



**Committee of Experts on the Transport of Dangerous Goods
and on the Globally Harmonized System of Classification
and Labelling of Chemicals****Sub-Committee of Experts on the Globally Harmonized
System of Classification and Labelling of Chemicals****Twenty-eight session**

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Item 3 (a) of the provisional agenda

Hazard communication issues:**Revision of Section 9 of Annex 4****Revision of Section 9 of the Safety Data Sheet****Transmitted by the expert from Germany on behalf of the
correspondence group¹**

1. This document presents the results of the work of the informal correspondence group on the revision of Section 9 of the Safety Data Sheet (SDS). Since the last meeting of the Sub-Committee in July 2014, in which the status of the work of the group was presented in document ST/SG/AC.10/C.4/2014/1, the group had two phone conferences in order to take into account the remaining comments and to complete its work.

2. The group participants were experts from a number of countries, international, intergovernmental and non-governmental organizations among which experts from Australia, Austria, Belgium, Canada, China, Finland, Germany, Ireland, Sweden, the United Kingdom, the United States of America, the European Commission, the European Chemicals Agency (ECHA), the World Health Organisation (WHO), the American Coatings Association (ACA), the International Association for Soaps, Detergents and Maintenance Products (AISE), the European Chemical Industry Council (CEFIC), the Dangerous Goods Advisory Council (DGAC), the European Industrial Gases Association (EIGA), Federation of European Aerosol Associations (FEA), International Petroleum Industry Environmental Conservation Association (IPIECA) and the International Paint and Printing Ink Council (IPPIC). They were all very constructive and only based on everyone's willingness to contribute, to listen, to weigh arguments and to compromise, it was possible

¹ In accordance with the programme of work of the Sub-Committee for 2013–2014 approved by the Committee at its sixth session (see ST/SG/AC.10/40, para. 14, and ST/SG/AC.10/C.4/48, Annex IV, item 2(a)).

bring this work to a satisfactory conclusion and hence to present the result as contained in this document.

3. This document contains general considerations and explanations in the main part (see below). The text proposals themselves and further detailed explanations and justifications are contained in the annexes to this document as follows:

Annex 1: Proposal for the new text for Section 9 of Annex 4;

Annex 2: Proposal for the revised text for Section 9 in Table 1.5.2 of Chapter 1.5;

Annex 3: Justification and detailed explanations for the proposed amendments.

Revision of section 9 of Annex 4

4. As outlined in previous reports to the Sub-Committee, the group had decided to introduce guidance in Annex 4 for each of the properties given in Section 9 of the SDS. This guidance is intended to clarify what kind of data is expected for each of the properties and aims at improving the quality and consistency of Section 9 of the SDS.

5. The group agreed to divide the properties/data required for Section 9 of the SDS into three tables with regards to their layout in Annex 4 of the GHS.

(a) Table A4.3.9.1 presents the proposed guidance for the basic physical and chemical properties which are required by Section 9 of Table 1.5.2 in Chapter 1.5 and which are mandatory in the sense that a line for each of them is required in every SDS even if they are not applicable or data is not available;

(b) Table A4.3.9.2 presents the proposed guidance for supplemental properties/safety characteristics and test results that may be useful when a substance or mixture is classified in the respective physical hazard class. The explanatory text above the table points out that data which are deemed relevant for a specific physical hazard but do not result in classification (e.g., negative test results close to the criterion) may also be useful to communicate.

(c) Table A4.3.9.3 presents the proposed guidance for further supplemental properties/safety characteristics and test results that may be useful for a substance or mixture. The explanatory text to this table also states that other physical properties/safety characteristics of the substance or mixture not identified in this table may also be useful to communicate.

6. The reason for this division into three tables is that the group found it useful to structure the properties for the purposes of giving guidance to the writer/preparer of the SDS (which is the purpose of Annex 4 to the GHS). However, the group agreed that this division into three tables is not necessarily useful for the reader/user of the SDS and therefore does not require or recommend applying the same layout to the SDS itself.

7. In order to clarify these considerations as well as possible, the group has come up with a refined text for the introductory paragraphs in A4.3.9 of Annex 4 (see the proposed text for A4.3.9.1 to A4.3.9.9 in Annex 1 to this document).

8. The introductory paragraphs A4.3.9.3 and A4.3.9.4 and the introductory text to Table A4.3.9.2 and Table A4.3.9.3 clearly state that information according to these tables is not required but is considered supplemental. As such data which have not been required so far, are not supposed to be made mandatory now. The main purpose is to harmonize the

nature of these data, if given, so that the reader/user of the SDS can benefit from a better consistency of Safety Data Sheets.

