The Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

Hazard communication

Objective

Develop a harmonized hazard communication system, including:

- Labelling;
- Safety Data Sheets (SDS's)

based on GHS classification criteria

Target audiences: needs

- Factors considered:
  - Potential use of products
  - Availability of information other than label
  - Availability of specific training
- Needs:
  - Workplace: labels, SDS, specific training
  - Consumers: labels
  - Emergency responders: labels, specific training
  - Transport: labels, transport documents, specific training

Comprehensibility of hazard communication elements

Guiding principles:

- Information should be conveyed in more than one way
- Comprehensibility should take account of existing information (literature, studies and data)
- Phrases indicating degree of hazard should be consistent across different hazard types
- Words and phrases should retain comprehensibility when translated into other languages
- Format and colour of the label elements, and SDS format should be standardized

Updating information

Labels and Safety Data Sheets should be updated when new and significant information is available for a chemical

"New and significant information" means any information that changes GHS classification and leads to a change in the information to be provided in the label or in the SDS

Labelling according to GHS

Information required on a GHS label:

- Pictograms
- Signal words
- Hazard statements
- Precautionary statements and pictograms
- Product identifier
- Supplier information

Pictograms (1)

- Definition:

  Graphical composition that includes a symbol and other graphic elements, such as a border, background pattern or colour that is intended to convey specific information

- Characteristics:
  - Shape: square set at a point.
  - Colours:
    - Symbol: black;
    - Background: white;
    - Border: red*.

    (In same cases, competent authorities may allow the use of a black border)*

Example:
GHS pictogram for skin irritant

*Pictograms and a code uniquely identifying each one "**GHSxx**" are listed in section 4 of Annex 3 of the GHS. The pictogram code is intended to be used for references purposes. It is not part of the pictogram and should not appear on labels or in section 2 of the safety data sheet.*

Pictograms (2)

- Packages covered by the UN Model Regulations:
  - For transport, the pictograms (labels) prescribed by the UN Model Regulations should be used
  - For specifications for transport pictograms see Part 5 of the UN Model Regulations
  - If a transport pictogram appears on the package, the GHS pictogram for the same hazard should not appear

Example:
Transport pictogram for flammable liquids

Signal words

- Definition

  word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label

  – "Danger" (for more severe hazard categories)

  – "Warning" (for less severe hazard categories)

Hazard statements

Definition:

phrase assigned to a hazard class and category that describes the nature of the hazards of a hazardous product, including, where appropriate, the degree of hazard.

Hazard statements and a code uniquely identifying each one "Hxxx" are listed in section 1 of Annex 3 of the GHS. Hazard statement codes are intended to be used for reference purposes only, are not part of the hazard statement text and should not be used to replace it

- Examples of hazard statements are:
  - "Highly flammable liquid and vapour" (H225)
  - "Toxic in contact with skin" (H311)
  - "Harmful to aquatic life" (H402)

Precautionary statements

Definition:

phrases (and/or pictograms) that describe recommended measures that should be taken to minimise or prevent adverse effects resulting from exposure to a hazardous product, or improper storage or handling of a hazardous product.

Precautionary statements and a code uniquely identifying each one "Pxxx" are listed in section 2 of Annex 3 of the GHS. Precautionary statement codes are intended to be used for reference purposes only, are not part of the precautionary statement text and should not be used to replace it

Precautionary statements

5 types of precautionary statements:

- General (codes “P1xx”)
- Prevention (codes “P2xx”);
- Response (in case of spillage or exposure) (codes “P3xx);
- Storage (codes “P4xx”); and
- Disposal (codes “P5xx”);

Annex 3 of the GHS provides guidance on the use of precautionary statements consistent with GHS

Precautionary pictograms

To be used where allowed by the competent authority.

