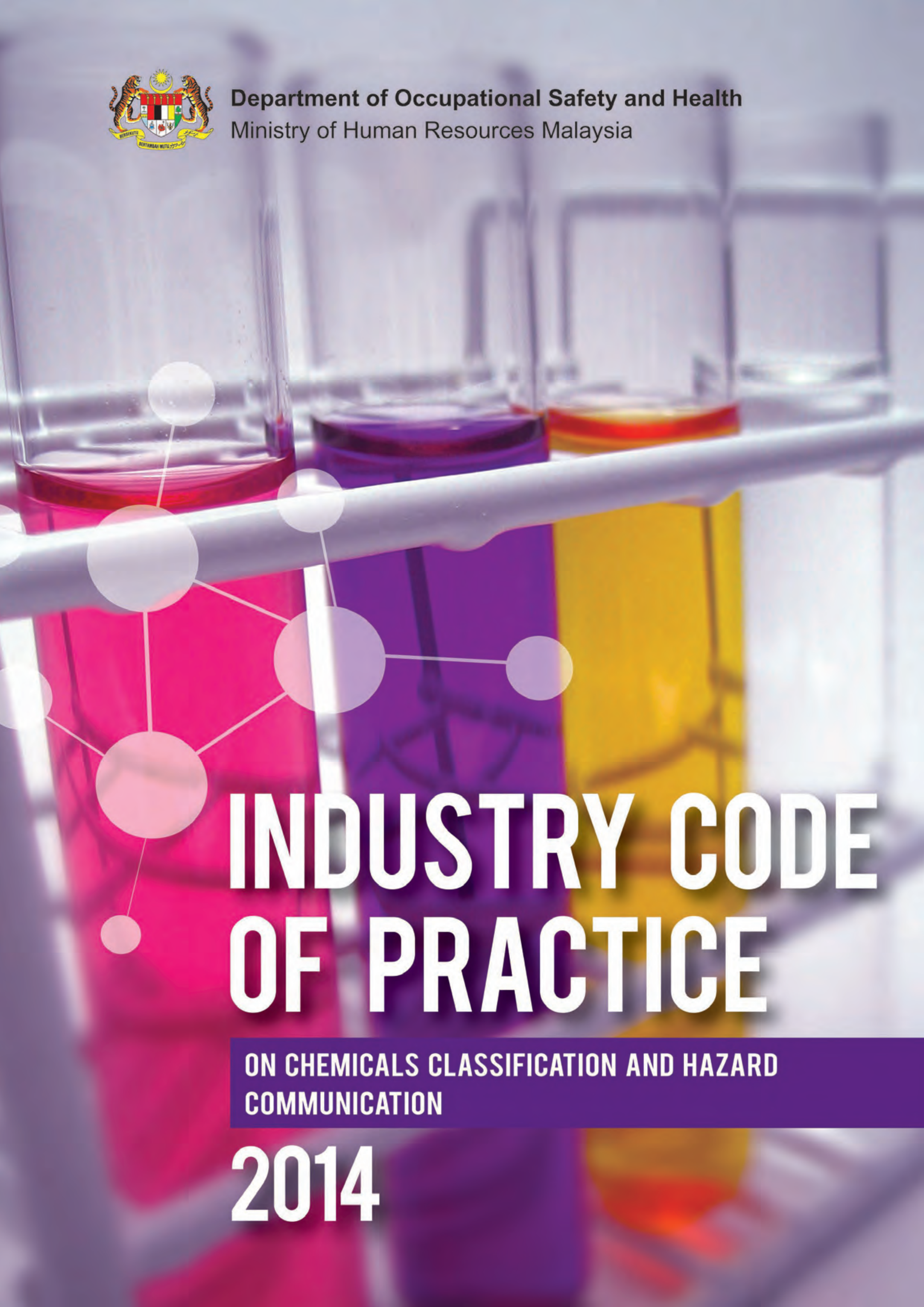

Department of Occupational Safety and Health
Ministry of Human Resources Malaysia

INDUSTRY CODE OF PRACTICE

ON CHEMICALS CLASSIFICATION AND HAZARD COMMUNICATION

2014

FOREWORD

The Industry Code of Practice on Chemical Classification and Hazard Communication 2013 (ICOP) is promulgated under Section 37 of Occupational Safety and Health Act 1994(OSHA 1994) as a guidance to chemical suppliers to comply with the provisions of Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013 [P.U. (A) 310/2013] which have been gazetted on 11 October 2013, hereinafter is referred to as "the Regulations". The Regulations is to replace Occupational Safety and Health (Classification, Packaging and Labelling of Hazardous Chemical) Regulations 1997 [P.U. (A) 143/1997]. The implementation of the Regulations is consistent with Malaysia's commitment in implementing the Globally Harmonised System for Classification and Labelling of Chemicals (GHS) for industrial workplace sector especially in supplying chemicals for use at work in Malaysia.

GHS is recommended by the United Nations in its effort to standardise chemical classification and labelling system, and hazard communication globally. The system includes harmonised classification criteria based on physical hazards, health hazards and environmental hazards; labelling elements and safety data sheet for hazardous chemicals. Implementation of GHS at international level could facilitate chemical trade globally by reducing the need to comply various legislative requirements on various chemical hazard information.

This ICOP contains a list of chemical subtances that have been classified; guidance on chemical classification and hazard communication. This ICOP provides guidance to the principal suppliers on self classification of chemicals according to method and classification criteria of GHS (Third revised edition, 2009). In addition, this ICOP can assist the suppliers in preparing labels and Safety Data Sheet (SDS) according to the Regulations. This ICOP is a legally binded document to fulfil the requirements under the Regulations.

Director General
Department of Occupational Safety and Health
Malaysia
January 2014

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ACKNOWLEDGEMENT

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INTRODUCTION

1.1 Objective

The objective of this ICOP is to provide the guidelines for the compliance of the requirements of the Regulations.

1.2 Scope of application

1.2.1 The ICOP includes harmonized criteria for classifying substances and mixtures according to their health, environmental, and physical hazards. It describes the classification criteria and the hazard communication elements by type of hazard (e.g. acute toxicity; flammability). Guidance has been included in the document to assist formulators, manufacturers, and importers in classifying chemicals within the hazard classes adopted by the Regulations.

1.2.2 This ICOP must be read together with the Regulations and is also designed to complement the requirements of:
(i) Classification under Part II of the Regulations;
(ii) Labelling under Part IV of the Regulations;
(iii) Safety Data Sheets (SDS) under Part V of the Regulations; and
(iv) Confidential Business Information (CBI) under Part VII of the Regulations.

1.2.3 This ICOP consists of four parts, which are:

Part 1: List of Classified Chemicals

This part consists of classified chemicals which will be updated from time to time. Refer to DOSH portal for update information on the list of classified chemicals.

If there are any differentiations or inconsistencies in the classification within the list, or among the manufacturers or importers, the Director General may determine the most appropriate harmonised classification and labelling elements for that particular chemical. The Director General may form a technical committee as deemed necessary to determine the classification for that particular chemical. For purpose of determining the classification, the affected parties are expected to make a representation to the committee to justify their proposal.

Part 2: Chemicals Classification

This part describes the method of classifying chemicals according to their physical, health, and environmental hazards. It contains the criteria for classifying the chemicals, decision logics, and hazard communication elements for each hazard classes. There are 16 hazard classes under physical hazards, 13 hazard classes under health hazards, and three hazard classes under environmental hazards.

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The hazard classification covered under the scope of the Regulations is summarised as below:

Physical hazards

Hazard class		Hazard category						
1.	Explosives	Unstable explosives	Div 1.1	Div 1.2	Div 1.3	Div 1.4	Div 1.5	Div 1.6
2.	Flammable gases	Cat. 1	Cat. 2					
3.	Flammable aerosols	Cat. 1	Cat. 2					
4.	Flammable liquids	Cat.1	Cat. 2	Cat. 3				
5.	Flammable solids	Cat. 1	Cat. 2					
6.	Oxidizing gases	Cat. 1						
7.	Oxidizing liquids	Cat. 1	Cat. 2	Cat. 3				
8.	Oxidizing solids	Cat. 1	Cat. 2	Cat. 3				
9.	Gases under pressure	Compressed gas	Liquefied gas		Refrigerated liquefied gas		Dissolved gas	
10.	Self-reactive chemicals	Type A	Type B	Type C	Type D	Type E	Type F	Type G
11.	Pyrophoric liquids	Cat. 1						
12.	Pyrophoric solids	Cat. 1						
13.	Self-heating chemicals	Cat. 1	Cat. 2					
14.	Chemicals which, if in contact with water, emit flammables gases	Cat. 1	Cat. 2	Cat. 3				
15.	Organic peroxides	Type A	Type B	Type C	Type D	Type E	Type F	Type G
16.	Corrosive to metals	Cat. 1						

Health hazards

Hazard class		Hazard category			
1.	Acute toxicity (oral)	Cat. 1	Cat. 2	Cat. 3	Cat. 4
2.	Acute toxicity (dermal)	Cat. 1	Cat. 2	Cat. 3	Cat. 4
3.	Acute toxicity (inhalation)	Cat. 1	Cat. 2	Cat. 3	Cat. 4
4.	Skin corrosion or irritation	Cat. 1A/1B/1C	Cat. 2		
5.	Serious eye damage or eye irritation	Cat. 1	Cat. 2		
6.	Respiratory sensitization	Cat.1			
7.	Skin sensitization	Cat.1			
8.	Germ cell mutagenicity	Cat.1A/1B	Cat. 2		
9.	Carcinogenicity	Cat.1A/1B	Cat. 2		
10.	Reproductive toxicity	Cat.1A/1B	Cat. 2	Effects on or via lactation	
11.	Specific target organ toxicity- single exposure	Cat. 1	Cat. 2	Cat. 3	
12.	Specific target organ toxicity- repeated exposure	Cat. 1	Cat. 2		
13.	Aspiration hazard	Cat. 1			

Environmental hazards

Hazard class		Hazard category			
1.	Hazardous to the aquatic environment – acute hazard	Cat. 1			
2.	Hazardous to the aquatic environment– chronic hazard	Cat. 1	Cat. 2	Cat. 3	Cat. 4
3.	Hazardous to the ozone layer	Cat. 1			

This part also contains format for classification record. Refer to paragraph 2.7 for details.

Part 3: Hazard Communication: Labelling and Safety Data Sheet (SDS)

Part 3 of this ICOP gives guidance on the preparation of the label and SDS in order to achieve compliance with Part IV and Part V of the Regulations.

Part 4: Confidential Business Information (CBI)

This Part provides guidance on the legal requirement of the CBI. The requirements on CBI were stipulated under regulation 15 of the Regulations.

1.3 Inventory of hazardous chemicals

The Department has developed an online submission system to facilitate the importer and manufacturer to submit the inventory to the Director General. The system can be accessed through http://cims.dosh.gov.my.

TERMINOLOGY

For the purpose of this ICOP, the following terminologies shall apply:

"concentration limit" means a threshold of any classified impurity, additive or individual ingredient in a substance or a mixture that triggers classification of the substance or the mixture respectively. The concentration limit is normally specified by concentration expressed as % of the component substances. For solids and liquids mass concentration (w/w units) is used and for gases volume concentration (v/v units) is used;

"cut-off value" means concentration level of a classified ingredient in a mixture above which the duty to furnish a SDS apply. The cut-off value is normally specified by concentration expressed as % of the component substances. For solids and liquids mass concentration (w/w units) is used and for gases volume concentration (v/v units) is used;

"hazard category" means the division of criteria within each hazard class, specifying hazard severity;

"hazard class" means the nature of the physical, health or environmental hazard;

"hazard classification" means the result of classifications of a chemical which consist of hazard class and hazard category as specified in the First Schedule;

"hazard pictogram" in relation to the labelling of a hazardous chemical, means a graphical composition conveying specific information on the hazard concerned;

"hazard statement" means a statement assigned to a hazard class and category that describes the nature of the hazards of hazardous chemicals, including, where appropriate, the degree of hazard;

"mixture" means a mixture or solution composed of two or more substances which do not react;

"precautionary statement" means a phrase and/or pictogram that describes recommended measures to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling of a hazardous chemical;

"signal word" means a word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. Two levels of severity are distinguished as follows:

(a) "Danger" means a signal word indicating the more severe hazard categories; and
(b) "Warning" means a signal word indicating the less severe hazard categories.

"substance" means a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

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PART 1

LIST OF CLASSIFIED CHEMICAL

PART 1

LIST OF CLASSIFIED CHEMICALS

This Part contains a list of chemicals which have been classified under the Regulations. The list consists of the hazard classification and related labelling elements.

For listed chemicals, the supplier shall classify chemicals according to the classification specified in the list as required under sub-regulation 4(1) of the Regulations.

The hazard classification for each chemical is specified under column *Classification*. Under column *Labelling*, the hazard statement code (H-code), signal word, and hazard pictogram for each chemical have been determined accordingly, and which the supplier is required to put on the labels for hazardous chemicals. For full list of H-codes and corresponding hazard statements refer to Appendix 3.1. The labelling elements for each hazard classes are given in Appendix 3.

