

**Committee of Experts on the Transport of Dangerous Goods
and on the Globally Harmonized System of Classification
and Labelling of Chemicals**

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**Issues relating to the Globally Harmonized System
of Classification and Labelling of Chemicals:
review of Chapter 2.1**

**Sub-Committee of Experts on the Globally Harmonized
System of Classification and Labelling of Chemicals**

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Item 3 (b) of the provisional agenda

**Classification criteria and related hazard
communication: review of Chapter 2.1**

Consolidated version of the new GHS Chapter 2.1

Transmitted by the expert from Sweden

This document contains the text of GHS Chapter 2.1 as amended in accordance with the proposals in documents ST/SG/AC.10/C.3/2020/20-ST/SG/AC.10/C.4/2020/5 and ST/SG/AC.10/C.3/2020/20/Add.1-ST/SG/AC.10/C.4/2020/5/Add.1. The amendments proposed in document ST/SG/AC.10/C.3/2020/20/Add.1-ST/SG/AC.10/C.4/2020/5/Add.1 are shown as follows:

- new text: **bold, underlined**

- deleted text: ~~**bold, strikethrough**~~

“CHAPTER 2.1 EXPLOSIVES

2.1.1 Definitions and general considerations

2.1.1.1 Definitions

An *explosive substance or mixture* is a solid or liquid substance or mixture which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances and mixtures are included even when they do not evolve gases.

A *pyrotechnic substance or mixture* is a substance or mixture designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions.

An *explosive article* is an article containing one or more explosive substances or mixtures.

Division means the classification of an explosive substance, mixture or article according to Part I of the *Manual of Tests and Criteria* and relates to it being in a certain configuration.

Primary packaging means the minimum level of packaging of a configuration assigned to a division, in which the explosive substance, mixture or article is intended to be retained until use.

NOTE: Divisions are generally assigned for the purpose of transport and may be subject to further packaging specifications according to the UN Model Regulations to be valid.

2.1.1.2 Scope

2.1.1.2.1 Except as provided in 2.1.1.2.2, the class of explosives comprises

- (a) Explosive substances and mixtures;
- (b) Explosive articles, except devices containing explosive substances or mixtures in such quantity or of such a character that their inadvertent or accidental ignition or initiation shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise; and
- (c) Substances, mixtures and articles not mentioned under (a) and (b) above which are manufactured with the view to producing a practical explosive or pyrotechnic effect.

2.1.1.2.2 The following substances, mixtures and articles are excluded from the class of explosives:

- (a) Ammonium nitrate based emulsions, suspensions or gels which meet the criteria of Test series 8 of the *Manual of Tests and Criteria* for classification as ANEs of Category 2 oxidizing liquids (Chapter 2.13) or Category 2 oxidizing solids (Chapter 2.14).
- (b) Substances and mixtures which meet the criteria for classification as desensitized explosives according to the criteria of Chapter 2.17.
- (c) Substances and mixtures which have not been manufactured with the view to producing, in themselves, an explosive or pyrotechnic effect and which:
 - (i) are self-reactive substances and mixtures according to the criteria of Chapter 2.8; or

- (ii) are organic peroxides according to the criteria of Chapter 2.15; or
- (iii) are deemed not to have explosive properties on basis of the screening procedures in Appendix 6 of the *Manual of Tests and Criteria*; or
- (iv) are too insensitive for inclusion in the hazard class according to Test series 2 of the *Manual of Tests and Criteria*; or
- (v) are excluded from assignment within Class 1 of the *UN Model Regulations* based on results in Test series 6 of the *Manual of Tests and Criteria*.

