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Sub-Committee of Experts on the Transport of Dangerous Goods

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Issues relating to the Globally Harmonized System of Classification and Labelling of Chemicals: miscellaneous

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

Forty-first session
Geneva, 8-10 December 2021
Item 2 (i) of the provisional agenda
Work on the Globally Harmonized System (GHS): Other matters

Amendment to GHS Chapter 2.17 "Desensitized explosives"

Transmitted by the expert from Germany*

Background

1. The issue discussed in this document has already been brought forward to the Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS Sub-Committee) at its fortieth session (informal document INF.6 (fortieth session)). Valuable comments were received by the experts. These were taken into account and the proposal was amended accordingly. As a physical hazard is concerned, the proposal is now also submitted to the Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-Committee) for its consideration and possibly for reference to the Working Group on Explosives.

2. The background was outlined in informal document INF.6 (GHS Sub-Committee, fortieth session) but is shortly summarized again in this document so that the experts of the TDG Sub-Committee have the same information.

Introduction

3. During the last session of the GHS Sub-Committee in July 2021, a few amendments to Chapter 2.17 "Desensitized explosives" that were consequential to the revision of Chapter 2.1 "Explosives" were discussed. In the course of that work, the expert from Germany noted that an amendment (not related to the consequential amendments) concerning an additional prerequisite for classification as desensitized explosive should be included in Chapter 2.17.

4. Explosives that are phlegmatized have to fulfil some conditions (i.e. they have to be desensitized beyond a certain point) in order to classify them as desensitized explosives in

* A/75/6 (Sect.20), para. 20.51.

the sense of Chapter 2.17. These conditions are mentioned in paragraph 2.17.1.1 and in the criteria in paragraph 2.17.2.1 and can also be found in the decision logic.

5. Likewise, explosives that are too sensitive or unstable according to test series 3 (as mentioned in footnote 1 in section 2.17.1.1) should at least be diluted in such a way that they are no longer too sensitive or unstable according to test series 3 in order to classify them as desensitized explosives in the sense of Chapter 2.17. This, however, goes without stating it explicitly.

6. In addition, nitrocellulose mixtures should be stable in the sense of Appendix 10 of the Manual of Tests and Criteria in order to classify them as desensitized explosives in the sense of Chapter 2.17 of the GHS.

7. The annexes to this document contain the following proposals:

- Annex I shows the according technical amendments to Chapter 2.17 of the GHS.
- Annex II shows further amendments to Chapter 2.17 which are consequential to the technical amendments.
- Annex III shows amendments to section 51 of the Manual of Tests and Criteria.

It should be noted that the expert from Germany aimed at including only amendments that are directly related to the issue at hand and refrained from including further amendments (e.g. with regard to general consistency between chapters in the GHS etc.).

8. More detailed explanations and justifications are given in the following paragraphs 9 to 20.

Consistency of possible exemptions from the class of explosives for desensitized explosives

9. The principle of classification of desensitized explosives in accordance with Chapter 2.17 of the GHS is that only explosives that are phlegmatized beyond a certain point may be classified in that hazard class. In the first section of Chapter 2.17 this is worded as “phlegmatized … in such a manner that”. That is why some explosives, even when desensitized, are explicitly excluded from Chapter 2.17. According to the current criteria that is the case when they (still) have a mass explosion hazard or when their burning rate is too high (> 1200 kg/min). These have to be classified as explosives based on Note 1 in paragraph 2.17.2.1 of the GHS.

10. Therefore, it would be consistent to also exclude those explosives from Chapter 2.17 that are too sensitive or unstable according to test series 3. Such explosives are considered even more hazardous and consequently may not be assigned a division. According to the GHS, such explosives would be classified as Explosives, Cat. 1 and according to the Model Regulations they are not classified and may not be transported at all.

11. To determine whether nitrocellulose mixtures are sufficiently desensitized, other stability tests are appropriate. Their stability is determined according to Appendix 10 of the Manual of Tests and Criteria (Bergmann-Junk test or methyl violet paper (MVP) test) and is important for safe storage, transport and use. These tests are already required in order to transport them as desensitized explosives.

12. In addition, it should be considered that also the hazard communication elements for Chapter 2.17 were selected specifically to cover only “less hazardous” desensitized explosives: All 4 categories – i.e. also Cat. 1 – have the flame assigned and not the exploding bomb. This would be not appropriate, if it were not consistently ensured that only explosives that are desensitized beyond a certain point are covered by Chapter 2.17.