Examples:



(Additional examples may be found in section 5 of Annex 3 of the GHS)

Product identifier

- Chemical identity of the substance
- For mixtures and alloys, chemical identities of:
  - all the ingredients/alloying elements contributing to the hazard of the mixture/alloy (as specified by the competent authority); or,
  - all the ingredients/alloying elements contributing to:
    - Acute toxicity
    - Skin corrosion/serious eye damage
    - Germ cell mutagenicity
    - Carcinogenicity
    - Reproductive toxicity
    - Skin/respiratory sensitization
    - Specific target organ toxicity

  when these hazards appear on the label

Product identifier and supplier identification

Product identifier *(cont'd):*

- Proper shipping name (for substances/mixtures covered by the UN Model Regulations)
- For substances/mixtures supplied exclusively for workplace use:
  - Competent authority may authorize chemical identities to be included only in SDS

However…

If a substance/ingredient meets the competent authority criteria for CBI, its identity does not have to be included on the label

Supplier identification

– Name, address and telephone number of the manufacturer or supplier of the substance/mixture

Example of arrangement of label elements

CODE

PRODUCT NAME

Danger

Keep out of the reach of children.
Read label before use.

COMPANY NAME

Street Address
City, State, Postal Code, Country
Phone Number
Emergency Phone Number

DIRECTIONS FOR USE:
XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX

Highly flammable liquid and vapour.
Harmful if inhaled.
May cause liver and kidney damage through prolonged or repeated exposure.

Keep container tightly closed.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Use only outdoors or in a well-ventilated area.
Do not breathe dust/fume/gas/mist/vapours/spray.
Wear protective gloves, protective clothing/eye protection/face protection [as specified….]
Ground and bond container and receiving equipment.

In case of fire: Use [as specified] to extinguish.

FIRST AID
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
Call a POISON CENTER/doctor if you feel unwell.

Store in a well-ventilated place. Keep cool

UN Number
Proper shipping name

[Universal Product Code (UPC)]

Fill weight:	XXXX	Lot Number:	XXXX
Gross weight:	XXXX	Fill Date:	XXXX
Expiration Date:	XXXX		

For additional examples of arrangements of the GHS labels see Annex 7 of the GHS

Precedence of hazard information Symbols and signal words

Symbols:

- For physical hazards:
  - Substances/mixtures covered by UN Model Regulations: as specified by the Model Regulations
  - Workplace: as specified by competent authority
- For health hazards:
  - Exclamation mark should not appear if:
    - if skull and crossbones applies; or
    - if used for skin sensitization or skin/eye irritation:
      - if corrosive symbol applies
      - if the health hazard symbol appears for respiratory sensitization

Signal words:

- If “Danger” applies, “warning” should not appear

Precedence of hazard information
Hazard statements

- All assigned hazard statements should appear on the label, except where otherwise provided below. The competent authority may specify the order in which they appear
- The following precedence rules may be applied:
  - If statement H410 “Very toxic to aquatic life with long lasting effects” is assigned, statement H400 “Very toxic to aquatic life” may be omitted
  - If statement H411 “Toxic to aquatic life with long lasting effects” is assigned, statement H401 “Toxic to aquatic life” may be omitted
  - If statement H412 “Harmful to aquatic life with long lasting effects” is assigned, statement H402 “Harmful to aquatic life” may be omitted
  - If statement H314 “Causes severe skin burns and eye damage” is assigned, statement H318 “Causes serious eye damage” may be omitted
- Competent authorities may decide whether to require use of the above precedence rules, or to leave the choice to the manufacturer/supplier
- Where a combined hazard statement is indicated, the competent authority may specify whether the combined hazard statement or the corresponding individual statements should appear on the label, or may leave the choice to the manufacturer/supplier

Labelling of small packagings
General principles

(a) All applicable GHS label elements should appear on the immediate container of a hazardous substance or mixture where possible

(b) Where it is impossible to put all the applicable label elements on the immediate container itself, other methods of providing the full hazard information should be used in accordance with the definition of “Label” in the GHS. Factors influencing this include *inter alia*:

  (i) the shape, form or size of the immediate container

  (ii) the number of label elements to be included, particularly where the substance or mixture meets the classification criteria for multiple hazard classes