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
1	Acetaldehyde; ethanal	75-07-0	Flam. Liq. 1 Carc. 2 Eye Irrit. 2 STOT SE 3	H224 H351 H319 H335	H224 H351 H319 H335	Danger	
2	Acetic acid	64-19-7	Flam. Liq. 3 Skin Corr. 1A Eye Dam. 1	H226 H314 H318	H226 H314	Danger	
3	Acetic anhydride	108-24-7	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1	H226 H332 H302 H314 H318	H226 H302+H332 H314	Danger	
4	Acetone; propan-2-one; propanone	67-64-1	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	H225 H319 H336	Danger	
5	Acetonitrile; cyanomethane	75-05-8	Flam. Liq. 2 Acute Tox. 4 (oral) Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Eye Irrit. 2	H225 H302 H312 H332 H319	H225 H302+H312+H332 H319	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
6	Acrolein acrylaldehyde; prop-2-enal	107-02-8	Flam. Liq. 2 Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1	H225 H330 H311 H301 H314 H318 H400	H225 H330 H301+H311 H314 H400	Danger	
7	Acrylamide; prop-2-enamide	79-06-1	Carc. 1B Muta. 1B Repr. 2 Acute Tox. 3 (oral) STOT RE 1 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1	H350 H340 H361f (b) H301 H372 (a) H332 H312 H319 H315 H317	H350 H340 H361f (b) H301 H372 (a) H312+H332 H319 H315 H317	Danger	
8	Acrylic acid; prop-2-enoic acid	79-10-7	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Skin Corr. 1A Eye Dam. 1 Aquatic Acute 1	H226 H332 H312 H302 H314 H318 H400	H226 H302+H312+H332 H314 H400	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
9	Acrylonitrile	107-13-1	Flam. Liq. 2 Carc. 1B Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT SE 3 Skin Irrit. 2 Eye Dam. 1 Skin Sens. 1 Aquatic Chronic 2	H225 H350 H331 H311 H301 H335 H315 H318 H317 H411	H225 H350 H301+H311+H331 H335 H315 H318 H317 H411	Danger	
10	Aldrin (ISO)	309-00-2	Carc. 2 Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H351 H311 H301 H372 (a) H400 H410	H351 H301+H311 H372 (a) H410	Danger	
11	Allyl chloride; 3-chloropropene	107-05-1	Flam. Liq. 2 Carc. 2 Muta. 2 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) STOT RE 2	H225 H351 H341 H332 H312 H302 H373(a) H319	H225 H351 H341 H302+H312+H332 H373 (a) H319 H335 H315	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
			Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1	H335 H315 H400	H400		
12	Allyl glycidyl ether; allyl 2,3-epoxypropyl ether; prop-2-en-1-yl 2,3-epoxypropyl ether	106-92-3	Flam. Liq. 3 Carc. 2 Muta. 2 Repr. 2 Acute Tox. 4 (inh) Acute Tox. 4 (oral) STOT SE 3 Skin Irrit. 2 Eye Dam. 1 Skin Sens. 1 Aquatic Chronic 3	H226 H351 H341 H361f (b) H332 H302 H335 H315 H318 H317 H412	H226 H351 H341 H361f (b) H302+ H332 H335 H315 H318 H317 H412	Danger	
13	Aluminium Inhalable dust Respirable dust Soluble salts, as Al Alkyls (NOC), as Al	7429-90-5	Water-react. 2 Pyr. Sol. 1	H261 H250	H261 H250	Danger	
14	Ammonia	7664-41-7	Flam. Gas 2 Press. Gas (c) Acute Tox. 3 (inh) Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1	H221 H280/281(d) H331 H314 H318 H400	H221 H280/281(d) H331 H314 H400	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
15	Ammonium chloride	12125-02-9	Acute Tox. 4 (oral) Eye Irrit. 2	H302 H319	H302 H319	Warning	
16	*n*-Amyl acetate; pentyl acetate	628-63-7	Flam. Liq. 3	H226	H226	Warning	
17	*sec*-Amyl acetate; 1-methylbutyl acetate	626-38-0	Flam. Liq. 3	H226	H226	Warning	
18	Aniline and homologues	62-53-3	Carc. 2 Muta. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 1 Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1	H351 H341 H331 H311 H301 H372[(a)] H318 H317 H400	H351 H341 H301+H311+H331 H372[(a)] H318 H317 H400	Danger	
19	o-Anisidine; 2-methoxyaniline	90-04-0	Carc. 1B Muta. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral)	H350 H341 H331 H311 H301	H350 H341 H301+H311+H331	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
20	p-Anisidine; 4-methoxyaniline	104-94-9	Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral) STOT RE 2 Aquatic Acute 1	H330 H310 H300 H373$^{(a)}$ H400	H300+H310+H330 H373$^{(a)}$ H400	Danger	
21	ANTU (ISO); 1-(1-naphthyl)-2-thiourea	86-88-4	Acute Tox. 2 (oral) Carc. 2	H300 H351	H300 H351	Danger	
22	Arsenic	7440-38-2	Acute Tox. 3 (oral) Acute Tox. 3 (inh) Aquatic Acute 1 Aquatic Chronic 1	H331 H301 H400 H410	H301+H331 H410	Danger	
23	Arsine	7784-42-1	Flam. Gas 1 Press. Gas $^{(c)}$ Acute Tox. 2 (inh) STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H220 H280/281$^{(d)}$ H330 H373$^{(a)}$ H400 H410	H220 H280/281$^{(d)}$ H330 H373$^{(a)}$ H410	Danger	
24	Benzene	71-43-2	Flam. Liq. 2 Carc. 1A Muta. 1B STOT RE 1 Asp. Haz. Eye Irrit. 2 Skin Irrit. 2	H225 H350 H340 H372$^{(a)}$ H304 H319 H315	H225 H350 H340 H372$^{(a)}$ H304 H319 H315	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
25	Benzoyl peroxide; dibenzoyl peroxide;	94-36-0	Org. Perox. B Eye Irrit. 2 Skin Sens. 1	H241 H319 H317	H214 H319 H317	Danger	
26	Beryllium and compounds, as Be	7440-41-7	Carc. 1B Acute Tox. 2 (inh) Acute Tox. 3 (oral) STOT RE 1 Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Skin Sens. 1	H350i[b] H330 H301 H372[a] H319 H335 H315 H317	H350i[b] H330 H301 H372[a] H319 H335 H315 H317	Danger	
27	Biphenyl; diphenyl	92-52-4	Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H319 H335 H315 H400 H410	H319 H335 H315 H410	Warning	
28	Bromine	7726-95-6	Acute Tox. 2 (inh) Skin Corr. 1A Eye. Dam. 1 Aquatic Acute 1	H330 H314 H318 H400	H330 H314 H400	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
29	*n*-Butanol; *n*-Butyl alcohol; Butan-1-ol	71-36-3	Flam. Liq. 3 Acute Tox. 4 (oral) Skin Irrit. 2 Eye Dam. 1 STOT SE 3	H226 H302 H315 H318 H335, H336	H226 H302 H315 H318 H335, H336	Danger	
30	*sec*-Butanol; Butan-2-ol	78-92-2	Flam. Liq. 3 Eye Irrit. 2 STOT SE 3	H226 H319 H335, H336	H226 H319 H335, H336	Warning	
31	*tert*-butyl alcohol; 2-methylpropan-2-ol;	75-65-0	Flam. Liq. 2 Acute Tox. 4 (inh)	H225 H332	H225 H332	Danger	
32	*n*-Butyl Acetate	123-86-4	Flam. Liq. 3 STOT SE 3	H226 H336	H226 H336	Warning	
33	*sec*-Butyl Acetate	105-46-4	Flam. Liq. 2	H225	H225	Danger	
34	*tert*-Butyl Acetate	540-88-5	Flam. Liq. 2	H225	H225	Danger	
35	Butylamine	109-73-9	Flam. Liq. 2 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Skin Corr. 1A Eye Dam. 1	H225 H332 H312 H302 H314 H318	H225 H302+H312+H332 H314	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
36	Cadmium, elemental and compound, as Cd	7440-43-9	Carc. 1B Muta. 2 Repr. 2 Acute Tox. 2 (inh) STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H350 H341 H361fd(b) H330 H372(a) H400 H410	H350 H341 H361fd(b) H330 H372(a) H410	Danger	
37	Calcium cyanamide	156-62-7	Acute Tox. 4 (oral) STOT SE 3 Eye Dam. 1	H302 H335 H318	H302 H335 H318	Danger	
38	Captafol (ISO); 1,2,3,6-tetrahydro-*N*-(1,1,2,2-tetrachloroethylthio) phthalimide	2425-06-1	Carc. 1B Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H350 H317 H400 H410	H350 H317 H410	Danger	
39	Captan; 1,2,3,6-tetrahydro-*N*-(trichloromethylthio) phthalimide	133-06-2	Carc. 2 Acute Tox. 3 (inh) Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1	H351 H331 H318 H317 H400	H351 H331 H318 H317 H400	Danger	
40	Carbofuran (ISO); 2,3-dihydro-2,2-dimethylbenzofuran-7-yl *N*-methylcarbamate	1563-66-2	Acute Tox. 2 (inh) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H330 H300 H400 H410	H300+H330 H410	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
41	Carbon disulfide	75-15-0	Flam. Liq. 2 Repr. 2 STOT RE 1 Eye Irrit. 2 Skin Irrit. 2	H225 H361fd[b] H372[a] H319 H315	H225 H361fd[b] H372[a] H319 H315	Danger	
42	Carbon monoxide	630-08-0	Flam. Gas 1 Press. Gas[c] Repr. 1A Acute Tox. 3 (inh) STOT RE 1	H220 280/281[d] H360D[b] H331 H372[a]	H220 280/281[d] H360D[b] H331 H372[a]	Danger	
43	Chlordane (ISO); 1,2,4,5,6,7,8, 8-octachloro-3a,4,7, 7a-tetrahydro-4, 7-methanoindan	57-74-9	Carc. 2 Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Aquatic Acute 1 Aquatic Chronic 1	H351 H312 H302 H400 H410	H351 H312+H302 H410	Warning	
44	Chlorine	7782-50-5	Acute Tox. 3 (inh) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1	H331 H319 H335 H315 H400	H331 H319 H335 H315 H400	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
45	Chloroacetaldehyde	107-20-0	Carc. 2 Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1	H351 H330 H311 H301 H314 H318 H400	H351 H301+ H311 H330 H314 H400	Danger	
46	Chloroform; trichloromethane	67-66-3	Carc. 2 Acute Tox. 4 (oral) STOT RE 2 Skin Irrit. 2	H351 H302 H373[(a)] H315	H351 H302 H373[(a)] H315	Warning	
47	Bis (Chloromethyl) ether; Oxybis(chloromethane)	542-88-1	Flam. Liq. 2 Carc. 1A Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 4 (oral)	H225 H350 H330 H311 H302	H225 H350 H330 H311 H302	Danger	
48	1-Chloro-1-nitropropane	600-25-9	Acute Tox. 4 (inh) Acute Tox. 4 (oral)	H332 H302	H302+ H332	Warning	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
49	β-Chloroprene; 2-chlorobuta-1,3-diene	126-99-8	Flam. Liq. 2 Carc. 1B Acute Tox. 4 (inh) Acute Tox. 4 (oral) STOT RE 2 Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H225 H350 H332 H302 $H373^{(a)}$ H319 H335 H315	H225 H350 H302+H332 $H373^{(a)}$ H319 H335 H315	Danger	
50	Chlorpyrifos (ISO); *O*,*O*-diethyl *O*-3,5, 6-trichloro-2-pyridyl phosphorothioate	2921-88-2	Acute Tox. 3 (oral) Aquatic Acute 1 Aquatic Chronic 1	H301 H400 H410	H301 H410	Danger	
51	Cobalt, elemental and inorganic compound, as Co	7440-48-4	Resp. Sens. 1 Skin Sens. 1 Aquatic Chronic 4	H334 H317 H413	H334 H317 H413	Danger	
52	Cresol; all isomers	1319-77-3	Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1	H311 H301 H314 H318	H301+H311 H314	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
53	Crotonaldehyde	4170-30-3	Flam. Liq. 2 Muta. 2 Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 STOT SE 3 Skin Irrit. 2 Eye Dam. 1 Aquatic Acute 1	H225 H341 H330 H311 H301 H373$^{(a)}$ H335 H315 H318 H400	H225 H341 H330 H301+H311 H373$^{(a)}$ H335 H315 H318 H400	Danger	
54	Crufomate; 4-*tert*-butyl-2-chlorophenyl methyl methylphosphoramidate	299-86-5	Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Aquatic Acute 1 Aquatic Chronic 1	H312 H302 H400 H410	H302+H312 H410	Warning	
55	Cumene	98-82-8	Flam. Liq. 3 Asp. Haz. STOT SE 3 Aquatic Chronic 2	H226 H304 H335 H411	H226 H304 H335 H411	Danger	
56	Cyanamide; carbanonitril	420-04-2	Acute Tox. 3 (oral) Acute Tox. 4 (dermal) Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1	H301 H312 H319 H315 H317	H301 H312 H319 H315 H317	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
57	Cyclohexanone	108-94-1	Flam. Liq. 3 Acute Tox. 4 (inh)	H226 H332	H226 H332	Warning	
58	Cyhexatin (ISO); Hydroxytricyclohexylstannane; tri(cyclohexyl)tin hydroxide	13121-70-5	Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Aquatic Acute 1 Aquatic Chronic 1	H332 H312 H302 H400 H410	H302+H312+H332 H410	Warning	
59	2, 4-D (ISO); 2,4-dichlorophenoxyacetic acid	94-75-7	Acute Tox. 4 (oral) STOT SE 3 Eye Dam. 1 Skin Sens. 1 Aquatic Chronic 3	H302 H335 H318 H317 H412	H302 H335 H318 H317 H412	Danger	
60	DDT (ISO); clofenotane (INN); dicophane; 1,1,1-trichloro-2,2-bis(4-chlorophenyl) ethane; dichlorodiphenyltrichloroethane	50-29-3	Carc. 2 Acute Tox. 3 (oral) STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H351 H301 H372[(a)] H400 H410	H351 H301 H372[(a)] H410	Danger	
61	Demeton	8065-48-3	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1	H310 H300 H400	H300+H310 H400	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
62	Diazinon; *O*,*O*-diethyl *O*-2-isopropyl-6-methylpyrimidin-4-yl phosphorothioate	333-41-5	Acute Tox. 4 (oral) Aquatic Acute 1 Aquatic Chronic 1	H302 H400 H410	H302 H410	Warning	
63	Diazomethane	334-88-3	Carc. 1B	H350	H350	Danger	
64	Dibutyl phthalate; DBP	84-74-2	Repr. 1B Aquatic Acute 1	H360Df$^{(b)}$ H400	H360Df$^{(b)}$ H400	Danger	
65	bis(2-chloroethyl) ether	111-44-4	Carc. 2 Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral)	H351 H330 H310 H300	H351 H310 H300+H330	Danger	
66	Dichloromethane; methylene chloride	75-09-2	Carc. 2	H351	H351	Warning	
67	1,1-Dichloro-1-nitroethane	594-72-9	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral)	H331 H311 H301	H301+H311+H331	Danger	
68	Dichlorvos (ISO); 2,2-dichlorovinyl dimethyl phosphate	62-73-7	Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Sens. 1 Aquatic Acute 1	H330 H311 H301 H317 H400	H301+H311 H330 H317 H400	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
69	Dicrotophos (ISO); (*Z*)-2-dimethylcarbamoyl-1-methylvinyl dimethyl phosphate	141-66-2	Acute Tox. 2 (oral) Acute Tox. 3 (dermal) Aquatic Acute 1 Aquatic Chronic 1	H300 H311 H400 H410	H300 H311 H410	Danger	
70	Dieldrin (ISO)	60-57-1	Carc. 1B Acute Tox. 2 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1	H350 H330 H312 H302 H314 H318	H350 H330 H302+H312 H314	Danger	
71	Diethylene triamine; 2,2'-iminodiethylamine	111-40-0	Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1 Skin Sens. 1	H312 H302 H314 H318 H317	H302+H312 H314 H317	Danger	
72	Di (2-ethylhexyl) phthalate; bis(2-ethylhexyl) phthalate; DEHP	117-81-7	Repr. 1B	H360FD(b)	H360FD(b)	Danger	
73	Diisobutyl ketone; 2,6-dimethylheptan-4-one	108-83-8	Flam. Liq. 3 STOT SE 3	H226 H335	H226 H335	Warning	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
74	Diisopropylamine	108-18-9	Flam. Liq. 2 Acute Tox. 4 (inh) Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1	H225 H332 H302 H314 H318	H225 H302+H332 H314	Danger	
75	N,n-dimethylacetamide	127-19-5	Repr. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal)	H360D(b) H332 H312	H360D(b) H312+H332	Danger	
76	Dimethylamine	124-40-3	Flam. Gas 1 Press. Gas (c) Acute Tox. 4 (inh) STOT SE 3 Skin Irrit. 2 Eye Dam. 1	H220 H280/281(d) H332 H335 H315 H318	H220 H280/281(d) H332 H335 H315 H318	Danger	
77	Dimethylformamide; *N,N*-dimethylformamide	68-12-2	Repr. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Eye Irrit. 2	H360D(b) H332 H312 H319	H360D(b) H312+H332 H319	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
78	DNOC (ISO); Dinitro-o-cresol	534-52-1	Muta. 2 Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Skin Irrit. 2 Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H341 H330 H310 H300 H315 H318 H317 H400 H410	H341 H310 H300+H330 H315 H318 H317 H410	Danger	
79	1,4-Dioxane	123-91-1	Flam. Liq. 2 Carc. 2 Eye Irrit. 2 STOT SE 3	H225 H351 H319 H335	H225 H351 H319 H335	Danger	
80	Diphenylamine	122-39-4	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H331 H311 H301 $H373^{(a)}$ H400 H410	H301+H311+H331 $H373^{(a)}$ H410	Danger	
81	Disulfoton (ISO); *O,O*-diethyl 2-ethylthioethyl phosphorodithioate	298-04-4	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H310 H300 H400 H410	H310 H300 H410	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
82	Diuron (ISO); 3-(3,4-dichlorophenyl)-1,1-dimethylurea	330-54-1	Carc. 2 Acute Tox. 4 (oral) STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H351 H302 H373$^{(a)}$ H400 H410	H351 H302 H373$^{(a)}$ H410	Warning	
83	Endrin (ISO); 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4:5,8-dimethanonaphthalene	72-20-8	Acute Tox. 2 (oral) Acute Tox. 3 (dermal) Aquatic Acute 1 Aquatic Chronic 1	H300 H311 H400 H410	H300 H311 H410	Danger	
84	Epichlorohydrin; 1-chloro-2,3-epoxypropane	106-89-8	Flam. Liq. 3 Carc. 1B Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Skin Sens. 1	H226 H350 H331 H311 H301 H314 H318 H317	H226 H350 H301+H311+H331 H314 H317	Danger	
85	*O*-ethyl *O*-4-nitrophenyl phenylphosphonothioate; EPN	2104-64-5	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H310 H300 H400 H410	H310 H300 H410	Danger	
86	Ethanol; ethyl alcohol	64-17-5	Flam. Liq. 2	H225	H225	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
87	Ethion (ISO); *O*,*O*,*O*',*O*'-tetraethyl *S*,*S*'-methylenedi (phosphorodithioate); diethion	563-12-2	Acute Tox. 3 (oral) Acute Tox. 4 (dermal) Aquatic Acute 1 Aquatic Chronic 1	H301 H312 H400 H410	H301 H312 H410	Danger	
88	2-Ethoxyethanol (EGEE); ethylene glycol monoethyl ether	110-80-5	Flam. Liq. 3 Repr. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H226 H360FD$^{(b)}$ H332 H312 H302	H226 H360FD$^{(b)}$ H302+H312+H332	Danger	
89	2-Ethoxyethyl acetate (EGEEA); ethylglycol acetate	111-15-9	Flam. Liq. 3 Repr. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H226 H360FD$^{(b)}$ H332 H312 H302	H226 H360FD$^{(b)}$ H302+H312+H332	Danger	
90	Ethyl acetate	141-78-6	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	H225 H319 H336	Danger	
91	Ethylamine	75-04-7	Flam. Gas 1 Press. Gas$^{(c)}$ Eye Irrit. 2 STOT SE 3	H220 H280/281$^{(d)}$ H319 H335	H220 H280/281$^{(d)}$ H319 H335	Danger	
92	Ethyl benzene	100-41-4	Flam. Liq. 2 Acute Tox. 4 (inh)	H225 H332	H225 H332	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
93	Ethyl chloride; Chloroethane	75-00-3	Flam. Gas 1 Press. Gas$^{(c)}$ Carc. 2 Aquatic Chronic 3	H220 H280/281$^{(d)}$ H351 H412	H220 H280/281$^{(d)}$ H351 H412	Danger	
94	Ethyl 2-cyanoacrylate	7085-85-0	Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H319 H335 H315	H319 H335 H315	Warning	
95	Ethylenediamine; 1,2-diaminoethane	107-15-3	Flam. Liq. 3 Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1 Resp. Sens. 1 Skin Sens. 1	H226 H312 H302 H314 H318 H334 H317	H226 H302+H312 H314 H334 H317	Danger	
96	Ethylene dibromide	106-93-4	Carc. 1B Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Chronic 2	H350 H331 H311 H301 H319 H335 H315 H411	H350 H301+H311+H331 H319 H335 H315 H411	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
97	Ethylene dichloride; 1,2-dichloroethane	107-06-2	Flam. Liq. 2 Carc. 1B Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H225 H350 H302 H319 H335 H315	H225 H350 H302 H319 H335 H315	Danger	
98	Ethylene glycol dinitrate; ethylene dinitrate	628-96-6	Unst. Expl. Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral) STOT RE 2	H200 H330 H310 H300 H373$^{(a)}$	H200 H330 H310 H300+H330 H373$^{(a)}$	Danger	
99	Ethylene oxide; oxirane	75-21-8	Press. Gas $^{(c)}$ Flam. Gas 1 Carc. 1B Muta. 1B Acute Tox. 3 (inh) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H280/281$^{(d)}$ H220 H350 H340 H331 H319 H335 H315	H280/281$^{(d)}$ H220 H350 H340 H331 H319 H335 H315	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
100	Ethylenimine; aziridine	151-56-4	Flam. Liq. 2 Carc. 1B Muta. 1B Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Skin Corr. 1B Eye Dam. 1 Aquatic Chronic 2	H225 H350 H340 H330 H310 H300 H314 H318 H411	H225 H350 H340 H310 H300+H330 H314 H411	Danger	
101	Diethyl ether; Ether	60-29-7	Flam. Liq. 1 Acute Tox. 4 (oral) STOT SE 3	H224 H302 H336	H224 H302 H336	Danger	
102	Ethyl formate	109-94-4	Flam. Liq. 2 Acute Tox. 4 (inh) Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3	H225 H332 H302 H319 H335	H225 H302+H332 H319 H335	Danger	
103	Fenamiphos (ISO); ethyl-4-methylthio-*m*-tolyl isopropyl phosphoramidate	22224-92-6	Acute Tox. 2 (oral) Acute Tox. 3 (dermal) Aquatic Acute 1 Aquatic Chronic 1	H300 H311 H400 H410	H300 H311 H410	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
104	Fenchlorphos (ISO); *O*,*O*-dimethyl *O*-2,4,5-trichlorophenyl phosphorothioate	299-84-3	Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Aquatic Acute 1 Aquatic Chronic 1	H312 H302 H400 H410	H302+H312 H410	Warning	
105	Ferbam (ISO); iron tris (dimethyldithiocarbamate)	14484-64-1	Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H319 H335 H315 H400 H410	H319 H335 H315 H410	Warning	
106	Fonofos (ISO); *O*-ethyl phenyl ethylphosphonodithioate	944-22-9	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H310 H300 H400 H410	H310 H300 H410	Danger	
107	Formaldehyde	50-00-0	Carc. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Skin Sens. 1	H351 H331 H311 H301 H314 H318 H317	H351 H301+H311+H331 H314 H317	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
108	Furfuryl alcohol	98-00-0	Carc. 2 Acute Tox. 3 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) STOT RE 2 Eye Irrit. 2 STOT SE 3	H351 H331 H312 H302 $H373^{(a)}$ H319 H335	H351 H331 H302+H312 $H373^{(a)}$ H319 H335	Danger	
109	Glutaraldehyde, activated and inactivated; glutaral; 1,5-pentanedial	111-30-8	Acute Tox. 3 (inh) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Resp. Sens. 1 Skin Sens. 1 Aquatic Acute 1	H331 H301 H314 H318 H334 H317 H400	H301+H331 H314 H334 H317 H400	Danger	
110	Glycidol; 2,3-epoxypropan-1-ol; oxiranemethanol	556-52-5	Carc. 1B Muta. 2 Repr. 1B Acute Tox. 3 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H350 H341 $H360F^{(b)}$ H331 H312 H302 H319 H335 H315	H350 H341 $H360F^{(b)}$ H331 H302+H312 H319 H335 H315	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
111	Hexachlorocyclopentadiene	77-47-4	Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1 Aquatic Chronic 1	H330 H311 H302 H314 H318 H400 H410	H330 H311 H302 H314 H410	Danger	
112	Hexamethylene diisocyanate	822-06-0	Acute Tox. 3 (inh) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Resp. Sens. 1 Skin Sens. 1	H331 H319 H335 H315 H334 H317	H331 H319 H335 H315 H334 H317	Danger	
113	n-Hexane	110-54-3	Flam. Liq. 2 Repr. 2 Asp. Haz. STOT RE 2 Skin Irrit. 2 STOT SE 3 Aquatic Chronic 2	H225 H361f$^{(b)}$ H304 H373$^{(a)}$ H315 H336 H411	H225 H361f$^{(b)}$ H304 H373$^{(a)}$ H315 H336 H411	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
114	Hydrazine	302-01-2	Flam. Liq. 3 Carc. 1B Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H226 H350 H331 H311 H301 H314 H318 H317 H400 H410	H226 H350 H301+H311+H331 H314 H317 H410	Danger	
115	Hydrogen bromide	10035-10-6	Press. Gas [c] Skin Corr. 1A Eye Dam. 1 STOT SE 3	H280/281 H314 H318 H335	H280/281 H314 H335	Danger	
116	Hydrogen chloride	7647-01-0	Press. Gas [c] Acute Tox. 3 (inh) Skin Corr. 1A Eye Dam. 1	H280/281[d] H331 H314 H318	H280/281[d] H331 H314	Danger	
117	Hydrogen cyanide; hydrocyanic acid	74-90-8	Flam. Liq. 1 Acute Tox. 2 (inh) Aquatic Acute 1 Aquatic Chronic 1	H224 H330 H400 H410	H224 H330 H410	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
118	Hydrogen fluoride, as F	7664-39-3	Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Skin Corr. 1A Eye Dam. 1	H330 H310 H300 H314 H318	H300+H310+H330 H314	Danger	
119	Hydrogen sulfide	7783-06-4	Flam. Gas 1 Press. Gas $^{(c)}$ Acute Tox. 2 (inh) Aquatic Acute 1	H220 H280/281$^{(d)}$ H330 H400	H220 H280/281$^{(d)}$ H330 H400	Danger	
120	Hydroquinone; 1,4-dihydroxybenzene; quinol	123-31-9	Carc. 2 Muta. 2 Acute Tox. 4 (oral) Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1	H351 H341 H302 H318 H317 H400	H351 H341 H302 H318 H317 H400	Danger	
121	Iodine	7553-56-2	Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Aquatic Acute 1	H332 H312 H400	H312+H332 H400	Warning	
122	Isoamyl acetate	123-92-2	Flam. Liq. 3	H226	H226	Warning	
123	Isobutyl acetate	110-19-0	Flam. Liq. 2	H225	H225	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
124	Isobutyl alcohol; 2-methylpropan-1-ol; iso-butanol	78-83-1	Flam. Liq. 3 STOT SE 3 Skin Irrit. 2 Eye Dam. 1 STOT SE 3	H226 H335 H315 H318 H336	H226 H335 H315 H318 H336	Danger	
125	Isophorone; 3,5,5-trimethylcyclohex-2-enone	78-59-1	Carc. 2 Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3	H351 H312 H302 H319 H335	H351 H302+H312 H319 H335	Warning	
126	Isopropyl alcohol; propan-2-ol; isopropanol	67-63-0	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	H225 H319 H336	Danger	
127	Lead chromate as Pb as Cr	7758-97-6	Carc. 1B Repr. 1A STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H350 H360Df$^{(b)}$ H373$^{(a)}$ H400 H410	H350 H360Df$^{(b)}$ H373$^{(a)}$ H410	Danger	
128	Lindane (ISO); γ-HCH or γ-BHC; γ-1,2,3,4,5,6-hexachlorocyclohexane	58-89-9	Acute Tox. 3 (oral) Acute Tox. 4 (inh) Acute Tox. 4 (dermal) STOT RE 2 Lact. Aquatic Acute 1 Aquatic Chronic 1	H301 H332 H312 H373$^{(a)}$ H362 H400 H410	H301 H312+H332 H373$^{(a)}$ H362 H410	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
129	Malathion (ISO); 1,2-bis (ethoxycarbonyl) ethyl *O*,*O*-dimethyl phosphorodithioate	121-75-5	Acute Tox. 4 (oral) Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H302 H317 H400 H410	H302 H317 H410	Warning	
130	Maleic anhydride	108-31-6	Acute Tox. 4 (oral) Skin Corr. 1B Resp. Sens. 1 Skin Sens. 1 Eye Dam.	H302 H314 H334 H317 H318	H302 H314 H334 H317	Danger	
131	Mercury, as Hg Alkyl compounds Aryl compounds Elemental mercury and inorganic compounds	7439-97-6	Repr. 1B Acute Tox. 2 (inh) STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H360D$^{(b)}$ H330 H372$^{(a)}$ H400 H410	H360D$^{(b)}$ H330 H372$^{(a)}$ H410	Danger	
132	Mesityl oxide; 4-methylpent-3-en-2-one	141-79-7	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H226 H332 H312 H302	H226 H302+H312+H332	Warning	
133	Methanol	67-56-1	Flam. Liq. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT SE 1	H225 H331 H311 H301 H370 $^{(a)}$	H225 H301+H311+H331 H370 $^{(a)}$	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
134	Methomyl	16752-77-5	Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H300 H400 H410	H300 H410	Danger	
135	2-Methoxyethanol (EGME)	109-86-4	Flam. Liq. 3 Repr. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H226 H360FD$^{(b)}$ H332 H312 H302	H226 H360FD$^{(b)}$ H302+H312+H332	Danger	
136	2-Methoxyethyl acetate (EGMEA); methylglycol acetate	110-49-6	Repr. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H360FD $^{(b)}$ H332 H312 H302	H360FD $^{(b)}$ H302+H312+H332	Danger	
137	Methyl acetate	79-20-9	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	H225 H319 H336	Danger	
138	Methyl acrylate	96-33-3	Flam. Liq. 2 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Skin Sens. 1	H225 H332 H312 H302 H319 H335 H315 H317	H225 H302+H312+H332 H319 H335 H315 H317	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
139	Methylamine	74-89-5	Flam. Gas 1 Press. Gas $^{(c)}$ Acute Tox. 4 (inh) STOT SE 3 Skin Irrit. 2 Eye Dam. 1	H220 H280/281$^{(d)}$ H332 H335 H315 H318	H220 H280/281$^{(d)}$ H332 H335 H315 H318	Danger	
140	Methyl n-amyl ketone; heptan-2-one;	110-43-0	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (oral)	H226 H332 H302	H226 H302+H332	Warning	
141	N-Methyl aniline	100-61-8	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H331 H311 H301 H373$^{(a)}$ H400 H410	H301+H311+H331 H373$^{(a)}$ H410	Danger	
142	Methyl bromide; bromomethane	74-83-9	Press. Gas$^{(c)}$ Muta. 2 Acute Tox. 3 (inh) Acute Tox. 3 (oral) STOT RE 2 Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1 Ozone	H280/281$^{(d)}$ H341 H331 H301 H373$^{(a)}$ H319 H335 H315 H400 H420	H280/281$^{(d)}$ H341 H301+H331 H373$^{(a)}$ H319 H335 H315 H400 H420	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
143	Methyl n-butyl ketone; hexan-2-one; butyl methyl ketone; methyl-*n*-butyl ketone	591-78-6	Flam. Liq. 3 Repr. 2 STOT RE 1 STOT SE 3	H226 H361f$^{(b)}$ H372$^{(a)}$ H336	H226 H361f$^{(b)}$ H372$^{(a)}$ H336	Danger	
144	Methyl chloride	74-87-3	Flam. Gas 1 Press. Gas$^{(c)}$ Carc. 2 STOT RE 2	H220 H280/281$^{(d)}$ H351 H373$^{(a)}$	H220 H280/281$^{(d)}$ H351 H373$^{(a)}$	Danger	
145	1,1,1-trichloroethane; Methyl chloroform	71-55-6	Acute Tox. 4 (inh) Ozone	H332 H420	H332 H420	Warning	
146	o-Methycyclohexanone	583-60-8	Flam. Liq. 3 Acute Tox. 4 (inh)	H226 H332	H226 H332	Warning	
147	Methyl ethyl ketone (MEK); butanone	78-93-3	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	H225 H319 H336	Danger	
148	Methyl iodide; iodomethane	74-88-4	Carc. 2 Acute Tox. 4 (dermal) Acute Tox. 3 (inh) Acute Tox. 3 (oral) STOT SE 3 Skin Irrit. 2	H351 H312 H331 H301 H335 H315	H351 H312 H301+H331 H335 H315	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
149	4-Methylpentan-2-one; isobutyl methyl ketone	108-10-1	Flam. Liq. 2 Acute Tox. 4 (inh) Eye Irrit. 2 STOT SE 3	H225 H332 H319 H335	H225 H332 H319 H335	Danger	
150	Methyl isocyanate	624-83-9	Flam. Liq. 2 Repr. 2 Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Resp. Sens. 1 Skin Sens. 1 STOT SE 3 Skin Irrit. 2 Eye Dam. 1	H225 H361d[(b)] H330 H311 H301 H334 H317 H335 H315 H318	H225 H361d[(b)] H330 H301+H311 H334 H317 H335 H315 H318	Danger	
151	Methanethiol; methyl mercaptan	74-93-1	Flam. Gas. 1 Press. Gas [(c)] Acute Tox. 3 (inh) Aquatic Acute 1 Aquatic Chronic 1	H220 H280/281[(d)] H331 H400 H410	H220 H280/281[(d)] H331 H410	Danger	
152	Methyl methacrylate; methyl 2-methylprop-2-enoate; methyl 2-methylpropenoate	80-62-6	Flam. Liq. 2 STOT SE 3 Skin Irrit. 2 Skin Sens. 1	H225 H335 H315 H317	H225 H335 H315 H317	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
153	Parathion-methyl (ISO); *O*,*O*-dimethyl *O*-4-nitrophenyl phosphorothioate	298-00-0	Flam. Liq. 3 Acute Tox. 2 (inh) Acute Tox. 2 (oral) Acute Tox. 3 (dermal) STOT RE 2 Aquatic Acute 1 Aquatic Chronic 1	H226 H330 H300 H311 H373$^{(a)}$ H400 H410	H226 H300+H330 H311 H373$^{(a)}$ H410	Danger	
154	2-Phenylpropene; α-methylstyrene	98-83-9	Flam. Liq. 3 Eye Irrit. 2 STOT SE 3 Aquatic Chronic 2	H226 H319 H335 H411	H226 H319 H335 H411	Warning	
155	Mevinphos (ISO); 2-methoxycarbonyl-1-methylvinyl dimethyl phosphate	7786-34-7	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H310 H300 H400 H410	H310 H300 H410	Danger	
156	Monocrotophos (ISO); dimethyl-1-methyl-2-(methylcarbamoyl)vinyl phosphate	6923-22-4	Muta. 2 Acute Tox. 2 (inh) Acute Tox. 2 (oral) Acute Tox. 3 (dermal) Aquatic Acute 1 Aquatic Chronic 1	H341 H330 H300 H311 H400 H410	H341 H300+H330 H311 H410	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
157	Morpholine	110-91-8	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (oral) Acute Tox. 4 (dermal) Skin Corr. 1B Eye Dam. 1	H226 H332 H312 H302 H314 H318	H226 H302+H312+H332 H314	Danger	
158	Naphtha; Low boiling point naphtha; [Refined, partly refined, or unrefined petroleum products by the distillation of natural gas. It consists of hydrocarbons having carbon numbers predominantly in the range of C5 through C6 and boiling in the range of approximately 100°C to 200°C (212°F to 392°F).]	8030-30-6	Carc. 1B Asp. Haz.	H350 H304	H350 H304	Danger	
159	Naphthalene	91-20-3	Carc. 2 Acute Tox. 4 (oral) Aquatic Acute 1 Aquatic Chronic 1	H351 H302 H400 H410	H351 H302 H410	Warning	
160	Nitric acid	7697-37-2	Ox. Liq. 3 Skin Corr. 1A Eye Dam. 1	H272 H314 H318	H272 H314	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
161	p-Nitroaniline	100-01-6	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Aquatic Chronic 3	H331 H311 H301 H373(a) H412	H301+H311+H331 H373(a) H412	Danger	
162	Nitrobenzene	98-95-3	Carc. 2 Repr. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 1 Aquatic Chronic 2	H351 H361f (b) H331 H311 H301 H372(a) H411	H351 H361f (b) H301+H311+H331 H372(a) H411	Danger	
163	Nitroethane	79-24-3	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (oral)	H226 H332 H302	H226 H302+H332	Warning	
164	Nitrogen dioxide	10102-44-0	Press. Gas(c) Ox. Gas 1 Acute Tox. 2 (inh) Skin Corr. 1B Eye Dam. 1	H280/281(d) H270 H330 H314 H318	H280/281(d) H270 H330 H314	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
165	Glycerol trinitrate; nitroglycerine	55-63-0	Unst. Expl. Acute Tox. 2 (inh) Acute Tox. 1 (dermal) Acute Tox. 2 (oral) STOT RE 2 Aquatic Chronic 2	H200 H330 H310 H300 H373$^{(a)}$ H411	H200 H310 H300+H330 H373$^{(a)}$ H411	Danger	
166	Nitromethane	75-52-5	Flam. Liq. 3 Acute Tox. 4 (oral)	H226 H302	H226 H302	Warning	
167	1-Nitropropane	108-03-2	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H226 H332 H312 H302	H226 H302+H312+H332	Warning	
168	2-Nitropropane	79-46-9	Flam. Liq. 3 Carc. 1B Acute Tox. 4 (inh) Acute Tox. 4 (oral)	H226 H350 H332 H302	H226 H350 H302+H332	Danger	
169	o-Nitrotoluene	88-72-2	Carc. 1B Muta. 1B Repr. 2 Acute Tox. 4 (oral) Aquatic Chronic 2	H350 H340 H361f $^{(b)}$ H302 H411	H350 H340 H361f $^{(b)}$ H302 H411	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
170	p-Nitrotoluene	99-99-0	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Aquatic Chronic 2	H331 H311 H301 H373(a) H411	H301+H311+H331 H373(a) H411	Danger	
171	Parathion (ISO); *O*,*O*-diethyl *O*-4-nitrophenyl phosphorothioate	56-38-2	Acute Tox. 2 (inh) Acute Tox. 2 (oral) Acute Tox. 3 (dermal) STOT RE 1 Aquatic Acute 1 Aquatic Chronic 1	H330 H300 H311 H372(a) H400 H410	H300+H330 H311 H372(a) H410	Danger	
172	Pentachlorophenol	87-86-5	Carc. 2 Acute Tox. 2 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H351 H330 H311 H301 H319 H335 H315 H400 H410	H351 H330 H301+H311 H319 H335 H315 H410	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
173	Pentane (all isomers)	109-66-0	Flam. Liq. 2 Asp. Haz. STOT SE 3 Aquatic Chronic 2	H225 H304 H336 H411	H225 H304 H336 H411	Danger	
174	Perchloroethylene (Tetrachloroethylene)	127-18-4	Carc. 2 Aquatic Chronic 2	H351 H411	H351 H411	Warning	
175	Phenol; carbolic acid; monohydroxybenzene; phenylalcohol	108-95-2	Muta. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Skin Corr. 1B Eye Dam. 1	H341 H331 H311 H301 H373$^{(a)}$ H314 H318	H341 H301+H311+H331 H373$^{(a)}$ H314	Danger	
176	o-Phenylenediamine	95-54-5	Carc. 2 Muta. 2 Acute Tox. 3 (oral) Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Eye Irrit. 2 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H351 H341 H301 H332 H312 H319 H317 H400 H410	H351 H341 H301 H312+H332 H319 H317 H410	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
177	m-Phenylenediamine	108-45-2	Muta. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Eye Irrit. 2 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H341 H331 H311 H301 H319 H317 H400 H410	H341 H301+H311+H331 H319 H317 H410	Danger	
178	p-Phenylenediamine	106-50-3	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Eye Irrit. 2 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H331 H311 H301 H319 H317 H400 H410	H301+H311+H331 H319 H317 H410	Danger	
179	Phorate (ISO); *O,O*-diethyl ethylthiomethyl phosphorodithioate	298-02-2	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H310 H300 H400 H410	H300+H310 H410	Danger	
180	Phosphine	7803-51-2	Flam. Gas 1 Press. Gas [(c)] Acute Tox. 2 (inh) Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1	H220 H280/281[(d)] H330 H314 H318 H400	H220 H280/281[(d)] H330 H314 H400	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
181	Phosphorus (red)	7723-14-0	Flam. Sol. 1 Aquatic Chronic 3	H228 H412	H228 H412	Danger	
182	Phosphorus trichloride	7719-12-2	Acute Tox. 2 (inh) Acute Tox. 2 (oral) STOT RE 2 Skin Corr. 1A Eye Dam. 1	H330 H300 $H373^{(a)}$ H314 H318	H300+H330 $H373^{(a)}$ H314	Danger	
183	Phthalic anhydride	85-44-9	Acute Tox. 4 (oral) STOT SE 3 Skin Irrit. 2 Eye Dam. 1 Resp. Sens. 1 Skin Sens. 1	H302 H335 H315 H318 H334 H317	H302 H335 H315 H318 H334 H317	Danger	
184	Picric acid; 2,4,6-trinitrophenol	88-89-1	Expl. 1.1 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral)	H201 H331 H311 H301	H201 H301+H311+H331	Danger	
185	Prop-2-yn-1-ol; propargyl alcohol	107-19-7	Flam. Liq. 3 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Skin Corr. 1B Eye Dam. 1 Aquatic Chronic 2	H226 H331 H311 H301 H314 H318 H411	H226 H301+H311+H331 H314 H411	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	**H-code**	**H-code**	**Signal Word**	**Hazard Pictogram**
186	Propoxur (ISO); 2-isopropyloxyphenyl *N* methylcarbamate; 2-isopropoxyphenyl methylcarbamate	114-26-1	Acute Tox. 3 (oral) Aquatic Acute 1 Aquatic Chronic 1	H301 H400 H410	H301 H410	Danger	
187	n-Propyl acetate	109-60-4	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	H225 H319 H336	Danger	
188	Propan-1-ol; *n*-propanol	71-23-8	Flam. Liq. 2 Eye Dam. 1 STOT SE 3	H225 H318 H336	H225 H318 H336	Danger	
189	1,2-Dichloropropane; propylene dichloride	78-87-5	Flam. Liq. 2 Acute Tox. 4 (inh) Acute Tox. 4 (oral)	H225 H332 H302	H225 H302+H332	Danger	
190	1-Methoxy-2-propanol; monopropylene glycol methyl ether	107-98-2	Flam. Liq. 3 STOT SE 3	H226 H336	H226 H336	Warning	
191	Propylene oxide; 1,2-epoxypropane; methyloxirane	75-56-9	Flam. Liq. 1 Carc. 1B Muta. 1B Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H224 H350 H340 H332 H312 H302 H319 H335 H315	H224 H350 H340 H302+H312+H332 H319 H335 H315	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
192	Pyridine	110-86-1	Flam. Liq. 2 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral)	H225 H332 H312 H302	H225 H302+H312+H332	Danger	
193	*p*-Benzoquinone; quinone	106-51-4	Acute Tox. 3 (inh) Acute Tox. 3 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1	H331 H301 H319 H335 H315 H400	H301+H331 H319 H335 H315 H400	Danger	
194	Rotenone (commercial); (2*R*,6a*S*,12a*S*)-1,2,6,6a,12,12a-hexahydro-2-isopropenyl-8,9-dimethoxychromeno[3,4-b]furo[2,3-h]chromen-6-one, rotenone	83-79-4	Acute Tox. 3 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H301 H319 H335 H315 H400 H410	H301 H319 H335 H315 H410	Danger	
195	Sodium azide As Sodium azide As Hydrozoic acid vapour	26628-22-8	Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H300 H400 H410	H300 H410	Danger	
196	Sodium hydroxide	1310-73-2	Skin Corr. 1A Eye Dam. 1	H314 H318	H314	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
197	Stoddard solvent Low boiling point naphtha – unspecified; [A colourless, refined petroleum distillate that is free from rancid or objectionable odors and that boils in a range of approximately 300^{o}F to 400^{o}F.]	8052-41-3	Carc. 1B Muta. 1B Asp. Haz.	H350 H340 H304	H350 H340 H304	Danger	
198	Strychnine	57-24-9	Acute Tox. 1 (dermal) Acute Tox. 2 (oral) Aquatic Acute 1 Aquatic Chronic 1	H310 H300 H400 H410	H300+H310 H410	Danger	
199	Styrene, monomer	100-42-5	Flam. Liq. 3 Acute Tox. 4 (inh) Eye Irrit. 2 Skin Irrit. 2	H226 H332 H319 H315	H226 H332 H319 H315	Warning	
200	Sulfur dioxide	7446-09-5	Press. Gas(c) Acute Tox. 3 (inh) Skin Corr. 1B Eye Dam. 1	H280/281(d) H331 H314 H318	H280/281(d) H331 H314	Danger	
201	Sulfuric acid	7664-93-9	Skin Corr. 1A Eye Dam. 1	H314 H318	H314	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
202	Sulfuryl fluoride	2699-79-8	Press. Gas Acute Tox. 3 (inh) STOT RE 2 Aquatic Acute 1	H280/281$^{(d)}$ H331 H373$^{(a)}$ H400	H280/281$^{(d)}$ H331 H373$^{(a)}$ H400	Danger	
203	2,4,5-T (ISO); 2,4,5-trichlorophenoxy acetic acid	93-76-5	Acute Tox. 4 (oral) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H319 H335 H315 H400 H410	H302 H319 H335 H315 H410	Warning	
204	Tetrahydrofuran	109-99-9	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H335	H225 H319 H335	Danger	
205	*N*-methyl-*N*,2,4,6-tetranitroaniline; tetryl	479-45-8	Expl. 1.1 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2	H201 H331 H311 H301 H373$^{(a)}$	H201 H301+H311+H331 H373$^{(a)}$	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
206	Thiram (ISO); tetramethylthiuram disulphide	137-26-8	Acute Tox. 4 (inh) Acute Tox. 4 (oral) STOT RE 2 Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H332 H302 H373$^{(a)}$ H319 H315 H317 H400 H410	H302+H332 H373$^{(a)}$ H319 H315 H317 H410	Warning	
207	Toluene	108-88-3	Flam. Liq. 2 Repr. 2 Asp. Haz. STOT RE 2 Skin Irrit. 2 STOT SE 3	H225 H361d$^{(b)}$ H304 H373$^{(a)}$ H315 H336	H225 H361d$^{(b)}$ H304 H373$^{(a)}$ H315 H336	Danger	
208	Toluene-2, 4-diisocyanate (TDI)	584-84-9	Carc. 2 Acute Tox. 2 (inh) Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Resp. Sens. 1 Skin Sens. 1 Aquatic Chronic 3	H351 H330 H319 H335 H315 H334 H317 H412	H351 H330 H319 H335 H315 H334 H317 H412	Danger	
209	o-Toluidine; 2-aminotoluene	95-53-4	Carc. 1B Acute Tox. 3 (inh) Acute Tox. 3 (oral) Eye Irrit. 2 Aquatic Acute 1	H350 H331 H301 H319 H400	H350 H301+H331 H319 H400	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
210	m-Toluidine; 3-aminotoluene	108-44-1	Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Aquatic Acute 1	H331 H311 H301 $H373^{(a)}$ H400	H301+H311+H331 $H373^{(a)}$ H400	Danger	
211	p-Toluidine	106-49-0	Carc. 2 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) Eye Irrit. 2 Skin Sens. 1 Aquatic Acute 1	H351 H331 H311 H301 H319 H317 H400	H351 H301+H311+H331 H319 H317 H400	Danger	
212	1,2,4-Trichlorobenzene	120-82-1	Acute Tox. 4 (oral) Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H315 H400 H410	H302 H315 H410	Warning	
213	Trichloroethylene; trichloroethene	79-01-6	Carc. 1B Muta. 2 Eye Irrit. 2 Skin Irrit. 2 STOT SE 3 Aquatic Chronic 3	H350 H341 H319 H315 H336 H412	H350 H341 H319 H315 H336 H412	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
214	Trimellitic anhydride; benzene-1,2,4-tricarboxylic acid 1,2-anhydride;	552-30-7	STOT SE 3 Eye Dam. 1 Resp. Sens. 1 Skin Sens. 1	H335 H318 H334 H317	H335 H318 H334 H317	Danger	
215	2,4,6-Trinitrotoluene; TNT	118-96-7	Expl. 1.1 Acute Tox. 3 (inh) Acute Tox. 3 (dermal) Acute Tox. 3 (oral) STOT RE 2 Aquatic Chronic 2	H201 H331 H311 H301 H373$^{(a)}$ H411	H201 H301+H311+H331 H373$^{(a)}$ H411	Danger	
216	Turpentine, oil	8006-64-2	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Acute Tox. 4 (oral) Asp. Haz. Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1 Aquatic Chronic 2	H226 H332 H312 H302 H304 H319 H315 H317 H411	H226 H302+H312+H332 H304 H319 H315 H317 H411	Danger	
217	Divanadium pentaoxide; vanadium pentoxide	1314-62-1	Muta. 2 Repr. 2 STOT RE 1 Acute Tox. 4 (inh) Acute Tox. 4 (oral) STOT SE 3 Aquatic Chronic 2	H341 H361d$^{(b)}$ H372$^{(a)}$ H332 H302 H335 H411	H341 H361d$^{(b)}$ H372$^{(a)}$ H302+H332 H335 H411	Danger	

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No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
218	Vinyl acetate	108-05-4	Flam. Liq. 2	H225	H225	Danger	
219	Vinyl bromide; bromoethylene	593-60-2	Press. Gas$^{(c)}$ Flam. Gas 1 Carc. 1B	H280/281$^{(d)}$ H220 H350	H280/281$^{(d)}$ H220 H350	Danger	
220	Vinyl chloride; chloroethylene	75-01-4	Press. Gas$^{(c)}$ Flam. Gas 1 Carc. 1A	H280/281$^{(d)}$ H220 H350	H280/281$^{(d)}$ H220 H350	Danger	
221	1,1-Dichloroethylene; vinylidene chloride	75-35-4	Flam. Liq. 1 Carc. 2 Acute Tox. 4 (inh)	H224 H351 H332	H224 H351 H332	Danger	
222	VM & P Naphta Ligroine; Low boiling point naphtha; [A complex combination of hydrocarbons obtained by the fractional distillation of petroleum. This fraction boils in a range of approximately 20 °C to 135 °C (58 °F to 275 °F).]	8032-32-4	Carc. 1B Muta. 1B Asp. Haz.	H350 H340 H304	H350 H340 H304	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
223	Xylene	1330-20-7	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Skin Irrit. 2	H226 H332 H312 H315	H226 H312+H332 H315	Warning	
224	o-Xylene	95-47-6	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Skin Irrit. 2	H226 H332 H312 H315	H226 H312+H332 H315	Warning	
225	m-Xylene	108-38-3	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Skin Irrit. 2	H226 H332 H312 H315	H226 H312+H332 H315	Warning	
226	p-Xylene	106-42-3	Flam. Liq. 3 Acute Tox. 4 (inh) Acute Tox. 4 (dermal) Skin Irrit. 2	H226 H332 H312 H315	H226 H312+H332 H315	Warning	
227	Zinc chloride fume	7646-85-7	Acute Tox. 4 (oral) Skin Corr. 1B Eye Dam. 1 Aquatic Acute 1 Aquatic Chronic 1	H302 H314 H318 H400 H410	H302 H314 H410	Danger	

No.	Chemical Name	CAS No.	Classification		Labelling		
			Classification Code	H-code	H-code	Signal Word	Hazard Pictogram
228	Zinc oxide Fume Dust	1314-13-2	Aquatic Acute 1 Aquatic Chronic 1	H400 H410	H410	Warning	
229	Zirconium and compounds, as Zr	7440-67-7	Water-react. 1 Pyr. Sol. 1	H260 H250	H260 H250	Danger	

NOTE

[a] *State the target organ.*

[b] *If the specific effect is not known, the general H-code H360 or H361 may be used.*

[c] *State the category (compressed gas, liquefied gas, dissolved gas or refrigerated liquefied gas).*

[d] *For gases under pressure, state the relevant H-code based on its hazard category.*

Abbreviation of classification code

Classification Code	Hazard Classification
Unst. Expl. Expl. 1.1 Expl. 1.2 Expl. 1.3 Expl. 1.4 Expl. 1.5 Expl. 1.6	Unstable explosives Explosives division 1.1 Explosives division 1.2 Explosives division 1.3 Explosives division 1.4 Explosives division 1.5 Explosives division 1.6
Flam. Gas 1 Flam. Gas 2	Flammable gases category 1 Flammable gases category 2
Flam. Aerosol 1 Flam. Aerosol 2	Flammable aerosols category 1 Flammable aerosols category 2
Flam. Liq. 1 Flam. Liq. 2 Flam. Liq. 3	Flammable liquids category 1 Flammable liquids category 2 Flammable liquids category 3
Flam. Sol. 1 Flam. Sol. 2	Flammable solids category 1 Flammable solids category 2
Ox. Gas 1	Oxidizing gases category 1
Ox. Liq. 1 Ox. Liq. 2 Ox. Liq. 3	Oxidizing liquids category 1 Oxidizing liquids category 2 Oxidizing liquids category 3
Ox. Sol. 1 Ox. Sol. 2 Ox. Sol. 3	Oxidizing solids category 1 Oxidizing solids category 2 Oxidizing solids category 3
Press. Gas (c)	Gases under pressure
Self-react. A Self-react. B Self-react. CD Self-react. EF Self-react. G	Self-reactive chemicals type A Self-reactive chemicals type B Self-reactive chemicals type C and D Self-reactive chemicals type E and F Self-reactive chemicals type G
Pyr. Liq. 1	Pyrophoric liquids category 1
Pyr. Sol. 1	Pyrophoric solids category 1
Self-heat. 1 Self-heat. 2	Self-heating chemicals category 1 Self-heating chemicals category 2
Water-react. 1 Water-react. 2 Water-react. 3	Chemicals which, if in contact with water, emits flammable gases category 1 Chemicals which, if in contact with water, emits flammable gases category 2 Chemicals which, if in contact with water, emits flammable gases category 3
Org. Perox. A Org. Perox. B Org. Perox. CD Org. Perox. EF Org. Perox. G	Organic peroxides type A Organic peroxides type B Organic peroxides type C and D Organic peroxides type E and F Organic peroxides type G

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Classification Code	Hazard Classification
Met. Corr. 1	Corrosive to metals category 1
Acute Tox. 1 Acute Tox. 2 Acute Tox. 3 Acute Tox. 4 *(inh)=inhalation	Acute toxicity category 1 Acute toxicity category 2 Acute toxicity category 3 Acute toxicity category 4
Skin Corr. 1A Skin Corr. 1B Skin Corr. 1C Skin Irrit. 2	Skin corrosion or irritation category 1A Skin corrosion or irritation category 1B Skin corrosion or irritation category 1C Skin corrosion or irritation category 2
Eye Dam. 1 Eye Irrit. 2	Serious eye damage or eye irritation category 1 Serious eye damage or eye irritation category 2
Resp. Sens. 1 Skin Sens. 1	Respiratory sensitization category 1 Skin sensitization category 1
Muta. 1A Muta. 1B Muta. 2	Germ cell mutagenicity category 1A Germ cell mutagenicity category 1B Germ cell mutagenicity category 2
Carc. 1A Carc. 1B Carc. 2	Carcinogenicity category 1A Carcinogenicity category 1B Carcinogenicity category 2
Repr. 1A Repr. 1B Repr. 2 Lact.	Reproductive toxicity category 1A Reproductive toxicity category 1B Reproductive toxicity category 2 Effect on or via lactation
STOT SE 1 STOT SE 2 STOT SE 3	Specific target organ toxicity – single exposure category 1 Specific target organ toxicity – single exposure category 2 Specific target organ toxicity – single exposure category 3
STOT RE 1 STOT RE 2	Specific target organ toxicity – repeated exposure category 1 Specific target organ toxicity – repeated exposure category 2
Asp. Haz.	Aspiration hazard category 1
Aquatic Acute 1 Aquatic Chronic 1 Aquatic Chronic 2 Aquatic Chronic 3 Aquatic Chronic 4	Hazardous to the aquatic environment – acute hazard category 1 Hazardous to the aquatic environment – chronic hazard category 1 Hazardous to the aquatic environment – chronic hazard category 2 Hazardous to the aquatic environment – chronic hazard category 3 Hazardous to the aquatic environment – chronic hazard category 4
Ozone	Hazardous to the ozone layer category 1

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PART 2

CHEMICALS CLASSIFICATION

PART 2

CHEMICALS CLASSIFICATION

This Part describes the classification criteria for substances and mixtures and how to classify chemicals as required under sub-regulation 4(2) of the Regulations.