Reference to test methods

13. During the last session, it was asked whether new testing requirements would be introduced and whether the reference to test methods would fit the concept of test method neutrality of the GHS. This is discussed in the following paragraphs 14 to 16.

Test series 3

14. There would be no need to carry out test series 3 if the explosive itself (before desensitisation) has already passed test series 3 and is therefore deemed insensitive and stable enough. This waiving possibility is proposed to be added in section 51.3.2 of the Manual of Tests and Criteria (see Annex III to this document). Therefore, test series 3 would be only applicable if the explosive itself is too sensitive or unstable in the sense of test series 3. In that case, test series 3 should be carried out anyway in order to establish the degree of desensitization and thus consequential measures that might be necessary (amongst them also the question whether it may be transported). This is currently expressed in footnote 1 in section 2.17.1.1 of the GHS.

Appendix 10

15. According to A10.1.1 (the introductory sentence in Appendix 10 of the Manual of tests and Criteria), the Bergmann-Junk-test and the methyl violet paper test are used to determine whether nitrocellulose mixtures are considered to be stable for transport. The same holds for safe storage and handling of nitrocellulose mixtures. Only if these stability tests are met, the nitrocellulose can be safely stored, transported and used.

Test method neutrality

16. According to section 1.1.2.5, the GHS is (only) test method neutral with regard to health and environmental hazards. For physical hazards it refers to specific test methods in almost every chapter. It should also be noted that the current criterion in 2.17.2.1 (b) refers explicitly to test 6 (a) and (b) and the burning rate test according to section 51.4 of the Manual of Tests and Criteria.

Harmonisation with the Model Regulations

17. During the last session, it was also asked whether the foreseen amendments might result in or increase “disharmony” with the Model Regulations. This can be clearly negated. Quite contrary, the additional criterion as foreseen for 2.17.2.1 (b) is already covered by the Model Regulations so that harmony with the transport regulations is actually increased:

- Explosives (whether in a desensitized state or not) failing test series 3 may not be transported at all and therefore may also not be transported as desensitized explosives.
- Nitrocellulose mixtures have to fulfil the Bergmann-Junk test or the methyl violet paper test (these are the tests given in Appendix 10 of the Manual of Tests and Criteria) in order to transport them as solid desensitized explosives (see special provisions 393 and 394 in Chapter 3.3 of the Model Regulations and the introductory sentence in Appendix 10 of the Manual of Tests and Criteria).

Justification for the amendments in section 2.17.1

18. The proposed amendments should also be reflected in section 2.17.1 – equivalent to the current text: “…do not mass explode and do not burn too rapidly …”. However, the experts involved beforehand in the development of this proposal could not come up with appropriate wording to that regard (without referencing directly to the test methods to be

included in section 2.17.2). Since the wording currently available is only a loose repetition of the criteria given in section 2.17.2 anyway, it is proposed to delete the respective wording (see Annex I to this document, section 2.17.1.1). Instead, a reference to the criteria in section 2.17.2 is added in order to clarify that not any phlegmatization is sufficient, but that it has to fulfill certain conditions.

19. Footnote 1 can be deleted for the following reasons: An explanation that test series 3 should be carried out in the case explosives that failed test series 3 (before desensitization) are phlegmatized and considered for classification according to Chapter 2.17 of the GHS is no longer necessary because the reference to test series 3 is added in section 2.17.2. Moreover, the kind of information that should be given in the Safety Data Sheets (SDS) is indicated in Annex 4, Section 9, Table A4.3.9.3 of the GHS.

Amendments to section 51 of the Manual of Tests and Criteria

20. The amendments in sections 51.1, 51.2 and 51.3.1 of the Manual of Tests and Criteria just mirror the amendments foreseen in Chapter 2.17 of the GHS. Only the amendments in section 51.3.2 add some (rather obvious but hopefully still helpful) waiving possibilities (see Annex III to this document). They are in line with the current footnote 1 in section 2.17.1 of the GHS and with special provision 393 of the Model Regulations. These are supposed to reduce testing to an absolute minimum.

Request to the TDG and GHS sub-committees

21. Experts of the TDG and GHS sub-committees are requested to consider the proposal outlined in annexes I to III to this document. The TDG Sub-Committee may also wish to refer the proposal to its Working Group on Explosives for consideration. The expert from Germany is aware that the Working Group on Explosives may not meet again before the session in July 2022. In that case, preliminary comments are highly appreciated and welcome.