  (iii) the need for label elements to appear in more than one official language

(c) Where the volume of a hazardous substance or mixture is so low and the supplier has data demonstrating, and the competent authority has determined, that there is no likelihood of harm to human health and/or the environment, then the label elements may be omitted from the immediate container

(d) Competent authorities may allow certain label elements to be omitted from the immediate container for certain hazard classes/categories where the volume of the substance or mixture is below a certain amount

(e) Some labelling elements on the immediate container may need to be accessible throughout the life of the product, e.g. for continuous use by workers or consumers

Safety Data Sheets

- Provide comprehensive information of a substance/mixture for use in workplace
- Are product related
- The information provided enables the employer:
  - To develop worker protection measures specific to the workplace
  - To consider measures to protect the environment

Safety Data Sheets

- SDS should be provided for:
  - all substances/mixtures meeting GHS harmonized criteria for physical, health and environmental hazards
  - mixtures containing substances meeting criteria for carcinogenicity, toxicity for reproduction or specific target organ toxicity, in concentration exceeding cut-off values
  - other substances/mixtures not meeting the criteria for classification as hazardous but containing hazardous substances in certain concentrations, if required by the competent authority

Safety Data Sheets

Information should be presented as follows

1. Identification
2. Hazard(s) 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.

For detailed guidance on the preparation of SDS refer to Annex 4 of the GHS

Safety Data Sheets: Sections 1 and 2

Section 1: Identification

- Identification of the substance or mixture:
  - GHS identifier
  - Other unique identifiers
- Supplier's details:
  - Name, full address and phone number(s)
- Recommended use of the chemical and restrictions on use; and
- Emergency phone number

Section 2: Hazard identification

- Classification of the substance or mixture
- GHS labels, including precautionary statements
- Other hazards which do not result in classification

Safety Data Sheets: Section 3

Section 3: Composition/information on ingredients

- Substances:
  - Chemical identity
  - Common name, synonym of the substance
  - CAS number and other unique identifiers
  - Impurities and stabilizing additives
- Mixtures (for all hazardous ingredients):
  - Chemical identity
  - Identification number
  - Concentration range

Safety Data Sheets: Sections 4 and 5

Section 4: First-aid measures

- Description
- Most important symptoms/effects, acute and delayed
- If needed, indication of:
  - Immediate medical attention
  - Special treatment

Section 5: Fire-fighting measures

- Suitable extinguishing media
- Specific hazards arising from the chemical
- Special protective equipment and precautions for fire-fighters

Safety Data Sheets: Sections 6, 7 and 8

Section 6: Accidental release measures

- Personal precautions, protective equipment and emergency procedures
- Environmental precautions
- Methods and materials for containment and cleaning up

Section 7: Handling and storage

- Precautions for safe handling
- Conditions for safe storage (including incompatibilities)

Section 8: Exposure controls/personal protection

- Control parameters
- Appropriate engineering controls
- Individual protection measures, including personal protective equipment (PPE)

Safety Data Sheets: Section 9

Section 9: Physical and chemical properties

- Physical state
- Colour
- Odour
- Melting point/freezing point
- Boiling point or initial boiling point and boling range
- Flammability
- Lower and upper explosion limit/flammability limit
- Flash point
- Auto-ignition temperature
- Decomposition temperature
- pH
- Kinematic viscosity
- Solubility
- Partition coefficient: n-octanol/water (log value)
- Vapour pressure
- Density and/or relative density
- Relative vapour density
- Particle characteristics

Table A4.3.9.1: Basic physical and chemical properties

This table lists basic physical and chemical properties and safety characteristics. Relevant information as required should be indicated for every property listed in this table, such as a short description, value(s), unit, conditions (e.g., temperature, pressure), method, each as appropriate.

If specific properties or safety characteristics do not apply (based on the respective information about applicability in the column “Remarks/Guidance”) they should still be listed in the SDS with the statement “not applicable”.

If information on specific properties or safety characteristics is not available, they should still be listed in the SDS with the statement “not available”. It is recommended that, where appropriate, a short explanation is included as to why the data is not available, e.g., “melts”, “decomposes”, “dissolves”.