~~(d) Articles containing explosives which are allowed for transport but excluded from Class 1 by specific UN numbers and associated special provisions according to the Dangerous Goods List of the *UN Model Regulations*, and which are in the transport configuration.~~

NOTE: Performing Test series 2 requires a substantial amount of material, which may not be available in the initial stages of research and development. Substances and mixtures in the research and development phase for which not enough material exists to perform Test series 2 of the Manual of Tests and Criteria may, for the purpose of further scientific characterisation, be regarded as self-reactive substances and mixtures Type C (see Chapter 2.8), provided that:

- (i) *The substance or mixture is not manufactured with the view to producing an explosive or pyrotechnic effect; and*
- (ii) *The decomposition energy of the substance or mixture is less than 2000 J/g; and*
- (iii) *The result in test 3(a) and test 3(b) of the Manual of Tests and Criteria is negative; and*
- (iv) *The result in test 2(b) of the Manual of Tests and Criteria is “no explosion” at an orifice diameter of 6 mm; and*
- (v) *The expansion of the lead block in Test F.3 of the Manual of Tests and Criteria is less than 100 ml per 10 gram substance or mixture.*

2.1.1.3 Other considerations

2.1.1.3.1 *The relation to the classification according to the UN Model Regulations*

The GHS classification of substances, mixtures and articles as explosives builds largely on the classification used for transport according to the *UN Model Regulations*. Information on their transport division and, when available, some of the underlying test results according to Part I of the *Manual of Tests and Criteria*, is therefore relevant for the GHS classification. **Where appropriate, analogy to tested explosives may be used, taking into consideration whether changes to the configuration may affect the hazard posed compared to the tested configuration, and being narrowly limited according to the quantity, packaging and design of the explosive.** While the transport divisions are designed for the purpose of safe transportation of explosives, the GHS classification draws from this classification to ensure appropriate hazard communication in other sectors, in particular supply and use. In doing this, any mitigating effects of the transport configuration on the explosive behaviour, such as a particular packaging, are evaluated as they may not be present in sectors outside of transport.

2.1.1.3.2 *The configuration dependence of the division*

Entry into the hazard class of explosives is based on the intrinsic explosive properties of substances and mixtures. The assignment to a division, however, is also dependent on the configuration using packaging, and the incorporation into articles of such substances and mixtures. The division is the relevant level of classification when the explosive is in the configuration to which the division was assigned, e.g. when transported or stored, and may form the basis for explosives licencing and safety

measures such as distance requirements. The hazard categories, on the other hand, are the relevant level of classification for the safe handling.

2.1.1.3.3 *The hierarchy of the categories*

Category 2 only contains explosives which have been assigned to a division and corresponds to Class 1 of the *UN Model Regulations*. The sub-categories within Category 2 classify explosives on basis of the hazardous behaviour of the explosive in its primary packaging or, where applicable, of the explosive article alone. An explosive that has not been assigned to a division is classified in Category 1 of the hazard class of explosives. This may be because it is considered too dangerous to be assigned a division, or because it is not (yet) in a suitable configuration to assign it to a division. Explosives in Category 1 are therefore not necessarily more hazardous than explosives in Category 2.

2.1.1.3.4 *Change of classification over the life cycle*

As the assignment to a division depends on the configuration, the classification of an explosive may change over its life cycle as a result of reconfiguration. An explosive that was assigned to a division in a certain configuration, and hence classified in a sub-category within Category 2, no longer retains that division when out of that configuration. If assigned to another division in the new configuration, it may need to be classified in another sub-category within Category 2, and if not assigned a to division it should be classified in ~~to~~ Category 1. However, the use of an explosive, meaning the preparation and intentional functioning, including removal from the primary packaging for functioning or installation or deployment in readiness for functioning, is not intended to require such re-classification.

2.1.1.3.5 *Exclusions from the hazard class*

Some substances, mixtures and articles that have explosive properties are excluded from the hazard class of explosives because they are not considered sensitive enough or because they do not present a significant explosion hazard in a particular configuration. The safety data sheet is an appropriate means to convey information on explosive properties for such substances and mixtures, and the explosion hazards of such articles (see Chapter 1.4).