9. The complete formal proposal for the new text for Section 9 of Annex 4 is contained in Annex 1 to this document.

10. Detailed explanations for the amendments are given in Annex 3 to this document.

Amendments to Section 9 in Table 1.5.2 of Chapter 1.5

11. With regard to technical contents, amendments to Table 1.5.2 in Chapter 1.5 of the GHS are supposed to be kept to a minimum. The following addition and deletion are proposed:

- (a) "Particle characteristics" are proposed to be added because they are important information for health hazard assessment and for physical hazard classification of solids. In addition, they might address issues with regard to solids in specific forms such as nanomaterials or dusts.
- (b) The "evaporation rate" is proposed to be deleted because it is effectively covered by the vapour pressure, and all aspects that are important with regard to occupational safety and the risk of exposure can be dealt with based on the vapour pressure and the saturated vapour concentration.

12. In addition, the group made some amendments to the terms identifying the physicochemical properties such as "Kinematic viscosity" instead of "Viscosity" (because the kinematic viscosity is used in the context of classification for aspiration hazard) or "Boiling point or initial boiling point and boiling range" instead of "Initial boiling point and boiling range" (in order to cover also substances with a distinct boiling point). For the complete list of justifications, see Annex 3 to this document. These amendments should also be included in Table 1.5.2 of Chapter 1.5 for consistency.

13. As the correspondence group conducted their analysis, it found that the physical properties listed in Annex 4 Section 9 did not follow a logical sequence useful for evaluating data for product identification or for evaluating data for classification purposes. Therefore, the group proposes to modify Table 1.5.2 based on the following principles:

- (a) Basic information (physical state, colour, odour, melting point and boiling point) which help identify the substance/mixture are listed at the beginning,
- (b) then, further safety characteristics related to classification follow, and finally
- (c) more general properties are provided at the end of the Table.

14. The revised order of Section 9 of Table 1.5.2 would also include a footnote to the Table. The footnote explains that the order presented in Section 9 of Table 1.5.2 may be followed, but is not mandatory. The competent authority may decide to prescribe an order for Section 9 of the SDS, or they may leave it to the preparer/writer of the SDS to re-order the properties, if deemed appropriate.

15. The proposal would also require that the properties listed in Table A4.3.9.1 be ordered to reflect the updated change to Table 1.5.2.

16. **RATIONALE:** The proposed table will improve usability by the SDS reader by better grouping information and thereby enhance its improved use for the purposes of health and safety. First, it places the basic information earlier in the table for easy and quick identification. The table also groups properties by how they might be used in combination during classification or determining precautions for safe use. For example, flammable gas

classification uses the flammability range in its criteria as a distinguishing characteristic in determining the hazard category. For flammable liquids, one needs the flash point and the boiling point to classify into the correct hazard category. The pH can be used for skin and eye classification and for determining the appropriate personal protective equipment (PPE) for safe handling. Kinematic viscosity is used when classifying aspiration hazards, and finally, partition coefficient and solubility are used when classifying hazards to the aquatic environment.

17. The amendments to Section 9 in Table 1.5.2 of Chapter 1.5 reflecting these changes are shown in Annex 2 to this document.

18. Detailed explanations for the amendments are given in Annex 3 to this document.

Request to the Sub-Committee

19. The correspondence group on the revision of Section 9 of the SDS invites the Sub-Committee to consider the proposed text in annexes 1 and 2 to this document and to adopt it for inclusion in the next revised edition of the GHS.

20. In addition, the Sub-Committee is invited to consider whether the numbering with letters as contained in every section of Table 1.5.2 is really necessary and appropriate. For Section 9 in Table 1.5.2 it is proposed to include the list of properties without any numbering, which is in line with the proposed footnote explaining that the order of properties within a section is not mandatory (see Annex 2 to this document). This approach might be used in the other sections in Table 1.5.2 as well by deleting all letters preceding the properties.

21. Should the proposal be adopted, the correspondence group considers that its work on this item is completed and does not request its continuation during the next biennium.

Annex 1

Proposal for the new text for Section 9 of Annex 4

(The text in this Annex is formatted in accordance with the format used in the GHS)

Section 9 Replace current section 9 in Annex 4 of the GHS with the following:

“A4.3.9 SECTION 9: Physical and chemical properties and safety characteristics

A4.3.9.1 This section of Annex 4 provides guidance for SDS preparers and is provided for information purposes. This guidance does not prescribe how this information should be presented on the SDS. The guidance is divided into three tables as discussed below.