2.1 Introduction

2.1.1 A substance or mixture fulfilling the criteria relating to physical hazards, health hazards or environmental hazards, laid down in Parts 2.4, 2.5, and 2.6 of this ICOP is hazardous and shall be classified in relation to the respective hazard classification and differentiation as provided for in this ICOP.

2.1.2 Where, in this Part, hazard classes are differentiated on the basis of the route of exposure or the nature of the effects, the substance or mixture shall be classified in accordance with such differentiation.

2.1.3 This Part includes harmonized criteria for classifying substances and mixtures according to their physical, health, and environmental hazards. It describes the classification criteria and the hazard communication elements by type of hazard (e.g. acute toxicity; flammability). In addition, decision logics for each hazard have been developed.

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2.2 Classification Results

In this ICOP, the classification results for substances and mixtures are expressed as follows:

Table 2.1: Classification results

Phrases used in classification results	Explanation
“Classification not possible”	In case insufficient or no data are available for classifying a substance or mixture after searching information sources described in this ICOP, the substance shall be designated as “Classification not possible”.
“Not applicable”	Substances or mixture with physical properties, chemical structure or groups not relevant to the hazard class being considered. For example: • Considering a hazard class of "flammable solids”, a substance or mixture whose normal state is a liquid or a gas is designated as “Not applicable”. • Considering a hazard class of “organic peroxides”, a substance which does not contain –O–O– structure is designated as “Not applicable”. • Considering a hazard class of “oxidizing liquids”, a substance or mixture which does not contain oxygen, fluorine or chlorine is designated as “Not applicable”.
"Not classified"	If a substance or mixture does not meet the classification criteria for any hazard class, then it is “Not classified” for that respective hazard class.

NOTE
In cases of a lack of sufficient information, do not designate as "Not classified" but instead, use "Classification not possible".

2.3 Principles of Classification

2.3.1 Concept of classification

2.3.1.1 The term “hazard classification” is used to indicate that only the intrinsic hazardous properties of substances or mixtures are considered. The classification criteria for substances and mixtures are presented in Parts 2.4, 2.5, and 2.6 of this ICOP, each of which is for a specific hazard class or a group of closely related hazard classes.

2.3.1.2 The recommended process of classification of mixtures is based on the following sequence:

(a) Where test data are available for the complete mixture, the classification of the mixture will always be based on that data;

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For health and environmental hazards,

(b) Where test data are not available for the mixture itself, then bridging principles included and explained in paragraph 2.3.4.2 shall be considered to see whether they permit classification of the mixture;

(c) If test data are not available for the mixture itself and the available information is not sufficient to allow the application of the above mentioned bridging principles, then the agreed method(s) described in each part for estimating the hazards based on the information known will be applied to classify the mixture.

2.3.1.3 For substances or mixtures tested as a whole, the hazard classification incorporates the following steps:

(a) Identification of relevant data regarding the hazards of the substance or mixture. If no data is available, the substance or mixture is not possible to be classified;

(b) Subsequent review of those data to ascertain the hazards associated with the substance or mixture;

(c) A decision on whether the substance or mixture will be classified as hazardous and the degree of hazard, where appropriate, by comparison of the data with agreed hazard classification criteria; and

(d) Determine hazard communication elements.

2.3.1.4 For mixture not tested as a whole or where the data is insufficient, the hazard classification incorporates the following steps:

(a) Identification of relevant data regarding hazard for mixture;

(b) Subsequent review on data:

  (i) If data on ingredient is available, use either bridging principle, additivity formula or summation method; or

  (ii) If data is insufficient, use additivity formula; or

  (iii) If data is insufficient to apply additivity formula, the mixture is not possible to be classified.

(c) A decision on whether the mixture will be classified as hazardous and the degree of hazard, where appropriate, by comparison of the data with agreed hazard classification criteria; and

(d) Determine the hazard communication elements.

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2.3.2 Process of classification

2.3.2.1 Substance or mixture tested as a whole

The recommended process of classification of substance or mixture tested as a whole is as follows (refer to Figure 2.1):

(a) Identify the product identifier of the substance or mixture and the CAS No. for the substance or ingredients or mixture, where available.

(b) Identify relevant test data regarding the hazard of the substance or mixture, e.g. for skin corrosion/irritation, data on pH testing, test result from skin corrosion/irritation, and historical human or animal experience may be relevant.

(c) Review data to ascertain hazard associated with the substance or mixture. If the data is not sufficient to evaluate each hazard class, then the classification is not possible for that particular hazard class. E.g. the substance or mixture is not possible to be classified as flammable liquids due to lack of data either on its flash point or initial boiling point.

(d) However, if the data is sufficient, decision on whether the substance or mixture will be classified as a hazardous substance or mixture and the degree of hazard, where appropriate, shall be made by comparing the data against the agreed hazard classification criteria. E.g. oxidizing liquids has three hazard categories i.e. category 1, category 2 and category 3. If the substance or mixture does not meet any agreed hazard classification criteria, it is not classified as hazardous. Refer to Parts 2.4, 2.5, and 2.6 for agreed hazard classification criteria.

(e) Gather information about previously classified substance or mixture under *United Nations Recommendations on the Transport of Dangerous Goods* (UNRTDG) or EU/ Occupational Safety and Health (Classification, Packaging and Labelling of Hazardous Chemicals) Regulations 1997 (CPL 1997). The information includes UNRTDG Division, hazard categories, risk phrases, and safety phrases. Where the substance or mixture has been classified under UNRTDG or EU/CPL 1997, translate from the previous system to the Regulations hazard class by referring to the conversion table in Appendix 2.1.

(f) In cases where test data are available for a substance or for a complete mixture and the chemical has been previously classified, the classification of that chemical shall be based on the test data.

(g) If the substance or mixture is classified as hazardous, the hazard communication elements shall be determined based on the classification result. Hazard communication elements include hazard pictogram, signal word, hazard statement, and precautionary statement.

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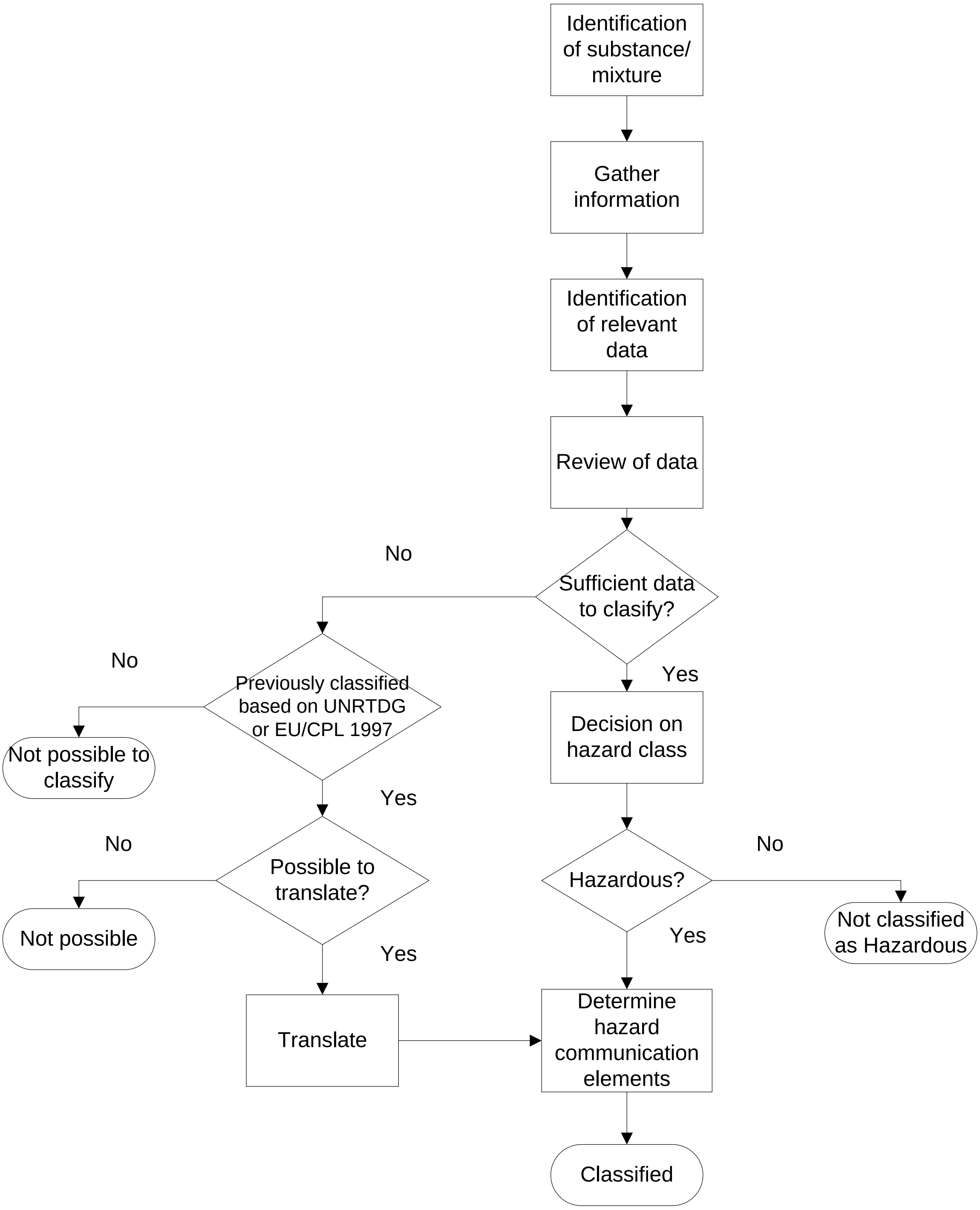
Figure 2.1: Process of classification where substance or mixture is tested as a whole



2.3.2.2 Mixture not tested as a whole

The recommended process of classification for mixture not tested as a whole is as follows (refer to Figure 2.2):

(a) Identify the product identifier of the mixture, composition, and the CAS No. for the ingredients of the mixture, where available.

(b) Identify relevant data on similar tested mixture. If there is sufficient data, use the data to apply the bridging principle in classifying the mixture. E.g. for acute toxicity, the relevant data includes the hazard class for the similar tested mixture and the toxicities of the ingredients.

(c) If relevant data on similar tested mixture is not available, gather test data on individual ingredients. Classify the individual ingredients (refer to 2.3.2.1). If the data is not sufficient to evaluate each hazard class, then the classification is not possible for that particular hazard class.

(d) If the data is sufficient, decision on whether the mixture will be classified as a hazardous mixture and the degree of hazard, where appropriate, shall be made by applying the agreed method. E.g. for acute toxicity, apply additivity formula; for carcinogenicity, apply concentration limits; or for environmental hazards, apply summation method and/or additivity formula to classify the mixture. If the mixture does not meet any agreed hazard classification criteria, it is not classified as hazardous. Refer to Parts 2.4, 2.5 and 2.6 for the agreed hazard classification criteria.

(e) Determine the hazard communication elements based on the classification result.

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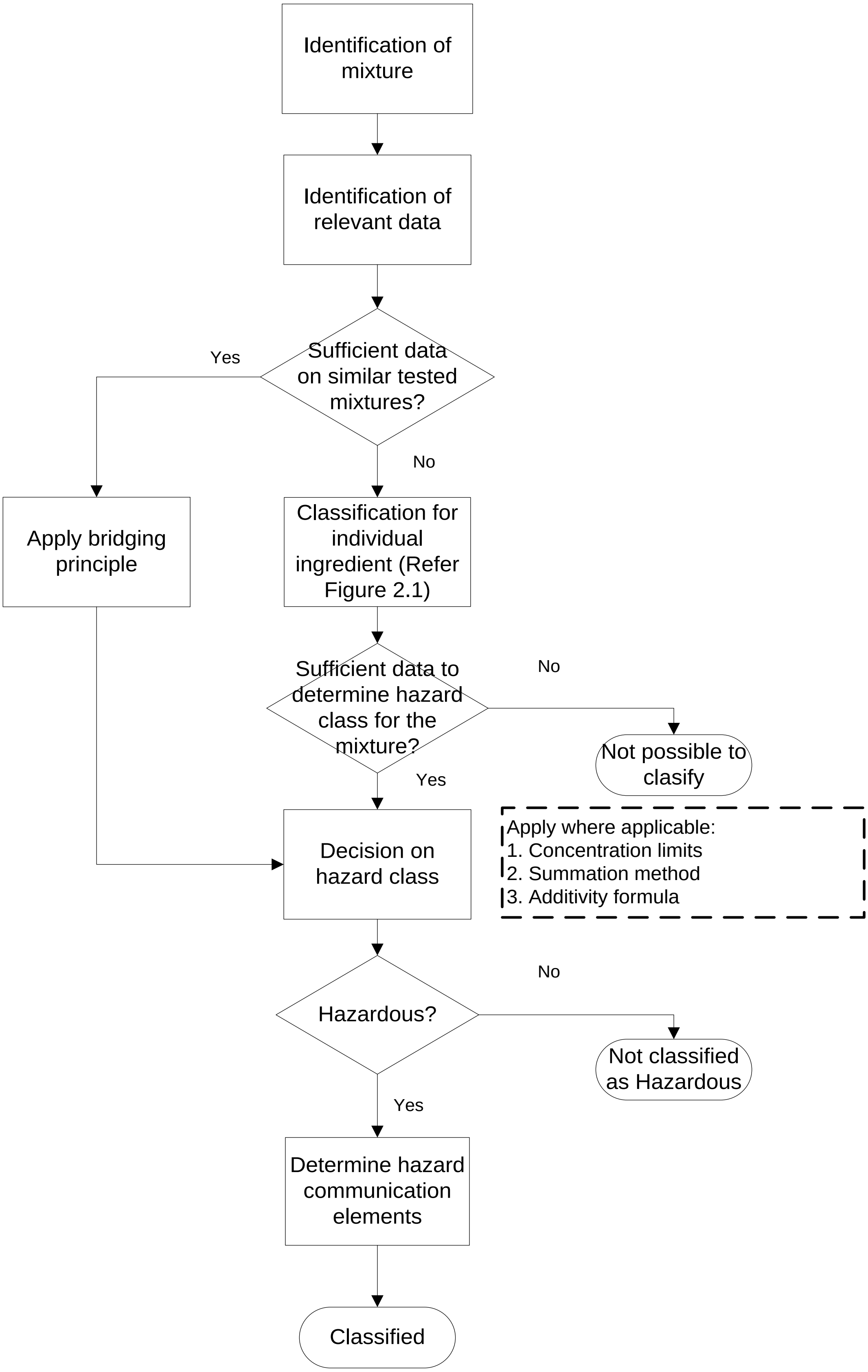
Figure 2.2: Process of classification where mixture is not tested as a whole or insufficient data



2.3.3 Available data, test method, and test data quality

The classification system itself does not include requirements for testing substances or mixtures. Therefore, there is no requirement to generate test data for any hazard class. However, for physical hazards, testing data may be required to determine the hazard class. The criteria established for classifying a mixture will allow the use of available data for the mixture itself and/or similar mixtures and/or data for ingredients of the mixture.

The classification of a chemical substance or mixture depends both on the criteria and on the reliability of the test methods underpinning the criteria.

Tests that determine hazardous properties, which are conducted according to internationally recognized scientific principles, can be used for purposes of determining the health and environmental hazards. The criteria for determining health and environmental hazards are test method neutral, allowing different approaches as long as they are scientifically sound and validated according to international procedures and criteria already referred to in existing systems for the hazard of concern and produce mutually acceptable data. Test methods for determining physical hazards are generally more clear-cut, and are specified in Part 2.4 of this ICOP.

2.3.3.1 Evidence from humans

For classification purposes, reliable epidemiological data and experience on the effects of chemicals on humans (e.g. occupational data, data from accident databases) shall be taken into account in the evaluation of human health hazards of a chemical.

2.3.3.2 Expert judgement

The approach to classifying mixtures includes the application of expert judgement in a number of areas in order to ensure existing information can be used for as many mixtures as possible to provide protection for human health and the environment. Expert judgement may also be required in interpreting data for hazard classification of substances, especially where weight of evidence determinations are needed.

2.3.3.3 Weight of evidence

2.3.3.3.1 For some hazard classes, classification results shall be taken directly when the data satisfy the criteria. For others, classification of a substance or a mixture is made on the basis of the total weight of evidence. This means that all available information bearing on the determination of toxicity is considered together, including the results of valid *in vitro* tests, relevant animal data, and human experience such as epidemiological and clinical studies and well-documented case reports and observations.

2.3.3.3.2 The quality and consistency of the data are important. Evaluation of substances or mixtures related to the material being classified shall be included, as shall site of action and mechanism or mode of action study results. Both positive and negative results are assembled together in a single weight of evidence determination.

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2.3.3.3.3 Positive effects which are consistent with the criteria for classification in each chapter, whether seen in humans or animals, will normally justify classification. Where evidence is available from both sources and there is a conflict between the findings, the quality and reliability of the evidence from both sources must be assessed in order to resolve the question of classification. Generally, data of good quality and reliability in humans will have precedence over other data. However, even well-designed and conducted epidemiological studies may lack sufficient numbers of subjects to detect relatively rare but still significant effects, or to assess potentially confounding factors. Positive results from well-conducted animal studies are not necessarily negated by the lack of positive human experience but require an assessment of the robustness and quality of both the human and animal data relative to the expected frequency of occurrence of effects and the impact of potentially confounding factors.

2.3.3.3.4 Route of exposure, mechanistic information, and metabolism studies are pertinent to determining the relevance of an effect in humans. When such information raises doubt about relevance in humans, a lower classification may be warranted. When it is clear that the mechanism or mode of action is not relevant to humans, the substance or mixture shall not be classified.

2.3.3.3.5 Both positive and negative results are assembled together in the weight of evidence determination. However, a single positive study performed according to good scientific principles and with statistically and biologically significant positive results may justify classification.

2.3.4 Specific considerations for the classification of mixtures

Where impurities, additives or individual constituents of a substance or mixture have been identified and are themselves classified, they shall be taken into account during classification if they exceed the concentration limit for a given hazard class.

It is recognized, as a practical matter, that some substances may react slowly with atmospheric gases, e.g. oxygen, carbon dioxide, water vapour, to form different substances; or they may react very slowly with other ingredient substances of a mixture to form different substances; or they may self-polymerize to form oligomers or polymers. However, the concentrations of different substances produced by such reactions are typically considered to be sufficiently low that they do not affect the hazard classification of the mixture.

2.3.4.1 Use of concentration limits

2.3.4.1.1 When classifying an untested mixture based on the hazards of its ingredients, generic concentration limits for the classified ingredients of the mixture are used for several hazard classes. While the adopted concentration limits adequately identify the hazard for most mixtures, there may be some that contain hazardous ingredients at lower concentrations than the generic concentration limit that still pose an identifiable hazard.

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2.3.4.1.2 The generic concentration limits adopted in this ICOP shall be applied. However, if the classifier has information that the hazard of an ingredient will be evident below the concentration limits, the mixture containing that ingredient shall be classified accordingly.

2.3.4.1.3 On occasion, conclusive data may show that the hazard of an ingredient will not be evident when present at a level above the generic concentration limit(s). In these cases, the mixture could be classified according to those data. The data shall exclude the possibility that the ingredient would behave in the mixture in a manner that would increase the hazard over that of the pure substance. Furthermore, the mixture shall not contain ingredients that would affect that determination.

2.3.4.1.4 Adequate documentation supporting the use of any values other than the generic concentration limits shall be retained and made available for review on request.

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2.3.4.2 Bridging principles

Where the mixture itself has not been tested to determine its hazardous properties, but there are sufficient data on the similar tested mixtures or individual hazardous ingredient substances to adequately characterize the hazards of the mixture, these data shall be used in accordance with the following bridging rules, subject to any specific provisions for mixtures in each hazard class. The summary of the application of bridging principles is given below.

Table 2.1A: Summary of bridging principles

Hazard Class	Dilution	Batching	Concentration of highly hazardous mixtures	Interpolation	Similar mixtures	Aerosols
Acute toxicity (oral/dermal/ inhalation)	√	√	√	√	√	√
Skin corrosion or irritation	√	√	√	√	√	√
Serious eye damage or eye irritation	√	√	√	√	√	√
Respiratory/skin sensitization	√	√	-	-	√	√
Germ cell mutagenicity	√	√	-	-	√	-
Carcinogenicity	√	√	-	-	√	-
Reproductive toxicity	√	√	-	-	√	-
Specific target organ toxicity - single & repeated exposure	√	√	√	√	√	√
Aspiration hazard	√	√	√	√	√	-
Hazardous to the aquatic environment – acute & chronic hazard	√	√	√	√	√	-

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2.3.4.2.1 *Dilution*

If a tested mixture is diluted with a substance that has an equivalent or lower hazard category classification than the least hazardous original ingredient substance and which is not expected to affect the hazard classification of other ingredient substances, then the new mixture may be classified as equivalent to the original tested mixture.

2.3.4.2.2 *Batching*

The hazard category of one tested production batch of a mixture can be assumed to be substantially equivalent to that of another untested production batch of the same commercial product, and produced by or under the control of the same principal supplier, unless there is reason to believe there is significant variation such that the hazard classification of the untested batch has changed. If the latter occurs, a new classification is necessary.

2.3.4.2.3 *Concentration of highly hazardous mixtures*

In the case of the classification of mixtures covered in Parts 2.5.1, 2.5.2, 2.5.3, 2.5.9, 2.5.10, 2.5.11, and 2.6.1, if a tested mixture is classified in category 1, and the concentration of the ingredients of the tested mixture that are in that category is increased, the resulting untested mixture shall be classified in category 1 without additional testing.

2.3.4.2.4 *Interpolation within one hazard category*

In the case of the classification of mixtures covered in Parts 2.5.1, 2.5.2, 2.5.3, 2.5.9, 2.5.10, 2.5.11, and 2.6.1, for three mixtures (A, B, and C) with identical hazardous ingredients, where tested mixtures A and B are in the same hazard category and untested mixture C has the same active hazardous ingredients with concentrations intermediate to the concentrations of those hazardous ingredients in mixtures A and B, then mixture C is assumed to be in the same hazard category as A and B.

2.3.4.2.5 *Substantially similar mixtures*

Given the following:

(a) Two mixtures, each containing two ingredients:
  (i) A + B;
  (ii) C + B;
(b) The concentration of ingredient B is essentially the same in both mixtures;
(c) The concentration of ingredient A in mixture (i) equals that of ingredient C in mixture (ii); and
(d) Hazard data for A and C are available and substantially equivalent, i.e. they are in the same hazard category and are not expected to affect the hazard classification of B.

If mixture (i) is already classified in a particular hazard class based on test data, then mixture (ii) shall be assigned the same hazard category.

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2.3.4.2.6 *Aerosols*

In the case of the classification of mixtures covered in Parts 2.5.1, 2.5.2, 2.5.3, 2.5.4, 2.5.5, 2.5.9 and 2.5.10, an aerosol form of a mixture may be classified in the same hazard category as the tested non-aerosolized form of the mixture, provided that the added propellant does not affect the hazardous properties of the mixture upon spraying, and scientific evidence is available demonstrating that the aerosolized form is not more toxic than the non-aerosolized form.

2.3.4.3 Synergistic or antagonistic effects

When performing classification, the classifier must take into account available information about the potential occurrence of synergistic effects among the ingredients of the mixture. Lowering classification of a mixture to a less hazardous category on the basis of antagonistic effects may be done only if the determination is supported by sufficient data.

2.3.5 Data Sources

Chemicals shall be classified according to the criteria for classification, obtaining the required data from the information sources. Information sources listed under each priority are similar in terms of their credibility and hence have the same priority, although they may vary in terms of the toxicity indices that they cover (for example, IARC specializes in information related to carcinogenicity and mutagenicity).

For classification, review all of the acquired or accessible evaluation documents specified under Priority 1 to look for information on the relevant chemical. If the selected source lacked the required information, check additional sources. If the required information could not be obtained from sources in Priority 1, repeat the process with sources in Priority 2. Similarly, if the required information could not be obtained from sources in Priority 2, repeat the process with sources in Priority 3.

NOTE
Good Laboratory Practice (GLP) generally refers to a system of management controls for laboratories and research organizations to ensure the consistency and reliability of results as outlined in the Organization for Economic Co-operation and Development (OECD) Principles of GLP and national regulations.

Priority 1:

Data derived from reliable information sources provided by international agencies, data sources validated by regulatory authorities, recognized international guidelines (e.g. OECD Guidelines) or national guidelines of equivalent quality (but not under GLP). Examples: EU Water Quality Monographs, USEPA Water Quality Criteria.

These data can be considered as valid for classification purposes. No assumption shall be made that these are the only data available. Due regard shall be given to the date of the relevant report. Newly available data may not have been considered.

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Priority 2:

Data derived from testing which, while not strictly according to a guideline detailed above, follows accepted scientific principles and procedures and/or has been peer reviewed prior to publication. Where all the experimental detail is not recorded, some judgement may be required to determine validity.

For environmental hazard, Quantitative Structure-Activity Relationship (QSAR) data can be relied upon to provide predictions of acute toxicity for fish, daphnia, and algae for non-electrolyte, non-electrophilic, and otherwise non-reactive substances. Reliable QSARs have been derived for chemicals acting by a basic narcosis mechanism, where, non-electrolytes of low reactivity, such as hydrocarbons, alcohols, ketones, and certain aliphatic chlorinated hydrocarbons, produce their biological effects as a function of their partition coefficients.

Priority 3:

Data derived from secondary sources, such as handbooks, reviews, citation, etc., where the data quality cannot be directly evaluated. Such data shall be examined where data from Priority 1 and 2 are not available, to determine whether they can be used. Such data shall have sufficient detail to allow quality to be assessed. In determining the acceptability of these data for the purposes of classification, due regard shall be given to the difficulties in testing that may have affected data quality and the significance of the reported result in terms of the level of hazard identified.

NOTE
Data derived from testing procedures, which deviate significantly from standard guidelines and are considered as unreliable, shall not be used in classification.

Priorities Where Conflicting Data Exist

(1) Data that are deemed reliable, such as those obtained by GLP-conforming laboratories or those whose scientific basis is available and verified, shall be given priority.
(2) Latest data or data derived from reliable publications shall be given priority.
(3) Conservative data shall be adopted, excluding measurement values that are considered abnormal when compared with other relevant data.
(4) Environmental testing data based on local aquatic species shall be given priority.

2.3.6 Translation of existing classification to classification under Occupational Safety and Health (Classification, Labelling and Safety Data Sheets of Hazardous Chemicals) Regulations 2013

Whenever data for the substances or mixtures are available and sufficient, an evaluation and classification shall be done in accordance with Parts 2.4, 2.5 and 2.6 of this ICOP.

If a substance or mixture has previously been classified under CPL 1997 or UNRTDG or EU Directive 67/548/EEC in Annex VII or Directive 1999/45/EC, the translation table in Appendix 2.1 (Translation Table) may be used to assist in deciding the hazard classification.

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2.4 Physical Hazards

The Regulations has stipulated 16 hazard classes of physical hazard. However, hazard classes to be evaluated may be reduced depending on the state of a substance (gas, liquid, or solid) and its chemical structure (refer to Table 2.2 for the summary of classification of physical hazards based on physical and chemical states, and chemical structure).

2.4.1 General considerations

2.4.1.1 Classification of physical hazards based on physicochemical properties and chemical structure

For the purpose of this Part, the following definitions shall apply:

2.4.1.1.1 *Physicochemical*

The state of a substance is defined, in general, under the temperature of 20℃ and an atmospheric pressure of 101.3 kPa. Although these conditions are determined as internationally common rules, some substances cannot be dealt with under these conditions.

For example, phenol (melting point, 43℃) and 1,6-diaminohexane (melting point, 42℃) are designated as solids according to definition, but they are normally transported and stored heated in the melted state. The primary reason is that liquids can be easily weighed and transferred from one container to another compared to solids, and another reason is that, for solids, they have the tendency to liquidize and leak under high temperature during transport, when packed in a box or bag.

2.4.1.1.2 *Gases*

“Gases” are defined as:
(i) Substances whose vapor pressure exceed 300 kPa (absolute) at 50℃; or
(ii) Substances which are completely gaseous at standard atmospheric pressure (101.3 kPa) at 20℃.

If they are combustible when mixed with air, they satisfy the criteria for “flammable gases”. When they contribute to combustion of other substances more than air does, they fall under “oxidizing gases”.

Gases which are contained in a receptacle at a pressure of 200 kPa (gauge pressure) or more for the purpose of supply, transport, storage, etc., or which are liquefied or liquefied and refrigerated fall under “gases under pressure”. Gases under pressure do not have chemical hazards inherent to substances but have physical hazards entailed by the conditions of substances.

When flammable gases are used as propellants, aerosols are to be considered for classification as “flammable aerosols”. Each aerosol product sample is tested individually because factors such as the structure of its nozzle affect combustibility/flammability. (When aerosols contain flammable liquids or flammable solids, their evaluation as “flammable aerosols” is required, even if inflammable gases are used as propellants.)

2.4.1.1.3 *Liquids*

“Liquids” are defined as substances whose vapor pressures are 300 kPa or less at 50℃ and that are not completely gaseous at standard atmospheric pressure (101.3 kPa) and at 20℃, and whose melting points or initial melting points are 20℃ or below at standard atmospheric pressure (101.3 kPa).

Highly viscous or pasty substances and mixtures, whose melting points cannot be determined, are tested according to ASTM D4359-90 or judged by the penetrometer test for specifying flowability as defined by section 2.3.4 in the Annex of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR).

Liquid substances are assessed to determine if they fall under “flammable liquids”, “pyrophoric liquids”, “self-heating chemicals”, or “corrosive to metals”.

2.4.1.1.4 *Solids*

Any substances or mixtures that do not meet the definitions of “liquids” or “gases” are defined as “solids”. Solids can be in various forms: powder, granule, paste, mass, fiber, tablet, etc. The hazards of powdered substance, for instance, may vary depending on their particle size.

Therefore, hazards that a substance has in its current form instead of hazards inherent to the substance shall be assessed. Solid substances are assessed to determine if they fall under “flammable solids”, “pyrophoric solids”, “self-heating chemicals”, and “corrosive to metals”.

2.4.1.2 Selection of assessment items according to chemical structure

When liquids and solids contain specific chemical groups in their molecules, an assessment shall be conducted that takes into account the presence of those groups.

(i) When they contain chemical groups related to explosivity, they shall be tested as “explosives” and “self-reactive chemicals”.

(ii) When they contain chemical groups related to explosivity as well as those related to self-reactivity, they shall be tested as “self-reactive chemicals”.

(iii) If they contain metals or semi-metals (Si, Ge, As, Sb, Bi, etc.) in their molecules, they shall be tested as “chemicalswhich, if in contact with water, emit flammable gases”.

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(iv) If they contain oxygen, fluorine, or chlorine and if any of these elements are bound to elements other than carbon and hydrogen, they shall be tested as “oxidizing liquids” and “oxidizing solids”.

(v) Organic compounds containing the –O–O– structure in their molecules, or mixtures containing such compounds, shall be tested as “organic peroxides”.

The following table summarizes the above.

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Table 2.2: Classification of physical hazards based on physical and chemical states, and chemical structure

Part	Hazard Class	Gas	Liquids	Solid	Classifiable chemical structure
2.4.2	Explosives	X	○	○	Substances containing chemical groups related to explosibility in their molecules.
2.4.3	Flammable gases	○	X	X	
2.4.4	Flammable aerosols	○	○	○	
2.4.5	Flammable liquids	X	○	X	
2.4.6	Flammable solid	X	X	○	(Powdered, granular, or pasty substances are to be assessed.)
2.4.7	Oxidizing gases	○	X	X	
2.4.8	Oxidizing liquids	X	○	X	Substances containing oxygen, fluorine or chlorine, any of which are bound to elements other than carbon and hydrogen.
2.4.9	Oxidizing solids	X	X	○	
2.4.10	Gases under pressure	○	X	X	
2.4.11	Self-reactive chemicals	X	○	○	Substances containing chemical groups related to explosivity as well as chemical groups related to self-reactivity in their molecules.
2.4.12	Pyrophoric liquids	X	○	X	
2.4.13	Pyrophoric solids	X	X	○	
2.4.14	Self-heating chemicals	X	△	○	
2.4.15	Chemicals which, if in contact with water, emit flammable gases	X	○	○	Substances containing metals or semi-metals (Si, Ge, As, Sb, Bi, etc.).
2.4.16	Organic peroxides	X	○	○	Organic compounds containing the –O–O– structure, excluding those whose content of active oxygen (%) meets the criteria in 2.4.15.3.
2.4.17	Corrosive to metals	△	○	△	

○ : Classifiable, X : Not classifiable, △ : Classifiable, but no test method is designated

When a substance does not contain chemical groups mentioned in the column for “classifiable chemical structure” in Table 2.2, the “classification result” shall be “not applicable”. Example: “Not applicable” in the class of “organic peroxides” (The substance in question is an organic compound not containing –O–O– structure.)