2.1.2 **Classification criteria**

2.1.2.1 Explosive substances, mixtures and articles of this class are classified into one of two categories, **and for Category 2 into one of three sub-categories**, according to the following table:

Category	Sub-category	Criteria
1		Explosive substances, mixtures and articles which (a) have not been assigned a division and which (i) are manufactured with the view of producing an explosive or pyrotechnic effect; or (ii) are substances or mixtures which show positive effects when tested in Test series 2 of the <i>Manual of Tests and Criteria</i> or (b) are out of the primary packaging of the configuration to which a division was assigned ^a , unless they are explosive articles assigned to a division: (i) without a primary packaging; or (ii) in a primary packaging that does not attenuate the explosive effect, taking into account also intervening packaging material, spacing or critical orientation.
2	2A	Explosive substances, mixtures and articles which have been assigned: (a) Division 1.1, 1.2, 1.3, 1.5 or 1.6; or (b) Division 1.4 and are not meeting the criteria for sub-category 2B or 2C. ^b
	2B	Explosive substances, mixtures and articles which have been assigned to Division 1.4 and a compatibility group other than S, and which: (a) do not detonate and disintegrate when functioned as intended; and (b) exhibit no high hazard event ^c in test 6(a) or 6(b) of the <i>Manual of Tests and Criteria</i> ; and (c) do not require attenuating features, other than that which may be provided by a primary packaging, to mitigate a high hazard event ^c .
	2C	Explosive substances, mixtures and articles which have been assigned to Division 1.4 compatibility group S, and which: (a) do not detonate and disintegrate when functioned as intended; and (b) exhibit no high hazard event ^c in test 6(a) or 6(b), or in the absence of these test results, similar results in test 6(d) of the <i>Manual of Tests and Criteria</i> ; and (c) do not require attenuating features, other than that which may be provided by a primary packaging, to mitigate a high hazard event ^c .

^a Explosives in Category 2 that are removed from their primary packaging for use remain classified in Category 2, see 2.1.1.3.4.

^b The manufacturer, supplier or competent authority may classify an explosive of Division 1.4 as sub-category 2A on basis of data or other considerations even if it meets the technical criteria for sub-category 2B or 2C.

^c A high hazard event is exhibited when performing test 6(a) or 6(b), according to the *Manual of Tests and Criteria*, by:

- (a) a significant change in the witness plate shape, such as perforation, gouge, substantial dent or bowing; or
- (b) instantaneous scattering of most of the confining material.

2.1.2.2 The Divisions are as follows:

- (a) Division 1.1: Substances, mixtures and articles which have a mass explosion hazard (a mass explosion is one which affects almost the entire quantity present virtually instantaneously);
- (b) Division 1.2: Substances, mixtures and articles which have a projection hazard but not a mass explosion hazard;
- (c) Division 1.3: Substances, mixtures and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard:
 - (i) combustion of which give rise to considerable radiant heat; or
 - (ii) which burn one after another, producing minor blast or projection effects or both;
- (d) Division 1.4: Substances and articles which present no significant hazard: substances, mixtures and articles which present only a small hazard in the event of ignition or initiation. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire shall not cause virtually instantaneous explosion of almost the entire contents of the package;
- (e) Division 1.4 compatibility group S: Substances, mixtures and articles so packed or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder fire-fighting or other emergency response efforts in the immediate vicinity of the package.
- (f) Division 1.5: Very insensitive substances or mixtures which have a mass explosion hazard: substances and mixtures which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions. The probability of transition from burning to detonation is greater when large quantities are present.
- (g) Division 1.6: Extremely insensitive articles which do not have a mass explosion hazard: articles which predominantly contain extremely insensitive substances or mixtures and which demonstrate a negligible probability of accidental initiation or propagation. The hazard from articles of Division 1.6 is limited to the explosion of a single article.

NOTE 1: For some regulatory purposes, the divisions are further subdivided into compatibility groups which identify the kinds of explosives that are deemed to be compatible (see 2.1.2 of the UN Model Regulations, Chapter 2.1).