Property	**Remarks/Guidance**
Physical state	− generally at standard conditions − for definitions for gas, liquid and solid see Chapter 1.2
Colour	− indicate the colour of the substance or mixture as supplied − in cases where one SDS is used to cover variants of a mixture which may have different colours the term 'various' can be used to describe the colour (see A4.3.1.1 for an SDS for variants of a mixture)
Odour	− give a qualitative description of the odour if it is well-known or described in the literature − if available, indicate the odour threshold (qualitatively or quantitatively)
Melting point/ freezing point	− not applicable to gases − at standard pressure − indicate up to which temperature no melting point was observed in case the melting point is above the measuring range of the method − indicate if decomposition or sublimation occurs prior to or during melting − for waxes and pastes the softening point/range may be indicated instead − for mixtures indicate if it is technically not possible to determine the melting point/freezing point
Boiling point or initial boiling point and boiling range	− generally at standard pressure (a boiling point at lower pressure might be indicated in case the boiling point is very high or decomposition occurs before boiling) − indicate up to which temperature no boiling point was observed in case the boiling point is above the measuring range of the method − indicate if decomposition occurs prior to or during boiling − for mixtures indicate if it is technically not possible to determine the boiling point or range; in that case indicate also the boiling point of the lowest boiling ingredient
Flammability	− applicable to gases, liquids and solids − indicate whether the substance or mixture is ignitable (capable of catching on fire or being set on fire, even if not classified for flammability) − if available and appropriate, further information may be indicated in addition, e.g. • whether the effect of ignition is other than a normal combustion (e.g., an explosion) • ignitability under non-standard conditions − more specific information on the flammability may be indicated based on the respective hazard classification in accordance with Table A4.3.9.2
Lower and upper explosion limit/ flammability limit	− not applicable to solids − for flammable liquids indicate at least the lower explosion limit: • if the flash point is approximately > -25 °C, it might be not possible to determine the upper explosion limit at standard temperature; in that case it is recommended to indicate the upper explosion limit at elevated temperature • if the flash point is > +20 °C the same holds for both the lower and upper explosion limit *Note: Depending on the region of the world the term “explosion limit“ or “flammability limit” is used, but is supposed to mean the same.*

Property	**Remarks/Guidance**
Flash point	− not applicable to gases, aerosols and solids − for information on test methods etc., see Chapter 2.6, paragraph 2.6.4.2 <u>for mixtures:</u> − indicate a value for the mixture itself if available, otherwise indicate the flash point(s) of those substances with the lowest flash point(s) as these are generally the main contributing ones
Auto-ignition temperature	− applicable to gases and liquids only <u>for mixtures:</u> − indicate a value for the mixture itself if available, otherwise indicate the auto-ignition temperature(s) of those ingredients with the lowest auto-ignition temperature(s)
Decomposition temperature	− applicable to self-reactive substance and mixtures and organic peroxides and other substances and mixtures which may decompose − indicate • the SADT (self-accelerating decomposition temperature), together with the volume to which it applies or • the decomposition onset temperature (see also section 20.3.3.3 of the *Manual of Tests and Criteria*) − indicate whether the temperature given is the SADT or the decomposition onset temperature − if no decomposition was observed, indicate up to which temperature no decomposition was observed, e.g., as “no decomposition observed up to x °C/°F”
pH	− not applicable to gases − applicable to aqueous liquids and solutions (the pH is linked to aqueous media by definition; measurements carried out in other media do not give the pH) − indicate the concentration of the test substance in water − where the pH is ≤ 2 or ≥ 11.5, see Table A4.3.9.3 for information on acid/alkaline reserve
Kinematic viscosity	− applicable to liquids only − use preferably *mm²/s* as unit (as the classification criteria for the hazard class aspiration hazard are based on this unit) − the dynamic viscosity may be indicated in addition. The kinematic viscosity is linked to the dynamic viscosity by the density: $\text{Kinematic viscosity}\,(\text{mm}^2/\text{s}) = \frac{\text{Dynamic viscosity}\,(\text{mPa}\cdot\text{s})}{\text{Density}\,(\text{g/cm}^3)}$ − for non-Newtonian liquids, indicate thixotropic or rheopexic behaviour
Solubility	− generally at standard temperature − indicate the solubility in water − the solubility in other (non-polar) solvents may also be included − for mixtures, indicate if it is fully or only partially soluble in or miscible with water or other solvent
Partition coefficient n-octanol/water (log value)	− not applicable to inorganic and ionic liquids − generally not applicable to mixtures − may be calculated (using QSAR – Quantitative structure-activity relationship) − indicate whether the value is based on testing or on calculation

