
**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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**Sub-Committee of Experts on the
Transport of Dangerous Goods**

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Item 2 (b) of the provisional agenda

**Recommendations made by the Sub-Committee on
its fifty-first, fifty-second and fifty-third sessions
and pending issues: explosives and related matters**

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

Thirty-sixth session

Geneva, 5-7 December 2018

Item 3 (b) of the provisional agenda

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

**Technical explosives classification and detailed criteria
flowchart support for sub-category 2 of explosives in the
GHS Chapter 2.1**

**Transmitted by the United States of America, the Institute of Makers of
Explosives (IME) and the Sporting Arms and Ammunition
Manufacturer's Institute (SAAMI)**

Background

1. At the thirty-fifth session (July 2018), the GHS Sub-Committee noted and welcomed the progress achieved by the informal correspondence group since the last session, through discussions at the Informal Correspondence group (ICG) meetings and parallel to the fifty-third session of the TDG Sub-Committee, jointly with the Working Group on Explosives (ST/SG/AC.10/C.4/70 paragraph 24).
2. Additionally, the GHS Sub-Committee also noted that there were still ongoing discussions on hazard communication and other issues and that an attempt to finalize the classification criteria will be made with the aim of submitting a proposal to the next session. To complete the task of updating Chapter 2.1, however, the work would have to be continued into the next biennium (ST/SG/AC.10.C.4/70 paragraph 26).
3. Experts from the United States of America, IME and SAAMI (US task force) appreciate the significant work and progress made by the ICG under the leadership of the expert from Sweden. The US task force has participated in ICG discussions, the 2018 IGUS EPP¹/CIE² meetings, joint UN TDG/GHS meetings, and dedicated significant time intersessionally to discuss and reach consensus on key principles of explosives classification in the context of the GHS.

¹ International Group of Experts on the Explosion Risks of Unstable Substances (IGUS), Explosives, Propellants, and Pyrotechnics working group (EPP)

² Chief Inspectors of Explosives

Introduction

4. This paper builds on the proposals and discussions developed at the July 2018 Sub-Committees meetings in Geneva and, proposes detailed criteria for Category 2 sub-categories intended to supplement ST/SG/AC.10/C.3/2018/85 - ST/SG/AC.10/C.4/2018/20. Additionally, this paper proposes an associated flowchart that augments the flowcharts in the above referenced documents.

5. The US task force volunteered to develop and propose detailed criteria, utilizing available transport classification data and protocol to assign explosives in their primary packaging to the Category 2 Sub-categories 2A (High Hazard), 2B (Medium Hazard), and 2C (Low Hazard) respectively. The following outlines the US task force approach to developing the Category 2 Sub-category detailed criteria.

Classification Approach

6. Building on the fact that transport packaging often provides mitigating effects for explosives, the US task force developed evaluation criteria utilizing clearly defined and applied packaging terminology. Two new definitions are proposed:

(a) The “primary packaging” is the minimum level of packaging that a) is responsible for preventing a violent reaction when a violent reaction is prevented by packaging, and b) will be retained until use of the explosive. The primary package is part or all of the configuration tested for assignment of a transport division. Although there may be cases where the primary packaging is synonymous with the transport inner packaging³, in some cases this may not be true, e.g. if the innermost layer is a bag which provides no attenuation of explosive effects, or if the configuration consists of only a single layer, e.g. a drum, in which case the drum is the primary packaging. For explosive articles, it may be possible for no primary packaging to be present, if Test Series 6(a) and/or 6(b) were performed with no violent reaction based on the design and functioning of the explosive article alone.

(b) “Configuration”⁴ means the complete package and explosive as classified for transport according to the UN Manual of Tests and Criteria (MTC), including special orientation for cancellation of explosive effects.

7. Assignment to the class of explosives is based on intrinsic properties, i.e. the potential of a blast, while assignment to a division is based on the configuration of an explosive. Where multiple packaging⁵ layers are used in a configuration, discarding outer or intermediate layers of packaging in the supply sector sometimes results in an increase in hazard. When a configuration is so modified, hazard communication that was accurate and necessary during transport or storage of the complete configuration may no longer be accurate or sufficiently protective.

8. We propose to extend the existing classification system to the primary packaging. Requirements for the retention of the original container are already common for explosives, and a precautionary statement already exists which could be adapted for this purpose: P234 “Keep only in original packaging”.

³ Per the UNMR definition

⁴ The definition of “package” in the UNMR may be synonymous with “configuration”, but explosives are unique in that the packaging may determine the classification.

⁵ See UNMR definition of packaging.

9. Divisions 1.1, 1.2, 1.3, 1.5 and 1.6 represent a high hazard even in their classified configuration. These explosives are assigned to Sub-category 2A based on their division assignment in the existing MTC, and no additional criteria are necessary.