When a substance falls under a highly prioritized class of hazards, the entry for less prioritized class of hazard is designated as “not applicable”.

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2.4.1.3 Guidance for classification results

This section schematically explains the guidelines for classification and illustrates the classification results indication for 16 types of physical hazards.

2.4.1.3.1 Judgement of not applicable

2.4.1.3.1.1 State of a substance which is different from the definition for the relevant hazard class or which does not meet the definition in terms of chemical structure, according to Table 2.2, shall be designated as "not applicable" with regard to that class.

2.4.1.3.1.2 In case a substance meets the conditions for a hazard class with higher priority:

Example:
A substance that shall be considered as "self-reactive chemicals" contains explosive or self-reacting chemical groups and is classified as "explosives", "organic peroxides", "oxidizing liquids", or "oxidizing solids".

Example entry:
Not applicable (classified as "explosives").

Example:
A substance that shall be considered as "self-heating chemicals" is classified as either "pyrophoric liquids" or "pyrophoric solids".

Example entry:
Not applicable (classified as "pyrophoric liquids").

Table 2.3 shows example entries and grounds classification of substances that are judged to be "not applicable" based on 2.4.1.3.1.1 or 2.4.1.3.1.2.

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Table 2.3: Filled examples of "Not applicable"

Hazard class	Classification result	Classification Grounds and Problems
Explosives	Not applicable	Not containing chemical groups related to explosivity.
Flammable aerosols	Not applicable	Not an aerosol product.
Flammable liquids	Not applicable	“Solids” according to definition.
Self-reactive chemicals	Not applicable	Classified as “explosives”.
	Not applicable	Containing neither chemical group related to explosivity nor those related to self-reactivity.
Self-heating chemicals	Not applicable	Classified as “pyrophoric liquids”.
Chemicals which, if in contact with water, emit flammable gases	Not applicable	Not containing metals or semi-metals (B, Si, P, Ge, As, Se, Sn, Sb, Te, Bi, Po, At).
Oxidizing liquids	Not applicable	An inorganic compound that does not contain oxygen or halogen.
Oxidizing solids	Not applicable	An organic compound that does not contain fluorine and chlorine but contains oxygen which is not bound to elements other than carbon and hydrogen.
Organic peroxides	Not applicable	An organic compound that does not contain the –O–O– structure.

2.4.1.3.2 *Judgement of not classified*

A substance or mixture subject to classification that obviously falls under none of the relevant hazard categories covered under the Regulations or its well-known scientific properties (for example, “non-combustibility”) shall be classified as “not classified”.

Example of entries and grounds for the classification of substances as “not classified” are given in Table 2.4.

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Table 2.4 Filled examples of “Not classified”

Hazard class	Classification result	Grounds and Example Entries
Explosives	Not classified	Based on the result of oxygen balance calculation.
	Not classified	Desensitized explosives (Title of the review document, year).
Flammable liquids	Not classified	Non-combustible (based on experience, name of the evaluating organization).
Flammable solids	Not classified	Non-combustible (Title of the review document, year).
Self-reactive chemicals	Not classified	Enter the concrete value (℃) of self-accelerating decomposition temperature (SADT). (Title of the review document, year).
Pyrophoric liquids	Not classified	Non-combustible (Title of the review document, year).
	Not classified	Does not self-ignite on contact with water of ambient temperature (Title of the review document, year).
	Not classified	Transport of Dangerous Goods (TDG) classification is Class 3. (UN number).
Pyrophoric solids	Not classified	Non-combustibility (Title of the review document, year).
	Not classified	Does not self-ignite when in contact with water of ambient temperature. (Title of the review document, year).
Self-heating chemicals	Not classified	Non-combustible (Title of the review document, year).
Chemicals which, if in contact with water, emit flammable gases	Not classified	Stable against water (Title of the review document, year).
	Not classified	Stable against water (based on experience, name of the evaluating organization).
Oxidizing liquids	Not classified	Reductive material (Title of the review document, year).
Oxidizing solids	Not classified	Reductive material (Title of the review document, year).
Organic peroxides	Not classified	Active oxygen amount is less than in the definition.
Corrosive to metals	Not classified	Copper and aluminum may be used as container. (Title of the review document, year).

2.4.1.3.3 *Judgement of "Classification not possible*"

As described above, a substance which is classified as neither "Not applicable" nor "Not classified" based on its state, chemical composition, chemical properties, etc., and cannot be classified based on literature data and TDG classification shall be designated as "Classification not possible" since there is no data that shall serve as the grounds for classification. Table 2.5 shows example entries and the grounds for classifying a substance as "Classification not possible".

Table 2.5: Filled examples of "Classification not possible"

Hazard class	Classification result	Grounds for Classification and Example Entries
Flammable liquids	Classification not possible	No data.
Flammable solids	Classification not possible	No data.
Self-reactive chemicals	Classification not possible	No data.
Pyrophoric liquids	Classification not possible	No data.
Self-heating chemicals	Classification not possible	No data available or no established test method suitable for liquid substances.
Corrosive to metals	Classification not possible	No data available or no established test method suitable for gaseous substances.
	Classification not possible	No data available or no established test method suitable for solid substances.

2.4.1.4 Categorization based on TDG classification

Most physical hazards test results, except for certain data such as flash point and explosion limit, are not published. If physical hazards data are not available, judgement based on TDG classification shall be made. Table 2.6 shows the correspondence between the Regulations and TDG classifications.

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Table 2.6: Comparison between the Regulations and TDG classifications (UNRTDG)

Hazard Class	Hazard Category	UNRTDG (Note: ( ) is a secondary hazard)
Explosives	Unstable explosives	Since their transport is prohibited, they have no UN number of dangerous goods transport.
	Division 1.1	1.1
	Division1.2	1.2
	Division1.3	1.3
	Division1.4	1.4
	Division1.5	1.5
	Division1.6	1.6
Flammable gases	Category 1	2.1 and 2.3(2.1).
	Category 2*	Although these substances are combustible at 20°C and atmospheric pressure in air, flammable gasses outside the above category are classified as 2.2 or 2.3.
Flammable aerosols	Category 1*	Aerosols are designated as UN1950 (aerosol) and Class 2 (Gas).
	Category 2*	
Oxidizing gases	Category 1	2.2(5.1) or 2.3(5.1).
Gases under pressure	Group compressed gas*	The definition of UN dangerous goods transport Class 2 (Gas) agrees with hazard class of gas under pressure. However they have no detailed category, which this hazard have.
	Group liquefied gas*	
	Group refrigerated liquefied gas*	
	Group dissolved gas*	
Flammable liquids	Category 1	3 I
	Category 2	3 II
	Category 3	3 III
Flammable solids	Category 1	4.1 II
	Category 2	4.1III
Self-reactive chemicals	Type A*	Since their transport is prohibited, they have no UN number of dangerous goods transport.
	Type B	UNRTDG4.1, UN3221, 3222, 3231, 3232.
	Type C	UNRTDG4.1, UN3223, 3224, 3233, 3234.
	Type D	UNRTDG4.1, UN3225, 3226, 3235, 3236.
	Type E	UNRTDG4.1, UN3227, 3228, 3237, 3238.
	Type F	UNRTDG4.1, UN3229, 3230, 3239, 3240
	Type G	Since they are not dangerous goods, they are outside TDG classification. (No number).

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Pyrophoric liquids	Category 1	4.2 I (Liquids)
Pyrophoric solids	Category 1	4.2 I (Solids)
Self-heating chemicals	Category 1	4.2 II
	Category 2	4.2 III
Chemicals which, if in contact with water, emit flammable gases	Category 1	4.3 I, 4.2 (4.3)
	Category 2	4.3 II
	Category 3	4.3 III
Oxidizing liquids	Category 1	5.1 I
	Category 2	5.1 II
	Category 3	5.1 III
Oxidizing solids	Category 1	5.1 I
	Category 2	5.1 II
	Category 3	5.1 III
Organic peroxides	Type A*	Since their transport is prohibited, they have no UN number of dangerous goods transport.
	Type B	UNRTDG5.2, UN3101, 3102, 3111, 3112.
	Type C	UNRTDG5.2, UN3103, 3104, 3113, 3114.
	Type D	UNRTDG5.2, UN3105, 3106, 3115, 3116.
	Type E	UNRTDG5.2, UN3107, 3108, 3117, 3118.
	Type F	UNRTDG5.2, UN3109, 3110, 3119, 3120.
	Type G*	Since their transport is prohibited, they have no UN number of dangerous goods transport.
Corrosive to metals	Category 1*	The UN dangerous goods transport Class 8 includes skin corrosion.

* Categories for which the Regulations hazard classification does not agree with UN transport classification.

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2.4.2 Explosives

2.4.2.1 Definition

2.4.2.1.1 The class of explosives comprises:

(a) 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 in points (a) and (b) which are manufactured with a view to producing a practical, explosive or pyrotechnic effect.

2.4.2.1.2 For the purposes of this ICOP the following definitions shall apply:

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 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 *unstable explosive* is an explosive substance or mixture which is thermally unstable and/or too sensitive for normal handling, transport, and use.

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

A *pyrotechnic article* is an article containing one or more pyrotechnic substances or mixtures.

An *intentional explosive* is a substance, mixture or article which is manufactured with a view to producing a practical, explosive or pyrotechnic effect.

2.4.2.2 Screening procedure

2.4.2.2.1 Explosive properties are associated with the presence of certain chemical groups in a molecule which can react to produce very rapid increases in temperature or pressure. The screening procedure is aimed at identifying the presence of such reactive groups and the potential for rapid energy release. If the screening procedure identifies the substance or mixture to be a potential explosive, the acceptance procedure (see section 10.3 of the *UNRTDG, Manual of Tests and Criteria)* has to be performed.

NOTE
Neither a Series 1 type (a) propagation of detonation test nor a Series 2 type (a) test of sensitivity to detonative shock is required if the exothermic decomposition energy of organic materials is less than 800 J/g.

2.4.2.2.2 A substance or mixture is not classified as explosive if:

(a) There are no chemical groups associated with explosive properties present in the molecule. Examples of groups which may indicate explosive properties are given in Table 2.7; or

(b) The substance contains chemical groups associated with explosive properties which include oxygen, and the calculated oxygen balance is less than -200.

The oxygen balance is calculated for the chemical reaction:

$C_xH_yO_z + [x + (y/4)-(z/2)]\ O_2 \rightarrow x.\ CO_2 + (y/2)\ H_2O$

Using the formula:

Oxygen balance = $-1600.\ [2.x + (y/2) - z]/\text{molecular weight}$;

(c) When the organic chemical or a homogenous mixture of organic substances contains chemical groups associated with explosive properties but the exothermic decomposition energy is less than 500 J/g and the onset of exothermic decomposition is below 500°C. (The temperature limit is to prevent the procedure being applied to a large number of organic materials which are not explosive but which will decompose slowly above 500°C to release more than 500 J/g.) The exothermic decomposition energy may be determined using a suitable calorimetric technique; or

(d) For mixtures of inorganic oxidizing substances with organic material(s), the concentration of the inorganic oxidizing substance is:

- (i) less than 15%, by mass, if the oxidizing substance is assigned to categories 1 or 2;
- (ii) less than 30%, by mass, if the oxidizing substance is assigned to category 3.

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2.4.2.2.3 In the case of mixtures containing any known explosives, the acceptance procedure has to be performed.

Table 2.7: Examples of groups which may indicate explosive properties

Group	Explosive Properties
Unsaturated C–C bond	Acetylenes, acetylides, 1,2-dienes
C–metals, N–metals	Grignard reagents, organolithium compounds
Neighboring nitrogen atoms	Azides, aliphatic azo compounds, diazonium salts, hydrazines, sulfonyl hydrazides
Neighboring oxygen atoms	Peroxides, ozonides
N–O	Hydroxylamines, nitrate salts, nitrate esters, nitro compounds, nitroso compounds, N oxides, 1,2–oxazoles
N–halogen	Chloroamines, fluoroamines
O–halogen	Chlorates, perchlorates, iodosyl compounds
(UNRTDG: *Manual of Tests and Criteria*, Appendix 6, Table A6.19)	

2.4.2.3 Classification criteria

2.4.2.3.1 Substances, mixtures, and articles of this class are classified as an unstable explosive on the basis of the flowchart in Figure 2.3. The test methods are described in Part I of the *UNRTDG, Manual of Tests and Criteria*.

2.4.2.3.2 Substances, mixtures and articles of this class, which are not classified as an unstable explosive, shall be assigned to one of the following six divisions depending on the type of hazard they present:

(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 gives 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, mixtures, 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 1.5 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;

(f) Division 1.6 Extremely insensitive articles which do not have a mass explosion hazard:

Articles which contain only extremely insensitive detonating substances or mixtures, and demonstrate a negligible probability of accidental initiation or propagation.

2.4.2.3.3 Explosives, which are not classified as an unstable explosive, shall be classified in one of the six divisions referred to in paragraph 2.4.2.3.2 based on Test Series 2 to 8 in Part I of the *UNRTDG, Manual of Tests and Criteria* according to the results of the tests laid down in Table 2.8:

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Table 2.8: Criteria for explosives

Category	Criteria
Unstable explosives or explosives of Division 1.1 to 1.6[1]	For explosives of divisions 1.1 to 1.6, the following are the core set of tests that need to be performed: Explosibility: According to UN Test Series 2 (Section 12 of the *UNRTDG, Manual of Tests and Criteria*). Intentional explosives[1] is not subject to UN Test series 2. Sensitiveness: According to UN Test Series 3 (Section 13 of the *UNRTDG, Manual of Tests and Criteria*). Thermal stability: According to UN Test 3(c) (Sub-section 13.6.1 of the *UNRTDG, Manual of Tests and Criteria*). Further tests are necessary to allocate the correct division.

2.4.2.3.4 If explosives are unpackaged or repacked in packaging other than the original or similar packaging, they shall be retested.

2.4.2.4 Classification decision consideration

2.4.2.4.1 The classification of substances, mixtures and articles in the class of explosives and further allocation to a division is a very complex, three step procedures. Reference to Part I *of the UNRTDG, Manual of Tests and Criteria,* is necessary.

2.4.2.4.2 The first step is to ascertain whether the substance or mixture has explosive effects (Test Series 1). The second step is the acceptance procedure (Test Series 2 to 4), and the third step is the assignment to a hazard division (Test Series 5 to 7). The assessment whether a candidate for “ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives (ANE)” is insensitive enough for inclusion as an oxidizing liquid (Part 2.4.8) or an oxidizing solid (Part 2.4.9) is answered by Test Series 8 tests. The classification procedure is according to the following decision logic (see Figures 2.3 to 2.6).

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[1] This comprises substances, mixtures, and articles which are manufactured with a view to producing a practical, explosive, or pyrotechnic effect.

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Figure 2.3: Overall scheme of the procedure for classifying a substance or mixture in the class of explosives (Class 1 for transport)

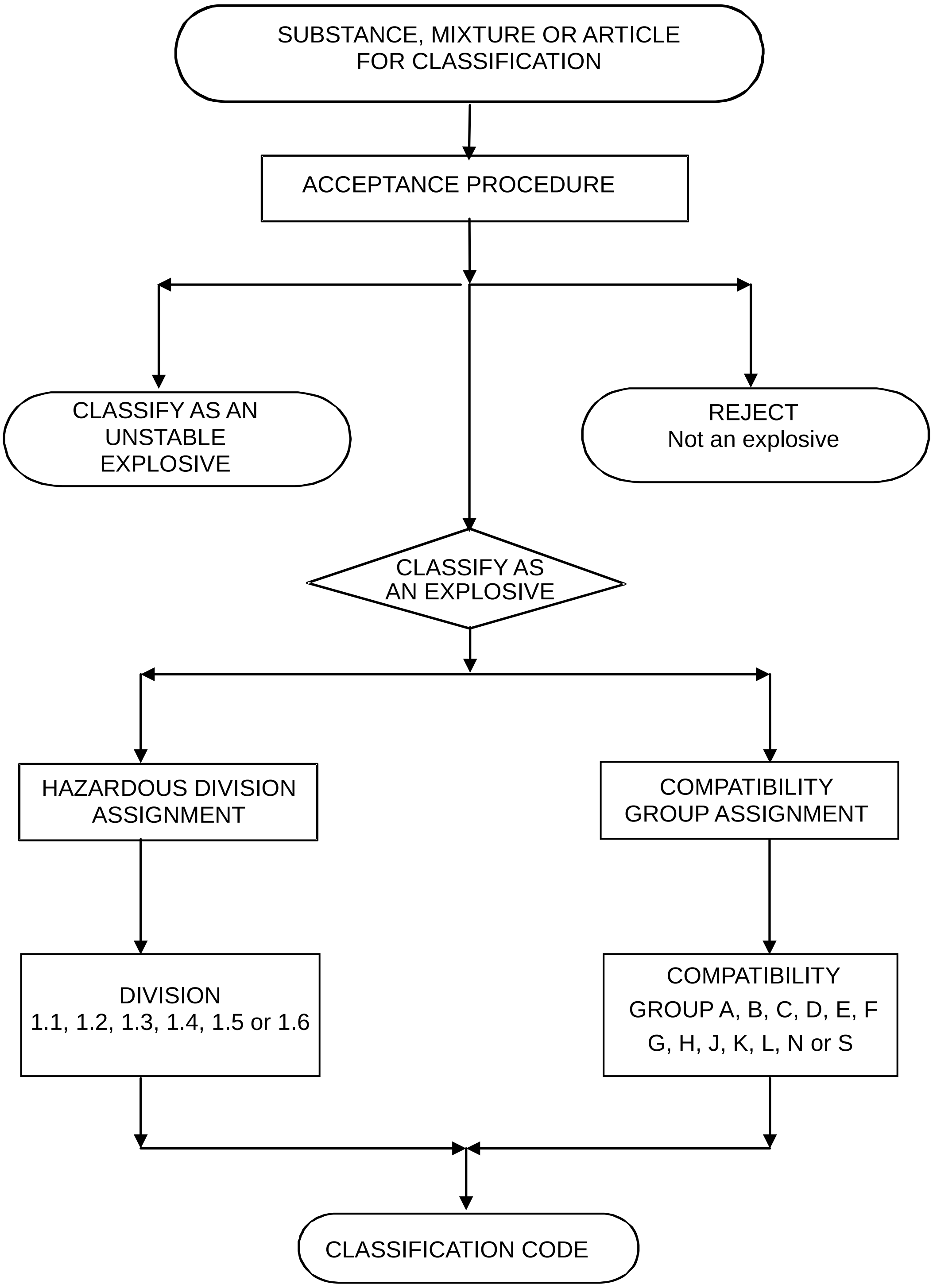

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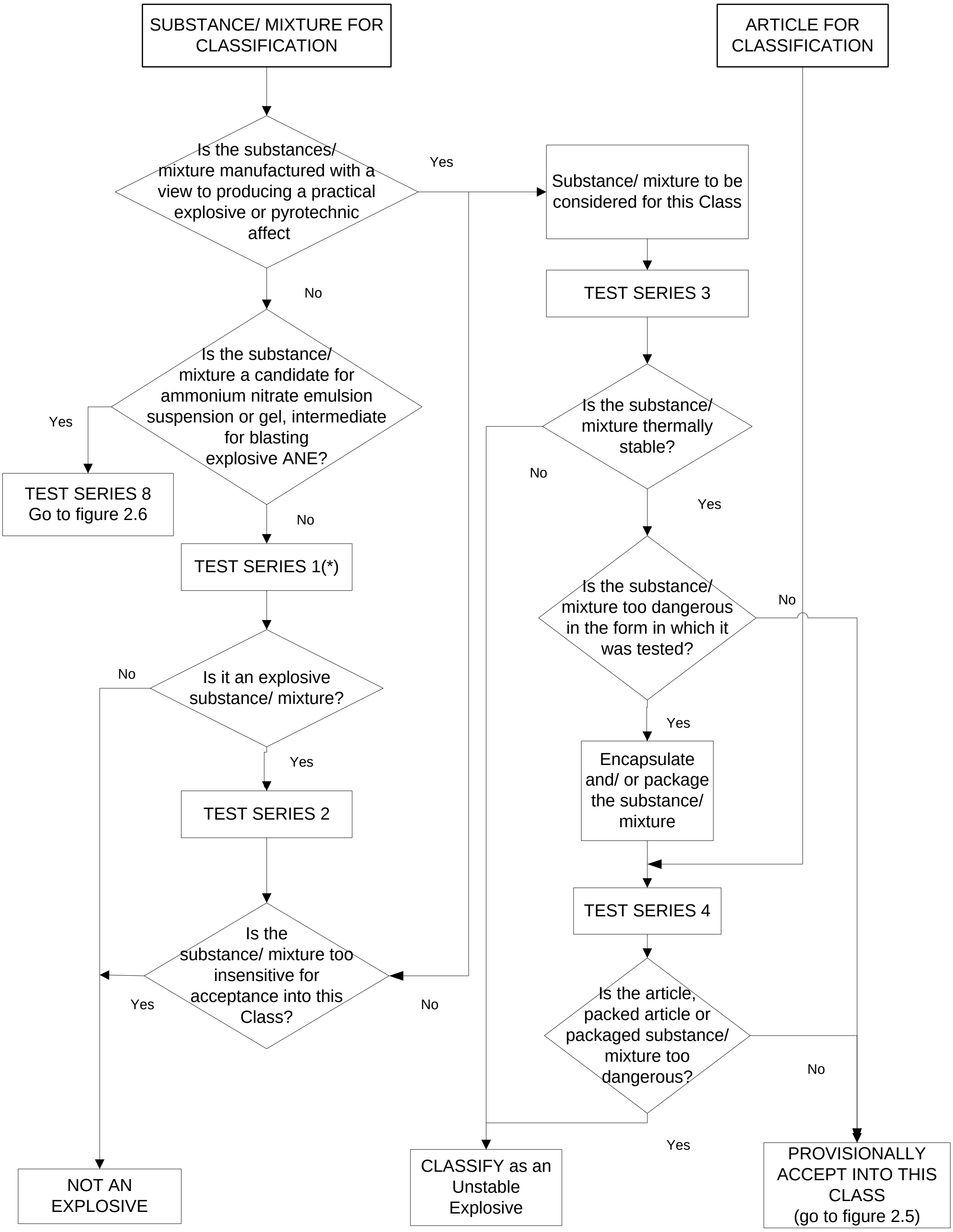
Figure 2.4: Procedure for provisional acceptance of a substance, mixture, or article in the class of explosives (Class 1 for transport)*



(*) For classification purpose, start with Test Series 2.

Figure 2.5: Procedure for assignment to a division in the class of explosives (Class 1 for transport)

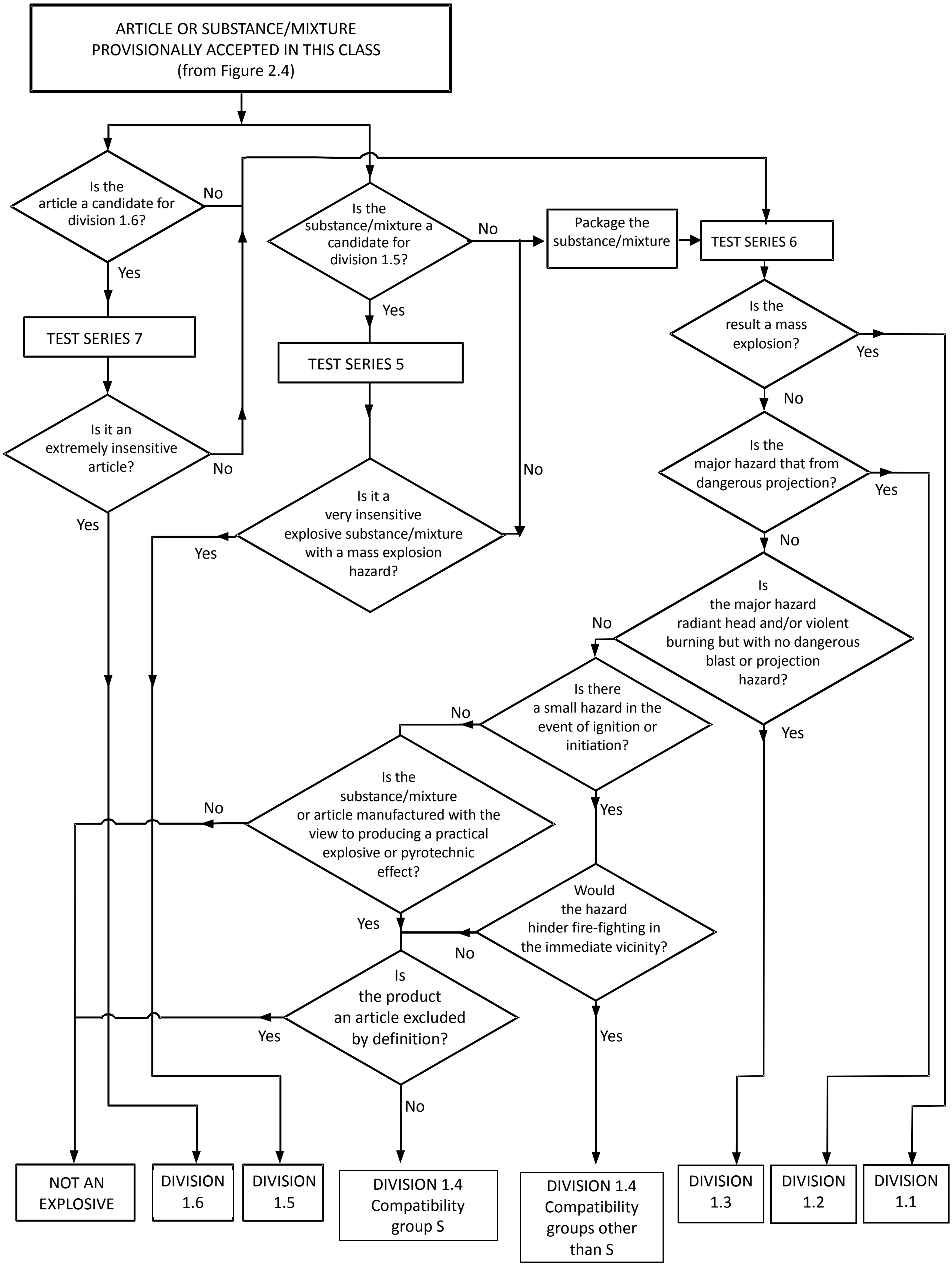


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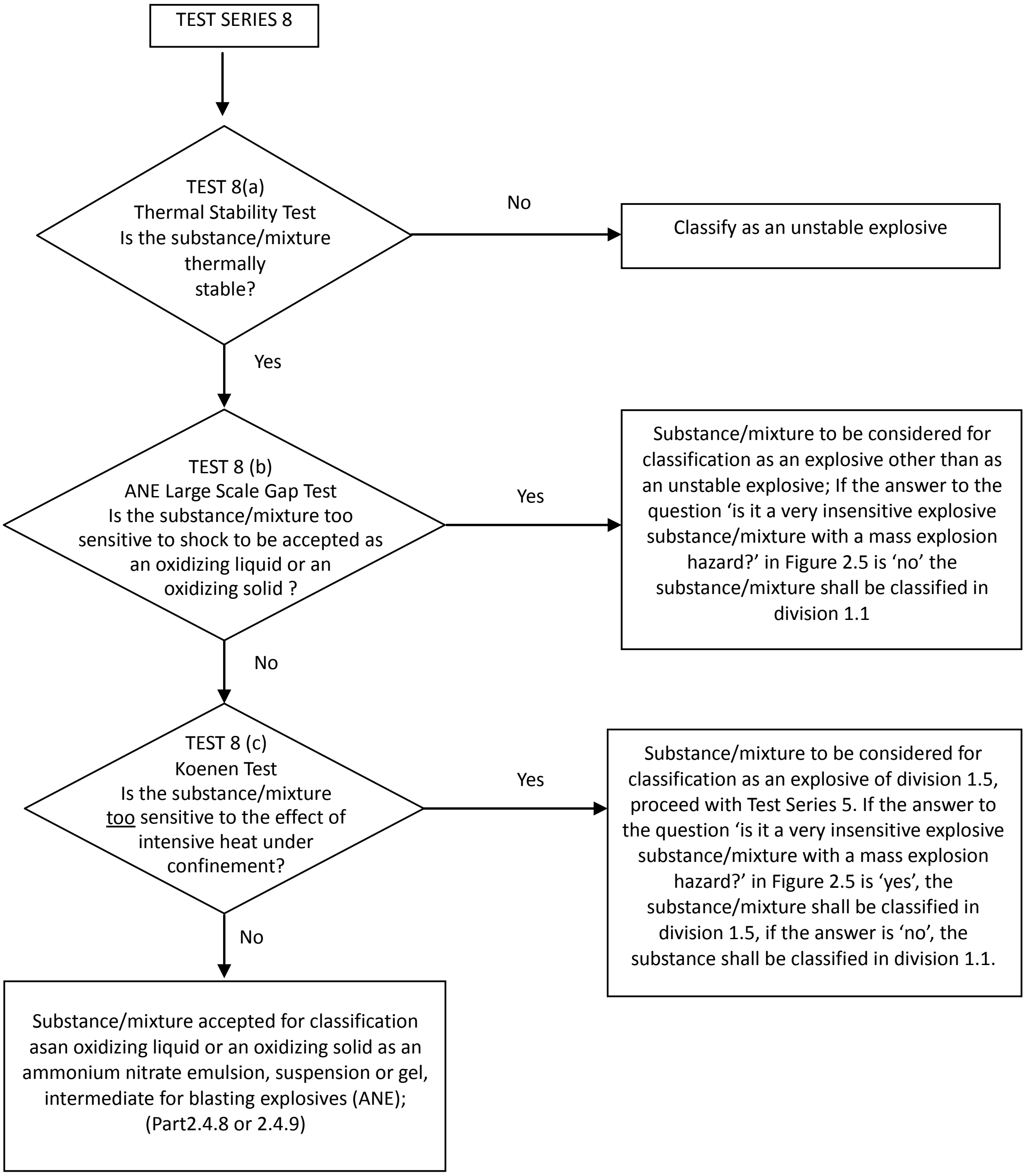
Figure 2.6: Procedure for classification of ammonium nitrate emulsions, suspensions, or gels



Is the substance/mixture thermally stable?

Classify as an unstable explosive

Is the substance/mixture too sensitive to shock to be accepted as an oxidizing liquid or an oxidizing solid ?

Substance/mixture to be considered for classification as an explosive other than as an unstable explosive; If the answer to the question ‘is it a very insensitive explosive substance/mixture with a mass explosion hazard?’ in Figure 2.5 is ‘no’ the substance/mixture shall be classified in division 1.1

Is the substance/mixture <u>too</u> sensitive to the effect of intensive heat under confinement?

Substance/mixture to be considered for classification as an explosive of division 1.5, proceed with Test Series 5. If the answer to the question ‘is it a very insensitive explosive substance/mixture with a mass explosion hazard?’ in Figure 2.5 is ‘yes’, the substance/mixture shall be classified in division 1.5, if the answer is ‘no’, the substance shall be classified in division 1.1.

Substance/mixture accepted for classification asan oxidizing liquid or an oxidizing solid as an ammonium nitrate emulsion, suspension or gel, intermediate for blasting explosives (ANE); (Part2.4.8 or 2.4.9)

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2.4.2.5 Hazard communication elements

Element	Unstable Explosive	Division 1.1	Division 1.2	Division 1.3	Division 1.4	Division 1.5	Division 1.6
Hazard pictogram						No hazard pictogram	No hazard pictogram
Signal word	Danger	Danger	Danger	Danger	Warning	Danger	No signal word
H-code: Hazard statement	H200: Unstable explosive	H201: Explosive; mass explosion hazard	H202: Explosive; severe projection hazard	H203: Explosive; fire, blast or projection hazard	H204: Fire or projection hazard	H205: May mass explode in fire	No hazard statement

2.4.3 Flammable Gases

2.4.3.1 Definition

Flammable gas means a gas or gas mixture having a flammable range with air at 20°C and a standard pressure of 101.3 kPa.

2.4.3.2 Classification criteria

A flammable gas is classified in one of the two categories for this class according to the following table:

Table 2.9: Criteria for flammable gases

Category	Criteria
1	Gases, which at 20°C and a standard pressure of 101.3 kPa: (a) are ignitable when in a mixture of 13% or less by volume in air; or (b) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit.
2	Gases, other than those of category 1, which, at 20°C and a standard pressure of 101.3 kPa, have a flammable range while mixed in air.

NOTE
Aerosols should not be classified as flammable gases.

2.4.3.3 Classification decision consideration

Flammability shall be determined by tests or, for mixtures where there are sufficient data available, by calculation in accordance with methods adopted by ISO 10156 as amended (see ISO 10156:1996 *Gases and gas mixtures – Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets*). Where insufficient data are available to use these methods, tests method EN 1839 (Determination of explosion limits of gases and vapours) may be used.

Example: Classification of a flammable gas mixture by calculation according to ISO 10156:1996

<u>Formula</u>

$$\sum_{i}^{n} \frac{\mathrm{V_i\%}}{T_{ci}}$$

where:

$V_i\%$ = the equivalent flammable gas content;
T_{ci} = the maximum concentration of a flammable gas in nitrogen at which the mixture is still not flammable in air;
i = the first gas in the mixture;
n = the n^{th} gas in the mixture;
K_i = the equivalency factor for an inert gas versus nitrogen;

Where a gas mixture contains an inert diluent other than nitrogen, the volume of this diluent is adjusted to the equivalent volume of nitrogen using the equivalency factor for the inert gas (K_i).

Criterion:

$$\sum_{i}^{n} \frac{V_i\%}{T_{ci}} \geq 1$$

Gas mixture

For the purpose of this example the following is the gas mixture to be used:

$$2\% (H_2) + 6\%(CH_4) + 27\%(Ar) + 65\%(He)$$

Calculation

1. Ascertain the equivalency factors (K_i) for the inert gases versus nitrogen

K_i (Ar) = 0.5
K_i (He) = 0.5

2. Calculate the equivalent mixture with nitrogen as balance gas using the K_i figures for the inert gases.

$$2\%(H_2) + 6\%(CH_4) + [27\% \times 0.5 + 65\% \times 0.5](N_2) = 2\%(H_2) + 6\%(CH_4) + 46\%(N_2) = 54\%$$

3. Adjust the sum of the contents to 100%

$$\frac{100}{54} \times [2\%(H_2) + 6\%(CH_4) + 46\%(N_2)] = 3.7\%(H_2) + 11.1\%(CH_4) + 85.2\%(N_2)$$

4. Ascertain the T_{ci} coefficients for the flammable gases:

T_{ci} H_2 = 5.7%
T_{ci} CH_4 = 14.3%

5. Calculate the flammability of the equivalent mixture using the formula:

$$\sum_{i}^{n} \frac{V_i\%}{T_{ci}} = \frac{3.7}{5.7} + \frac{11.1}{14.3} = 1.42$$

$1.42 > 1$,

Therefore, the mixture is flammable in air.

