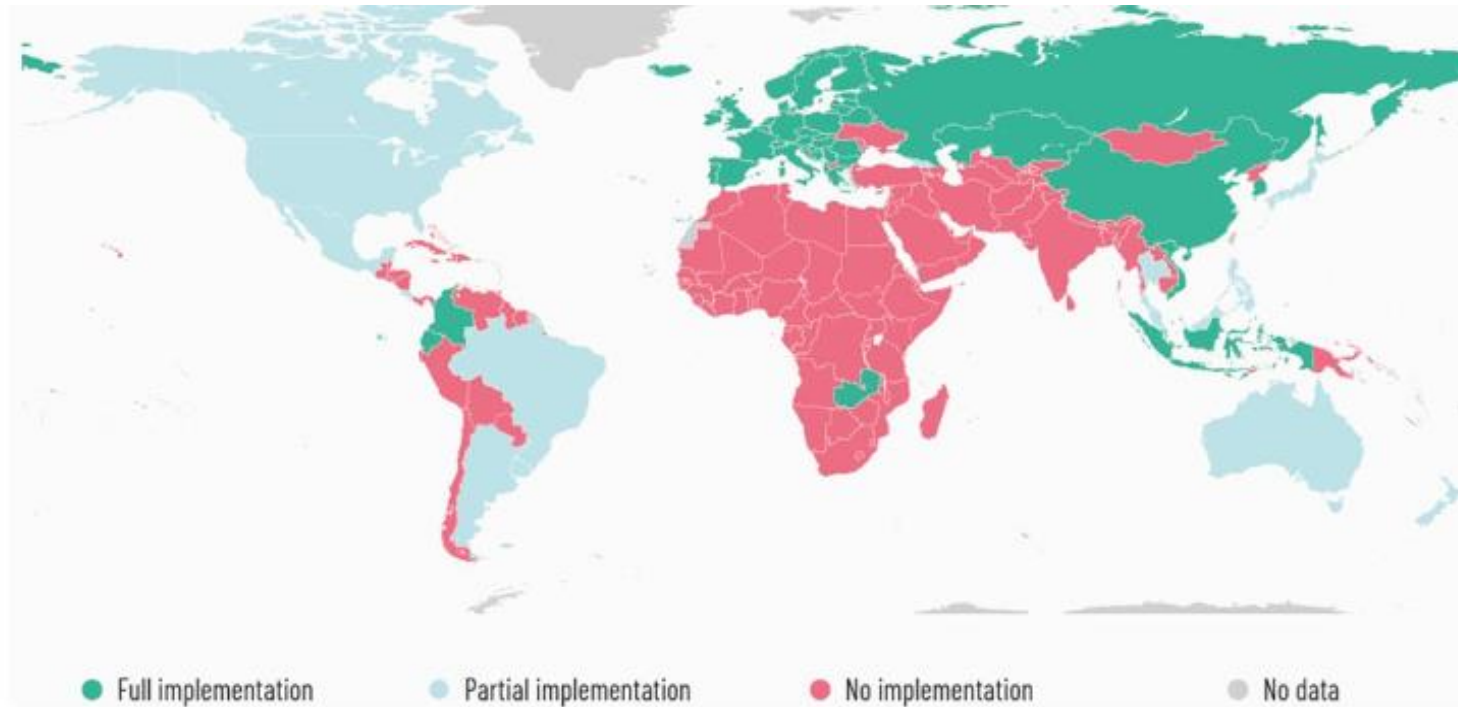
The [Globally Harmonized System of Classification and Labelling](#) (GHS) is a voluntary international agreement on a standardised approach to identify chemical hazards and communicate on them

- The GHS defines various types of chemical hazards (the hazard classes) and gives guidance on the process of analysing if a chemical has one or several hazards
- It assigns standard phrases to each of the hazard classes and categories to ensure that the same wording is used across the globe to identify a chemical hazard to the users of these chemicals
- The GHS applies to individual elements or compounds as well as mixtures of chemicals



Implementation of GHS

- Many, but not all countries have implemented the GHS into their national (China) or regional (Europe) legislation on chemicals
- As the GHS is voluntary, national authorities can decide which parts of it are, or are not implemented. Therefore, the classification and labelling provisions in countries/regions that have implemented the GHS are very much aligned but not always exactly the same