10. Classifications “1.4-other-than-S” and “1.4S”⁶ represent a medium or low hazard respectively in their classified configuration, and constitute a significant portion of explosives that are in and outside the traditionally recognized explosives industry, i.e. in industry which uses explosives without special awareness or knowledge. Consistent with consensus from the ICG and EWG discussions, only such explosives in their primary packaging can be potential candidates for assignment to sub-categories 2B or 2C respectively. This is based on the explosives in the primary packaging being a subset of a configuration that has been classified for transport as 1.4-other-than-S or 1.4S, and the likelihood that the primary packaging is removed from the classified configuration in sectors downstream of transport.

(a) When evaluating assignment to sub-categories 2B or 2C, the results of the classification testing of the configuration should be used to consider whether a violent reaction can occur from initiation of the explosive contents within the primary packaging. If there was no violent reaction, evaluation should include whether this outcome was based on outer or intermediate layers of packaging which may be removed in the supply sector:

(i) initiation of a 1.4-other-than-S or 1.4S explosive in its primary packaging causes a violent reaction, then the primary package or unpackaged article is classified in sub-category 2A.

(ii) If there was no violent reaction, but this outcome is based on packaging beyond the primary packaging, then the classification is 2A.

(iii) If an explosive article or primary packaging is sufficient by itself to limit the explosive effect to a medium or low hazard, then it may be classified as sub-category 2B or 2C respectively.

11. The existing MTC Test Series 6(a) and 6(b)⁷ are used in the process of assigning a division and to evaluate the reaction when the explosive article or substance is initiated within a configuration. The MTC criteria for the 6(a) and 6(b) tests are only used to determine if a mass explosion event occurs for a given configuration, in which case the explosive may be assigned to Division 1.1. Although the test procedures indicate observations should be made on a number of possible effects, violent effects less than a mass explosion are not currently used as criteria for classification. The available unused data from these observations, however could be used for GHS classification purposes with no new or additional testing

⁶ Compatibility groups are normally used to identify a type of explosive. Their sole purpose in the regulations is for keeping different types of explosives separated, known as segregation. There is an exception that Division 1.4, Compatibility Group S is used instead to denote a significantly lower hazard using five discreet criteria, and 1.4S has significantly less controls than other Division 1.4 explosives. Compatibility Group S is not used for segregation. On first glance in the UNMR it appears that Compatibility Group S is used for segregation from Compatibility Groups A & L (rare and dangerous explosives), but an analysis shows that A & L explosives are segregated from dangerous goods of all 8 classes to which segregation rules apply, not just 1.4S.

⁷ Test Series 6(b) may be used where 6(a) results were inconclusive or marginal, (e.g. to further examine explosives propagation if most, but not all, surrounding primary packages or explosives articles reacted, or there were no surrounding explosives in the test set-up. Also, for efficiency Test Series 6(b) may be voluntarily performed in lieu of Test Series 6(a) when there is an expectation that Test Series 6(b) will be required or desired.

required. The US task force therefore assessed how Test Series 6(a) and 6(b) could be used to record a violent reaction, and assign sub-category 2A versus 2B and 2C:

(a) Test Series 6(a) provides information on the violence of the reaction of a primary packaging within a configuration or unpackaged explosives article, including the degree to which it causes surrounding explosives to potentially react, and the overall damage. The Test Series 6(a) indicative criteria are:

- (i) Damage to the witness plate
- (ii) A crater in the ground
- (iii) Overpressure measured
- (iv) Disruption of the confining medium.

(b) These existing criteria are too vague to be adapted as is, as they were written as indicative (not always conclusive) for discerning a mass explosion, whereas the GHS now needs discrete criteria for violent effects. Also, for transport purposes, Test Series 6(b) is a more severe test and has correspondingly relaxed criteria compared to Test Series 6(a), but for hazcom purposes and conservatism, this aspect should be ignored and the same criteria can be used for Test Series 6(b) as for Test Series 6(a). The US task force recommends that the following two new criteria be used:

- (i) Significant⁸ change in witness plate shape
- (ii) Instantaneous scattering of most of the confining material

(c) These two new discrete criteria completely incorporate all four indicative criteria:

- (i) “Significant change in the witness plate shape” evaluates both the witness plate and a crater, since if a crater in the ground occurs, the witness plate shape would be changed.
- (ii) “Instantaneous scattering of most of the confining material” evaluates both the confining material and overpressure (blast wave), since it would also be an indicator of an overpressure.

(d) These two indicators of a violent reaction are already being observed and often recorded, and require no additional testing since this is done in conjunction with 6(a) and/or 6(b) tests when performed for transport classification.

12. In a minority of cases, Test Series 6(d) may be a separate alternative for measuring a violent reaction. The US task force assessed the applicability, criteria and available data associated with the 6(d) test, including cases where Test Series 6(a) or 6(b) are not performed. TS 6(d) may be said to be an indicator of any observable reaction, and not only a violent reaction. Therefore, whenever TS 6(a) or 6(b) are performed, they should supersede results from TS 6(d) for the purpose of GHS sub-categorization.