Property	Remarks/Guidance
Vapour pressure	– generally at standard temperature – indicate the vapour pressure at 50 °C for volatile fluids in addition (in order to enable distinction between gases and liquids based on the definitions in Chapter 1.2) – in cases where one SDS is used to cover variants of a liquid mixture or liquefied gas mixture indicate a range for the vapour pressure – for liquid mixtures or liquefied gas mixtures, indicate a range for the vapour pressure or at least the vapour pressure of the most volatile ingredient(s) where the vapour pressure of the mixture is predominantly determined by this/these ingredient(s) – for liquid mixtures or liquefied gas mixtures, the vapour pressure may be calculated using the activity coefficients of the ingredients – the saturated vapour concentration (*SVC*) may be indicated in addition. The saturated vapour concentration can be estimated as follows: $\mathrm{SVC\,(in\ ml/m^3)} = \mathrm{VP\,(in\ hPa = mbar)} \cdot 987.2$ $\mathrm{SVC\,(in\ mg/l)} = \mathrm{VP\,(in\ hPa = mbar)} \cdot \mathrm{MW} \cdot 0.0412$ where • *VP* is the vapour pressure • *MW* is the molecular weight
Density and/or relative density	– applicable to liquids and solids only – generally at standard conditions – indicate as appropriate • the absolute density and/or • the relative density based on water at 4 °C as reference (sometimes also called the specific gravity) – a range may be indicated in cases where variations in density are possible, e.g., due to batch manufacture, or where one SDS is used to cover several variants of a substance or mixture ***NOTE**: For clarity, the SDS should indicate if absolute density (indicate units) and/or relative density (no units) is being reported.*
Relative vapour density	– applicable to gases and liquids only – for gases, indicate the relative density of the gas based on air at 20 °C as reference (=*MW*/29) – for liquids, indicate the relative vapour density based on air at 20 °C as reference (=*MW*/29) – for liquids, the relative density of the vapour/air-mixture at 20 °C (air = 1) may be indicated in addition. It can be calculated as follows: $\mathrm{D_m} = 1 + \left(34 \cdot \mathrm{VP_{20}} \cdot 10^{-6} \cdot (\mathrm{MW} - 29)\right)$ where • D_m is the relative density of the vapour/air mixture at 20 °C • VP_{20} is the vapour pressure at 20 °C in mbar • *MW* is the molecular weight
Particle characteristics	– applicable to solids only – indicate the particle size (median and range) – if available and appropriate, further properties may be indicated in addition, e.g. • size distribution (range) • shape and aspect ratio • specific surface area

Table A4.3.9.2: Data relevant with regard to physical hazard classes (supplemental)

This table lists properties/safety characteristics and test results that are not required on the SDS but may be useful to communicate when a substance or mixture is classified in the respective physical hazard class. Data which is deemed relevant with regard to a specific physical hazard but not resulting in classification (e.g., negative test results close to the criterion) may also be useful to communicate. Include any relevant information, such as a short description, value(s), unit, conditions (e.g., temperature, pressure), method, each as appropriate.

The name of the hazard class the data relates to may be indicated together with the data but it is not necessary to do so because the resulting classification is already indicated in Section 2 of the SDS. Thus, the data may be listed in the same way as the data according to Table A4.3.9.1.

Unless otherwise specified, the test methods referred to in this Table are described in the *Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria* (referred to as the *Manual of Tests and Criteria* hereafter).