Annex I

Amendments to sections 2.17.1 and 2.17.2 of Chapter 2.17 of the GHS

*(Additions are shown in **bold and underlined**, deletions are ~~struck through.~~ The proposal takes into account the corrections adopted by the Sub-Committee at its fortieth session).*

"CHAPTER 2.17

DESENSITIZED EXPLOSIVES

2.17.1 Definitions and general considerations

2.17.1.1 Desensitized explosives are solid or liquid explosive substances or mixtures which are phlegmatized to suppress their explosive properties **at least as specified in section 2.17.2 so that they** ~~in such a manner that they do not mass explode and do not burn too rapidly and therefore~~ may be exempted from the hazard class "Explosives" (Chapter 2.1; see paragraph 2.1.1.2.2).~~[1]~~

2.17.1.2 The class of desensitized explosives comprises:

(a) Solid desensitized explosives: explosive substances or mixtures which are wetted with water or alcohols or are diluted with other substances, to form a homogeneous solid mixture to suppress their explosive properties.

NOTE: *This includes desensitization achieved by formation of hydrates of the substances.*

(b) Liquid desensitized explosives: explosive substances or mixtures which are dissolved or suspended in water or other liquid substances, to form a homogeneous liquid mixture to suppress their explosive properties.

2.17.2 Classification criteria

2.17.2.1 Any explosive while in a desensitized state shall be considered in this class unless, in that state:

(a) It is intended to produce a practical explosive or pyrotechnic effect;

(b) It is too sensitive or unstable according to test series 3, and, for nitrocellulose mixtures, it is not stable according to Appendix 10 of the *Manual of Tests and Criteria*;

(**c**~~b~~) It has a mass explosion hazard according to test series 6 (a) or 6 (b) or the corrected burning rate according to the burning rate test described in part V,

~~[1] *Explosives of GHS Chapter 2.1 that are considered too sensitive to assign a division can also be stabilized by desensitization and consequently may be classified as desensitized explosives, provided all criteria of GHS Chapter 2.17 are met. In this case the desensitized explosive should be tested according to test series 3 (Part I of this Manual) because information about its sensitiveness to mechanical stimuli is likely to be important for determining conditions for safe handling and use. The results should be communicated in the safety data sheet.*~~

sub-section 51.4 of the *Manual of Tests and Criteria* is greater than 1200 kg/min; or

(**d**~~c~~) The exothermic decomposition energy is less than 300 J/g.

NOTE 1: *Substances or mixtures which meet the criterion (a)**,*** ~~*or*~~ *(b)* ***or (c)*** *in their desensitized state shall be classified as explosives (see Chapter 2.1). Substances or mixtures which meet the criterion (**d**~~c~~) may fall within the scope of other physical hazard classes.*

NOTE 2: *The exothermic decomposition energy may be estimated using a suitable calorimetric technique (see section 20, sub-section 20.3.3.3 in Part II of the Manual of Tests and Criteria).*

[No amendments are foreseen in the further text of Section 2.17.2]

Annex II

Consequential amendments to Chapter 2.17 of the GHS

*(Additions are shown in **bold** and **underlined**).*

2.17.4.1 Amend as follows:

"2.17.4.1 *Decision logic*

To classify desensitized explosives, data for **the sensitiveness and stability,** the explosive potential and the corrected burning rate should be determined as described in Part V of the *Manual of Tests and Criteria*. Classification is according to decision logic 2.17.1.".

Amend decision logic 2.17.1 as follows:

Add two boxes (one below the other) below the box "Is the exothermic decomposition energy less than 300 J/g?" with the following text:

- The first box with "**Is it too sensitive or unstable according to test series 3?**"
- The second box with "**For nitrocellulose mixtures: Is it unstable according to Appendix 10?**"

Add an arrow with "**No**" to the bottom of both boxes.

Add an arrow with "**Yes**" from both boxes to the right. These arrows lead to a shape as the one to the right of the box "A_c > 1200 kg/min?" with the text "**Hazard class "Explosives" (see criteria in Chapter 2.1)**". One box should be used (equivalent to the first shape on the top at the right side of the decision logic).