Map of countries that have implemented GHS

(UNEP Report 2018, Global Chemicals Outlook II. From Legacies to Innovative Solutions)

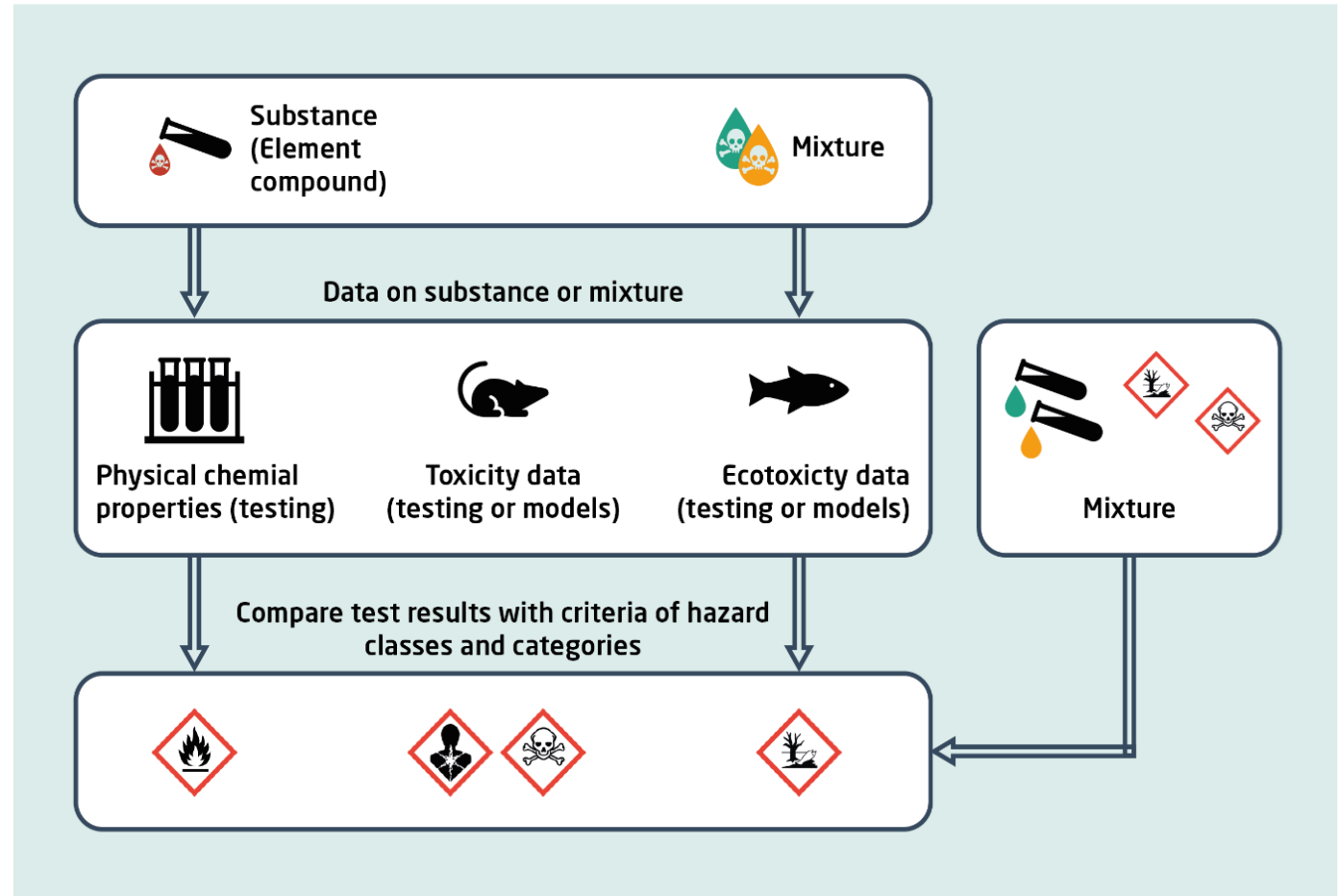
What is classification?

- Classification is the process of how the producers of substances and chemical mixtures identify if their chemicals are hazardous
- It means a structured approach to generate knowledge on chemical hazards and it is therefore the precondition and basis of any hazard communication

How does classification work?