Chapter	Hazard class	Property/Safety characteristic/Test result and Remarks/Guidance
2.1	Explosives	− indicate the sensitivity to shock, generally determined by the UN gap test: test 1 (a) and/or test 2 (a) (section 11.4 or 12.4 of the *Manual of Tests and Criteria*) (indicate at least + or −) − indicate the effect of heating under confinement, generally determined by the Koenen test: test 1 (b) and/or test 2 (b) (section 11.5 or 12.5 of the *Manual of Tests and Criteria*) (indicate preferably the limiting diameter) − indicate the effect of ignition under confinement, generally determined by test 1 (c) and/or test 2 (c) (section 11.6 or 12.6 of the *Manual of Tests and Criteria*) (indicate at least + or −) − indicate the sensitiveness to impact, generally determined by test 3 (a) (section 13.4 of the *Manual of Tests and Criteria*) (indicate preferably the limiting impact energy) − indicate the sensitiveness to friction, generally determined by test 3 (b) (section 13.5 of the *Manual of Tests and Criteria*) (indicate preferably the limiting load) − indicate the thermal stability, generally determined by test 3 (c) (section 13.6 of the *Manual of Tests and Criteria*) (indicate at least + or −) − in addition, this entry is also applicable to substances and mixtures which are exempted based on Note 2 in Chapter 2.1, section 2.1.3 and to other substances and mixtures which show a positive effect if heated under confinement − indicate the package (type, size, net mass of substance or mixture) based on which the division was assigned or based on which the substance or mixture was exempted
2.2	Flammable gases	<u>for pure flammable gases:</u> − no data on the explosion/flammability limits is needed because these are indicated based on Table A4.3.9.1 − indicate the T_{Ci} (maximum content of flammable gas which, when mixed with nitrogen, is not flammable in air, in %) as per ISO 10156 − indicate the fundamental burning velocity if the gas is classified as Category 1B based on fundamental burning velocity, generally determined by ISO 817:2014, Annex C <u>for flammable gas mixtures:</u> − indicate the explosion/flammability limits, if tested, or indicate whether the classification and category assignment is based on the calculation as per ISO 10156 − indicate the fundamental burning velocity if the gas mixture is classified as Category 1B based on fundamental burning velocity, generally determined by ISO 817:2014, Annex C
2.3	Aerosols	− indicate the total percentage (by mass) of flammable components unless the Aerosol is classified as Aerosol cat. 1 because it contains more than 1 % flammable components or has a heat of combustion of at least 20 kJ/g and is not submitted to the flammability classification procedures (see the Note in Chapter 2.3, paragraph 2.3.2.2)
2.4	Oxidizing gases	<u>for pure oxidizing gases:</u> − indicate the C_i (coefficient of oxygen equivalency) as per ISO 10156 <u>for oxidizing gas mixtures</u>: − indicate “Oxidizing gas Category 1 (tested as per ISO 10156)” for tested mixtures or indicate the calculated oxidizing power (OP) as per ISO 10156