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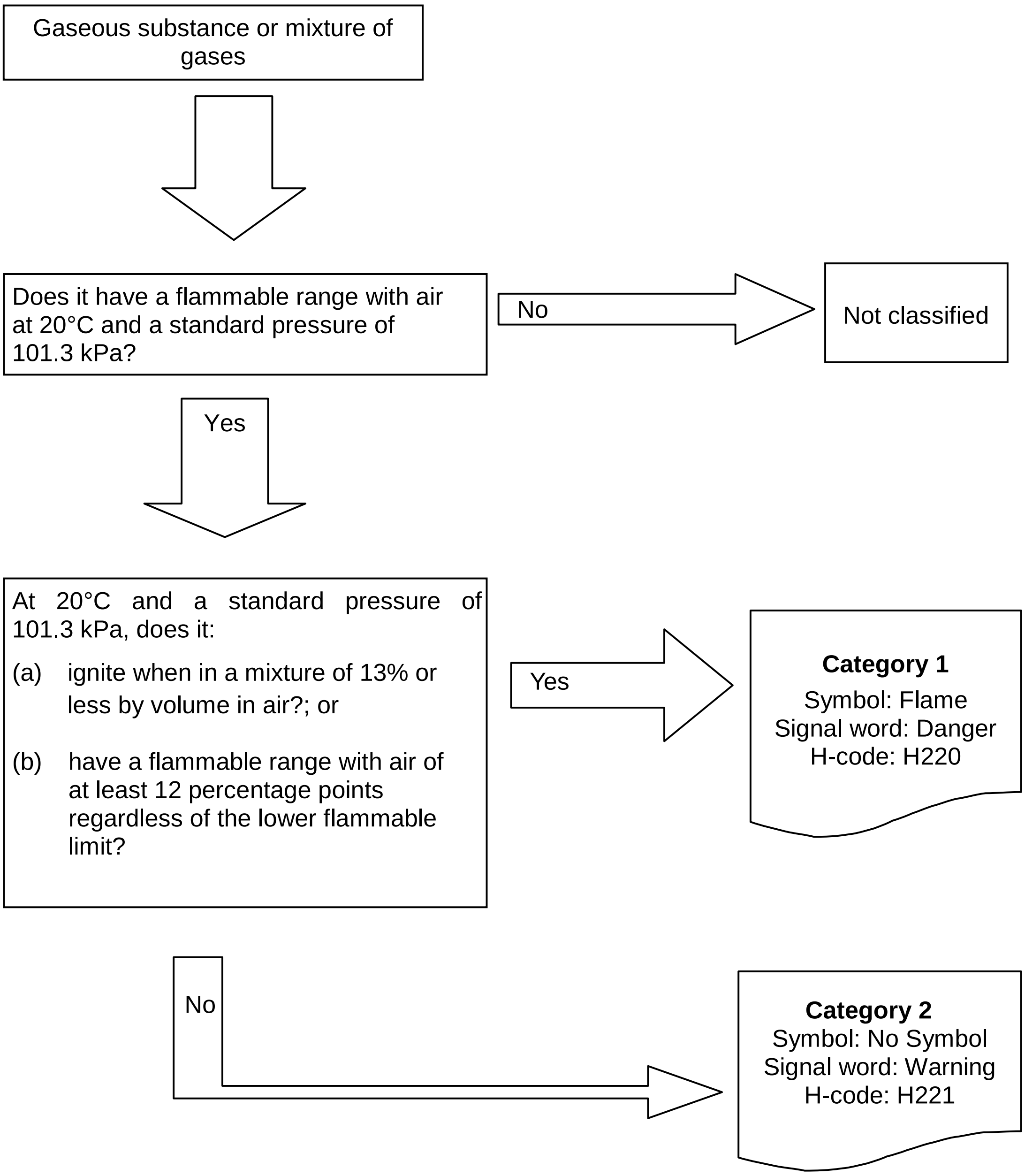
2.4.3.4 Decision logic

To classify a flammable gas, data on its flammability are required. The classification is according to the following decision logic.



2.4.3.5 Hazard communication elements

Element	Category 1	Category 2
Hazard pictogram		No hazard pictogram
Signal word	Danger	Warning
H-code: Hazard statement	H220: Extremely flammable gas	H221: Flammable gas

2.4.4 Flammable Aerosols

2.4.4.1 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.

2.4.4.2 Classification criteria

2.4.4.2.1 Aerosols shall be considered for classification as flammable if they contain any component which is classified as flammable according to the classification criteria, i.e.:

Flammable gases (see Part 2.4.3);

Flammable liquids (see Part 2.4.5); or

Flammable solids (see Part 2.4.6).

NOTE
Flammable components do not cover pyrophoric, self-heating or water-reactive substances and mixtures because such components are never used as aerosol contents.

NOTE
Flammable aerosols do not fall additionally within the scope of flammable gases, flammable liquids or flammable solids.

2.4.4.2.2 A flammable aerosol is classified in one of the two categories for this class 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 2.4.4.4.

NOTE
Aerosols not submitted to the flammability classification procedures in this hazard class should be classified as extremely flammable (Category 1).

2.4.4.3 Classification decision consideration

2.4.4.3.1 To classify a flammable 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.

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

For a composite aerosol 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.

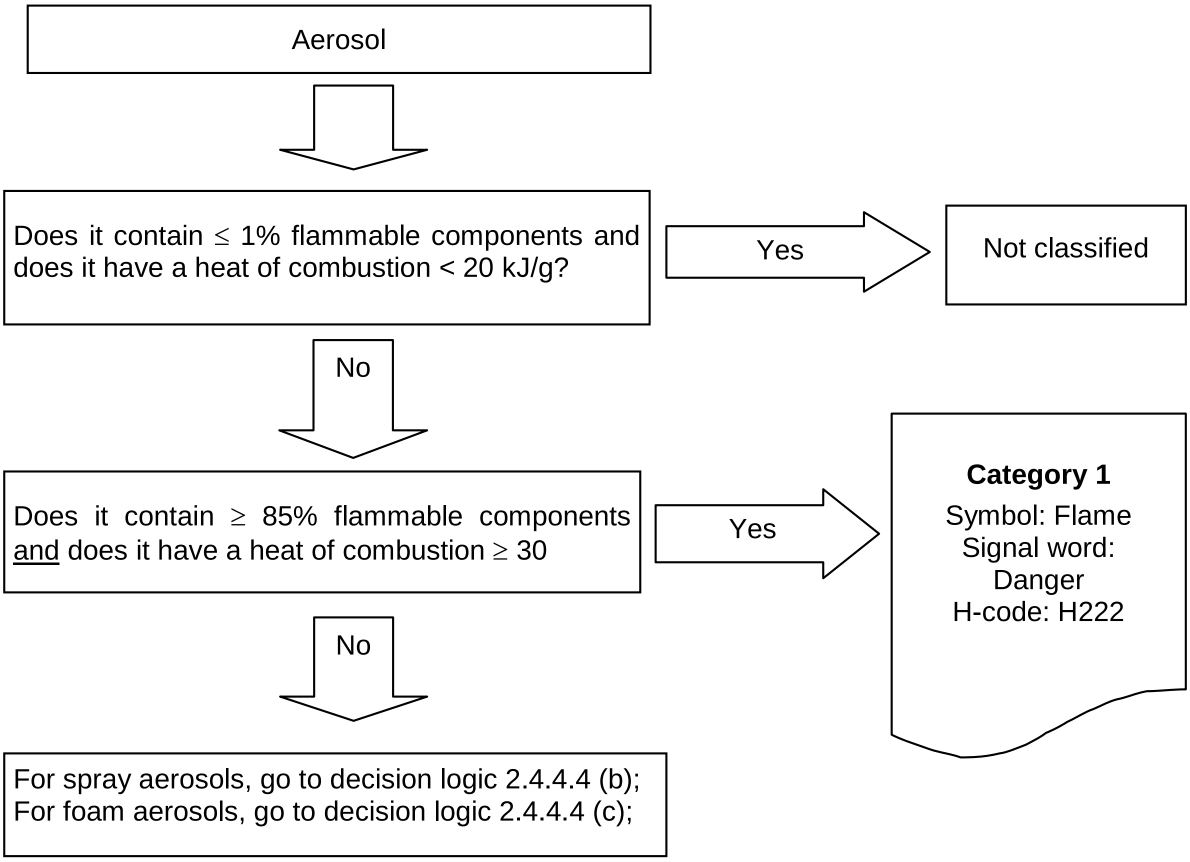
2.4.4.3.3 The chemical heats of combustion can be found in the literature, calculated or determined by tests (see ASTM D 240 as amended – Standard Test Methods for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter, EN/ISO 13943 as amended, 86.l to 86.3 – Fire safety – Vocabulary, and NFPA 30B as amended – Code for the Manufacture and Storage of Aerosol Products).

2.4.4.3.4 Refer to sub-sections 31.4, 31.5, and 31.6 of the *UNRTDG, Manual of Tests and Criteria,* for ignition distance test, enclosed space ignition test, and aerosol foam flammability test.

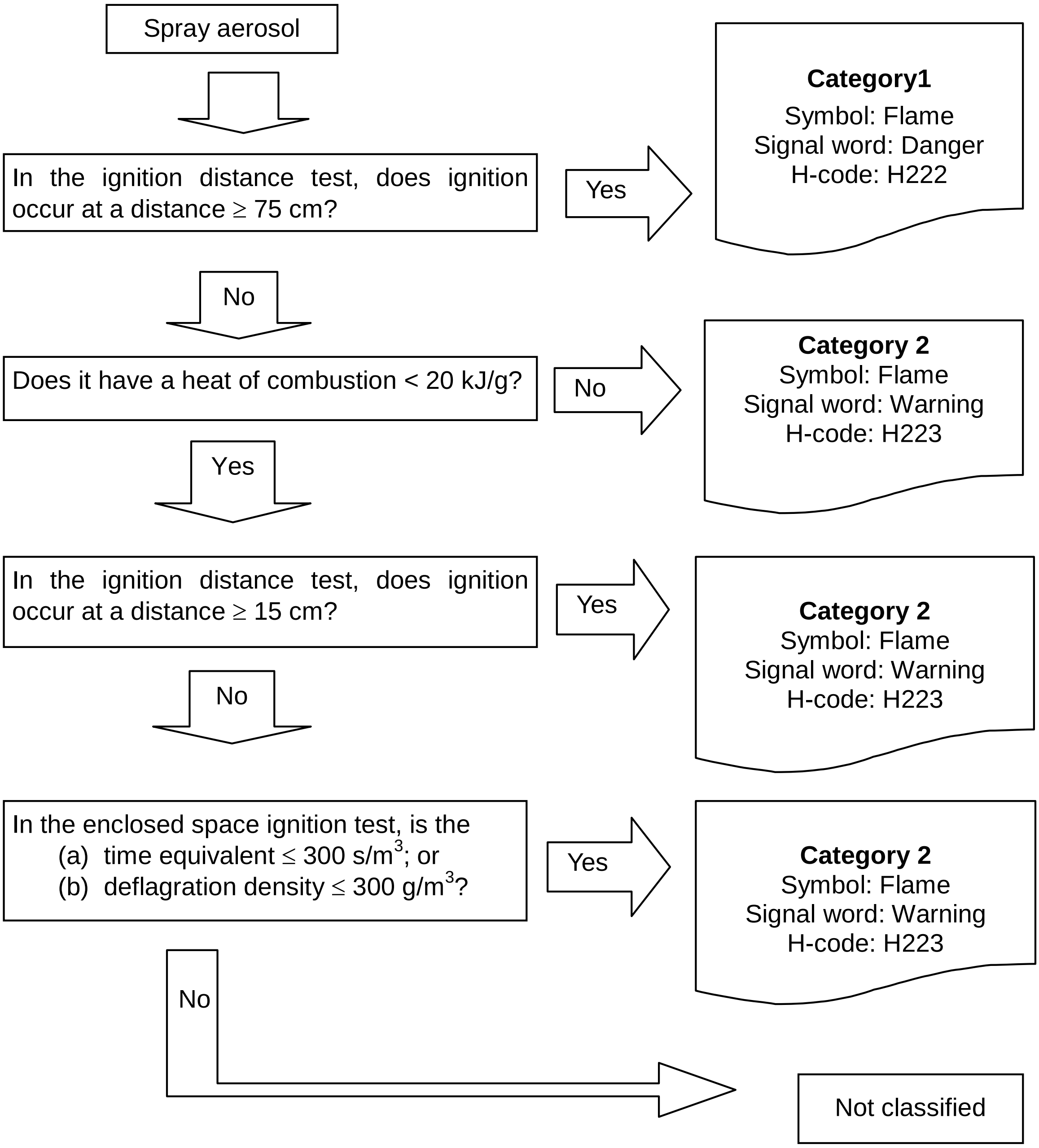
2.4.4.4 Decision logic

Classification shall be made according to the following decision logics.

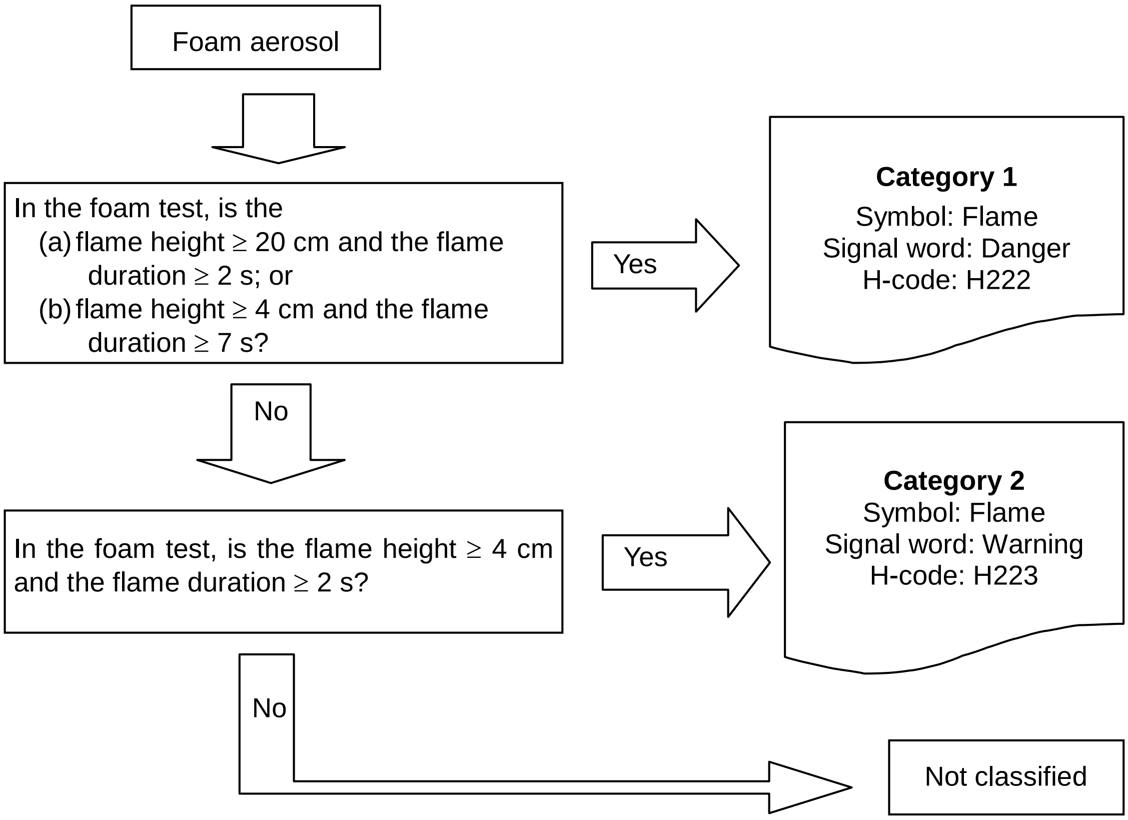
(a) For flammable aerosols



(b) For spray aerosols



(c) For foam aerosols



2.4.4.5 Hazard communication elements

Element	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
H-code: Hazard statement	H222: Extremely flammable aerosol	H223: Flammable aerosol

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2.4.5 Flammable Liquids

2.4.5.1 Definition

Flammable liquid means a liquid having a flash point of not more than 60°C.

2.4.5.2 Classification criteria

2.4.5.2.1 A flammable liquid is classified in one of the three categories for this class according to the following table:

Table 2.10: Criteria for flammable liquids

Category	Criteria
1	Flash point < 23°C and initial boiling point ≤ 35°C.
2	Flash point < 23°C and initial boiling point > 35°C.
3	Flash point ≥ 23°C and ≤ 60°C.

NOTE
Aerosols should not be classified as flammable liquids.

2.4.5.2.2 For the purpose of the Regulations, gas oils, diesel, and light heating oils in the flash point range of 55°C to 75°C may be regarded as category 3.

2.4.5.3 Classification decision consideration

2.4.5.3.1 For the classification of flammable liquids, data on flash point and initial boiling point are needed. Data can be determined by testing, found in literature or calculated. If data are not available, the flash point and the initial boiling point shall be determined through testing. For flash point determination, a closed-cup method shall be used.

2.4.5.3.2 In the case of mixtures[2]containing known flammable liquids in defined concentrations, although they may contain non-volatile components, e.g. polymers, additives, the flash point need not be determined experimentally if the calculated flash point of the mixture, using the method given in 2.4.5.3.3, is at least 5°C[3] greater than the relevant classification criterion and provided that:

---

[2] To date, the calculation method has been validated for mixtures containing up to 6 volatile components. These components may be flammable liquids like hydrocarbons, ethers, alcohols, esters (except acrylates), and water. It is, however, not yet validated for mixtures containing halogenated sulphurous, and/or phosphoric compounds as well as reactive acrylates.

[3] If the calculated flash point is less than 5°C greater than the relevant classification criterion, the calculation method may not be used and the flash point shall be determined experimentally.

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(a) the composition of the mixture is accurately known (if the material has a specified range of composition, the composition with the lowest calculated flash point shall be selected for assessment);

(b) the lower explosion limit of each component is known (an appropriate correlation has to be applied when these data are extrapolated to other temperatures than test conditions) as well as a method for calculating the lower explosion limit;

(c) the temperature dependence of the saturated vapour pressure and of the activity coefficient is known for each component as present in the mixture;

(d) the liquid phase is homogeneous.

2.4.5.3.3 One suitable method is described in Gmehling and Rasmussen (Ind. Eng. Fundament, 21, 186, (1982)). For a mixture containing non-volatile components, the flash point is calculated from the volatile components. It is considered that a non-volatile component only slightly decreases the partial pressure of the solvents and the calculated flash point is only slightly below the measured value.

2.4.5.3.4 Possible test methods for determining the flash point of flammable liquids are listed in Table 2.11.

Table 2.11: Method for determining flash point of flammable liquids

European Standards:	EN ISO 1516 as amended. Determination of flash/no flash – Close cup equilibrium method.
	EN ISO 1523 as amended. Determination of flash – Close cup equilibrium method.
	EN ISO 2719 as amended. Determination of flash – Pensky-Martens closed cup method.
	EN ISO 3679 as amended. Determination of flash – Rapid equilibrium closed cup method.
	EN ISO 3680 as amended. Determination of flash/no flash – Rapid equilibrium closed cup method.
	EN ISO 13736 as amended. Petroleum products and other liquids – Determination of flash –Able closed cup method.
Association Francaise de Normalization , AFNOR:	NF M07-036 as amended. *Determination du point declair – Vase clos Abel-Pensky* (identical to DIN 51755).
British Standard Institute	BS 2000 Part 170 as amended (identical to EN ISO 13736).

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Deutsches Institute fur Normung	DIN 51755 (flash point below 65 C) as amended *Prufun von Mineralolen und anderen brennbaren Flussigkeiten: Bestimmung des Flammpunktes im geschlossenen Tiegel, nach Abel-Pensky* *(identical to NF M07-036).*
National Standards	Australia (Standards Australia, GPO Box 476, Sydney, NSW, 2001; www.standards.org.au). AS 2610-series, Method for the determination of the flash point of flammable liquids (closed cup). United States of America (American Society for Testing Materials International, 100 Barr Harbor Drive, PO Box C 700, West Conshohocken, Pennsylvania, USA 19428-2959). ASTM D 3828-93, Standard test methods for flash point by small scale closed tester. ASTM D 56-93, Standard test method for flash point by tag closed tester. ASTM D 3278-96, Standard test methods for flash point of liquids by setaflash closed-cup apparatus. ASTM D 0093-96, Standard test methods for flash point by Pensky-Martens closed cup tester. United Kingdom (British Standards Institute, Customer Services, 389 Chiswick High Road, London, N7 8LB). British Standard BS EN 22719. British Standard BS 2000 Part 170.

2.4.5.3.5 Possible test methods for determining the initial boiling point of flammable liquids are listed in Table 2.12.

Table 2.12: Method for determining initial boiling point of flammable liquids

International Standard	ISO 3924. ISO 4626. ISO 3405.
National Standards	United States of America (American Society for Testing Materials International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959). ASTM D86-07a, Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure. ASTM D1078-05, Standard Test Method for Distillation Range of Volatile Organic Liquids.
Further acceptable methods:	Method A.2 as described in Part A of the Annex to Commission Regulation (EC) No 440/2008[4].

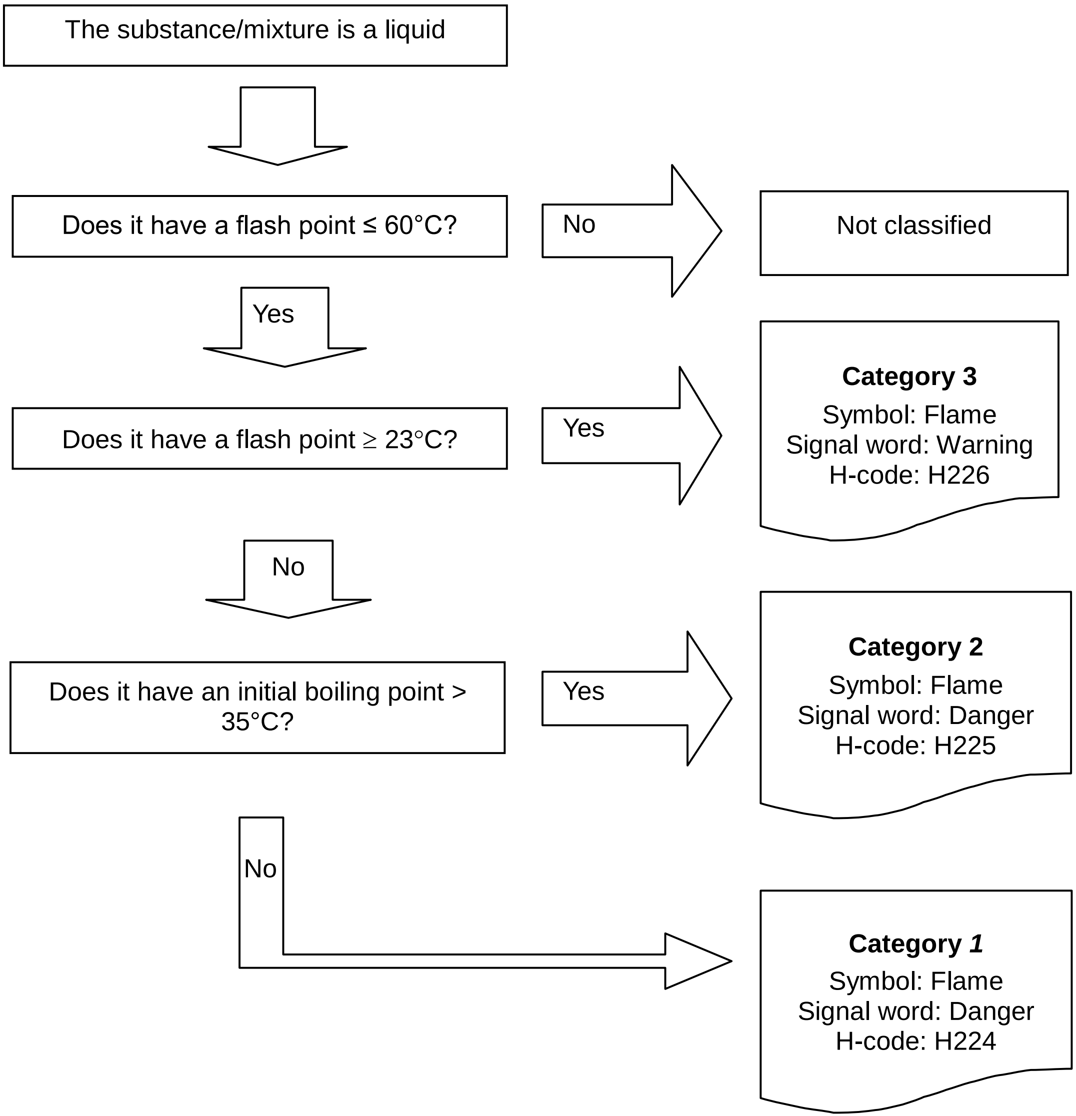
2.4.5.3.6 Liquids with a flash point of more than 35°C need not be classified in category 3 if negative results have been obtained in the sustained combustibility test L.2, Part III, section 32 of the *UNRTDG, Manual of Tests and Criteria*.

---

[4] *Commission Regulation (EC) No 440/2008 of 30 May 2008 laying down test methods pursuant to Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)* (Official Journal of the European Union, No.L142 of 31.05.2008, p. 1-739 and No. L143 of 03.06.2008, p. 55).

2.4.5.4 Decision logic

Once the flash point and the initial boiling point are known, the classification of the substance or mixture and the relevant harmonized label information may be obtained according to the following decision logic:



2.4.5.4.1 Hazard communication elements

Element	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
H-code: Hazard statement	H224: Extremely flammable liquid and vapour	H225: Highly flammable liquid and vapour	H226: Flammable liquid and vapour

2.4.6 Flammable Solids

2.4.6.1 Definition

2.4.6.1.1 A flammable solid means a solid which is readily combustible, or may cause or contribute to fire through friction.

2.4.6.1.2 Readily combustible solids are powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

2.4.6.2 Classification criteria

2.4.6.2.1 Powdered, granular or pasty substances or mixtures (except metals or metal alloys – see 2.4.6.2.2) shall be classified as readily combustible solids when the time of burning of one or more of the test runs, performed in accordance with the test method described in the Part III, sub-section 33.2.1 of the *UNRTDG, Manual of Tests and Criteria* is less than 45 seconds or the rate of burning is more than 2.2 mm/s.

2.4.6.2.2 Powders of metals or metal alloys shall be classified as flammable solids when they can be ignited and the reaction spreads over the whole length of the sample in 10 minutes or less.

2.4.6.2.3 A flammable solid shall be classified in one of the two categories for this class using Method N.1 as described in Part III, sub-section 33.2.1 of the *UNRTDG, Manual of Tests and Criteria*, according to the following table:

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Table 2.13: Criteria for flammable solids

Category	Criteria
1	Burning rate test: • Substances or mixtures other than metal powders: (a) wetted zone does not stop fire; and (b) burning time < 45 seconds or burning rate > 2.2 mm/s. • Metal powders: (a) burning time ≤ 5 minutes.
2	Burning rate test: • Substances or mixtures other than metal powders: (a) wetted zone stops the fire for at least 4 minutes; and (b) burning time < 45 seconds or burning rate > 2.2 mm/s. • Metal powders: (a) burning time > 5 minutes and ≤ 10 minutes.

NOTE
The test shall be performed on the substance or mixture in its physical form as presented. If, for example, for the supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter performance in a classification test, the substance shall also be tested in the new form.

NOTE
Aerosols should not be classified as flammable solids.

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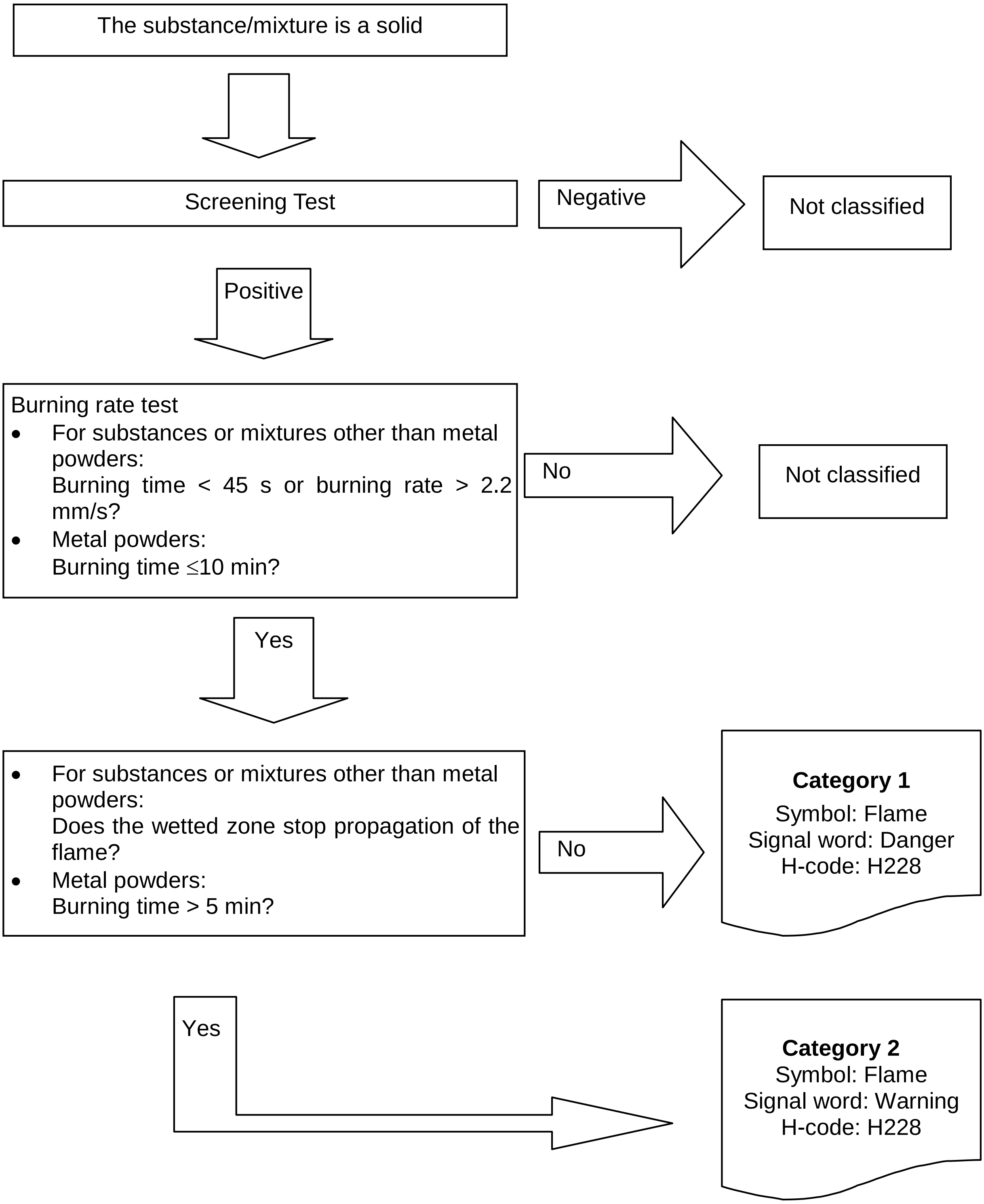
2.4.6.3 Decision logic

The classification is according to the following decision logic:



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2.4.6.4 Hazard communication elements

Element	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
H-code: Hazard statement	H228: Flammable solid	H228: Flammable solid

2.4.7 Oxidizing Gases

2.4.7.1 Definition

An oxidizing gas means any gas or gas mixture which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

2.4.7.2 Classification criteria

An oxidizing gas is classified in a single category for this class according to the following table:

Table 2.14: Criteria for oxidizing gases

Category	Criteria
1	Any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

NOTE
‘*Gases which cause or contribute to the combustion of other material more than air’ means pure gases or gas mixtures with an oxidising power greater than 23.5% as determined by a method specified in ISO 10156 as amended or 10156-2 as amended*.

2.4.7.3 Classification decision consideration

To classify an oxidizing gas, tests or calculation methods as described in ISO 10156:1996, *Gases and gas mixtures – Determination of fire potential and oxidizing ability for the selection of cylinder valve outlet* and ISO 10156-2:2005, *Gas cylinders, gases and gas mixtures – Determination of oxidizing ability of toxic and corrosive gases and gas mixtures,* shall be performed.

Example: Classification of an oxidizing gas mixture by calculation according to ISO-10156

Formula

$$\sum_{i}^{n} V_i \% x Ci$$

where:

$V_i\%$ = volume percentage of a gas
C_i = coefficient of oxygen equivalency
i = first gas in the mixture
n = n^{th} gas in the mixture

NOTE

Balance gas is not taken into consideration.

Criterion:

$$\sum_{i}^{n} V_i \% \times C_i \geq 21$$

Gas mixture

For the purpose of this example the following gas mixture is used:

$9\%(O_2) + 16\%(N_2O) + 75\%(N_2)$

Calculation:

1. Ascertain the coefficient of oxygen equivalency (C_i) for the oxidizing gases in the mixture.

C_i (N_2O) = 0.6 (nitrous oxide)
C_i (O) = 1 (oxygen)
C_i (all other oxidizing gases) = 40

2. Calculate if the gas mixture is oxidizing using the coefficient of oxygen equivalency figures for the oxidizing gases.

$9\% (O_2) + 16\% (N_2O) + 75\% (N_2) = (9x1) + (16x0.6)$
$= 18.6$

$18.6 < 21$

Therefore the mixture is considered less oxidizing than air.

If the gas mixture had been 0.6% F_2 in nitrogen, the equivalent calculation would have been

$0.6\%(F_2) + 99.4\%(N_2)$

The coefficient of oxygen equivalency (C_i) for F2 = 40.

$40 x 0.6 = 24 > 21$

Therefore, the mixture is considered more oxidizing than air.