A4.3.9.2 Table A4.3.9.1 provides guidance on the physical and chemical properties specified by Chapter 1.5, Table 1.5.2. The SDS preparer should clearly describe/identify the physical and chemical properties specified in Table 1.5.2. In cases where the specific physical and chemical properties required by Table 1.5.2 do not apply or are not available under a particular subheading, this should be clearly indicated.

A4.3.9.3 Table A4.3.9.2 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.

A4.3.9.4 Table A4.3.9.3 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.

NOTE: *The properties in Tables A4.3.9.1, A4.3.9.2, and A4.3.9.3 may be presented with or without any division (that is, as a list). Also the order of the properties may be adjusted if deemed appropriate.*

A4.3.9.5 Generally, the information given in this section of the SDS should relate to standard conditions for temperature and pressure (temperature of 20 °C and absolute pressure of 101.3 kPa). If other conditions apply, these should be indicated together with the respective property.

A4.3.9.6 Data on the SDS should be provided in appropriate units. Where the data relate to a hazard class, the units of measure should be as specified in the criteria for that hazard class.

A4.3.9.7 If relevant for the interpretation of the information or numeric value given, indicate the determination method (e.g., open-cup/closed-cup for flash point) or state whether the value was calculated.

A4.3.9.8 In the case of a mixture, where valid data is available for the mixture as a whole, it should be provided. When data for the mixture as a whole cannot be provided, data for the most relevant ingredient(s) may be provided, and this data should clearly indicate to which ingredient(s) the data apply.

A4.3.9.9 Other appropriate physical or chemical parameters or safety characteristics, in addition to those listed below, may also be included in this section of the SDS.

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	<ul style="list-style-type: none"> – generally at standard conditions – for definitions for gas, liquid and solid see Chapter 1.2
Colour	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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. <ul style="list-style-type: none"> - 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

Property	Remarks/Guidance
Lower and upper explosion limit / flammability limit	<ul style="list-style-type: none"> - not applicable to solids - for flammable liquids indicate at least the lower explosion limit: <ul style="list-style-type: none"> - 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 <p><i>Note: Depending on the region of the world the term “explosion limit“ or “flammability limit” is used, but is supposed to mean the same.</i></p>
Flash point	<ul style="list-style-type: none"> - not applicable to gases, aerosols and solids - for information on test methods etc., see Chapter 2.6, paragraph 2.6.4.2 <p><u>for mixtures:</u></p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - applicable to gases and liquids only <p><u>for mixtures:</u></p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - applicable to self-reactive substance and mixtures and organic peroxides and other substances and mixtures which may decompose - indicate <ul style="list-style-type: none"> - 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 UN 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - applicable to liquids only - use preferably mm^2/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: $\text{Kinematic viscosity (mm}^2/\text{s)} = \frac{\text{Dynamic viscosity (mPa} \cdot \text{s)}}{\text{Density (g/cm}^3\text{)}}$ <ul style="list-style-type: none"> - for non-Newtonian liquids, indicate thixotropic or rheopexic behaviour

Property	Remarks/Guidance
Solubility	<ul style="list-style-type: none"> - 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)	<ul style="list-style-type: none"> - 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
Vapour pressure	<ul style="list-style-type: none"> - 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: $SVC \text{ (in ml/m}^3\text{)} = VP \text{ (in hPa = mbar)} \cdot 987.2$ $SVC \text{ (in mg/l)} = VP \text{ (in hPa = mbar)} \cdot MW \cdot 0.0412$ where <ul style="list-style-type: none"> - VP is the vapour pressure - MW is the molecular weight
Density and/or relative density	<ul style="list-style-type: none"> - applicable to liquids and solids only - generally at standard conditions - indicate as appropriate <ul style="list-style-type: none"> - 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 <p><i>Note: For clarity the SDS should indicate if absolute density (indicate units) and/or relative density (no units) is being reported.</i></p>

Property	Remarks/Guidance
Relative vapour density	<ul style="list-style-type: none"> - 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: $D_m = 1 + (34 \cdot VP_{20} \cdot 10^{-6} \cdot (MW - 29))$ where <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - applicable to solids only - indicate the particle size (median and range) - if available and appropriate, further properties may be indicated in addition, e.g. <ul style="list-style-type: none"> - 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 UN Manual of Tests and Criteria (referred to as the UN Manual in the following).