Chapter	Hazard class	Property/Safety characteristic/Test result and Remarks/Guidance
2.5	Gases under pressure	<u>for pure gases</u>: – indicate the critical temperature <u>for gas mixtures</u>: – indicate the pseudo-critical temperature; it is estimated as the mole weighted average of the critical temperatures of the components as follows: $\sum_{i=1}^{n} x_i \cdot T_{Crit\,i}$ where • x_i is molar fraction of component *i* • $T_{Crit\,i}$ is the critical temperature of component *i*
2.6	Flammable liquids	– no additional data is needed because the boiling point and the flash point are indicated based on Table A4.3.9.1 – indicate information on sustained combustibility if exemption based on Test L.2 (section 32.5.2 of the *Manual of Tests and Criteria)*, in accordance with Note 2 in Chapter 2.6, section 2.6.2, is considered
2.7	Flammable solids	– indicate the burning rate (or burning time for metal powders), generally determined by Test N.1 (section 33.2.1 of the *Manual of Tests and Criteria*) – indicate whether the wetted zone has been passed or not
2.8	Self-reactive substances and mixtures	– for the SADT (self-accelerating decomposition temperature), see the entry for the decomposition energy in Table A4.3.9.1 – indicate the decomposition energy (value and method of determination) – indicate detonation properties (Yes/Partial/No), also in packaging where relevant – indicate deflagration properties (Yes rapidly/Yes slowly/No), also in packaging where relevant – indicate the effect of heating under confinement (Violent/Medium/Low/No), also in packaging where relevant – indicate the explosive power if applicable (Not low/Low/None)
2.9	Pyrophoric liquids	– indicate whether spontaneous ignition or charring of the filter paper occurs, generally determined by Test N.3 (section 33.3.1.5 of the *Manual of Tests and Criteria*) (indicate e.g. “the liquid ignites spontaneously in air” or “a filter paper with the liquid chars in air”)
2.10	Pyrophoric solids	– indicate whether spontaneous ignition occurs when poured or within five minutes thereafter, generally determined by Test N.2 (section 33.3.1.4 of the *Manual of Tests and Criteria*) (e.g., “the solid ignites spontaneously in air”) – indicate whether pyrophoric properties could be altered over time, e.g., by formation of a protective surface layer through slow oxidation
2.11	Self-heating substances and mixtures	– indicate whether spontaneous ignition occurs, include possible screening data and/or method used (generally Test N.4, section 33.3.1.6 of the *Manual of Tests and Criteria*) and note the maximum temperature rise obtained – indicate the results of screening tests according to Chapter 2.11, paragraph 2.11.4.2, if relevant and available
2.12	Substances and mixtures which, in contact with water, emit flammable gases	– indicate the identity of the emitted gas, if known – indicate whether the emitted gas ignites spontaneously – indicate the gas evolution rate, generally determined by Test N.5 (section 33.4.1.4 of the *Manual of Tests and Criteria*), unless the test has not been completed e.g. because the gas ignites spontaneously
2.13	Oxidizing liquids	– indicate whether spontaneous ignition occurs when mixed with cellulose, generally determined by Test O.2 (section 34.4.2 of the *Manual of Tests and Criteria*) (e.g., “the mixture with cellulose (prepared for Test O.2) ignites spontaneously”)
2.14	Oxidizing solids	– indicate whether spontaneous ignition occurs when mixed with cellulose, generally determined by Test O.1 or Test O.3 (sections 34.4.1 or 34.4.3 of the *Manual of Tests and Criteria*) (e.g., “the mixture with cellulose (prepared for Test O.1 or O.3) ignites spontaneously”)

Chapter	Hazard class	Property/Safety characteristic/Test result and Remarks/Guidance
2.15	Organic peroxides	– for the SADT (self-accelerating decomposition temperature) see the entry for the decomposition energy in Table A4.3.9.1 – indicate the decomposition energy (value and method of determination), if available – indicate detonation properties (Yes/Partial/No), also in packaging where relevant – indicate deflagration properties (Yes rapidly/Yes slowly/No), also in packaging where relevant – indicate the effect of heating under confinement (Violent/Medium/Low/No), also in packaging where relevant – indicate the explosive power if applicable (Not low/Low/None)
2.16	Corrosive to metals	– indicate which metals are corroded by the substance or mixture (e.g., “corrosive to aluminium” or “corrosive to steel” etc.), if available – indicate the corrosion rate and whether it refers to steel or aluminium, generally determined by Test C.1 (section 37.4 of the *Manual of Tests and Criteria*), if available – include a reference to other sections of the SDS with regard to compatible or incompatible materials (e.g., to packaging compatibilities in Section 7 or to incompatible materials in Section 10), as appropriate
2.17	Desensitized explosives	– indicate what desensitizing agent is used – indicate the exothermic decomposition energy – indicate the corrected burning rate A_c

Table A4.3.9.3: Further safety characteristics (supplemental)

This table lists further properties/safety characteristics and test results that are not required on the SDS but may be useful to communicate for a substance or mixture. Other physical properties/safety characteristics of the substance or mixture not identified in this table may also be useful to communicate. Include all relevant information, such as a short description, value(s), unit, conditions (e.g., temperature, pressure), method, each as appropriate.