- The classifier of a substance has to gather data from (animal) testing and compare the test results to the criteria of a chemical hazard
- If a criterion is met, the hazard applies, and the chemical must be classified accordingly
- For some hazardous properties, it is also possible to use computer models to identify if a criterion is met

- The classification of a mixture can be derived from the classification of its components, as the hazards of a mixture result from the hazards of the substances contained
- Some hazards of mixtures must be tested because they cannot be predicted



The steps of the classification process for substances and mixtures

Adapted from: Oekopol (2021). Das Vorgehen bei Einstufung und Kennzeichnung im Chemikalienrecht und die resultierenden Rechtsfolgen. Presentation at the Workshop: Dialoge an der Schnittstelle Abfall- und Chemikalienrecht.

Classification criteria

The classification criteria are provided in three sections of the GHS: PART 2: Physical hazards, PART 3: health hazards and PART 4: environmental hazards.

The term “hazard classification” is used to indicate that only the intrinsic hazardous properties of substances and mixtures are considered

Type of hazard	Criterion	Example
Physical Hazard: Flammable liquid	Flashpoint (PF) and initial boiling point (IBP). Categories: 1: $FP < 23^{\circ}C$ and $IBP \leq 35^{\circ}C$ 2: $FP < 23^{\circ}C$ and $IBP > 35^{\circ}C$ 3: $23^{\circ} \leq FP \leq 60^{\circ}C$ 4: $60 < FP \leq 93^{\circ}C$	A classifier determines the flashpoint of his chemical as $22^{\circ}C$ --> Category 1 or Category 2 may apply. He tests the initial boiling point as $45^{\circ}C$ --> He classifies the chemical as Flammable Liquid, Category 2
Environmental Hazard: Acute aquatic toxicity	Ecotoxicity tests with fish, crustacea or algae Concentration at which 50% of the test organisms are either dead or show significantly decreased activity (LC/EC or ErC) Categories: 1: concentration ≤ 1 mg/l 2: 1 mg/l > concentration ≤ 10 mg/l 3 10 mg/l > concentration ≤ 100 mg/l	A classifier makes a test of his chemical with algae and crustaceans. He finds out that about half of the organisms are dead or do not grow anymore at a concentration of 25 mg/l, --> He classifies the chemical as hazardous to the aquatic environment (short-term) category 3

What is a Hazard Class?

A **hazard class** describes the nature of the physical, health or environmental hazard, e.g., flammable, harmful, hazardous to the environment, etc

Health hazards

The most severe and irreversible health damage chemicals may cause are **C**ancer, **M**utations of the genes and altering the **R**eproductive system. These properties are abbreviated '**CMR**'

Carcinogenicity refers to the induction of cancer or an increase in the incidence of cancer. The more general term is carcinogenic chemical

Germ Cell Mutagenicity refers to heritable gene mutations. The more general term is genotoxic chemical

Reproductive toxicity refers to adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring. The more general term is reprotoxic chemical

Health hazards (2)

Severe health damage to different body parts: STOT (RE/SE)

- **Specific target organ [toxicity](#) - single exposure (STOT-SE)** refers to specific, non-lethal target organ effects occurring after a single exposure to a substance or a mixture. This is an example of an [acute effect](#).
- **Specific target organ toxicity - repeated exposure (STOT-RE)** refers to specific toxic effects on target organs occurring after repeated exposure to a substance or mixture. This is an example of an [chronic effect](#).

Sensitisation

- **Respiratory sensitization** refers to hypersensitivity of the airways occurring after inhalation of a substance or mixture.
- **Skin Sensitization** refers to an allergic response occurring after skin contact with a substance or mixture.

Health hazards (3)

Skin Corrosion refers to the production of irreversible damage to the skin.

Acute toxicity refers to serious adverse health effects (i.e. lethality) occurring after a single or short-term oral, dermal or inhalation exposure to a substance or mixture.

Serious eye damage refers to the production of tissue damage in the eye, or serious physical decay of vision, which is not fully reversible.

Irritation

- **Skin irritation:** refers to the production of reversible damage to the skin occurring after exposure to a substance or mixture.
- **Eye irritation:** refers to the production of changes in the eye, which are fully reversible, occurring after exposure of the eye to a substance or mixture.