NOTE 2: While Division 1.4 compatibility group S is not a division of its own, this classification corresponds to a separate division based on additional criteria.

NOTE 3: For classification tests on explosive substances or mixtures, the tests should be performed on the substance or mixture as presented. If for example, for the purposes of supply or transport, the same substance or mixture is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, it must also be tested in the new form.

2.1.3 Hazard communication

General and specific considerations concerning labelling requirements are provided in Hazard communication: Labelling (Chapter 1.4). Annex 1 contains summary tables about classification and labelling. Annex 3 contains examples of precautionary statements and pictograms which can be used where allowed by the competent authority.

Category	1	2		
Sub-category	<i>Not applicable</i>	2A	2B	2C
Symbol ^a	Exploding bomb	Exploding bomb	Exploding bomb	Exclamation mark
Signal word	Danger	Danger	Warning	Warning
Hazard statement	Explosive	Explosive	Fire or projection hazard	Fire or projection hazard
Additional hazard statement	Very sensitive ^b <i>or</i> May be sensitive ^c	<i>Not applicable</i>	<i>Not applicable</i>	<i>Not applicable</i>

^a For divisions 1.4, 1.5 and 1.6 no symbol appears on the label for transport, according to the UN Model Regulations.

^b To be assigned additionally to explosives that are sensitive to initiation as determined by test series 3 or 4 of the Manual of Tests and Criteria. May also be applied to explosives sensitive to other stimuli, e.g. electrostatic discharge.

^c To be assigned additionally to explosives for which sufficient information on their sensitivity to initiation is not available.

NOTE: Substances and mixtures excluded by 2.1.1.2.2 (c), point (v) still have explosive properties. The user should be informed of these intrinsic explosive properties because they have to be considered for handling – especially if the substance or mixture is removed from its packaging or is repackaged – and for storage. For this reason, the explosive properties of the substance or mixture should be communicated in Sub-section 2.3 (Other hazards which do not result in classification) and Section 9 (Physical and chemical properties) or 10 (Stability and reactivity) of the Safety Data Sheet in accordance with Table 1.5.2, and other sections of the Safety Data Sheet, as appropriate.

~~Similarly, articles excluded by 2.1.1.2.2 d) may still pose an explosion hazard which should be conveyed in Sub-section 2.3 of the Safety Data Sheet, and in other sections as appropriate.~~

2.1.4 Decision logic and guidance

The decision logic and guidance, which follow, are not part of the harmonized classification system, but have been provided here as additional guidance. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

2.1.4.1 Decision logic

[DECISION LOGIC FLOWCHARTS TO BE INSERTED]

2.1.4.2 Description of explosion hazard levels

Sub-category	Explosion hazard level
2A	Sub-category 2A represents a high explosion hazard. An explosive in this sub-category has the potential to cause complete destruction of objects and lethal or very severe injuries to persons.
2B	Sub-category 2B represents a medium explosion hazard. An explosive in this sub-category has the potential to cause serious damage to objects and serious injuries to persons. Injuries may result in permanent impairment.
2C	Sub-category 2C represents a low explosion hazard. An explosive in this sub-category can cause minor damage to objects and moderate injuries to persons. Injuries would not normally result in permanent impairment.

2.1.4.3 Principles of explosives classification

2.1.4.3.1 *Assigning explosives to divisions by testing*

2.1.4.3.1.1 Explosives are assigned to divisions based on testing of specific configurations, which quantifies levels of blast, projections and fire. Formation of a configuration provides a level of protection from outside stimuli and fixes the sensitivity and hazard magnitude, which enables the assignment to a division. The divisions therefore describe the explosive behaviour in the particular configuration. Such descriptions reflect attenuating properties of the packaging and article, which may include spacing, or specific orientations of explosive articles to mitigate an explosive effect. The configuration is further controlled by design and packaging requirements specified in the *UN Model Regulations*.