Safety characteristic and/or test result	Remarks/Guidance
Mechanical sensitivity	– applicable to energetic substances and mixtures with an exothermic decomposition energy ≥ 500 J/g in accordance with the *Manual of Tests and Criteria*, Appendix 6, section 3.3 (c) – indicate the sensitiveness to impact, generally determined by test 3 (a) (section 13.4 of the *Manual of Tests and Criteria*) (indicate preferably the limiting impact energy) – indicate the sensitiveness to friction, generally determined by test 3 (b) (section 13.5 of the *Manual of Tests and Criteria*) (indicate preferably the limiting load)
SAPT (self-accelerating polymerization temperature)	– applicable to substances and mixtures which may self-polymerize thereby generating dangerous amounts of heat and gas or vapour – indicate the volume for which the SAPT is given
Formation of explosible dust/air mixtures	– not applicable to gases and liquids – not applicable to solids containing only substances which are fully oxidized (e.g., silicon dioxide) – in case formation of explosible dust/air mixtures might be possible based on Section 2 of the SDS, relevant safety characteristics may be indicated in addition, such as • lower explosion limit / minimum explosible concentration • minimum ignition energy • deflagration index (K_{st}) • maximum explosion pressure – indicate the particle characteristics to which the data apply if different from the particle characteristics as indicated based on Table A4.3.9.1 ***NOTE 1**: The ability to form explosible dust/air mixtures may be determined e.g. by VDI* 2263-1 "Dust Fires and Dust Explosions; Hazards - Assessment - Protective Measures; Test Methods for the Determination of the Safety Characteristics of Dusts" or by ISO/IEC 80079-20-2 "Explosive atmospheres - Part 20-2: Material characteristics - Combustible dusts test methods" (in preparation).* ***NOTE 2**: Explosion characteristics are specific for the tested dust. Normally they cannot be transferred to other dusts even if these are comparable. Fine-sized dusts of a particular substance tend to react stronger than coarser dusts.*
Acid/alkaline reserve	– applicable to substances and mixtures which have an extreme pH (pH ≤ 2 or ≥ 11.5) – indicate acid/alkaline reserve when used for evaluating skin and eye hazards

* *VDI stands for "Verein Deutscher Ingenieure"*

Safety Data Sheets: Section 10

Section 10: Stability and reactivity

- Reactivity
- Chemical stability
- Possibility of hazardous reactions
- Conditions to avoid
- Incompatible materials
- Hazard decomposition products

Safety Data Sheets: Section 11

Section 11: Toxicological information

- Provide data for all the health hazards covered by the GHS.

  If data for any of those hazards is not available, they should be listed on the SDS with a statement that data is not available.
- Information on the likely routes of exposure;
- Symptoms related to the physical, chemical and toxicological characteristics;
- Delayed and immediate effects and chronic effects from short or long term exposure;
- Numerical measures of toxicity (such as ATE)
- Interactive effects
- Where specific chemical data are not available
- Mixtures
- Mixture versus ingredient information
- Other relevant information

Safety Data Sheets: Sections 12 and 13

Section 12: Ecological information

- Toxicity
- Persistence and degradability
- Bioaccumulative potential
- Mobility in soil
- Other adverse effects

Section 13: Disposal considerations

- Disposal methods

Safety Data Sheets: Section 14

Section 14: Transport information

- UN Number
- UN Proper Shipping Name
- Transport hazard classes
- Packing group, if applicable
- Environmental hazards
- Special precautions for user
- Transport in bulk according to IMO instruments

Safety Data Sheets: Sections 15 and 16

Section 15: Regulatory information

- Regulatory information not provided elsewhere in the SDS
- Safety, health and environmental regulations specific for the chemical in question

Section 16: Other information

- Date of preparation of the latest version of the SDS
  - Clear indication of the changes made to the previous revision
- Key/legend to abbreviations and acronyms used in the SDS
- Key literature references and sources for data used to compile the SDS

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

End of hazard communication