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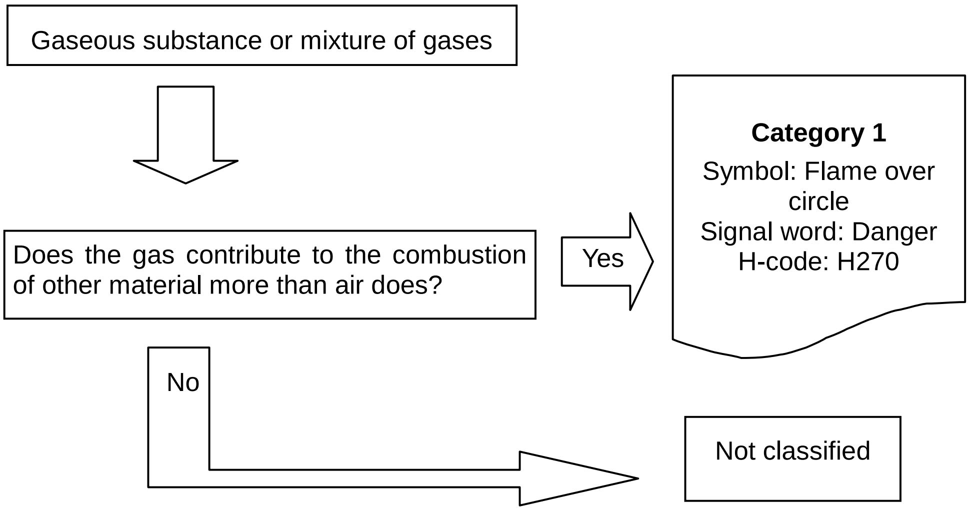
2.4.7.4 Decision logic

The classification shall be according to the following decision logic:



2.4.7.5 Hazard communication element

Element	Category 1
Hazard pictogram	
Signal word	Danger
H-code: Hazard statement	H270: May cause or intensify fire; oxidizer

2.4.8 Oxidizing Liquids

2.4.8.1 Definition

Oxidizing liquid means a liquid substance or mixture which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material.

2.4.8.2 Screening procedure

2.4.8.2.1 For organic substances or mixtures, the classification procedure for this class need not be applied if:

(a) The substances or mixture does not contain oxygen, fluorine or chlorine; or

(b) The substances or mixture contains oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen.

2.4.8.2.2 For inorganic chemicals or mixtures, the classification procedure for this class need not be applied if they do not contain oxygen or halogen atoms.

2.4.8.3 Classification criteria

An oxidizing liquid shall be classified in one of the three categories for this class using test O.2 in Part III, sub-section 34.4.2 of the *UNRTDG, Manual of Tests and Criteria*, according to the following table:

Table 2.15: Criteria for oxidizing liquids

Category	Criteria
1	Any substance or mixture which, in the 1:1 mixture, by mass, of substance (or mixture) and cellulose tested, spontaneously ignites; or the mean pressure rise time of a 1:1 mixture, by mass, of substance and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose.
2	Any substance or mixture which, in the 1:1 mixture, by mass, of substance (or mixture) and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose; and the criteria for category 1 are not met.
3	Any substance or mixture which, in the 1:1 mixture, by mass, of substance (or mixture) and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose; and the criteria for categories 1 and 2 are not met.

2.4.8.4 Classification decision consideration

2.4.8.4.1 In the event of divergence between test results and known experience in the handling and use of substances or mixtures, which shows them to be oxidizing, judgements based on known experience shall take precedence over test results.

2.4.8.4.2 In cases where substances or mixtures generate a pressure rise (too high or too low), caused by chemical reactions not characterising the oxidising properties of the substance or mixture, the test described in Part III, sub-section 34.4.2 of the *UNRTDG, Manual of Tests and Criteria* shall be repeated with an inert substance, e.g. diatomite (kieselguhr), in place of the cellulose in order to clarify the nature of the reaction and to check for a false positive result.

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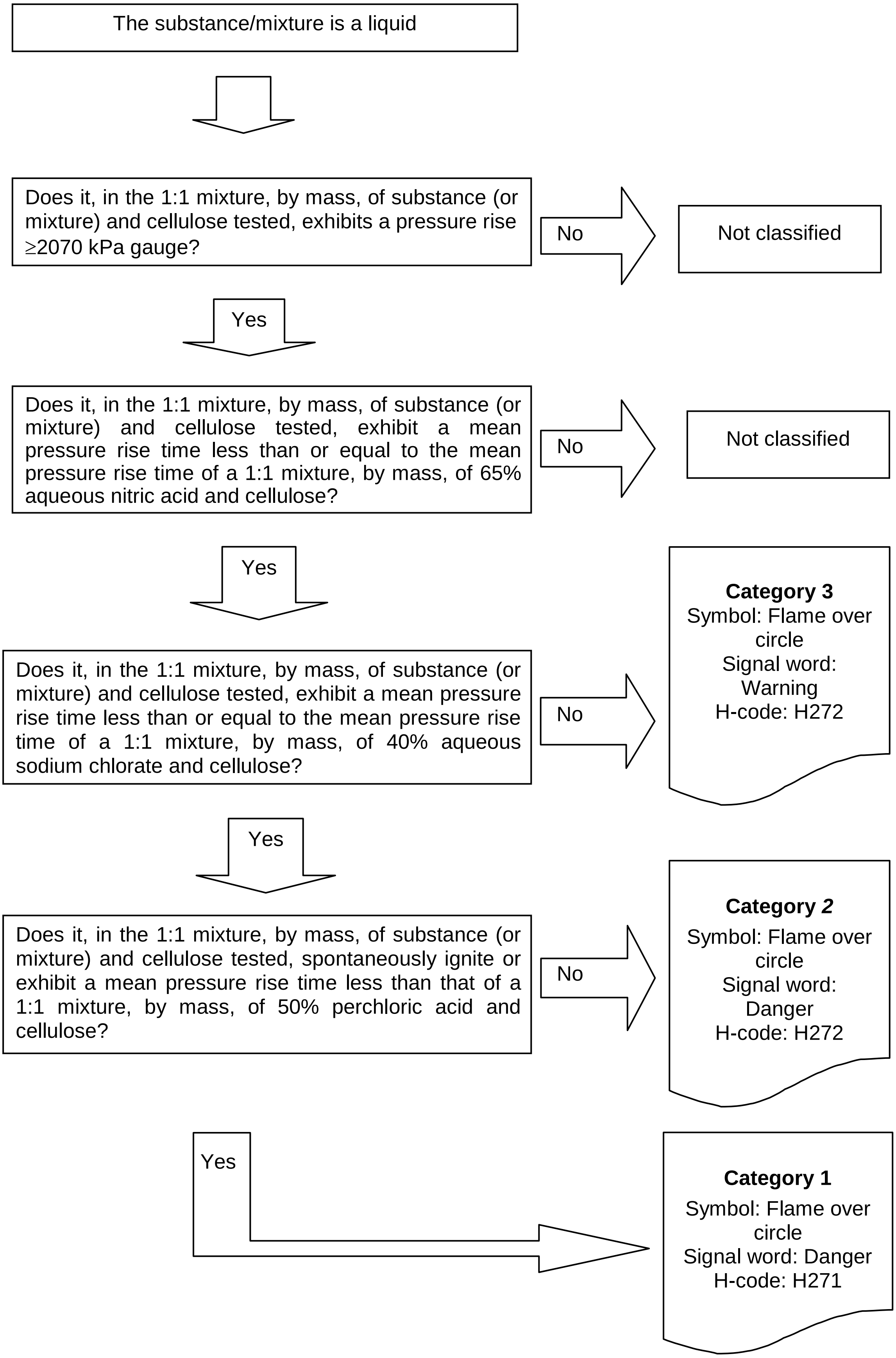
2.4.8.5 Decision logic

Classification shall be made according to the following decision logic:



2.4.8.6 Hazard communication elements

Element	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
H-code: Hazard statement	H271: May cause fire or explosion; strong oxidizer	H272: May intensify fire; oxidizer	H272: May intensify fire; oxidizer

2.4.9 Oxidizing Solids

2.4.9.1 Definition

Oxidizing solid means a solid substance or mixture which, while in itself is not necessarily combustible, may, generally by yielding oxygen, cause or contribute to the combustion of other material.

2.4.9.2 Screening procedure

2.4.9.2.1 For organic substances or mixtures, the classification procedure for this class shall not apply if:

(a) the substance or mixture does not contain oxygen, fluorine or chlorine; or

(b) the substance or mixture contains oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen.

2.4.9.2.2 For inorganic substances or mixtures, the classification procedure for this class shall not apply if they do not contain oxygen or halogen atoms.

2.4.9.3 Classification criteria

An oxidizing solid shall be classified in one of the three categories for this class using test O.1 in Part III, sub-section 3.4.4.1 of the *UNRTDG, Manual of Tests and Criteria*, according to the following table:

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Table 2.16: Criteria for oxidizing solids

Category	Criteria
1	Any substance or mixture which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose.
2	Any substance or mixture which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose; and the criteria for category 1 are not met.
3	Any substance or mixture which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose; and the criteria for category 1 and 2 are not met.

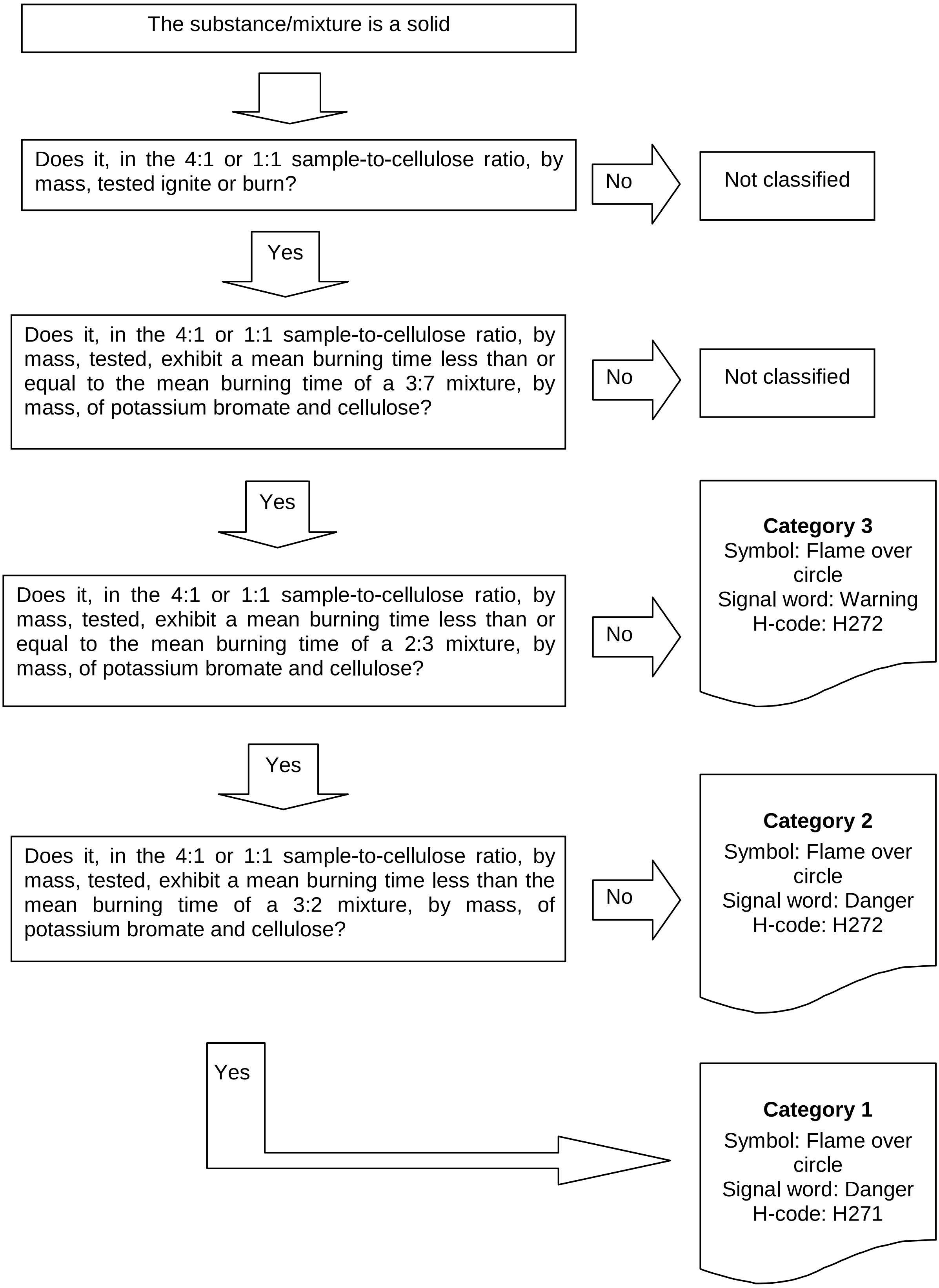
NOTE
The test shall be performed on the substance or mixture in its physical form as presented. If, for example, for the purposes of supply or transport, the same chemical is to be presented in a physical form different from that which was tested and which is considered likely to materially alter its performance in a classification test, the substance shall also be tested in the new form.

2.4.9.4 Classification decision consideration

In the event of divergence between test results and known experience in the handling and use of substances or mixtures, which shows them to be oxidising, judgements based on known experience shall take precedence over test results.

2.4.9.5 Decision logic

Classification shall be made according to the following decision logic:



The substance/mixture is a solid

Does it, in the 4:1 or 1:1 sample-to-cellulose ratio, by mass, tested ignite or burn?

Does it, in the 4:1 or 1:1 sample-to-cellulose ratio, by mass, tested, exhibit a mean burning time less than or equal to the mean burning time of a 3:7 mixture, by mass, of potassium bromate and cellulose?

Does it, in the 4:1 or 1:1 sample-to-cellulose ratio, by mass, tested, exhibit a mean burning time less than or equal to the mean burning time of a 2:3 mixture, by mass, of potassium bromate and cellulose?

Does it, in the 4:1 or 1:1 sample-to-cellulose ratio, by mass, tested, exhibit a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose?

Not classified

Not classified

Category 3
Symbol: Flame over circle
Signal word: Warning
H-code: H272

Category 2
Symbol: Flame over circle
Signal word: Danger
H-code: H272

Category 1
Symbol: Flame over circle
Signal word: Danger
H-code: H271

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2.4.9.6 Hazard communication elements

Element	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
H-code: Hazard statement	H271: May cause fire or explosion; strong oxidizer	H272: May intensify fire; oxidizer	H272: May intensify fire; oxidizer

2.4.10 Gases under Pressure

2.4.10.1 Definition

Gases under pressure are gases which are contained in a receptacle at a pressure of 200 kPa (gauge) or more, or which are liquefied or liquefied and refrigerated. They comprise compressed gases, liquefied gases, dissolved gases, and refrigerated liquefied gases.

2.4.10.2 Classification criteria

Gases shall be classified, according to their physical state when packaged, in one of four categories in the following table:

Table 2.17: Criteria for gases under pressure

Category	Criteria
Compressed gas	A gas which, when packaged under pressure, is entirely gaseous at -50°C; including all gases with a critical temperature ≤-50°C.
Liquefied gas	A gas which, when packaged under pressure, is partially liquid at temperatures above -50°C. A distinction is made between: (a) High pressure liquefied gas: A gas with a critical temperature between -50°C and +65°C; and (b) Low pressure liquefied gas: A gas with a critical temperature above +65°C.
Refrigerated liquefied gas	A gas which, when packaged, is made partially liquid because of its low temperature.
Dissolved gas	A gas which, when packaged under pressure, is dissolved in a liquid phase solvent.

NOTE
The critical temperature is the temperature above which a pure gas cannot be liquefied, regardless of the degree of compression.

2.4.10.3 Classification decision consideration

2.4.10.3.1 To classify gases under pressure, the following information is required:

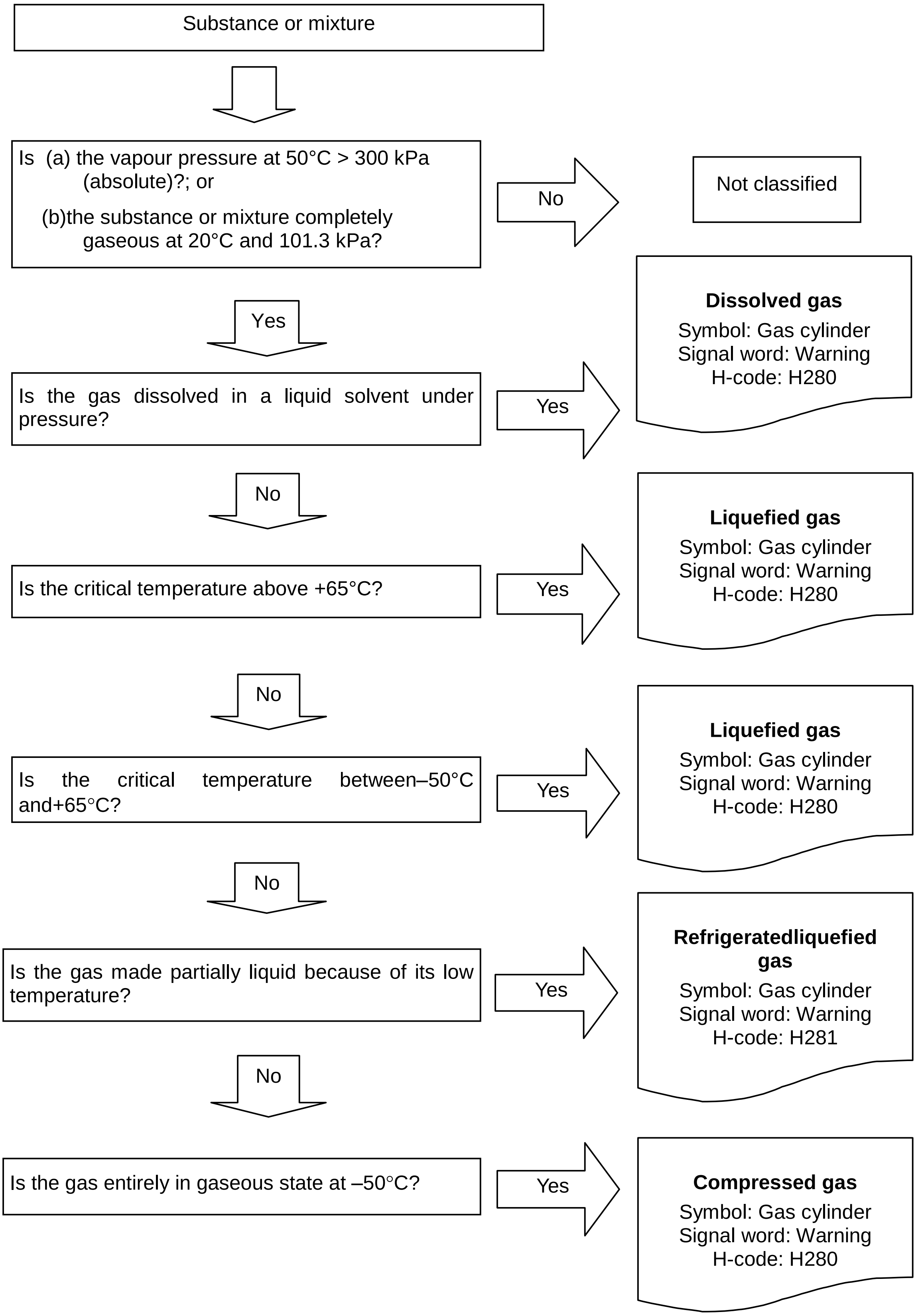
(a) The vapour pressure at 50°C;
(b) The physical state at 20°C at standard ambient pressure; and
(c) The critical temperature.

2.4.10.3.2 Data can be found in literature, calculated, or determined by testing. Most pure gases are already classified in the *UNRTDG, Model Regulations*.

2.4.10.3.3 Substance and mixture that are not compressed in pressure vessels (cylinders) shall be classified as “not applicable”.

2.4.10.4 Decision logic

Classification shall be made according to the following decision logic:



2.4.10.5 Hazard communication elements

Element	Compressed gas	Liquefied gas	Refrigerated liquefied gas	Dissolved gas
Hazard pictogram				
Signal word	Warning	Warning	Warning	Warning
H-code: Hazard statement	H280: Contains gas under pressure; may explode if heated	H280: Contains gas under pressure; may explode if heated	H281: Contains refrigerated gas; may cause cryogenic burns or injury	H280: Contains gas under pressure; may explode if heated

2.4.11 Self-Reactive Chemicals

2.4.11.1 Definition

2.4.11.1.1 A self-reactive chemical means a thermally unstable liquid or solid substance or mixture liable to undergo a strongly exothermic decomposition even without the participation of oxygen (air). This definition excludes substances and mixtures classified in this Part as explosives, organic peroxides, or as oxidizing.

2.4.11.1.2 A self-reactive chemical is regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

2.4.11.2 Screening procedure

2.4.11.2.1 Any self-reactive chemicals shall be considered for classification in this class unless:

(a) They are explosives, according to the criteria given in Part 2.4.2;

(b) They are oxidizing liquids or solids, according to the criteria of Parts 2.4.8 or 2.4.9, except that mixtures of oxidizing substances which contain 5% or more of combustible organic substances shall be classified as self-reactive substances according to the procedure defined in the note below;

(c) They are organic peroxides, according to the criteria of Part 2.4.16;

(d) Their heat of decomposition is less than 300 J/g; or

(e) Their self-accelerating decomposition temperature (SADT) is greater than 75°C for a 50 kg package[5].

---

[5] See *UNRTDG, Manual of Tests and Criteria*, sub-sections 28.1, 28.2, 28.3 and Table 28.3

NOTE

Mixtures of oxidizing substances, meeting the criteria for classification as oxidizing substances, which contain 5.0% or more of combustible organic substances and which do not meet the criteria mentioned in (a), (c), (d) or (e) above, shall be subjected to the self-reactive chemicals classification procedure. Such a mixture showing the properties of a self-reactive chemicals type B to F (see 2.4.11.3.1) shall be classified as a self-reactive chemicals.

2.4.11.2.2 The classification procedures for self-reactive chemicalsneed not be applied if:

(a) There are no chemical groups present in the molecule associated with explosive or self-reactive properties. Examples of such groups are given in Tables 2.18 and 2.19.

Table 2.18: Examples of chemical groups indicating explosive properties in organic materials

Structural feature	**Examples**
C-C unsaturation	Acetylenes, acetylides, 1,2-dienes
C-Metal, N-Metal	Grignard reagents, organo-lithium compounds
Contiguous nitrogen atoms	Azides,aliphatic azo compounds, diazonium salts, hydrazines, sulphonylhydrazides
Contiguous oxygen atoms	Peroxides, ozonides
N-O	Hydroxylamines, nitrates, nitro compounds, nitroso compounds, N-oxides, 1,2-oxazoles
N-halogen	Chloroamines, fluoroamines
O-halogen	Chlorates, perchlorates, iodosyl compounds
(UNRTDG: *Manual of Tests and Criteria*, Appendix 6, Table A6.1)	

Table 2.19: Examples of chemical groups indicating self reactive properties in organic materials

Structural feature	**Examples**
Mutually reactive group	Aminonitriles, haloanilines, organic salts of oxidizing acids.
S＝O	Sulfonyl halides, sulfonyl cyanides, sulfonyl hydrazides.
P–O	Phosphites.
Strained rings	Epoxides, aziridines.
Unsaturation	Olefines, cyanides.
(UNRTDG: *Manual of Tests and Criteria*, Appendix 6, Table A6.2)	

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or

(b) For a single organic substance or a homogeneous mixture of organic substances, the estimated SADT is greater than 75°C or the exothermic decomposition energy is less than 300 J/g. The onset temperature and decomposition energy may be estimated using a suitable calorimetric technique (see 20.3.3.3 in Part II of the *UNRTDG,Manual of Tests and Criteria*).

2.4.11.3 Classification criteria

2.4.11.3.1 Self-reactive chemicals shall be classified in one of the seven categories of "types A to G" for this class, according to the following principles:

(a) TYPE A
Any self-reactive chemicals which can detonate or deflagrate rapidly, as packaged, will be defined as self-reactive chemicals type A;

(b) TYPE B
Any self-reactive chemicals possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package will be defined as self-reactive chemicals type B;

(c) TYPE C
Any self-reactive chemicals possessing explosive properties when the substance or mixture, as packaged, cannot detonate or deflagrate rapidly or undergo a thermal explosion will be defined as self-reactive chemicals type C;

(d) TYPE D
Any self-reactive chemicals which in laboratory testing:

(i) detonates partially, does not deflagrate rapidly, and shows no violent effect when heated under confinement; or

(ii) does not detonate at all, deflagrates slowly, and shows no violent effect when heated under confinement; or

(iii) does not detonate or deflagrate at all and shows a medium effect when heated under confinement;

will be defined as self-reactive chemicals type D;

(e) TYPE E
Any self-reactive chemicals which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement will be defined as self-reactive chemicals type E;

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(f) TYPE F

Any self-reactive chemicals which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power will be defined as self-reactive chemicals TYPE F;

(g) TYPE G

(i) Any self-reactive chemicals which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable (self-accelerating decomposition temperature is 60°C to 75°C for a 50 kg package), and, for liquid mixtures, a diluent having a boiling point not less than 150°C is used for desensitization will be defined as self-reactive chemicals type G.

(ii) If the mixture is not thermally stable or a diluent having a boiling point less than 150°C is used for desensitization, the mixture shall be defined as self-reactive chemicals type F.

NOTE

Where the test is conducted in the package form and the packaging is changed, a further test shall be conducted where it is considered that the change in packaging will affect the outcome of the test.

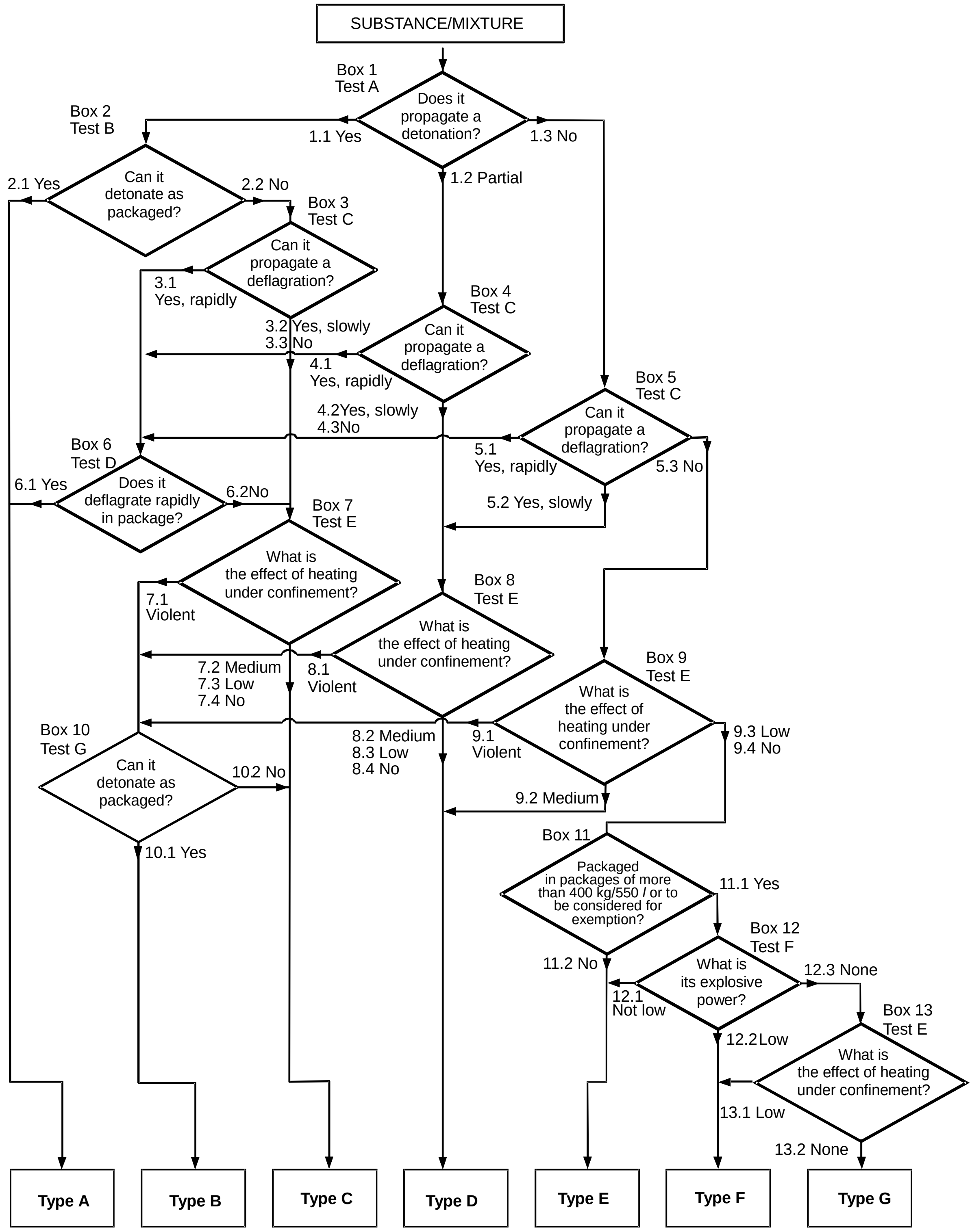
2.4.11.3.2 *Criteria for temperature control*

Self-reactive chemicals need to be subjected to temperature control if their self-accelerating decomposition temperature (SADT) is less than or equal to 55°C. Test methods for determining the SADT as well as the derivation of control and emergency temperatures are given in section 28, Part II of the *UNRTDG, Manual of Tests and Criteria*. The test selected shall be conducted in a manner which is representative, both in size and material, of the package.

2.4.11.4 Decision logic

2.4.11.4.1 The properties of self-reactive chemicals which are decisive for their classification shall be determined experimentally. The classification of a self reactive chemical shall be performed in accordance with test series A to H as described in Part II of the *UNRTDG, Manual of Tests and Criteria*. The Method for classifying self reactive chemicals is described in Figure 2.7.

Figure 2.7: Procedure to classify self-reactive chemicals



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2.4.11.5 Hazard communication elements

Element	Type A	Type B	Type C and D	Type E and F	Type G
Hazard pictogram		 			No label elements allocated for this hazard category
Signal word	Danger	Danger	Danger	Warning	
H-code: Hazard statement	H240: Heating may cause explosion	H241: Heating may cause fire or explosion	H242: Heating may cause fire	H242: Heating may cause fire	

Type G has no hazard communication elements assigned but shall be considered for properties belonging to other hazard classes.

2.4.12 Pyrophoric Liquids

2.4.12.1 Definition

Pyrophoric liquid means a liquid substance or mixture which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

2.4.12.2 Screening procedure

2.4.12.2.1 The classification procedure for pyrophoric liquids need not be applied when experience in production or handling shows that the substance or mixture does not ignite spontaneously on coming into contact with air at normal temperatures (i.e. the chemical is known to be stable at room temperature for prolonged periods of time (days)). Such chemicals shall be determined as “not classified”.

2.4.12.2.2 Chemicals that are gases or solids shall be determined as “not applicable”.

2.4.12.3 Classification criteria

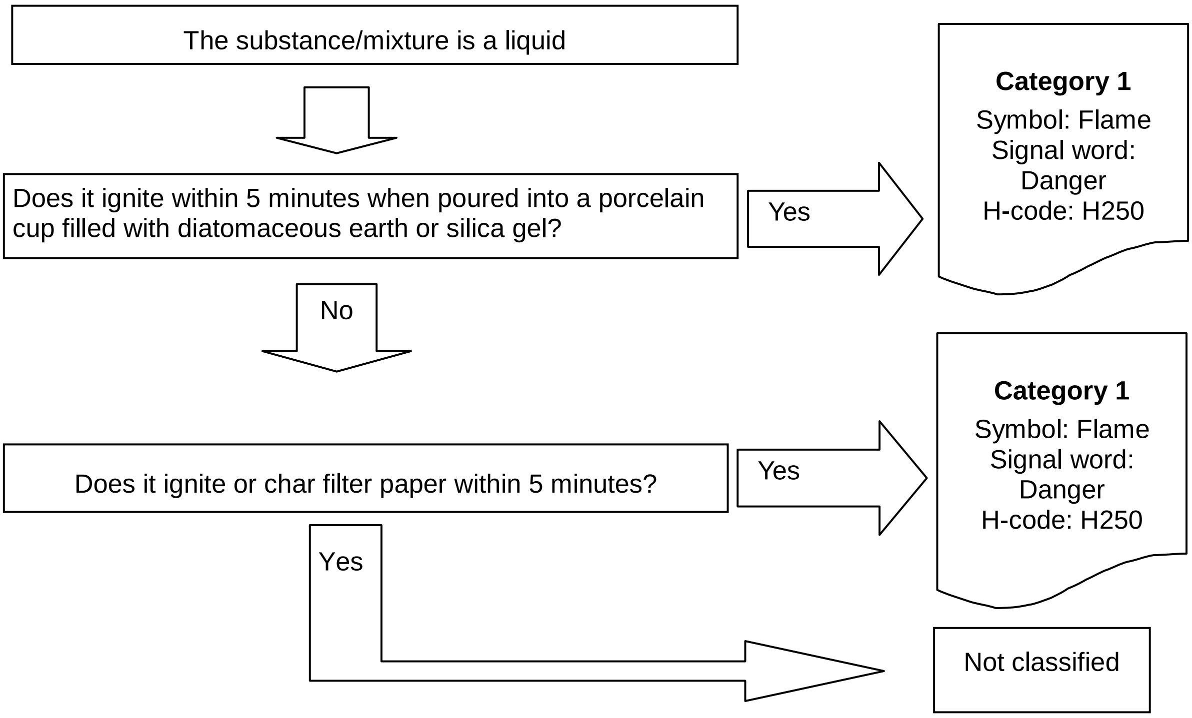
A pyrophoric liquid is classified in a single category for this class using test N.3 in Part III, sub-section 33.3.1.5 of the *UNRTDG, Manual of Tests and Criteria*, according to the following table:

Table 2.20: Criteria for pyrophoric liquids

Category	Criteria
1	The liquid ignites within 5 minutes when added to an inert carrier and exposed to air, or it ignites or chars a filter paper on contact with air within 5 minutes.

2.4.12.4 Decision logic

The classification shall be made according to the following decision logic:



2.4.12.5 Hazard communication element

Element	Category 1
Hazard pictogram	
Signal word	Danger
H-code: Hazard statement	H250: Catches fire spontaneously if exposed to air

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2.4.13 Pyrophoric Solids

2.4.13.1 Definition

A pyrophoric solid means a solid substance or mixture which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.

