

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

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Item 2 (h) of the provisional agenda

Classification criteria and related hazard communication:

Miscellaneous

Proposal for a new classification for chemicals under pressure

**Submitted by the European Chemical Industry Council (CEFIC) and
the European Industrial Gases Association (EIGA)**

Introduction

1. Some years ago the Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-committee) implemented new UN numbers for chemicals under pressure (UN3500 - UN3505). These products function similarly to aerosol dispensers (UN 1950), but are packed in pressure receptacles (refillable and non-refillable) up to 450 litres. These UN-numbers are also used by the EIGA members to transport liquids that are packed under a head of pressure for inerting the product or to facilitate its transfer in the process lines (e.g., benzene under hydrogen pressure). With the implementation of GHS in more and more countries, the question came up how these products need to be classified and labelled according to the GHS.
2. Current GHS chapters do not appropriately cover the hazards associated with this product type, leading to confusion and possibly resulting in over- or under-classification of products. An assignment to existing chapters on flammable gases, liquids, or solids would potentially miss communication of important hazards. For example, Chapter 2.3 does not recognize pressure receptacles like gas cylinders, it only describes aerosol cans.
3. Therefore CEFIC and EIGA proposed to introduce a new chapter into GHS to cover these type of products (document UN/SCEGHS/31/INF.11). During the Sub-Committee meeting in July 2016 the document was discussed and some questions were made, in particular about the possibility to include the classification of these products in existing chapters and to justify the cut-off values.
4. Chemicals under pressure used for spray applications present hazards that are similar to those requiring the use of aerosol cans that could be considered as one of the packaging possibilities for chemicals under pressure. Due to the similarities, aerosols and chemicals under pressure could be combined in the same chapter (2.3) of GHS. This approach has been taken in the proposal outlined in Annex I.
5. The attached proposal for chemicals under pressure presents three hazard categories for this new hazard class. The hazard class contains three categories - two are designated for extremely flammable and flammable chemicals under pressure and one for non-flammable chemicals under pressure. The information on the hazard class follows the

chapter structure used for the aerosols hazard class.6. New related labelling requirements are also presented, including the proposal for new hazard statements. Regarding the number of pictograms on a label for chemicals under pressure, this paper proposes to have two pictograms for category 1 and 2 and only one for category 3. This is in line with the way the GHS is dealing today with gases under pressure. Regarding the hazard statements for chemicals under pressure, the two statements used for category 1 and 2 were merged into one hazard statement.

7. In order to differentiate “chemical under pressure” from “gas mixtures” that may also contain liquid components, and to differentiate “liquids” under a low gas pressure head for inerting from “chemical under pressure”, it is necessary to introduce some cut-off values.

- (a) The components of “chemical under pressure” are “predominantly liquids or solids”, while the components of gas mixtures are “predominantly gaseous”. 50% of liquids or solids is proposed as a cut-off value to differentiate chemical under pressure from gas mixtures.
- (b) 200 kPa (gauge) is the minimum pressure used in chapter 2.5, *Gases under pressure* and is proposed as the cut-off value to differentiate chemicals under pressure from liquids packed under a low pressure head of gas.

8. A change is proposed in Sections 2.3.1.4 and 2.3.2.4, Decision logic and guidance. In (most) other GHS chapters, the decision logic is not required, and a chemical can actually be classified based on the information in the section “Classification criteria”. For oxidizing liquids (Chapter 2.13), for example, the decision logic only repeats and visualizes the information already provided in “Classification criteria”. However, this is not true for aerosols and chemicals under pressure. Without the decision logic, it is not possible to distinguish between categories 1 and 2. For aerosols, category 3 as shown in the flowcharts for spray and foam aerosols can only be assigned based on the flowcharts, i.e. the respective decision criteria are not completely described in the section “Classification criteria”. This paper, therefore, proposes to strike “are not part of the harmonized classification system” to emphasize the significance of the decision logics. We would like to point that, in this specific case, a flowchart is superior in clarifying the decision process compared to conveying the same information in words.