Environmental hazards

- Acute Aquatic Toxicity
- Chronic Aquatic Toxicity
- Bioaccumulation

Acute aquatic toxicity means the intrinsic property of a substance to be injurious to an organism in a short-term aquatic exposure to that substance.

Chronic aquatic toxicity means the intrinsic property of a substance to cause adverse effects to aquatic organisms during aquatic exposures, which are determined in relation to the life cycle of the organism.

Bioaccumulation refers to the potential of a substance to accumulate in an organism (e.g. in humans or in animals).

What is a Hazard Category?

- A hazard category indicates how potent a chemical is in causing an effect
- The lower the dose or concentration at which a chemical causes damage, the more potent it is and the lower its hazard category

Hazard category describes the division of criteria within each hazard class, e.g. oral acute toxicity includes five hazard categories [Category 1, 2, 3, 4, 5] and flammable liquids includes four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.





Exemption: CMRs – here hazard categories specify type of evidence

- Cat. 1A: Evidence based on human data (e.g. tobacco smoke)
- Cat. 1B: Strong evidence from animal studies
- Cat. 2: some evidence from animal studies but not sufficient for a classification in Cat. 1, the Cat. 2 (suspected carcinogen)

How is the classification communicated with chemical labels?

Hazard pictograms: means a graphical composition that may include a symbol plus other graphic elements, such as a border, background pattern or colour that is intended to convey specific information. Hazard pictograms convey health, physical and environmental hazard information, assigned to a GHS hazard class and category

GHS Pictograms for Health Hazards

Acute toxicity (severe)		Corrosives	
Carcinogenic		Irritant	
Mutagenic			
Reprotoxic			
Respiratory Sensitization			
Target Organ Toxicity			
Aspiration Toxicity			

How is the classification communicated with chemical labels?

GHS Pictograms for Environmental Hazards







Hazardous to the aquatic environment

How is the classification communicated with chemical labels?

The following pictograms may be relevant for the safety of toy production but normally are not important in final toys or toy parts

GHS Pictograms for Physical Hazards

			
Unstable explosives Explosives Self-reactive substances and mixtures Organic peroxides	Oxidizing gases Oxidizing liquids Oxidizing solids	Flammable gases, aerosols, liquids, and solids Self-reactive substances and mixtures Pyrophoric liquids and solids Combustible solids and liquids Self-heating substances and mixtures Substances and mixtures, which in contact with water, emit flammable gases, Organic peroxides	Compressed gases Liquefied gases Refrigerated liquefied gases Dissolved gases

Hazard statement: means standard phrases assigned to a hazard class and category that describes the nature of the hazards of a hazardous chemical substance or mixture, including, where appropriate, the degree of hazard

For example: a chemical substance with an assigned **hazard class** “Carcinogenicity” and a **hazard category** “Category 1A” will have a **hazard statement** “May cause cancer”.

Signal Words: “Danger” or “Warning” are used to emphasize hazards and indicate the relative level of severity of the hazard, assigned to a GHS hazard class and category

Other chemical hazards

Persistence of a chemical

- Persistence of a chemical in the environment is also considered a property that can be cause for concern
- Persistence refers to insufficient degradation of a chemical in the natural environment, e.g. by sunlight or through degradation by microorganisms
- As a consequence, persistent chemicals will not disappear from the environment
- Persistence is one criterion that all substances fulfil that are regulated under the global Stockholm Convention on Persistent Organic Pollutants

Further information

This presentation gives you only a brief overview of the GHS.

There is a further reading for interested user available:

➤ **Background information about GHS**

- United Nations Economic Commission for Europe: Globally Harmonized System of Classification and Labelling of Chemicals (GHS); <https://unece.org/about-ghs>
- United Nations Institute for Training and Research (UNITAR): Globally Harmonized System of Classification and Labelling of Chemicals; [Globally Harmonized System of Classification and Labelling of Chemicals | UNITAR](#);

➤ **Guidance documents**

- United Nations Economic Commission for Europe (UNECE): Guidance on the application of GHS criteria; [Guidance on the application of GHS criteria | UNECE](#);

➤ **GHS e-Learning** course

- United Nations Institute for Training and Research (UNITAR): GHS e-Learning course; [online video]. [UNITAR GHS e-Learning Course - YouTube](#)