Chapter	Hazard class	Property/Safety characteristic/Test result and Remarks/Guidance
2.1	Explosives	<ul style="list-style-type: none"> – 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 UN Manual) (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 UN Manual) (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 UN Manual) (indicate at least + or –) – indicate the sensitiveness to impact, generally determined by test 3 (a) (section 13.4 of the UN Manual) (indicate preferably the limiting impact energy) – indicate the sensitiveness to friction, generally determined by test 3 (b) (section 13.5 of the UN Manual) (indicate preferably the limiting load) – indicate the thermal stability, generally determined by test 3 (c) (section 13.6 of the UN Manual) (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	<p><u>for pure flammable gases:</u></p> <ul style="list-style-type: none"> – 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 <p><u>for flammable gas mixtures:</u></p> <ul style="list-style-type: none"> – indicate the explosion / flammability limits, if tested (if classification as flammable is based on the calculation as per ISO 10156, assignment of cat. 1 is compulsory)
2.3	Aerosols	<ul style="list-style-type: none"> – 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)

Chapter	Hazard class	Property/Safety characteristic/Test result and Remarks/Guidance
2.4	Oxidizing gases	<p><u>for pure oxidising gases:</u></p> <ul style="list-style-type: none"> – indicate the C_i (coefficient of oxygen equivalency) as per ISO 10156 <p><u>for oxidising gas mixtures:</u></p> <ul style="list-style-type: none"> – indicate “Oxidising gas cat. 1 (tested as per ISO 10156)” for tested mixtures or indicate the calculated Oxidising Power (OP) as per ISO 10156
2.5	Gases under pressure	<p><u>for pure gases:</u></p> <ul style="list-style-type: none"> – indicate the critical temperature <p><u>for gas mixtures:</u></p> <ul style="list-style-type: none"> – indicate the pseudo-critical temperature; it is estimated as the mole weighted average of the critical temperatures of the components as follows: $\sum_{i=1}^n x_i \cdot T_{Crit_i}$ <p>where</p> <ul style="list-style-type: none"> - x_i is molar fraction of component i - T_{Crit_i} is the critical temperature of component i
2.6	Flammable liquids	<ul style="list-style-type: none"> – 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, in accordance with Note 2 in Chapter 2.6, section 2.6.2, is considered
2.7	Flammable solids	<ul style="list-style-type: none"> – indicate the burning rate (or burning time for metal powders), generally determined by Test N.1 (section 33.2.1 of the UN Manual) – indicate whether the wetted zone has been passed or not
2.8	Self-reactive substances and mixtures	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – indicate whether spontaneous ignition or charring of the filter paper occurs, generally determined by Test N.3 (section 33.3.1.5 of the UN Manual) (indicate e.g. “the liquid ignites spontaneously in air” or “a filter paper with the liquid chars in air”)
2.10	Pyrophoric solids	<ul style="list-style-type: none"> – 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 UN Manual) (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	<ul style="list-style-type: none"> – indicate whether spontaneous ignition occurs, include possible screening data and/or method used (generally Test N.4, section 33.3.1.6 of the UN Manual) 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

Chapter	Hazard class	Property/Safety characteristic/Test result and Remarks/Guidance
2.12	Substances and mixtures which, in contact with water, emit flammable gases	<ul style="list-style-type: none"> – 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 UN Manual), unless the test has not been completed e.g. because the gas ignites spontaneously
2.13	Oxidizing liquids	<ul style="list-style-type: none"> – indicate whether spontaneous ignition occurs when mixed with cellulose, generally determined by Test O.2 (section 34.4.2 of the UN Manual) (e.g., “the mixture with cellulose (prepared for Test O.2) ignites spontaneously”)
2.14	Oxidizing solids	<ul style="list-style-type: none"> – 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 UN Manual) (e.g., “the mixture with cellulose (prepared for Test O.1 or O.3) ignites spontaneously”)
2.15	Organic peroxides	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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 UN Manual), 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

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	<ul style="list-style-type: none"> – applicable to energetic substances and mixtures with an exothermic decomposition energy ≥ 500 J/g in accordance with the UN Manual, Appendix 6, section 3.3 (c) – indicate the sensitiveness to impact, generally determined by test 3 (a) (section 13.4 of the UN Manual) (indicate preferably the limiting impact energy) – indicate the sensitiveness to friction, generally determined by test 3 (b) (section 13.5 of the UN Manual) (indicate preferably the limiting load)
SAPT (self-accelerating polymerization temperature)	<ul style="list-style-type: none"> – 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	<ul style="list-style-type: none"> – 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 <ul style="list-style-type: none"> - 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 <p><i>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).</i></p> <p><i>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.</i></p>
Acid/alkaline reserve	<ul style="list-style-type: none"> – applicable to substances and mixtures which have an extreme pH ($\text{pH} \leq 2$ or ≥ 11.5) – indicate acid/alkaline reserve when used for evaluating skin and eye hazards