9. Subsequent changes to the annexes or other chapters of the GHS have not been taken into consideration at this point in time. They will be included in further proposals when the way forward is clearer.

10. The intersessional working group had multiple telephone conferences between 15 February 2017 and 21 June 2017 and developed a new structure for a combined chapter for aerosols and chemicals under pressure. This proposal avoids introducing a new chapter in GHS and clearly distinguishes between aerosols and chemicals under pressure. In this structure, the text from chapter 2.3 (Aerosols) is edited and renumbered, and the new text for chemicals under pressure is added after it. There is an introduction added at the very beginning of the combined chapter to guide the users. The chapter presented in this paper is the compromise that was agreed on in the intersessional working group.

11. The Sub-Committee is invited to consider the draft text and to comment as appropriate. Based on the comments received, it is foreseen to prepare a formal document.

“CHAPTER 2.3 AEROSOLS AND CHEMICALS UNDER PRESSURE

2.3.0 Introduction

This chapter contains the definition, classification criteria, hazard communication, decision logic and guidance for aerosols and chemicals under pressure. Although this chapter presents two similar hazards, they are discussed in separate sections. A substance or mixture is classified as either an aerosol in accordance with 2.3.1 or a chemical under pressure in accordance with 2.3.2.

2.3.1 Aerosols

2.3.1.1 Definition

Aerosols, this means aerosol dispensers, are any non-refillable receptacles made of metal, glass or plastics and containing a gas compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid state or in a gaseous state.

NOTE: *Requirements for the design, manufacture and testing of aerosol dispensers are set out in the Recommendations on the Transport of Dangerous Goods, Model Regulations and its related modal regulations. In practice, these requirements generally limit the maximum capacity of aerosol dispensers to 1000 ml.*

2.3.1.2 Classification criteria

2.3.1.2.1 Aerosols are classified in one of three categories, depending on their flammable properties and their heat of combustion.

2.3.1.2.2 Aerosols should be considered for classification in Category 1 or 2 if they contain more than 1% components (by mass) which are classified as flammable according to the GHS criteria, i.e.:

- Flammable gases (see Chapter 2.2);
- Flammable liquids (see Chapter 2.6);
- Flammable solids (see Chapter 2.7);

or if their heat of combustion is at least 20 kJ/g.

NOTE: *Flammable components do not include pyrophoric, self-heating or water-reactive substances and mixtures because such components are not allowed in aerosol dispensers according to the Recommendations on the Transport of Dangerous Goods, Model Regulations.*

2.3.1.2.3 Aerosols are classified in Category 3 if

- they contain 1% or less components (by mass) that are classified as flammable according to the above GHS criteria, and;
- the heat of combustion of the aerosol is less than 20 kJ/g.

2.3.1.2.4 An aerosol is classified in one of the three categories on the basis of its components, of its chemical heat of combustion and, if applicable, of the results of the foam test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols). See decision logic in 2.3.1.4.1. Aerosols which do not meet the criteria for

inclusion in Category 1 or Category 2 (extremely flammable or flammable aerosols) should be classified in Category 3 (non-flammable aerosols).

NOTE 1: *Aerosols containing more than 1% flammable components or with a heat of combustion of at least 20 kJ/g, which are not submitted to the flammability classification procedures in this chapter should be classified as aerosols, Category 1.*

NOTE 2: *Aerosols do not fall additionally within the scope of chapters 2.2 (flammable gases), 2.3.2 (chemicals under pressure), 2.5 (gases under pressure), 2.6 (flammable liquids) and 2.7 (flammable solids). Depending on their contents, aerosols may however fall within the scope of other hazard classes, including their labelling elements.*

2.3.1.3 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.