2.4.13.2 Screening procedure

2.4.13.2.1 The classification procedure for pyrophoric solids need not be applied when experience in production or handling shows that the substance or mixture does not ignite spontaneously on coming into contact with air at normal temperatures (i.e. the chemical is known to be stable at room temperature for prolonged periods of time (days)). Such chemicals shall be determined as “not classified”.

2.4.13.2.2 Chemicals that are gases or liquids shall be determined as “not applicable”.

2.4.13.3 Classification criteria

A pyrophoric solid shall be classified in a single category for this class using test N.2 in Part III, sub-section 33.3.1.4 of the *UNRTDG, Manual of Tests and Criteria* according to the following table:

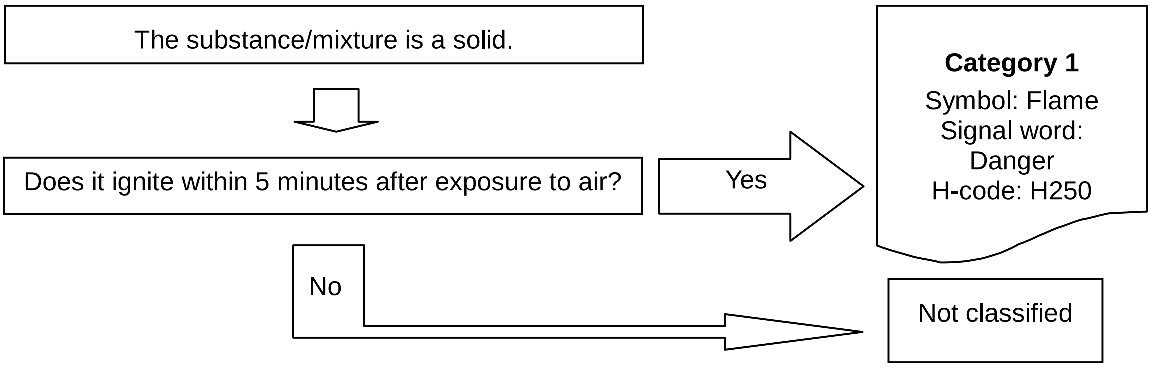
Table 2.21: Criteria for pyrophoric solids

Category	Criteria
1	The solid ignites within 5 minutes of coming into contact with air.

NOTE
For classification tests on solid substances or mixtures, the tests shall be performed on the substance or mixture in its physical form as presented. If for example, for the purposes of supply or transport, the same chemical 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, the substance or mixture must also be tested in the new form.

2.4.13.4 Decision logic

Procedure for classification is as described in the following decision logic:



2.4.13.5 Hazard communication element

Element	Category 1
Hazard pictogram	
Signal word	Danger
H-code: Hazard statement	H250: Catches fire spontaneously if exposed to air

2.4.14 Self-Heating Chemicals

2.4.14.1 Definition

2.4.14.1.1 A self-heating chemical means a solid or liquid substance or mixture, other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat. This chemical differs from a pyrophoric liquid or solid in that it will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

2.4.14.1.2 Self-heating of chemicals is a process where the gradual reaction of the substance or mixture with oxygen (in air) generates heat. If the rate of heat production exceeds the rate of heat loss, then the temperature of the substance or mixture will rise, which, after an induction time, may lead to self-ignition and combustion.

2.4.14.2 Screening procedure

2.4.14.2.1 The classification procedure for self-heating chemicals need not be applied if the results of a screening test can be adequately correlated with the classification test and an appropriate safety margin is applied. Examples of screening tests are:

(a) The Grewer Oven test (VDI guideline 2263, part 1, 1990, Test methods for the Determination of the Safety Characteristics of Dusts) with an onset temperature of 80 K above the reference temperature for a volume of 1litre;

(b) The Bulk Powder Screening Test (Gibson, N. Harper, D. J. Rogers, R. Evaluation of the fire and explosion risks in drying powders, Plant Operations Progress, 4 (3), 181 - 189, 1985) with an onset temperature of 60 K above the reference temperature for a volume of 1 litre.

2.4.14.2.2 Substances or mixtures are determined as “not applicable” if:

(a) The substances or mixtures are gases.
(b) The substances or mixtures are pyrophoric liquids or solids.

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2.4.14.2.3 Substances or mixtures are determined as “not classified” if they are non-flammable liquids or solids.

2.4.14.3 Classification criteria

2.4.14.3.1 A substance or mixture shall be classified as a self-heating chemical, if the tests performed in accordance with the test method given in subsection 33.3.1.6, Part III of the *UNRTDG, Manual of Tests and Criteria*:

(a) A positive result is obtained using a 25 mm cube sample at 140°C;

(b) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 100 mm cube sample at 120°C, and the substance or mixture is to be packed in packages with a volume of more than 3 m^3;

(c) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 100 mm cube sample at 100°C, and the substance or mixture is to be packed in packages with a volume of more than 450 litres;

(d) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a positive result is obtained using a 100 mm cube sample at 100°C.

2.4.14.3.2 A self-heating chemical is classified in one of the two categories for this class if the tests performed in accordance with test method N.4 in sub-section 33.3.1.6, Part III of the *UNRTDG, Manual of Tests and Criteria*, the result meets the criteria shown in Table 2.22.

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Table 2.22: Criteria for self-heating chemicals

Category	Criteria
1	A positive result is obtained in a test using a 25 mm sample cube at 140°C.
2	(a) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm cube sample at 140°C, and the substance or mixture is to be packed in packages with a volume of more than 3 m^3; or (b) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm cube sample at 140°C, a positive result is obtained in a test using a 100 mm cube sample at 120 C, and the substance or mixture is to be packed in packages with a volume of more than 450 litres; or (c) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm cube sample at 140°C, and a positive result is obtained in a test using a 100 mm cube sample at 100°C.

NOTE
For classification tests on solid substances or mixtures, the tests shall be performed on the substance or mixture as presented. If for example, for the purposes of supply or transport, the same chemical 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, the substance or mixture must also be tested in the new form.

2.4.14.3.3 Substances and mixtures with a temperature of spontaneous combustion higher than 50^{o}C for a volume of 27 m^3 shall not be classified as self-heating chemicals.

2.4.14.3.4 Substances and mixtures with a spontaneous ignition temperature higher than 50^{o}C for a volume of 450 litres shall not be assigned to category 1 of this class.

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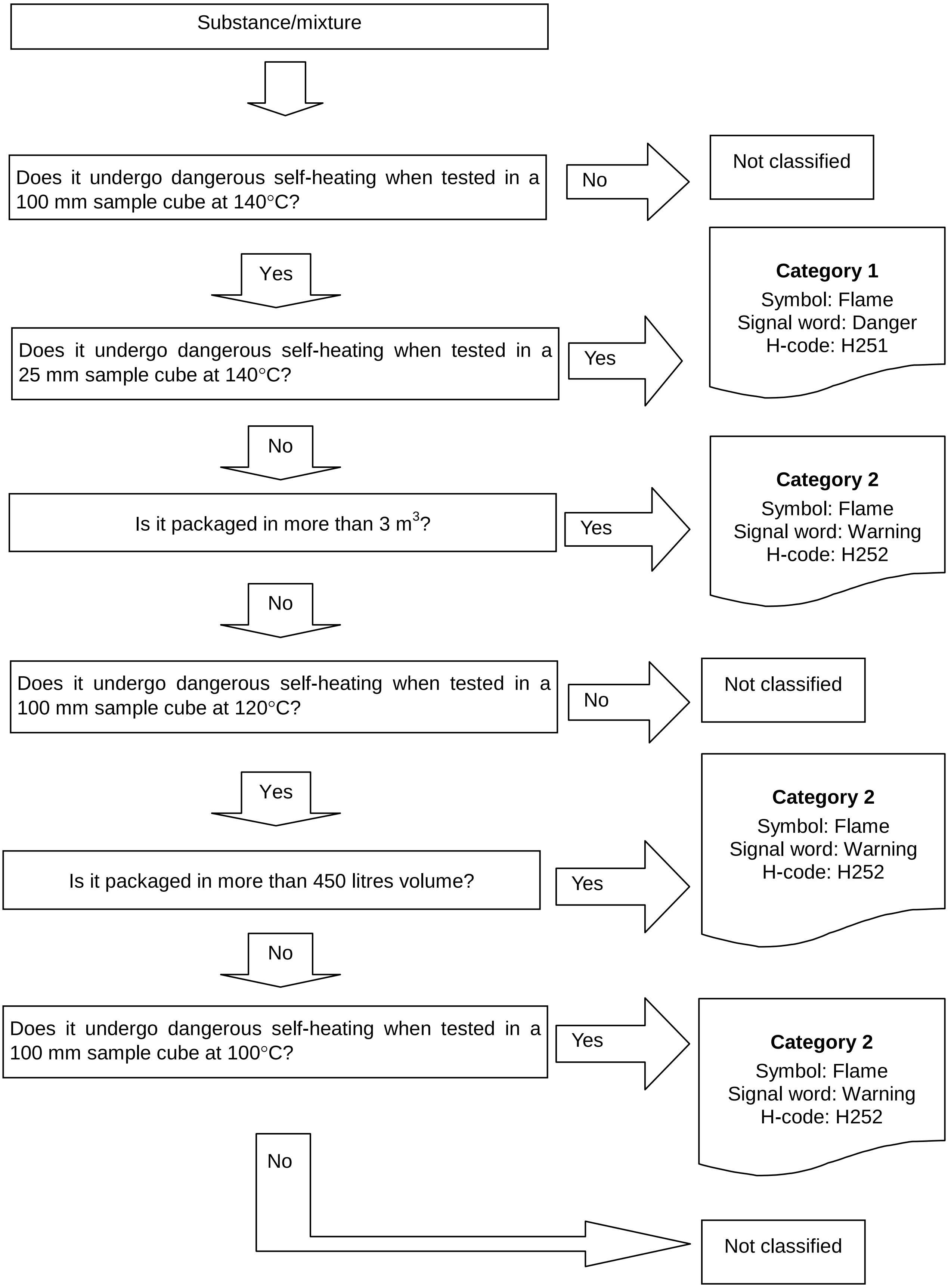
2.4.14.4 Decision logic

Procedure for classification is as described in the following decision logic:



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2.4.14.5 Hazard communication elements

Element	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
H-code: Hazard statement	H251: Self-heating; may catch fire	H252: Self-heating in large quantities; may catch fire

2.4.15 Chemicals which, if in Contact with Water, Emit Flammable Gases

2.4.15.1 Definition

Chemicals which, if in contact with water, emit flammable gases refer to solid or liquid substances or mixtures which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

2.4.15.2 Screening procedure

Chemicals are determined as "not applicable" if:

(a) The substance or mixture is a gas;

(b) The chemical structure of the substance or mixture does not contain metals or metalloids;

(c) Experience in production or handling shows that the substance or mixture does not react with water, e.g. the chemical is manufactured with water or washed with water; or

(d) The substance or mixture is known to be soluble in water to form a stable mixture.

2.4.15.3 Classification criteria

2.4.15.3.1 A chemical which, if in contact with water, emit flammable gases is classified in one of the three categories for this class, using test N.5 in sub-section 33.4.1.4, Part III of the *UNRTDG, Manual of Tests and Criteria*, according to Table 2.23.

2.4.15.3.2 A substance or mixture shall be classified as a chemical which, if in contact with water, emits flammable gases, if:

(a) A spontaneous ignition takes place in any step of the test or procedure; or

(b) There is an evolution of a flammable gas at a rate greater than 1 litre per kilogram of the chemical per hour.

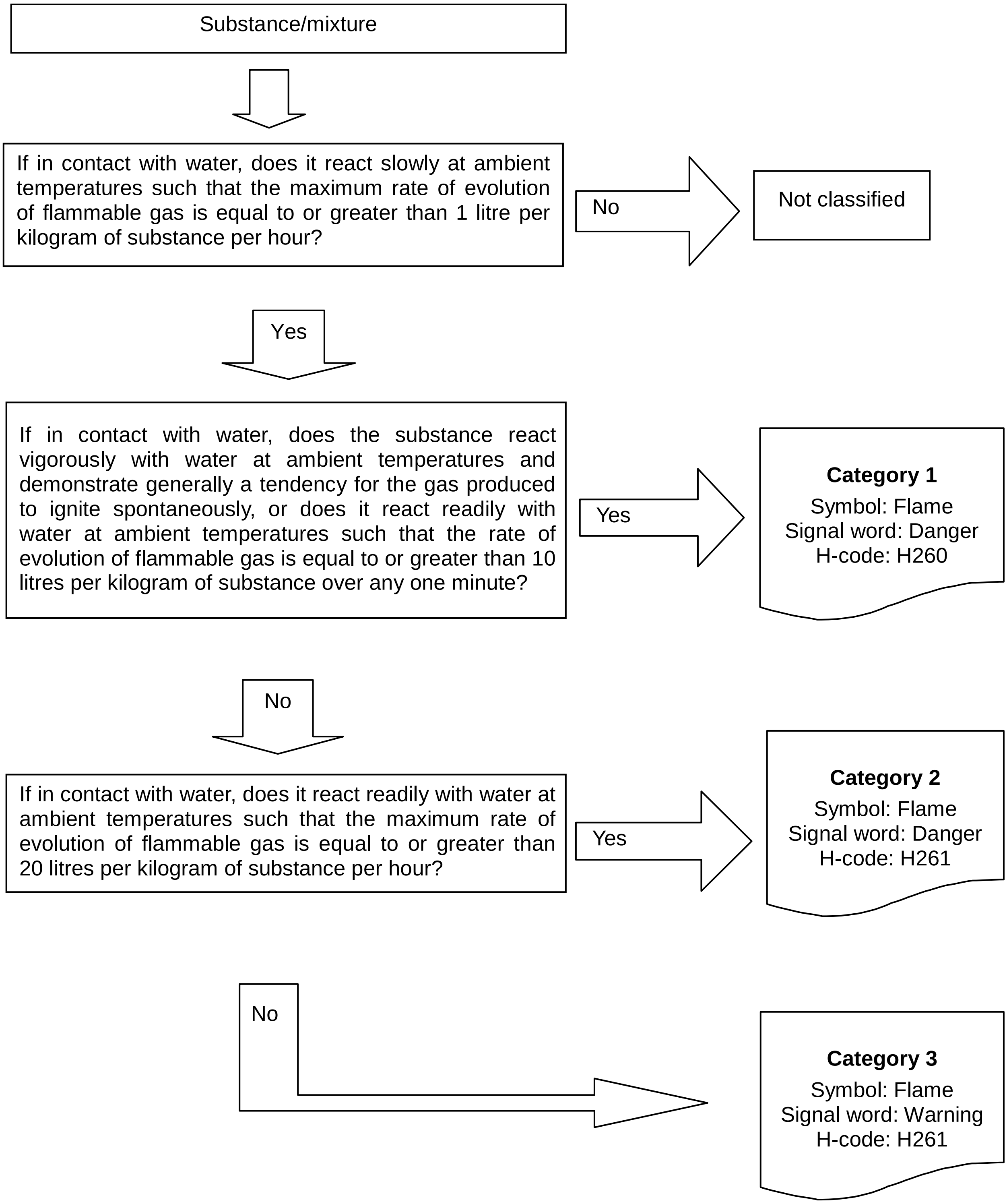
Table 2.23: Criteria for chemicals which, if in contact with water, emit flammable gases

Category	Criteria
1	Any chemical which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 litres per kilogram of substance over any one minute.
2	Any chemical which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 litres per kilogram of substance per hour, and which does not meet the criteria for category 1.
3	Any chemical which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 1 litre per kilogram of substance per hour, and which does not meet the criteria for Categories 1 and 2.

NOTE
The test shall be performed on the chemicalsin its physical form as presented. If, for example, for the purposes of supply or transport, the same chemical 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, the substance must also be tested in the new form.

2.4.15.4 Decision logic

Procedure for classification is as described in the following decision logic:



2.4.15.5 Hazard communication elements

Element	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
H-code: Hazard statement	H260: If in contact with water, releases flammable gases which may ignite spontaneously	H261: If in contact with water, releases flammable gases	H261: If in contact with water, releases flammable gases

2.4.16 Organic Peroxides

2.4.16.1 Definition

2.4.16.1.1 Organic peroxides refer to liquid or solid organic substances which contain the bivalent −O−O− structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. The term also includes organic peroxide formulations (mixtures). Organic peroxides are thermally unstable substances or mixtures, which may undergo exothermic self-accelerating decomposition. In addition, they may have one or more of the following properties:

(a) Be liable to explosive decomposition;
(b) Burn rapidly;
(c) Be sensitive to impact or friction; or
(d) React dangerously with other substances.

2.4.16.1.2 An organic peroxide is regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

2.4.16.2 Screening procedure

Chemicals are determined as “not applicable” if:

(a) The chemical is a gas;

(b) The chemical is inorganic; or

(c) The chemical is an organic substance that does not contain the bivalent −O−O− structure.

2.4.16.3 Classification criteria

2.4.16.3.1 Any organic peroxide shall be considered for classification in this class, unless it contains:

(a) Not more than 1.0% available oxygen from the organic peroxides when containing not more than 1.0% hydrogen peroxide; or
(b) Not more than 0.5% available oxygen from the organic peroxides when containing more than 1.0% but not more than 7.0% hydrogen peroxide.

NOTE

The available oxygen content (%) of an organic peroxide mixture is given by the formula:

$$16 \times \sum_{i}^{n} \left(\frac{n_i \times c_i}{m_i} \right)$$

where:

n_i = number of peroxygen groups per molecule of organic peroxide *i*;

c_i = concentration (mass %) of organic peroxide *i*;

m_i = molecular mass of organic peroxide *i*.

2.4.16.3.2 Organic peroxides shall be classified in one of the seven categories of "types A to G" for this class, according to the following principles:

(a) Type A
Any organic peroxide which, as packaged, can detonate or deflagrate rapidly will be defined as organic peroxide type A;

(b) Type B
Any organic peroxide possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package will be defined as organic peroxide type B;

(c) Type C
Any organic peroxide possessing explosive properties when the substance or mixture, as packaged, cannot detonate or deflagrate rapidly or undergo a thermal explosion will be defined as organic peroxide type C;

(d) Type D
Any organic peroxide which in laboratory testing:

(i) Detonates partially, does not deflagrate rapidly, and shows no violent effect when heated under confinement; or
(ii) Does not detonate at all, deflagrates slowly, and shows no violent effect when heated under confinement; or

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(iii) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement;
will be defined as organic peroxide type D;

(e) Type E
Any organic peroxide which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement will be defined as organic peroxide type E;

(f) Type F
Any organic peroxide which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power will be defined as organic peroxide type F;

(g) Type G
Any organic peroxide which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows no effect when heated under confinement nor any explosive power, provided that it is thermally stable, i.e the SADT is 60°C or higher for a 50 kg package[6], and, for liquid mixtures, a diluent having a boiling point of not less than 150°C is used for desensitization, will be defined as organic peroxide type G.

If the organic peroxide is not thermally stable or a diluent having a boiling point less than 150°C is used for desensitization, it shall be defined as organic peroxide type F.

NOTE
Where the test is conducted in the package form and the packaging is changed, a further test shall be conducted where it is considered that the change in packaging will affect the outcome of the test.

2.4.16.3.3 *Criteria for temperature control*

The following organic peroxides need to be subjected to temperature control:

(a) Organic peroxide types B and C with an SADT ≤ 50°C;
(b) Organic peroxide type D showing a medium effect when heated under confinement[7] with an SADT ≤ 50°C or showing a low or no effect when heated under confinement with an SADT ≤ 45°C; and
(c) Organic peroxide types E and F with an SADT ≤ 45°C.

---

[6] See sub-sections 28.1, 28.2, 28.3 and Table 28.3 of the *UNRTDG, Manual of Tests and Criteria*.
[7] As determined by test series E as prescribed in the *Manual of Tests and Criteria*, Part II.

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2.4.16.3.4 Test methods for determining the SADT as well as the derivation of control and emergency temperatures are given in section 28, Part II of the *UNRTDG, Manual of Tests and Criteria*. The test selected shall be conducted in a manner which is representative, both in size and material, of the package.

2.4.16.4 Additional decision consideration

2.4.16.4.1 Organic peroxides are classified by definition based on their chemical structure and on the available oxygen and hydrogen peroxide contents of the mixture (see 2.4.16.3.1).

2.4.16.4.2 The properties of organic peroxides which are necessary for their classification shall be determined experimentally. The classification of organic peroxides shall be performed in accordance with test series A to H as described in Part II of the *UNRTDG, Manual of Tests and Criteria.*

2.4.16.4.3 Mixtures of already classified organic peroxides may be classified as the same type of organic peroxide as that of the most dangerous component. However, as two stable components can form a thermally less stable mixture, the self-accelerating decomposition temperature (SADT) of the mixture shall be determined.

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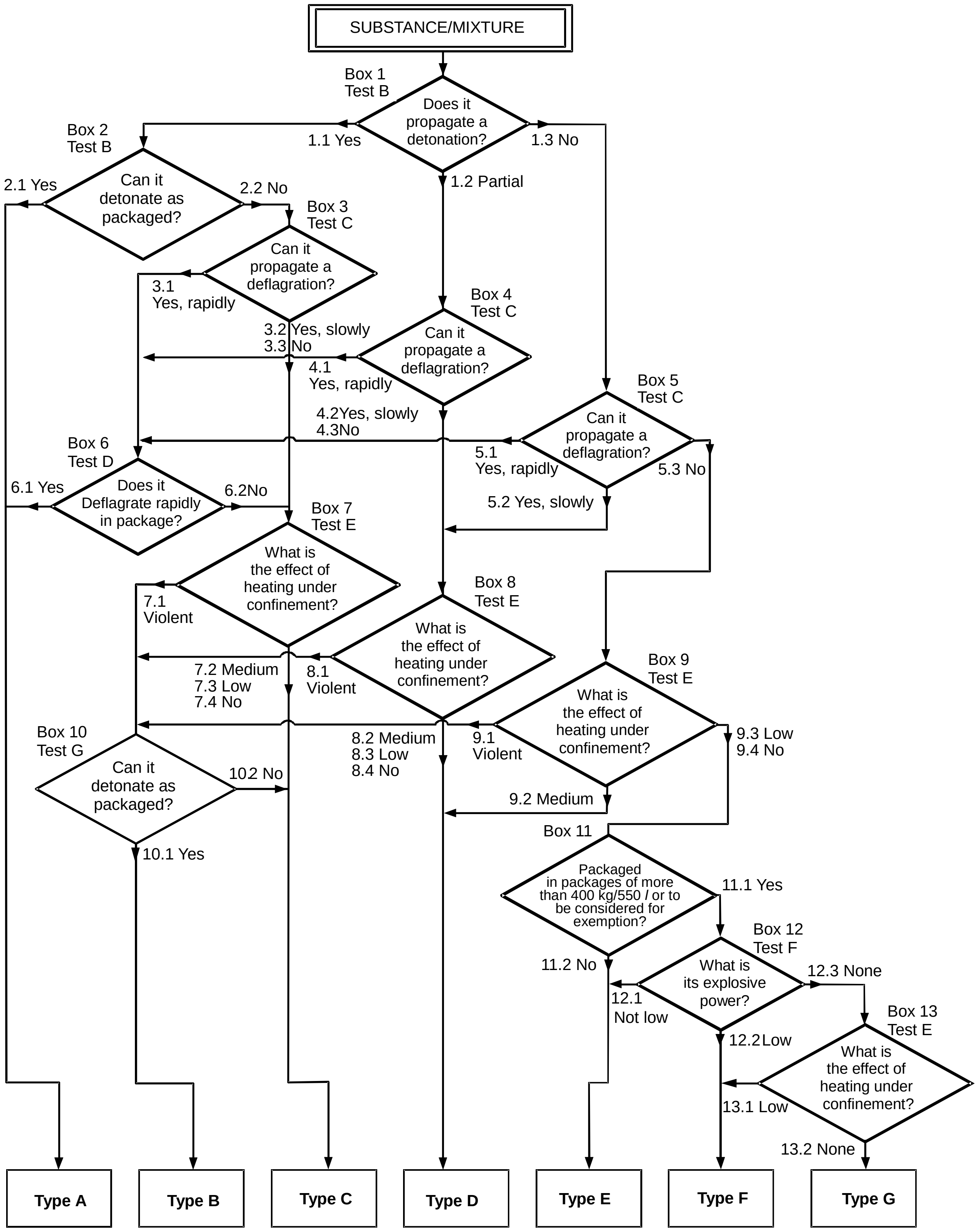
2.4.16.5 Decision logic

The procedure for classification is as described in the following decision logic:



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2.4.16.6 Hazard communication elements

Element	Type A	Type B	Type C and D	Type E and F	Type G
Hazard pictogram		 			No label elements allocated for this hazard category
Signal word	Danger	Danger	Danger	Warning	
H-code: Hazard statement	H240: Heating may cause explosion	H241: Heating may cause fire or explosion	H242: Heating may cause fire	H242: Heating may cause fire	

Type G has no hazard communication elements assigned but shall be considered for properties belonging to other hazard classes.

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2.4.17 Corrosive to Metals

2.4.17.1 Definition

A substance or mixture that is corrosive to metals means a substance or mixture which, by chemical action, will materially damage, or even destroy metals.

2.4.17.2 Classification criteria

2.4.17.2.1 A chemical which is corrosive to metals is classified in a single category for this class, using the test in sub-section 37.4, Part III of the *UNRTDG, Manual of Tests and Criteria*, according to the following table:

Table 2.24: Criteria for chemicals corrosive to metals

Category	Criteria
1	Corrosion rate on steel or aluminium surfaces exceeding 6.25 mm per year at a test temperature of 55°C when tested on both materials.

NOTE
Where an initial test on either steel or aluminium indicates the substance or mixture being tested is corrosive, the follow up test on the other metal is not required.

2.4.17.2.2 The corrosion rate can be measured according to the test method in sub-section 37.4, Part III of the *UNRTDG, Manual of Tests and Criteria.*

2.4.17.3 Classification decision consideration

2.4.17.3.1 Based on paragraph 37.4.1.4 of the *UNRTDG, Manual of Tests and Criteria*, there are two types of corrosion behaviour; i.e. uniform corrosion and localised corrosion.

2.4.17.3.2 Test evaluation for uniform corrosion is described under paragraph 37.4.1.4.1 of the *UNRTDG, Manual of Tests and Criteria.* The mass loss of the most corroded sample (three samples shall be tested) shall be used. The test is considered positive if in any specimen the mass loss on the metal is more than the amount stated in the table below.

Exposure time (days)	Mass loss (%)
7	13.5
14	26.5
21	39.2
28	51.5

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2.4.17.3.3 Test evaluation for localised corrosion is described under paragraph 37.4.1.4.2 of the *UNRTDG, Manual of Tests and Criteria.* When localized corrosion occurs besides or instead of uniform corrosion, if the depth of the deepest intrusion exceeds the values in the table below, the results are to be considered as positive.

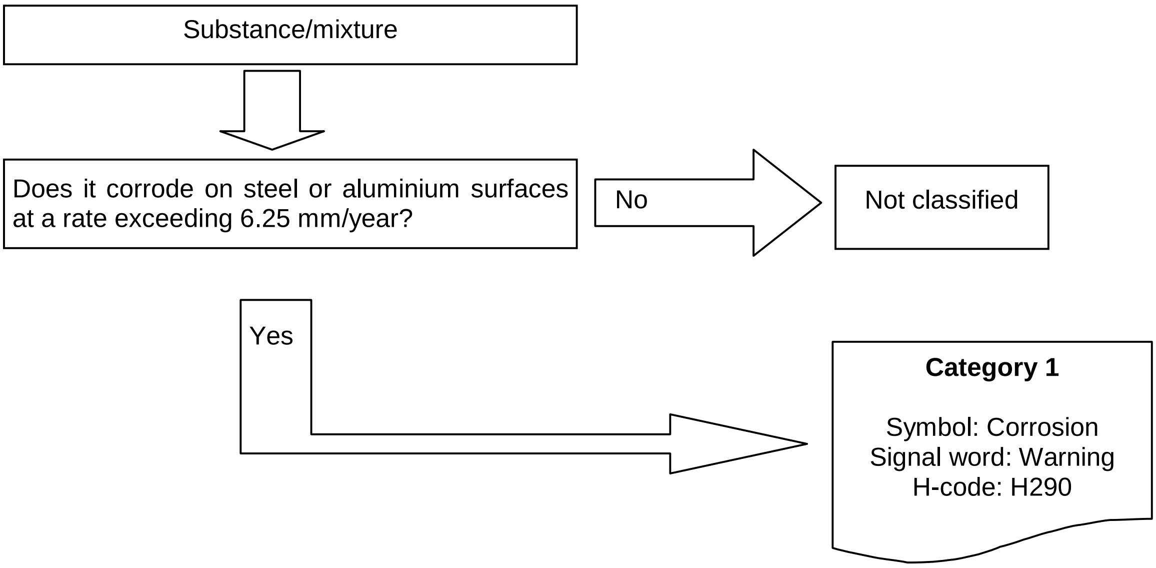
Exposure time (days)	Minimum intrusion depth (µm)
7	120
14	240
21	360
28	480

NOTE

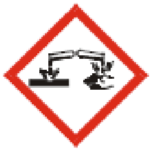
These values are calculated based on the criteria of 6.25 mm/year corrosion rate.

2.4.17.4 Decision logic

Procedure for classification is as described in the following decision logic:



2.4.17.5 Hazard communication element

Element	Category 1
Hazard pictogram	
Signal word	Warning
H-code: Hazard statement	H290: May be corrosive to metals

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2.5 Health Hazards

2.5.1 Acute Toxicity

2.5.1.1 Definition

2.5.1.1.1 Acute toxicity means those adverse effects occurring following oral or dermal administration of a single dose of a substance or a mixture, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.

2.5.1.1.2 The hazard class acute toxicity is differentiated into:

(i) Acute toxicity (oral);

(ii) Acute toxicity (dermal); or

(iii) Acute toxicity (inhalation).

2.5.1.1.3 The terms ‘dust’, ‘mist’ and ‘vapour’ are defined as follows:

(i) Dust: Solid particles of a substance or mixture suspended in a gas (usually air);

(ii) Mist: Liquid droplets of a substance or mixture suspended in a gas (usually air);

(iii) Vapour: The gaseous form of a substance or mixture released from its liquid or solid state.

Dust is generally formed by mechanical processes. Mist is generally formed by condensation of supersaturated vapours or by physical shearing of liquids. Dusts and mists generally have sizes ranging from less than 1 to about 100 µm.

2.5.1.2 Criteria for classification of substances as acutely toxic

2.5.1.2.1 Substances can be allocated to one of four toxicity categories based on acute toxicity by the oral, dermal or inhalation route according to the numeric criteria shown in Table 2.25. Acute toxicity values are expressed as (approximate) LD_{50} (oral, dermal) or LC_{50} (inhalation) values or as acute toxicity estimates (ATE). Explanatory notes are shown following Table 2.25.

Table 2.25:Acute toxicity hazard categories and acute toxicity estimates (ATE) defining the respective categories

Exposure Route	Category 1	Category 2	Category 3	Category 4
Oral (mg/kg bodyweight) *See Note (a)*	ATE ≤ 5	5 < ATE ≤ 50	50 < ATE ≤ 300	300 < ATE ≤ 2,000
Dermal (mg/kg bodyweight) *See Note (a)*	ATE ≤ 50	50 < ATE ≤ 200	200 < ATE ≤ 1,000	1,000 < ATE ≤ 2,000
Gases (ppmV) (1) *See: Note (a)* *Note (b)*	ATE ≤ 100	100 < ATE ≤ 500	500 < ATE ≤ 2,500	2,500 < ATE ≤ 20,000
Vapours (mg/l) *See: Note (a)* *Note (b)* *Note (c)*	ATE ≤ 0.5	0.5 < ATE ≤ 2.0	2.0 < ATE ≤ 10.0	10.0 < ATE ≤ 20.0
Dusts and Mists (mg/l) *See: Note (a)* *Note (b)*	ATE ≤ 0.05	0.05 < ATE ≤ 0.5	0.5 < ATE ≤ 1.0	1.0 < ATE ≤ 5.0

(1) Gas concentrations are expressed in parts per million per volume (ppmV).

NOTE

(a) The acute toxicity estimate (ATE) for the classification of a substance or ingredient in a mixture is derived using:

- *(i) The LD_{50}/LC_{50}, where available;*
- *(ii) The appropriate conversion value from Table 2.26that relates to the results of a range test; or*
- *(iii) The appropriate conversion value from Table 2.26that relates to a classification category.*

(b) The acute toxicity estimate (ATE) for inhalation toxicity in the table is based on 4-hour testing exposures. Conversion of existing inhalation toxicity data generated from exposure other than 4 hours shall be by using the following formulae:

(i) For gas and vapour:$D = B\frac{\sqrt{A}}{2}$

(ii) For dust and mist: $D = B\frac{A}{4}$

where,
B is the LC_{50} value for A hour
D is the LC_{50} value for 4 hours

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(i) Mg/m^3 to mg/L

Conversion of inhalation data for vapour, dusts or mists specified as mg/m^3 to mg/L is as follows:

mg/L = mg/m^3 ÷1000

(ii) mg/m^3 to ppm

Conversion of inhalation data for gases specified as mg/m^3 to ppm is as follows:

ppm = (mg/m^3 x 24.45) ÷(gram molecular weight of substance)
(Where 24.45 is the molar volume of air in litres at Standard Temperature and Pressure)

(iii) ml/kg to mg/kg

Conversion of oral or dermal data specified as ml/kg to mg/kg is as follows:

Mass (g) = volume (ml) x density (g/ml)

(c) For some substances or mixtures, the test atmosphere will not just be a vapour but will consist of a mixture of liquid and vapour phases. For other substances or mixtures, the test atmosphere may consist of a vapour which is near the gaseous phase. In these latter cases, classification shall be based on ppmV as follows: category 1(100 ppmV), category 2 (500 ppmV), category 3 (2500 ppmV), category 4 (20,000 ppmV).

