



**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-seventh session**

Geneva, 2 (afternoon) – 4 July 2014

Item 4 (a) of the provisional agenda

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 reports about the status of work of the informal correspondence group on the revision of Section 9 of the Safety Data Sheet (SDS). This report is presented as a formal document in order to give delegations enough time to consider the work adequately. It is not making a formal proposal at this time. A formal proposal for inclusion in the new revised edition of the GHS is intended to be submitted for the twenty-eight session in December 2014.

Status of work**Revision of section 9 of Annex 4**

2. As outlined in previous reports, the group had decided to introduce guidance for each of the properties given in section 9 of the SDS in Annex 4. 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.

3. The group agreed to divide the properties/data required in section 9 of the SDS into three tables as regards their layout in Annex 4 of the GHS.

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)).

- (a) Table A4.3.9.1 is foreseen for the basic physicochemical properties and safety characteristics required by 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 lists properties/safety characteristics and test results that may be useful 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, but is not required on the SDS.
- (c) Table A4.3.9.3 lists further properties/safety characteristics and test results that may be useful 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, but are not required on the SDS.

4. 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 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 recommend to apply the same layout to the SDS itself.

5. In order to clarify these considerations as good as possible, the group has come up with a refined text for the introductory paragraphs in A4.3.9 of Annex 4.

6. The current status of this work, i.e. the draft text for section 9 of Annex 4, is presented in Annex 1 to this document.

Amendments to item No. 9 in Table 1.5.2 of Chapter 1.5

7. Amendments to Table 1.5.2 in Chapter 1.5 of the GHS are supposed to be kept to an absolute minimum. The following two changes are foreseen:

- (a) 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;
- (b) 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, it might address issues with regard to solids in specific forms such as nanomaterials or dusts.

8. In addition, the group made some editorial amendments to the terms identifying the physicochemical properties such as "Kinematic viscosity" instead of "Viscosity" and to the order of the properties. These amendments should also be taken over in Table 1.5.2 of Chapter 1.5 for consistency.

9. The amendments to item No. 9 in Table 1.5.2 of Chapter 1.5 reflecting these changes are shown in Annex 2 to this document.

Request to the Sub-Committee and further work

10. The correspondence group on the revision of Section 9 of the SDS **invites the Sub-Committee** to consider the draft text that has been worked out so far and to make comments or suggestions as deemed necessary.

11. After consideration of the comments received, the group will submit a revised formal proposal for the next session with a view to having the work finished within this biennium.

Annex 1

Draft text for section 9 in Annex 4

“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).*

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)
Density	<ul style="list-style-type: none"> – applicable to liquids and solids only – generally at standard conditions – indicate the density or bulk-density, as applicable – 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
Relative 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 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 and MW is the molecular weight

Property	Remarks/Guidance
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
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 <i>VP</i> is the vapour pressure and <i>MW</i> is the molecular weight
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
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

Property	Remarks/Guidance
Kinematic viscosity	<ul style="list-style-type: none"> – 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: $\text{Kinematic viscosity (mm}^2/\text{s)} = \frac{\text{Dynamic viscosity (mPa} \cdot \text{s)}}{\text{Density (g/cm}^3\text{)}}$ – for non-Newtonian liquids indicate thixotropic or rheopexic behaviour
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
Lower and upper explosion / flammability limits	<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, section 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	<i>(this entry will also be completed but is still under discussion)</i>

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

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 can 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, paragraph 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 (including chemically unstable 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 A4.9.3.1 – 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 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 percentage 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 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 x_i is molar fraction of component i and T_{Crit_i} is the critical temperature of component i</p>
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 A4.9.3.1 – indicate information on sustained combustibility if exemption based on Test L.2, in accordance with Note 2 in chapter 2.6, paragraph 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"> – indicate the decomposition energy (value and method of determination) – indicate the SADT (self-accelerating decomposition temperature) together with the volume the SADT relates to – 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"> – indicate the SADT (self-accelerating decomposition temperature) together with the volume the SADT relates to – 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) – indicate the decomposition energy (value and method of determination), if available
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

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: <ul style="list-style-type: none"> • sensitiveness to impact, generally determined by test 3 (a) • sensitiveness to friction, generally determined by test 3(b)
SADT (self-accelerating decomposition temperature)	<ul style="list-style-type: none"> – applicable to substances and mixtures which may generate dangerous amounts of heat and gas, or vapour under normal conditions and which are not stabilized – indicate the volume for which the SADT 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 (Kst) • maximum explosion pressure – indicate the particle characteristics to which the data applies if different from the particle characteristics which are indicated based on Table A4.3.9.1 <p>NOTE 1: <i>The ability to form explosive dust/air mixtures may be determined e.g. by VDI* 2263-1 (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>NOTE 2: <i>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>

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* VDI stands for "Verein Deutscher Ingenieure"

Annex 2**Amendments to item No. 9 in Table 1.5.2 of Chapter 1.5**

Draft text for item No. 9 in Table 1.5.2 of Chapter 1.5

"9.	Physical and chemical properties	(a) Physical state; (b) Colour; (c) Odour; (d) Density; (e) Relative density; (f) Melting point / freezing point; (g) Boiling point or initial boiling point and boiling range; (h) Vapour pressure; (i) Solubility (j) Partition coefficient n-octanol/water (log value); (k) pH; (l) Kinematic viscosity; (m) Particle characteristics; (n) Lower and upper explosion / flammability limits (o) Flash point (p) Auto-ignition temperature; (q) Decomposition temperature."
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