2.1.4.3.1.2 Although divisions are not valid outside of the configurations to which they were assigned, they may still be used as a basis for regulatory measures in storage and handling when these configurations are modified. This normally presumes that additional safety measures are taken to account for the modified configurations, e.g. aggregate quantity limits and protective building designs.

2.1.4.3.2 *Assigning explosives to divisions based on analogy*

While classification in a division or a sub-category is based on testing in accordance with Part I of the *Manual of Tests and Criteria*, similar explosives configurations may be classified without testing, where appropriate, based on analogy to tested explosives. The use of analogy should take into consideration whether changes to the configuration may affect the hazard posed compared to the tested configuration, and is narrowly limited according to the quantity, packaging and design of the explosive.

2.1.4.3.3 *Assigning explosives to sub-categories*

2.1.4.3.3.1 Assignment to subcategories within Category 2 builds on the information provided by the division to better reflect the hazard of the explosive in its primary packaging, which is intended to be retained until use. The primary packaging is all or part of the original tested configuration. It is normally the immediate container or the innermost packaging layer and may include attenuating properties which mitigate hazardous effects. However, only flexible inner packaging such as a thin-wall plastic bag or other unsubstantial material which provides negligible attenuation of explosive effects should not be considered the primary packaging. As explosives are unpackaged from their primary packaging they may present greater sensitivity or blast, projection or fire hazards. Retaining the primary packaging until use and limiting the amount of unpacked explosives are therefore generally important safety measures when handling explosives. When an explosive is installed or deployed and is later removed from use without initiation, it should be replaced in its primary packaging or an identical primary packaging.

2.1.4.3.3.2 Multiple explosive articles may sometimes be supplied where they are in direct contact without any intervening packaging material or spacing, or critical orientation. Provided all applicable classification evaluation occurred in this configuration, their primary packaging can be discarded without affecting the classification.

2.1.4.3.3.3 Occasionally, larger explosive articles are supplied without any packaging, e.g. in a handling device such as a cradle. In these cases, there may be no primary packaging, i.e. the classification is of the article as such. Handling devices that do not affect the classification can be discarded.

2.1.4.3.4 *Classification ~~during explosives manufacturing and processing of explosives in situations where they cannot be assigned to a division~~*

2.1.4.3.4.1 Explosives in manufacturing, ~~and~~ processing **and otherwise unfinished stages** cannot be assigned to a division until configured for transport, and hence are assigned to Category 1. Similarly, explosives assigned to Category 2 when taken out of their primary packaging for purposes other than use, are re-assigned to Category 1 (unless their primary packaging can be discarded, see 2.1.4.3.3).

2.1.4.3.4.2 The sensitivity and hazard severity of unpackaged explosives ~~in manufacturing and processing~~ is dependent on non-intrinsic parameters related to the methods used, including quantity, depth, confinement, initiation stimulus, composition, physical state such as particle size, etc. The hazards posed by explosives in Category 1 thus vary extensively and may also vary dynamically as they flow through a process. For these reasons, the hazard communication for Category 1 cannot provide any details regarding the explosive behaviour. Process hazards analysis and risk management principles should be applied in these cases to identify and manage the risk of processes in accordance with best practices and applicable regulations.

2.1.4.3.5 *Safety ~~during explosives manufacturing and processing related to explosives failing Test series 3 or 4~~*

Category 1 also includes explosives that fail Test series 3 or **Test series** 4 as configured, having an unacceptable level of sensitivity to stimuli encountered during transport. ~~These tests and their~~ **The** thresholds **of these tests** may not be representative of the energy levels encountered during explosives processing and manufacturing. ~~and~~ **Furthermore, these tests** do not include all types of stimuli that may be encountered, such as electrostatic discharge. ~~Therefore, further~~ **Additional** investigations of the properties of the explosive at hand ~~and appropriate risk management are may~~ **thus be** needed for safe processing and handling.”