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* VDI stands for “Verein Deutscher Ingenieure”

Annex 2

Proposal for the revised text for Section 9 in Table 1.5.2 of Chapter 1.5 and for a new footnote to Table 1.5.2

(The text in this Annex is formatted in accordance with the format used in the GHS)

Table 1.5.2 in Chapter 1.5 Replace the row for section 9 “Physical and chemical properties” and insert a new note at the end of the table as follows:

“

9.	Physical and chemical properties	Physical state; Colour; Odour; Melting point / freezing point; Boiling point or initial boiling point and boiling 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.
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NOTE (to Table 1.5.2): *The order of the physical and chemical properties presented in Section 9 may be followed on the SDS as shown in this table, but is not mandatory. The competent authority may decide to prescribe an order for Section 9 of the SDS, or they may leave it to the preparer of the safety data sheet to re-order the properties, if deemed appropriate.”*

Annex 3

Justification and detailed explanations for the proposed amendments

Amendments to the terms themselves in Table A4.3.9.1 and hence in Section 9 of Table 1.5.2

1. The foreseen terms "Physical state" and "Colour" are supposed to replace the current term "Appearance". The term appearance actually consists of more than one kind of information (as pointed out by the parenthesized remark it contains). It therefore is divided into two lines to reflect this. A reference to the definitions for gas, liquid and solid is added for clarification.
2. The foreseen term "Odour" is supposed to combine the current terms "Odour" and "Odour threshold". The new line for the odour contains a specific remark in the "Remarks/Guidance"-column in which it is clarified that the odour threshold should only be indicated if that information is available anyway. Data with regard to the odour threshold should not be newly generated because of health concerns.
3. The term "Melting point/freezing point" is not changed.
4. The foreseen term "Boiling point or initial boiling point and boiling range" is just an amendment of the current term "Initial boiling point and boiling range" in order to cover not only mixtures but also substances for which a distinct boiling point can be indicated.
5. The foreseen term "Flammability" is replacing the current term "Flammability (solid, gas)". It is supposed to be applicable regardless of the physical state. Although flammability is covered by the hazard classification in accordance with Table A4.3.9.2, it is kept in Table A4.3.9.1 because it is supposed to be mandatory information (as it has been before).
6. The foreseen term "Lower and upper explosion limit / flammability limit" is used instead of "Upper/lower flammability or explosive limits" in order to reflect the common way of indicating the lower limit first and in order to use the correct term explosion limit instead of explosive limit.
7. The term "Flash point" is not changed.
8. The term "Auto-ignition temperature" is not changed.
9. The term "Decomposition temperature" is not changed.
10. The term "pH" is not changed.
11. The foreseen term "Kinematic viscosity" is an amendment of the term "Viscosity" because it is the kinematic viscosity which is used in the context of classification for aspiration hazard. The relation of the kinematic viscosity and the dynamic viscosity are indicated in addition in case the preparer/writer of the SDS wants to indicate both values.
12. The term "Solubility" is not changed (except that singular is used instead of plural in order to be in line with the general wording).
13. The foreseen term "Partition coefficient n-octanol/water (log value)" is just amended by the parenthesized expression (log value) in order to be more specific.
14. The term "Vapour pressure" is not changed.

15. The foreseen term "Density and/or relative density" is an amendment of the current line for the "Relative density". It is supposed to also allow for the (absolute) density and not only for the relative density.

16. The foreseen term "Relative vapour density" is an amendment of the current line for the "Vapour density" in order to be unambiguous. Furthermore, it gives additional guiding information on the relative density of the vapour/air-mixture.

17. The foreseen term "Particle characteristics" is added because these are important information for health hazard assessment and for physical hazard classification of solids. In addition, such information might address issues with regard to solids in specific forms such as nanomaterials or dusts.

18. The term "Evaporation rate" is proposed to be deleted because it is effectively covered by the vapour pressure and all aspects that are important with regard to occupational safety and the risk of exposure can be dealt with based on the vapour pressure and the saturated vapour concentration which is also explained in the line for the vapour pressure.