Annex III

Amendments to section 51 of the Manual of Tests and Criteria

*(Additions are shown in **bold and underlined**, deletions are ~~struck through~~.)*

"SECTION 51

CLASSIFICATION PROCEDURES, TEST METHODS AND CRITERIA RELATING TO THE HAZARD CLASS DESENSITIZED EXPLOSIVES

51.1 Purpose

51.1.1 This section presents the United Nations scheme of the classification of liquid and solid desensitized explosives **(**see Chapter 2.17 of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)). The text should be used in conjunction with the classification principles of Chapter 2.17 of the GHS and the test series given in **section 13 and** sub-sections 16.4 and 16.5 of this Manual.

For testing of liquid desensitized explosives for transport purposes, refer to section 32, sub-section 32.3.2 of this Manual and to Chapter 2.3, sub-section 2.3.1.4 of the Model Regulations. Testing of solid desensitized explosives for transport purposes is addressed in section 33, sub-section 33.3 of this Manual and in Chapter 2.4, sub-section 2.4.2.4 of the Model Regulations.

51.2 Scope

51.2.1 Desensitized explosives are solid or liquid explosive substances or mixtures which are phlegmatized to suppress their explosive properties **at least as specified in sub-section 51.2.2 so** ~~in such a manner~~ that they may be excluded from the hazard class "Explosives" (Chapter 2.1 of GHS). Desensitized explosives~~,~~ should be first tested according to the tests series 1 (type 1(a)), 2**, 3** and 6 (type (a) and (b), respectively) **and nitrocellulose mixtures should be tested according to Appendix 10** of this Manual[1].

51.2.2 Any explosive while in a desensitized state shall be considered in this class unless, in that state:

(a) It is intended to produce a practical explosive or pyrotechnic effect;

(b) It is too sensitive or unstable according to test series 3, and, for nitrocellulose mixtures, it is not stable according to Appendix 10;

(**c**~~b~~) It has a mass explosion hazard according to Test Series 6(a) or 6(b) or the corrected burning rate according to the burning rate test 51.4 is more than 1 200 kg/min;

(**d**~~c~~) The exothermic decomposition energy is less than 300 J/g[1] [2].

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[1] ~~*Unstable explosives as defined in Chapter 2.1 of the GHS can also be stabilized by desensitization and consequently may be classified as desensitized explosives, provided all criteria of GHS Chapter 2.17 are met. In this case the desensitized explosive should be tested according to test series 3 (Part I of this Manual) because information about its sensitiveness to mechanical stimuli is likely to be important for determining conditions for safe handling and use. The results should be communicated in the safety data sheet.*~~

[1] [2] *The exothermic decomposition energy should be determined using the explosive already desensitized (i.e.: the homogenous solid or liquids mixture formed by the explosive and the substance(s) used to suppress its explosive properties). The exothermic decomposition energy may be estimated using a suitable calorimetric technique (see Section 20, sub-section 20.3.3.3 in Part II of this Manual).*

51.3 Classification procedure

51.3.1 **Test series 3 is carried out with the unpackaged substance/mixture.** Before packaged substances or mixtures are subjected to the burning rate test, the test series 6 types 6 (a) and 6 (b) shall be performed in alphabetical order. The substances or mixtures should be tested first with a standard detonator (Appendix 1 of the Manual) and, if no explosion occurs, with an igniter just sufficient (but not more than 30 g of black powder) to ensure ignition of the substance or mixture in the packaging. The initiation system giving a positive result in the 6 (a) test should be used for the 6 (b) test.

51.3.2 However, it is not always necessary to conduct tests of all types. **Test series 3 may be waived if the explosive itself (i.e. before desensitized) is not too sensitive or unstable according to test series 3. Test series 3 type (c) test may be waived for nitrocellulose mixtures for which stability is established according to Appendix 10.** Test type 6 (b) may be waived if in each type 6 (a) test:

(a) The exterior of the package is undamaged by internal detonation and/or ignition; or

(b) The contents of the package fail to explode, or explode so feebly as would exclude propagation of the explosive effect from one package to another in test type 6(b).

51.3.3 If a substance or mixture gives a negative result (no propagation of detonation) in the Series 1 type 1(a) test, the 6(a) test with a detonator may be waived[3]). If a substance or mixture gives a negative result (no or slow deflagration) in a Series 2 type 2(c) test, the 6 (a) test with an igniter may be waived.

51.3.4 The test for determination of the burning rate by large-scale test need not be performed if, in a test type 6 (b), there is practically instantaneous explosion of virtually the total contents of the stack. In such cases the product is assigned to Division 1.1.”.

(No amendments are foreseen in the further text of Section 51)