Table 2.3.1.1: Label elements for aerosols

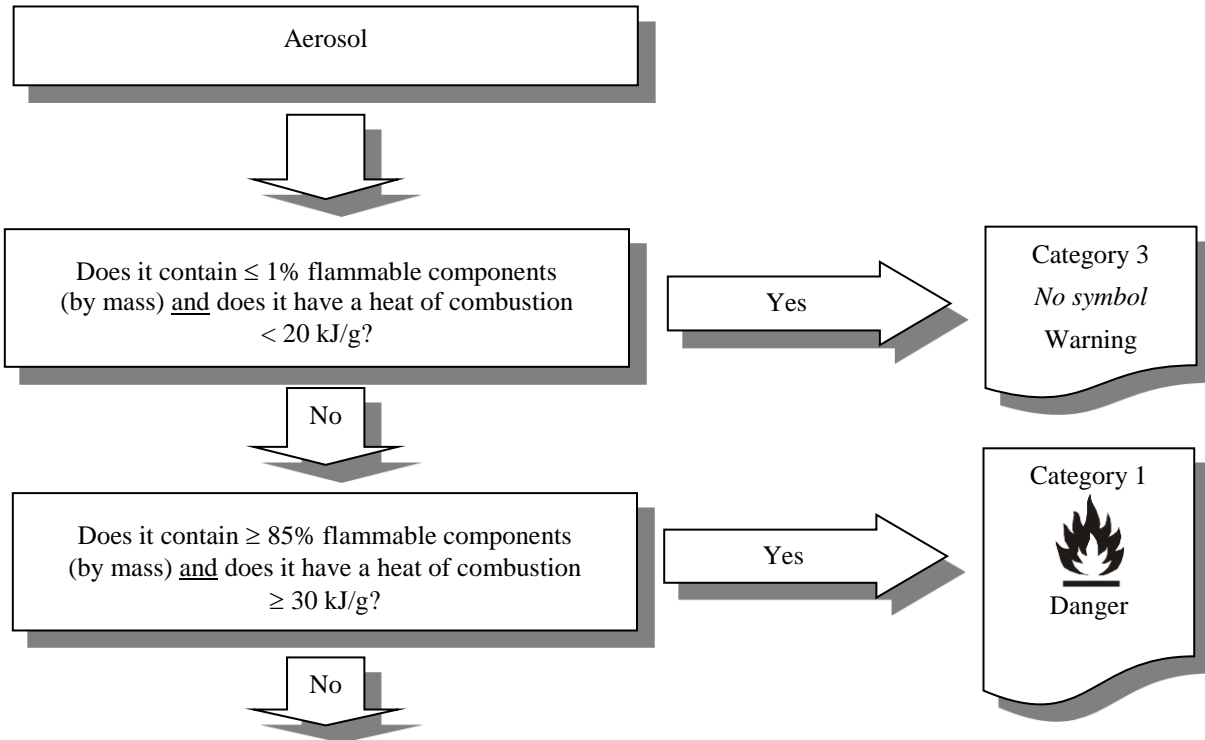
	Category 1	Category 2	Category 3
Symbol	Flame	Flame	<i>No symbol</i>
Signal word	Danger	Warning	Warning
Hazard statement	Extremely flammable aerosol Pressurized container: May burst if heated	Flammable aerosol Pressurized container: May burst if heated	Pressurized container: May burst if heated

2.3.1.4 Decision logic and guidance

The decision logics 2.3.1 (a) to (c) which follow and the guidance on chemical heat of combustion in 2.3.3 have been provided as additional guidance. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