Additional information contained in the new column "Remarks/Guidance" in Table A4.3.9.1

19. The current section 9 of Annex 4 just lists the same properties as currently already listed in Table 1.5.2 of Chapter 1.5 and does not give any additional guiding information (although this is the headline and purpose of Annex 4). This is also reflected in many SDS on the market in which different kind of data can be found under one and the same headline, sometimes even without the necessary clarifying information (e.g. data are indicated for individual ingredients of mixtures without that this is stated explicitly etc.).

20. Therefore the terms as contained in Table A4.3.9.1 are supported by guiding information in a second column called "Remarks/Guidance". The following guiding information is given in that column:

- (a) In case the required information/data is not applicable to all substances/mixtures this is stated explicitly. Examples are the pH which is not applicable to gases or the kinematic viscosity which is applicable to liquids only.
- (b) Further guiding information includes the applicable conditions, especially if also data under other than standard conditions might be useful and what kind of data is expected to be given.
- (c) In some cases it also points out additional data which might be of interest, such as the relation between the expected data for the kinematic viscosity and the (supplemental) data on the dynamic viscosity.
- (d) For some entries it gives additional guiding information with regard to mixtures, especially when it is known that information on the mixtures as a whole often is not available for the respective entry.

21. Apart from the above explanations, it is hoped that the guiding information as foreseen for the "Remarks/Guidance" column is self-explanatory. With this guiding information it is hoped that the consistency and quality of SDS is facilitated and possibly improved.

Order of the properties given in Table A4.3.9.1 and in Table 1.5.2

22. The order in which the properties are listed in Table 1.5.2 is revised, based on the following principles:

- (a) Basic information (physical state, colour, odour, melting point and boiling point) which help identify the substance/mixture are listed in the beginning,
- (b) then further safety characteristics related to classification follow, and finally
- (c) more general properties are provided at the end of the Table.

23. The revised order of section 9 of Table 1.5.2 would also include a footnote to the Table. The footnote explains that the order presented in section 9 of Table 1.5.2 may be followed, but is not mandatory. The competent authority may decide to prescribe an order for section 9 of the SDS, or they may leave it to the preparer of the SDS to re-order the properties, if deemed appropriate.

24. The proposal would also require that the properties listed in Table A4.3.9.1 be ordered to reflect the updated change to Table 1.5.2.

25. Rationale: The proposed table would help improve health and safety because it puts the important information earlier in the table and groups properties by how they might be used in combination during classification. For example, flammable gas classification uses the flammability range in its criteria as a distinguishing characteristic in determining the category. For flammable liquids, one needs flash point and boiling point to classify into the correct category. The pH can be used when evaluating skin and eye hazards. Kinematic viscosity is used when classifying aspiration hazards, and finally, partition coefficient and solubility are used when classifying hazards to the aquatic environment.

Additional Table A4.3.9.2

26. So far, there is no section in the SDS foreseen in which the data available which was used to classify physical hazards is to be identified (equivalent to for example data in accordance with section 11 based on which health hazards were identified).

27. However, such data may be useful with regard to occupational safety: Just as it is important not only to know the hazard class and category of a flammable liquid but also its flash point (and boiling point) in order to select the most appropriate occupational safety measures as good as possible, the same holds for other physical hazard classes.

28. For that purpose, Table A4.3.9.2 lists properties/safety characteristics and test results that may be useful when a substance or mixture is classified in the respective physical hazard class.

29. It is also pointed out that 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.

30. As these data have not been required so far, they are not supposed to be made mandatory. This is clearly pointed out in the headline of the table as well as in the foreseen introductory text (see paragraph A4.3.9.3). The main purpose is to harmonize the nature of these data, if given, so that the reader/user of the SDS can benefit from a better consistency of SDS.

Additional Table A4.3.9.3

31. The group has identified some further safety characteristics which may be useful for the user of the SDS. These were not contained in the current section 9 of Annex 4 nor are they directly related to a physical hazard class. Therefore, these characteristics are compiled in a third Table A4.3.9.3.

32. Just as the data according to Table A4.3.9.2, these data have not been required so far, and they are not supposed to be made mandatory with this proposal. This is clearly pointed out in the headline of the table as well as in the foreseen introductory text (see paragraph A4.3.9.4) using a very similar wording to the one used for Table A4.3.9.2. The main purpose is to harmonize the nature of these data, if given, so that the reader/user of the SDS can benefit from a better consistency of SDS.