(a) 1.4S Explosives: Test Series 6(d) is required for a subset of 1.4S explosives which are subject to Special Provision 347. In this case, if the explosive passes Test Series 6(d), it may be assigned to Sub-category 2C.

(b) If a candidate for 1.4S subject to SP 347 fails Test Series 6(d), it is assigned to Sub-category 2A. If the TS 6(a) or 6(b) are performed on the explosive that failed 6(d) and there is no violent reaction, then the TS 6(d) results are superseded and the

⁸ A slight dent or bowing is a change in witness plate shape and may result even though there is no damage to the package exterior itself. Such slight dent or bowing is not considered evidence of a violent reaction.

explosive may be assigned to Sub-category 2B, as is appropriate for Division 1.4-other-than-S transport classifications.

(c) Sometimes it occurs that a classifier only performs Test Series 6(d) when not required in lieu of Test Series 6(a) and/or 6(b), as the 6(d) test can be easier to perform. In this case, the same rationale is applied as shown immediately above, with the exception that a Sub-category 2C classification is possible.

13. A manufacturer may use additional data or considerations to supersede the criteria above and assign the explosive to Sub-category 2A. For example, in the commercial explosives industry the potential presence of other explosives may escalate the hazard, and it also may be desired to maximize hazard communication in case of inadvertent contact with untrained personnel or the public.

Conclusion

14. The existing transport classification protocol includes strict criteria to qualify explosives for assignment as 1.4. Compliance with five more criteria is required to qualify for assignment as 1.4S, resulting in additional safety. To achieve 1.4-other-than-S or 1.4S requires investment in article design and packaging components by the manufacturer/supplier. This investment derives benefits for distribution on the market. Therefore, using the above detailed criteria in conjunction with the Transport Classification of 1.4-other-than-S, and 1.4S, the proper GHS Category 2 Sub-category can be assigned.

15. The additional packaging evaluation criteria required for GHS are as follows:

(a) Was there a violent reaction in Test Series 6(a) or 6(b), or in the absence of these test results, did it fail Test 6(d)?

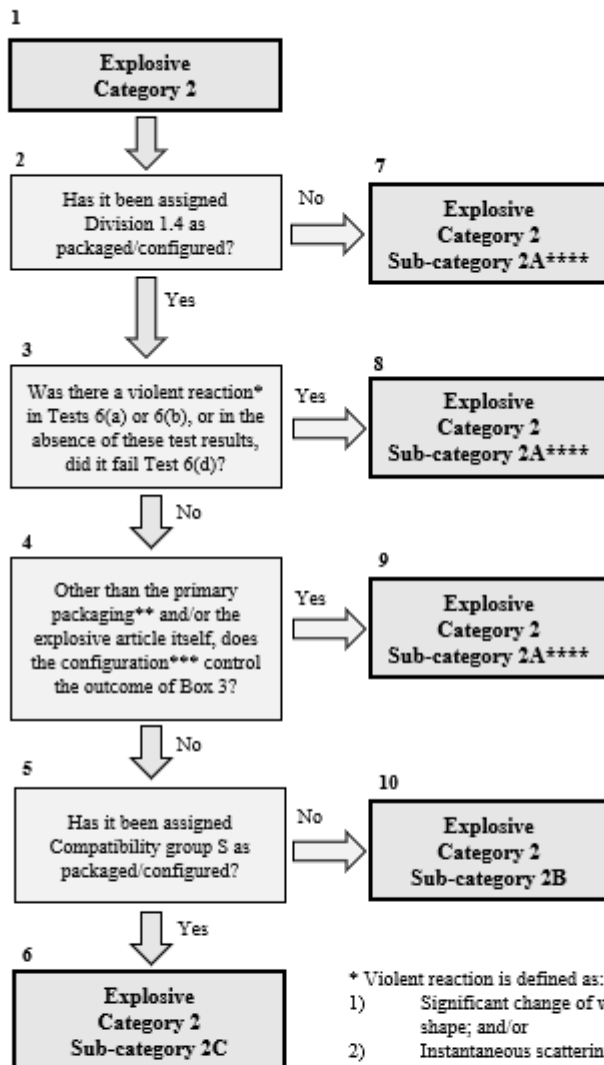
(b) Other than the primary packaging and/or the explosive article itself, are removable portions of the configuration responsible for elimination of a violent effect?

16. The flow chart in Annex 1 illustrates how the detailed criteria above should be applied to determine the appropriate GHS 2.1 Category 2 Sub-category.

Proposals

17. Adopt the detailed criteria and flow chart as provided in Annex 1.

ANNEX 1 Flow Chart for Category 2 Sub-categories



* Violent reaction is defined as:
 1) Significant change of witness plate shape; and/or
 2) Instantaneous scattering of most of the confining material.

** The “primary packaging” is the minimum level of packaging that a) is responsible for preventing a violent reaction, and b) is required to be retained until use of the explosive.

*** Configuration means the complete package and explosive as tested according to the UNMTC, including special orientation for cancellation of explosive effects.

**** The classifier may assign as High Hazard (2A) based on other data or considerations.