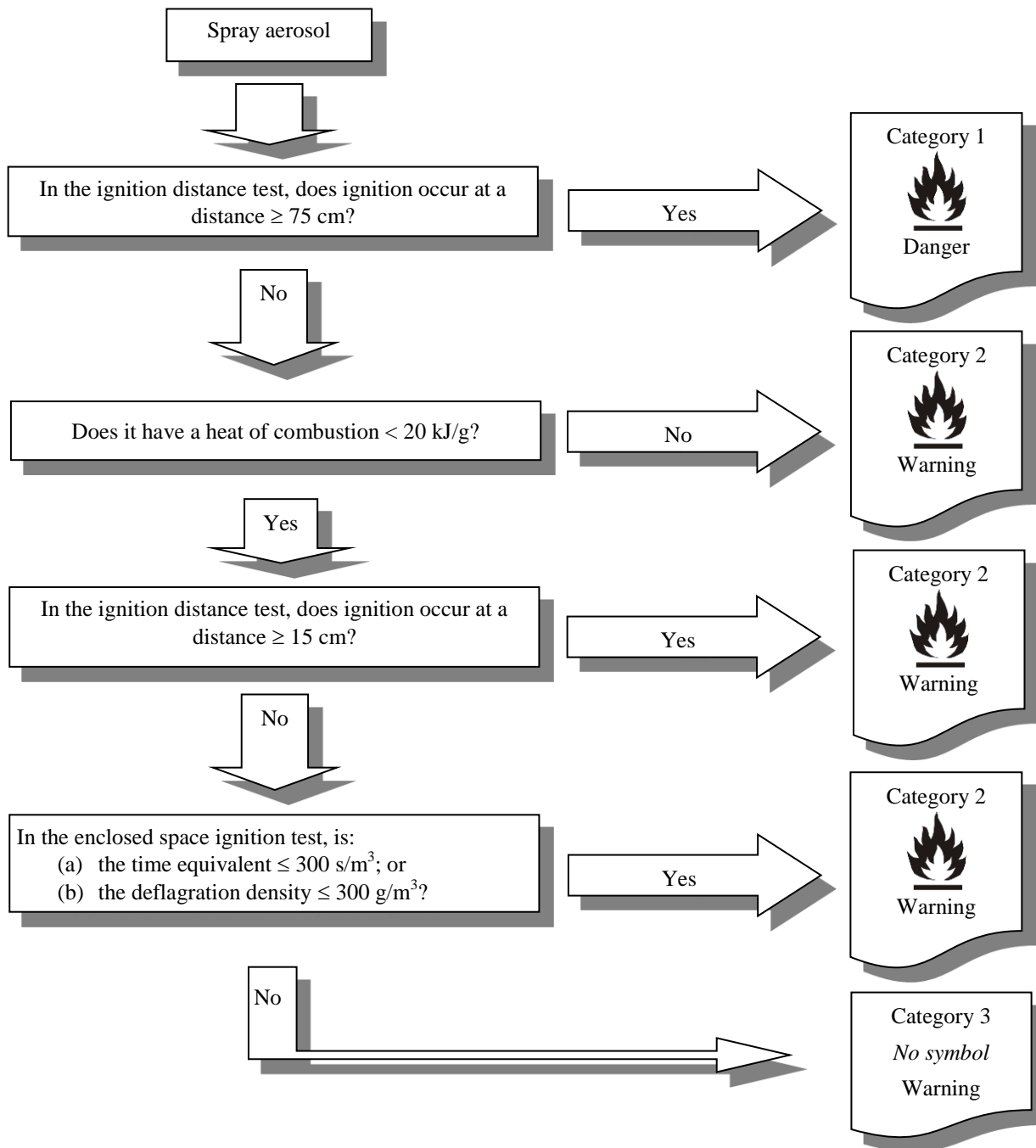
2.3.1.4.1 *Decision logic*

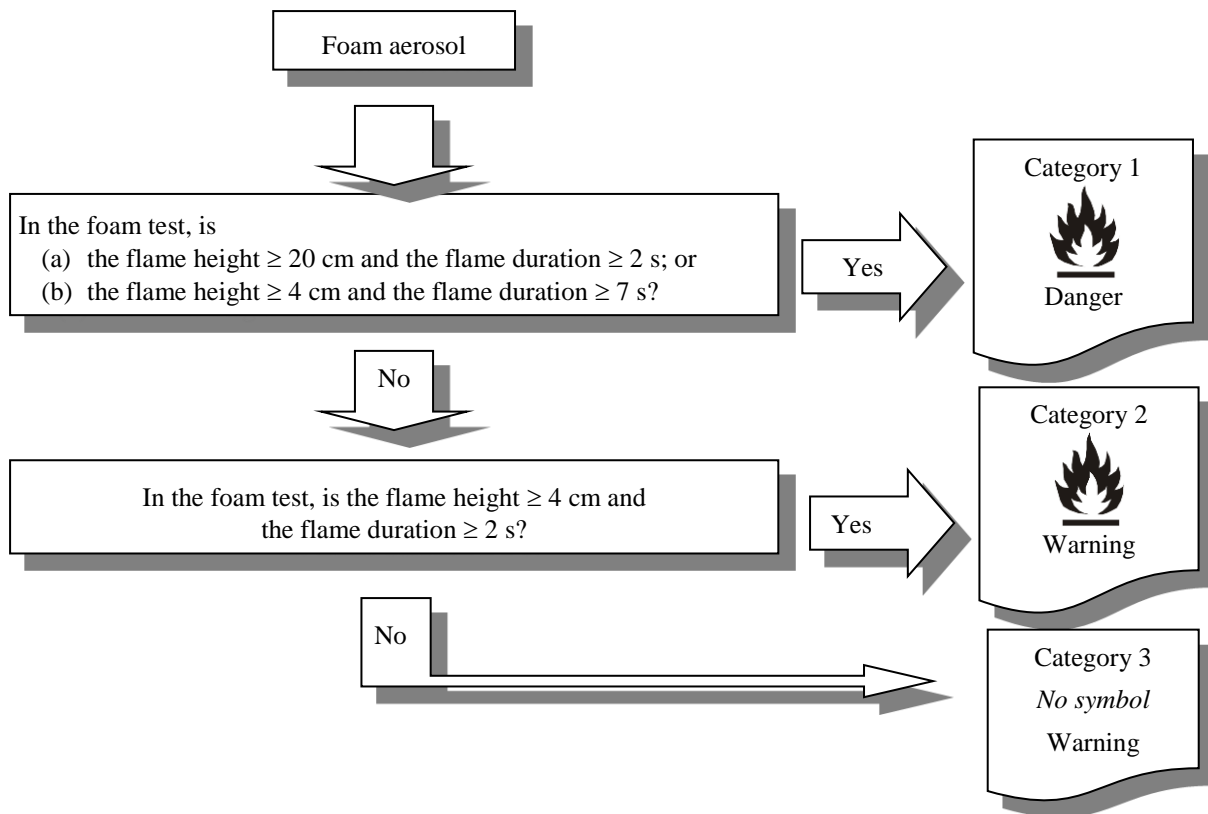
To classify an aerosol, data on its flammable components, on its chemical heat of combustion and, if applicable, the results of the foam test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols) are required. Classification should be made according to decision logics 2.3.1 (a) to 2.3.1 (c).

Decision logic 2.3.1 (a) for aerosols

For spray aerosols, go to decision logic 2.3.1 (b);
For foam aerosols, go to decision logic 2.3.1 (c);

Decision logic 2.3.1 (b) for spray aerosols



Decision logic 2.3.1 (c) for foam aerosols

2.3.1.4.2 See sub-sections 31.4, 31.5 and 31.6 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, for Ignition distance test, Enclosed space ignition test, and Aerosol foam flammability test.

2.3.2 Chemicals under pressure

2.3.2.1 Definition

Chemicals under pressure are mixtures containing 50% or more by mass of liquids or solids [e.g., pastes or powders] and a propellant, in pressure receptacles other than aerosol dispensers, at a pressure of 200 kPa (gauge) or more at 20 °C. The propellant (gas) can be a compressed, liquefied or dissolved gas under pressure.

NOTE: *Mixtures, containing less than 50% by mass of liquids or solids, [e.g., pastes or powders], should be considered for classification as gases under pressure (see chapter 2.5) or, if not meeting the criteria for classification as gases under pressure, should be considered for other physical hazard classes appropriate for liquids or solids (see decision logic 2.3.2.).*

2.3.2.2 Classification criteria

2.3.2.2.1 Chemicals under pressure are classified in one of three categories, depending on their flammable properties and their heat of combustion (see 2.3.2.4.1).

2.3.2.2.2. Chemicals under pressure should be considered for classification in Category 1 or 2 if they contain more than 1% components (by mass) which are classified as flammable according to the GHS criteria, i.e.:

- Flammable gases (see Chapter 2.2);
- Flammable liquids (see Chapter 2.6);
- Flammable solids (see Chapter 2.7);

or if their heat of combustion is at least 20 kJ/g.

NOTE: *The flammable components in a chemical under pressure do not include pyrophoric, self-heating or water-reactive substances and mixtures because such components are not allowed in chemicals under pressure according to the Recommendations on the Transport of Dangerous Goods, Model Regulations.*

2.3.2.2.3 Chemicals under pressure are classified in Category 3 if

- they contain 1% or less components (by mass) that are classified as flammable according to the above GHS criteria, and;
- the heat of combustion of the aerosol is less than 20 kJ/g.

2.3.2.2.4 A chemical under pressure is classified in one of the three categories on the basis of its components, and its chemical heat of combustion. See decision logic in 2.3.2.4.

NOTE: *Chemicals under pressure do not fall additionally within the scope of chapters 2.2 (flammable gases), 2.3.1 (aerosols), 2.5 (gases under pressure), 2.6 (flammable liquids) and 2.7 (flammable solids). Depending on their contents, chemicals under pressure may however fall within the scope of other hazard classes, including their labelling elements.*

2.3.2.3 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.

Table 2.3.2.1: Label elements for chemical under pressure

	Category 1	Category 2	Category 3
Symbol	Flame Gas cylinder	Flame Gas cylinder	Gas cylinder
Signal word	Danger	Warning	Warning
Hazard statement	Extremely flammable chemical under pressure	Flammable chemical under pressure	Chemical under pressure

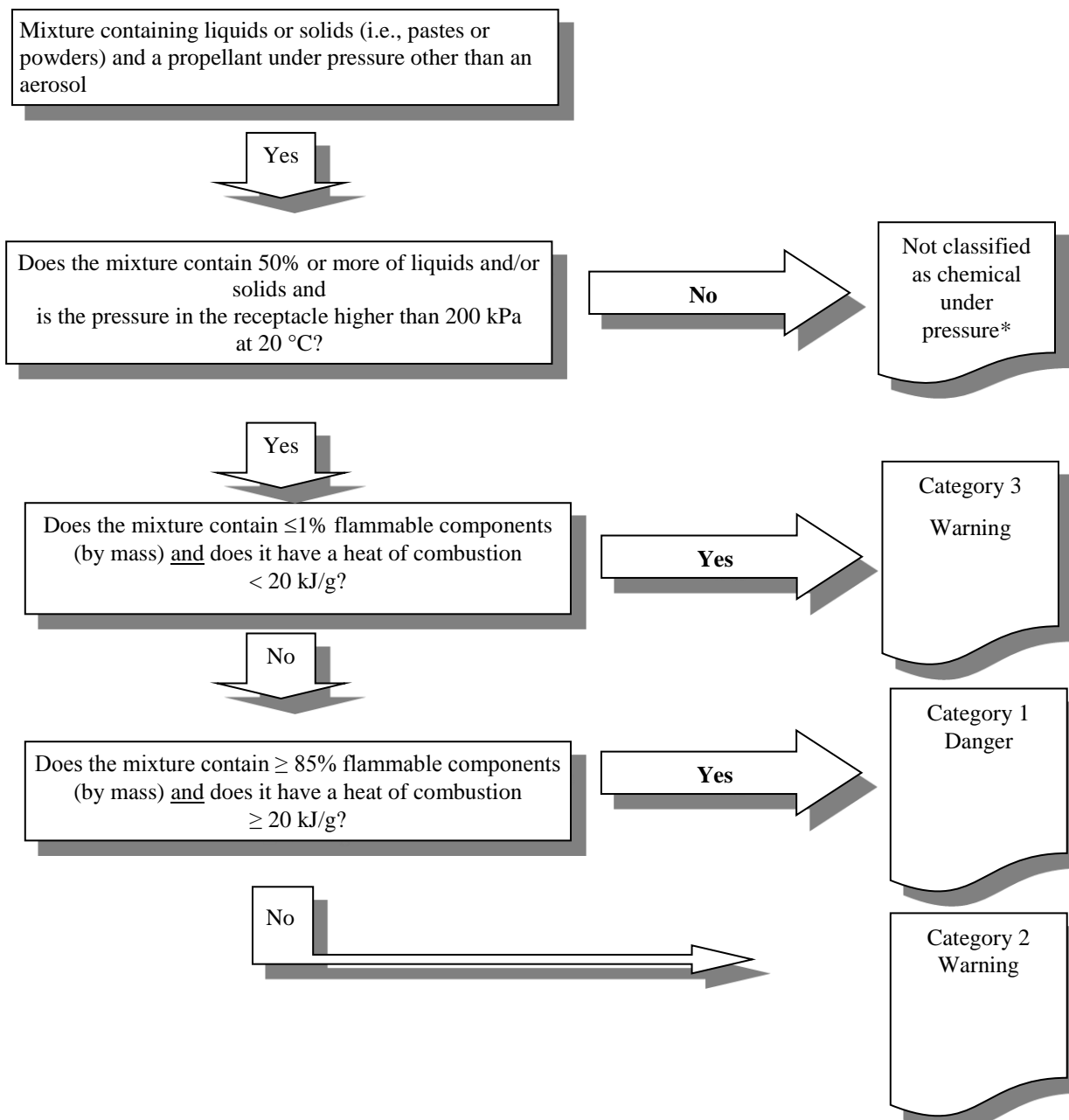
2.3.2.4 Decision logic and guidance

Decision logic 2.3.2 and the guidance on chemical heat of combustion in 2.3.3 have been provided as additional guidance. Mixtures of liquids or solids (i.e., pastes or powders) under pressure may be classified as chemicals under pressure, gases under pressure or in other physical hazard classes appropriate for liquids or solids. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

2.3.2.4.1 *Decision logic*

To classify a mixture as a chemical under pressure, data on its pressure, its flammable components, and on its chemical heat of combustion are required. Classification should be made according to the decision logic 2.3.2.

Decision logic 2.3.2



*should be considered for classification in other physical hazard classes as appropriate.

2.3.3 *Guidance on chemical heat of combustion*

The chemical heat of combustion (ΔH_c), in kilojoules per gram (kJ/g) is the product of the theoretical heat of combustion (ΔH_{comb}) and the combustion efficiency, usually less than 1.0 (a typical efficiency is 0.95 or 95%).

For a composite formulation, the chemical heat of combustion is the summation of the weighted heats of combustion for the individual components, as follows:

$$\Delta H_c(\text{product}) = \sum_i^n [w_i\% \times \Delta H_c(i)]$$

Where:

ΔH_c = chemical heat of combustion (kJ/g);

$w_i\%$ = mass fraction of component I in the product;

$\Delta H_c(i)$ = specific heat of combustion (kJ/g) of component I in the product

The chemical heat of combustion can be found in the literature, calculated or determined by tests (see ASTM D 240, ISO/FDIS 13943:1999 (E/F) 86.1 to 86.3 and NFPA 30B.)”