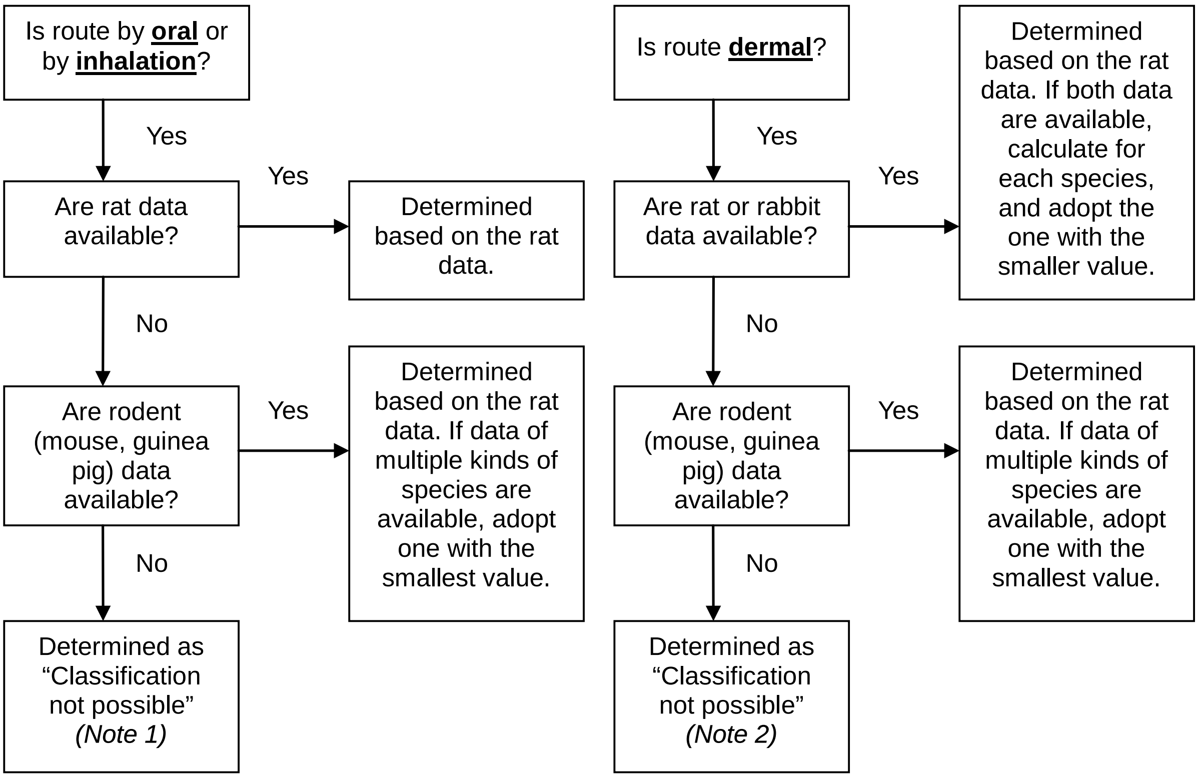
2.5.1.3 Specific considerations for classification of substances as acutely toxic

2.5.1.3.1 *Test species*

The preferred test species for the evaluation of acute toxicity by oral and inhalation routes is the rat, while the rat or rabbit is preferred for evaluation of acute dermal toxicity.

When experimental data for acute toxicity are available in several animal species, scientific judgement shall be used in selecting the most appropriate LD_{50} value from among valid, well-performed tests. Figure 2.8 shows the flow chart for handling of animal species differences.

Figure 2.8: Flowchart of classification determined by animal species



NOTE

1. *Data for animals other than rodents are not adopted for classification.*
2. *Data for animals other than rodents and rabbits are not adopted for classification.*

2.5.1.3.2 *Inhalation route*

2.5.1.3.2.1 Units for inhalation toxicity are a function of the form of the inhaled material. Values for dusts and mists are expressed in mg/l. Values for gases are expressed in ppmV. Acknowledging the difficulties in testing vapours, some of which consist of mixtures of liquid and vapour phases, the table provides values in units of mg/l. However, for those vapours which are near the gaseous phase, classification shall be based on ppmV.

2.5.1.3.2.2 Of particular importance in classifying for inhalation toxicity is the use of well articulated values in the high toxicity categories for dusts and mists. Inhaled particles between 1 micron and 4 microns mean that mass aerodynamic diameter (MMAD) will deposit in all regions of the rat respiratory tract. This particle size range corresponds to a maximum dose of about 2 mg/l. In order to achieve applicability of animal experiments to human exposure, dusts and mists would ideally be tested in this range in rats.

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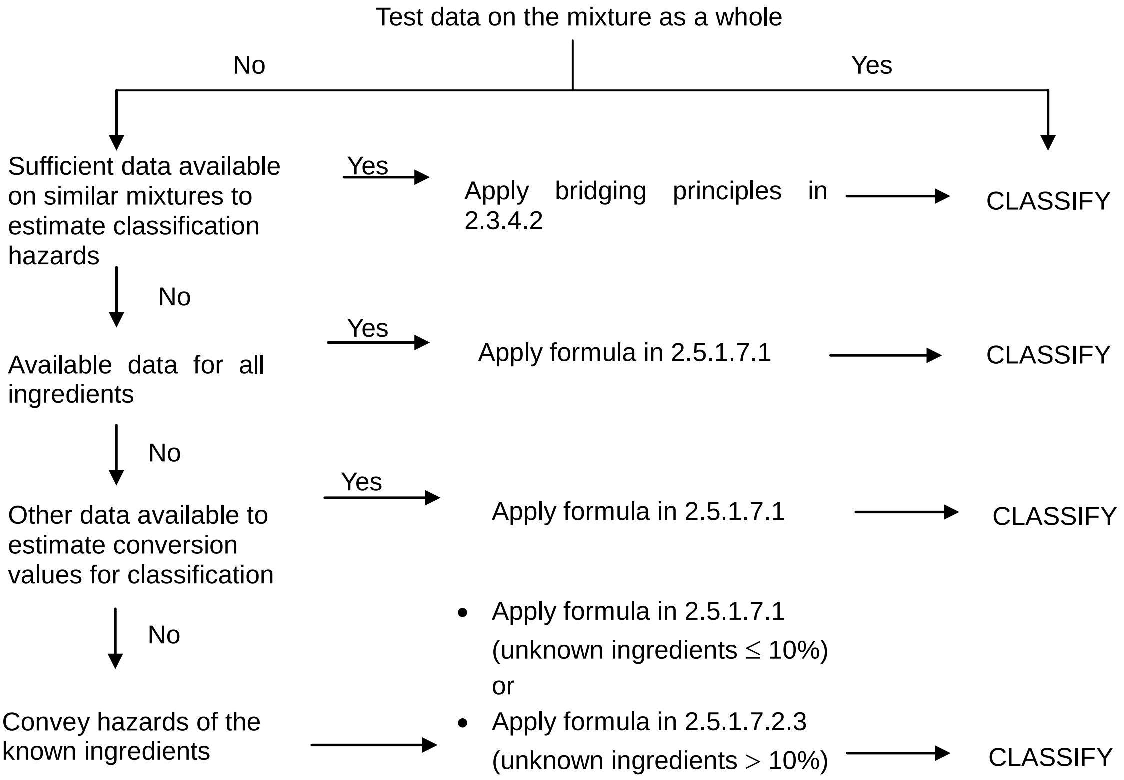
2.5.1.4 Criteria for classification of mixtures as acutely toxic

2.5.1.4.1 The criteria for classification of substances for acute toxicity as outlined in paragraph 2.5.1.2 are based on lethal dose data (tested or derived). For mixtures, it is necessary to obtain or derive information that allows the criteria to be applied to the mixture for the purpose of classification. The approach to classification for acute toxicity is tiered, and is dependent upon the amount of information available for the mixture itself and for its ingredients. The flow chart of Figure 2.9 outlines the process to be followed.

Figure 2.9: Tiered approach to classification of mixtures for acute toxicity



2.5.1.4.2 For acute toxicity, each route of exposure shall be considered for the classification of mixtures, but only one route of exposure is needed as long as this route is followed (estimated or tested) for all ingredients. If the acute toxicity is determined for more than one route of exposure, the more severe hazard category will be used for classification. All available information shall be considered and all relevant routes of exposure shall be identified for hazard communication.

2.5.1.4.3 In order to make use of all available data for purposes of classifying the hazards of the mixtures, certain assumptions have been made and are applied, where appropriate, in the tiered approach:

(a) The 'relevant ingredients' of a mixture are those which are present in concentrations of 1% (w/w for solids, liquids, dusts, mists and vapours, and v/v for gases) or greater, unless there is a reason to suspect that an ingredient present at a concentration of less than 1% is still relevant for classifying the mixture for acute toxicity.

(b) Where a classified mixture is used as an ingredient of another mixture, the actual or derived acute toxicity estimate (ATE) for that mixture may be used when calculating the classification of the new mixture using the formulae in paragraph 2.5.1.7.1 and paragraph 2.5.1.7.2.3.

2.5.1.5 Classification of mixtures where acute toxicity data are available for the complete mixture

Where the mixture itself has been tested to determine its acute toxicity, it shall be classified according to the same criteria as those used for substances presented in Table 2.25. If test data for the mixture are not available, the procedures presented under paragraph 2.5.1.6 and paragraph 2.5.1.7 shall be followed.

2.5.1.6 Classification of mixtures where acute toxicity data are available for the complete mixture: Bridging principles

2.5.1.6.1 Where the mixture itself has not been tested to determine its acute toxicity, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging rules set out in paragraph 2.3.4.2.

2.5.1.6.2 If a mixture is diluted with water or other totally non-toxic material, the toxicity of the mixture can be calculated from test data on the undiluted mixture. For example, if a mixture with an LD_{50} of 1000 mg/kg bodyweight were diluted with an equal volume of water, the LD_{50} of the diluted mixture would be 2000 mg/kg bodyweight.

2.5.1.7 Classification of mixtures based on ingredients of the mixture (Additivity formula)

2.5.1.7.1 Data available for all ingredients

In order to ensure that classification of the mixture is accurate, and that the calculation need only be performed once for all systems, sectors, and categories, the acute toxicity estimate (ATE) of ingredients shall be considered as follows:

(a) Include ingredients with a known acute toxicity, which fall into any of the acute toxicity categories shown in Table 2.25;

(b) Ignore ingredients that are presumed not acutely toxic (e.g., water, sugar);

(c) Ignore ingredients if the oral limit test does not show acute toxicity at 2000 mg/kg bodyweight.

Ingredients that fall within the scope of this paragraph are considered to be ingredients with a known acute toxicity estimate (ATE).

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The ATE of the mixture is determined by calculation from the ATE values for all relevant ingredients according to the following formula for oral, dermal or inhalation toxicity:

$$\frac{100}{\text{ATEmix}} = \sum_{n} \frac{\text{Ci}}{\text{ATE}_{\text{i}}}$$

where:

C_i = concentration of ingredient *i* (%w/w or %v/v)
i = the individual ingredient from 1 to n
n = the number of ingredients
ATE_i = Acute Toxicity Estimate of ingredient *i*

2.5.1.7.2 Data are not available for one or more ingredients of the mixture

2.5.1.7.2.1 Where an ATE is not available for an individual ingredient of the mixture, but available information such as that listed below can provide a derived conversion value as laid out in Table 2.26, the formula in paragraph 2.5.1.7.2.3 shall be applied.

This includes evaluation of:

(a) Extrapolation between oral, dermal and inhalation acute toxicity estimates[8]. Such an evaluation could require appropriate pharmacodynamic and pharmacokinetic data;

(b) Evidence from human exposure that indicates toxic effects but does not provide lethal dose data;

(c) Evidence from any other toxicity tests/assays available on the substance that indicates toxic acute effects but does not necessarily provide lethal dose data; or

(d) Data from closely analogous substances using structure/activity relationships.

This approach generally requires substantial supplemental technical information, and a highly trained and experienced expert (expert judgement, see 2.3.3.2), to reliably estimate acute toxicity. If such information is not available, proceed to the provisions of paragraph 2.5.1.7.2.3.

---

[8] For ingredients with acute toxicity estimates available for other than the most appropriate exposure route, values may be extrapolated from the available exposure route(s) to the most appropriate route. Dermal and inhalation route data are not always required for ingredients. However, in case data requirements for specific ingredients include acute toxicity estimates for the dermal and inhalation route, the values to be used in the formula need to be from the required exposure route.

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2.5.1.7.2.2 In the event that an ingredient without any useable information at all is used in a mixture at a concentration of ≥ 1%, it is concluded that the mixture cannot be attributed a definitive acute toxicity estimate. In this situation the mixture shall be classified based on the known ingredients only, with the additional statement that "*x* percent of the mixture consists of ingredient(s) of unknown toxicity".

2.5.1.7.2.3 If the total concentration of the ingredient(s) with unknown acute toxicity is ≤ 10% then the formula presented in paragraph 2.5.1.7.1 shall be used. If the total concentration of the ingredient(s) with unknown toxicity is > 10%, the formula presented in paragraph 2.5.1.7.1 shall be corrected to adjust for the total percentage of the unknown ingredient(s) as follows:

$$\frac{100-\left(\sum C_{\text{unknown}} \text{ if } >10\%\right)}{\text{ATE}_{\text{mix}}}=\sum_{n}\frac{\text{Ci}}{\text{ATE}_{i}}$$

Example 1:

A mixture contains 70% of component A with an oral LD_{50} of 200 mg/kg body weight and 30% component B with an oral LD_{50} of 500 mg/kg body weight. Using the additivity formula (paragraph 2.5.1.7.2.3), the calculated ATE_{mix} of the mixture would be:

$100/ATE_{mix} = C_A/LD_{50A} + C_B/LD_{50B}$
$100/ATE_{mix} = 70/200 + 30/500$
$ATE_{mix} = 244$ mg/kg body weight

The calculated ATE_{mix} is 244 mg/kg body weight and hence, the mixture is classified as category 3.

Example 2:

A mixture contains:

Component A 10%	category 3 (oral)
Component B 30%	LD_{50} of 1500 mg/kg body weight
Component C 60%	unknown toxicity

Using the range conversion table (Table 2.26), a category 3 (oral) classification is equivalent to acute toxicity point estimate of 100 mg/kg body weight. Using formula in paragraph 2.5.1.7.2.3, the calculated ATE_{mix} would be:

$(100\text{-unknown})/ATE_{mix} = C_A/LD_{50A} + C_B/LD_{50B}$
$(100-60)/ATE_{mix} = 10/100 + 30/1500$
$ATE_{mix} = 333$ mg/kg body weight

The calculated ATE_{mix} is 333 mg/kg body weight and hence, the mixture is classified as category 4.

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Table 2.26: Conversion from experimentally obtained acute toxicity range values (or acute toxicity hazard categories) to acute toxicity point estimates for classification for the respective routes of exposure

Exposure routes	Classification category or experimentally obtained acute toxicity range estimate	Converted acute toxicity point estimate
Oral (mg/kg bodyweight)	0 < Category 1 ≤ 5 5 < Category 2 ≤ 50 50 < Category 3 ≤ 300 300 < Category 4 ≤ 2000	0.5 5 100 500
Dermal (mg/kg bodyweight)	0 < Category 1 ≤ 50 50 < Category 2 ≤ 200 200 < Category 3 ≤ 1000 1000 < Category 4 ≤ 2000	5 50 300 1100
Gases (ppmV)	0 < Category 1 ≤ 100 100 < Category 2 ≤ 500 500 < Category 3 ≤ 2500 2500 < Category 4 ≤ 5000	10 100 700 4500
Vapours (mg/l)	0 < Category 1 ≤ 0.5 0.5 < Category 2 ≤ 2.0 2.0 < Category 3 ≤ 10.0 10.0 < Category 4 ≤ 20.0	0.05 0.5 3 11
Dust/mist (mg/l)	0 < Category 1 ≤ 0.05 0.05 < Category 2 ≤ 0.5 0.5 < Category 3 ≤ 1.0 1.0 < Category 4 ≤ 5.0	0.005 0.05 0.5 1.5

NOTE
These values are designed to be used in the calculation of the ATE for classification of a mixture based on its components and do not represent test results.

2.5.1.8 Decision logic for acute toxicity

The decision logic which follows is not part of the harmonized classification system but is provided here as additional guidance. It is strongly recommended that the person responsible for classification study the criteria before and during use of the decision logic.

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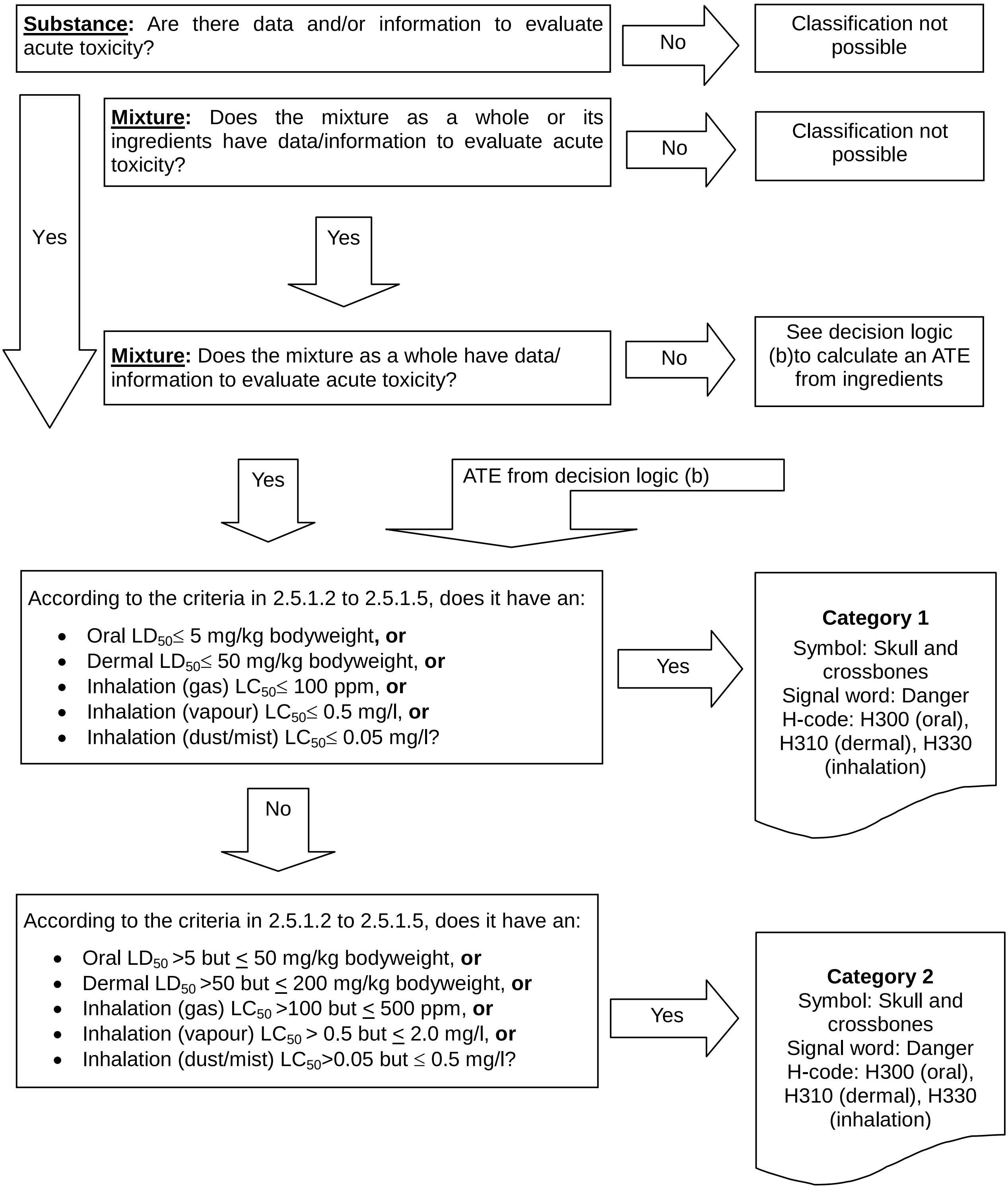
Decision logic (a) for acute toxicity



Substance: Are there data and/or information to evaluate acute toxicity?

Classification not possible

Mixture: Does the mixture as a whole or its ingredients have data/information to evaluate acute toxicity?

Classification not possible

Mixture: Does the mixture as a whole have data/ information to evaluate acute toxicity?

See decision logic (b)to calculate an ATE from ingredients

ATE from decision logic (b)

According to the criteria in 2.5.1.2 to 2.5.1.5, does it have an:

- Oral $LD_{50} \leq 5$ mg/kg bodyweight**, or**
- Dermal $LD_{50} \leq 50$ mg/kg bodyweight, **or**
- Inhalation (gas) $LC_{50} \leq 100$ ppm, **or**
- Inhalation (vapour) $LC_{50} \leq 0.5$ mg/l, **or**
- Inhalation (dust/mist) $LC_{50} \leq 0.05$ mg/l?

Category 1
Symbol: Skull and crossbones
Signal word: Danger
H-code: H300 (oral), H310 (dermal), H330 (inhalation)

According to the criteria in 2.5.1.2 to 2.5.1.5, does it have an:

- Oral LD_{50} >5 but $\leq$ 50 mg/kg bodyweight, **or**
- Dermal LD_{50} >50 but $\leq$ 200 mg/kg bodyweight, **or**
- Inhalation (gas) LC_{50} >100 but $\leq$ 500 ppm, **or**
- Inhalation (vapour) LC_{50} > 0.5 but $\leq$ 2.0 mg/l, **or**
- Inhalation (dust/mist) LC_{50}>0.05 but $\leq$ 0.5 mg/l?

Category 2
Symbol: Skull and crossbones
Signal word: Danger
H-code: H300 (oral), H310 (dermal), H330 (inhalation)

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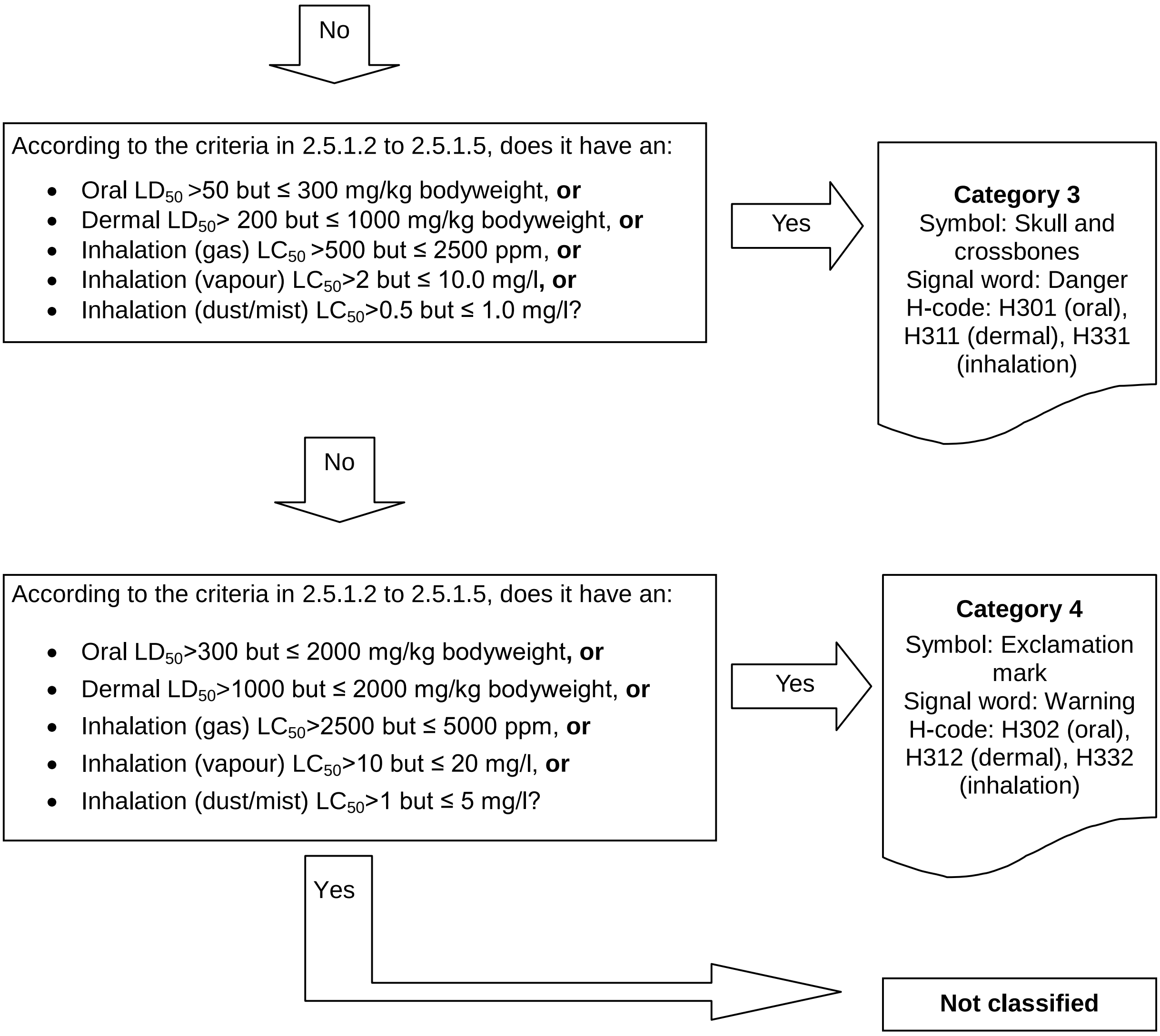


According to the criteria in 2.5.1.2 to 2.5.1.5, does it have an:

- Oral LD_{50} >50 but ≤ 300 mg/kg bodyweight, **or**
- Dermal LD_{50}> 200 but ≤ 1000 mg/kg bodyweight, **or**
- Inhalation (gas) LC_{50} >500 but ≤ 2500 ppm, **or**
- Inhalation (vapour) LC_{50}>2 but ≤ 10.0 mg/l**, or**
- Inhalation (dust/mist) LC_{50}>0.5 but ≤ 1.0 mg/l?

Category 3
Symbol: Skull and crossbones
Signal word: Danger
H-code: H301 (oral), H311 (dermal), H331 (inhalation)

According to the criteria in 2.5.1.2 to 2.5.1.5, does it have an:

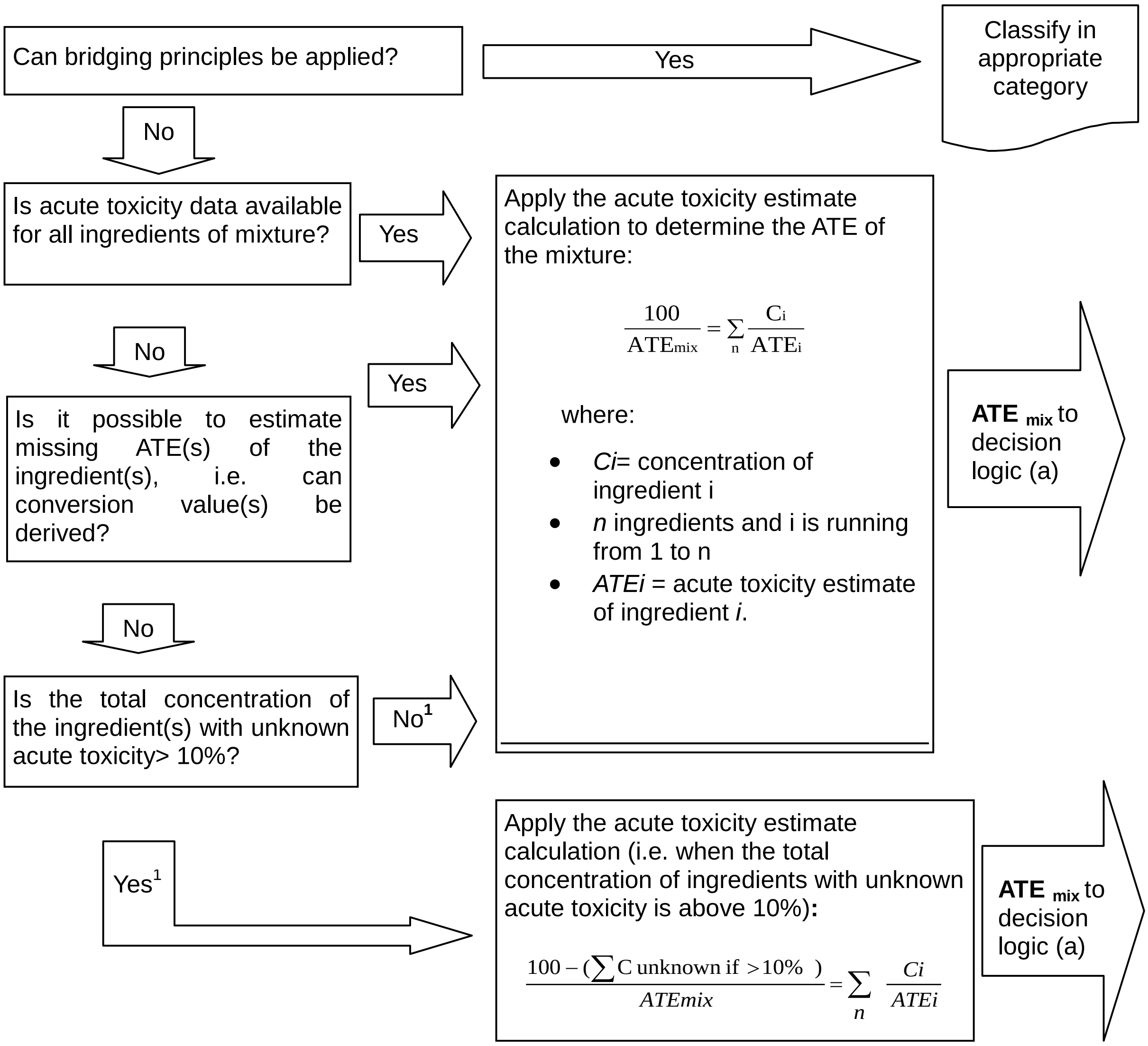
- Oral LD_{50}>300 but ≤ 2000 mg/kg bodyweight**, or**
- Dermal LD_{50}>1000 but ≤ 2000 mg/kg bodyweight, **or**
- Inhalation (gas) LC_{50}>2500 but ≤ 5000 ppm, **or**
- Inhalation (vapour) LC_{50}>10 but ≤ 20 mg/l, **or**
- Inhalation (dust/mist) LC_{50}>1 but ≤ 5 mg/l?

Category 4
Symbol: Exclamation mark
Signal word: Warning
H-code: H302 (oral), H312 (dermal), H332 (inhalation)

Not classified

Decision logic (b) for acute toxicity

(See criteria in 2.3.4.2 and 2.5.1.7)



Can bridging principles be applied?

Classify in appropriate category

Is acute toxicity data available for all ingredients of mixture?

Is it possible to estimate missing ATE(s) of the ingredient(s), i.e. can conversion value(s) be derived?

Is the total concentration of the ingredient(s) with unknown acute toxicity> 10%?

Apply the acute toxicity estimate calculation to determine the ATE of the mixture:

$$\frac{100}{\text{ATE}_{\text{mix}}} = \sum_{n} \frac{\text{C}_{\text{i}}}{\text{ATE}_{\text{i}}}$$

where:

- *Ci*= concentration of ingredient i
- *n* ingredients and i is running from 1 to n
- *ATEi* = acute toxicity estimate of ingredient *i*.

ATE $_{\text{mix}}$ to decision logic (a)

Apply the acute toxicity estimate calculation (i.e. when the total concentration of ingredients with unknown acute toxicity is above 10%)**:**

$$\frac{100 - (\sum \text{C unknown if} > 10\%\ )}{ATEmix} = \sum_{n} \frac{Ci}{ATEi}$$

ATE $_{\text{mix}}$ to decision logic (a)

---

[1] *In the event that an ingredient without any useable information is used in a mixture at a concentration ≥ 1%, the classification shall be based on the ingredients with the known acute toxicity only, and an additional statement on the label shall identify the fact that the acute toxicity of x percent of the mixture is unknown.*

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2.5.1.9 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.27.

Table 2.27: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL				
	Oral	Dermal	Inhalation		
			Gas	Vapour	Dust/mist
1	▨	R27	▨	R26	▨
2	R28	▨	R26	R23	R26
3	R25	R24	R23	▨	R23
4	R22	R21	R20		

2.5.1.10 Hazard communication elements

Element	Category 1	Category 2	Category 3	Category 4
Hazard pictogram				
Signal word	Danger	Danger	Danger	Warning
H-code: Hazard statement	H300 (oral): Fatal if swallowed H310 (dermal): Fatal if in contact with skin H330 (inhalation): Fatal if inhaled	H300 (oral): Fatal if swallowed H310 (dermal): Fatal if in contact with skin H330 (inhalation): Fatal if inhaled	H301 (oral): Toxic if swallowed H311 (dermal): Toxic if in contact with skin H331 (inhalation): Toxic if inhaled	H302 (oral): Harmful if swallowed H312 (dermal): Harmful if in contact with skin H332 (inhalation): Harmful if inhaled

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2.5.2 Skin Corrosion or Irritation

2.5.2.1 Definition

2.5.2.1.1 Skin corrosion means the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours. Corrosive reactions are typified by ulcers, bleeding, bloody scabs, and, by the end of observation at 14 days, by discolouration due to blanching of the skin, complete areas of alopecia, and scars. Histopathology shall be considered to evaluate questionable lesions.

2.5.2.1.2 Skin irritation means the production of reversible damage to the skin following the application of a test substance for up to 4 hours.

2.5.2.2 Classification criteria for substances

2.5.2.2.1 *Skin corrosion*

2.5.2.2.1.1 On the basis of the results of animal testing, a substance is classified as corrosive, as shown in Table 2.28. A corrosive substance is a substance that produces destruction of skin tissue, namely, visible necrosis through the epidermis and into the dermis, in at least 1 tested animal after exposure up to 4 hour duration.

2.5.2.2.1.2 Three subcategories are provided within the corrosive category:

(a) Sub-category 1A – where responses are noted following up to 3 minutes exposure and up to 1 hour observation;

(b) Sub-category 1B – where responses are described following exposure between 3 minutes and 1 hour and observations up to 14 days; and

(c) Sub-category 1C – where responses occur after exposures between 1 hour and 4 hours and observations up to 14 days.

2.5.2.2.1.3 If the substance meets the criteria defined in paragraph 2.5.2.2.1.1 but the data is not adequate to classify into sub-categories as specified in paragraph 2.5.2.2.1.2 or Table 2.28, the substance may be classified as category 1.

Table 2.28: Skin corrosion category and subcategories

	Corrosive sub-categories	**Corrosive in ≥ 1 of 3 animals**	
		Exposure	**Observation**
Category 1: **Skin Corrosion**	**1A**	≤ 3 minutes	≤ 1 hour
	1B	> 3 minutes ≤ 1 hour	≤ 14 days
	1C	> 1 hour ≤ 4 hours	≤ 14 days

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2.5.2.2.2 *Skin irritation*

Using the results of animal testing, a single irritant category (category 2) is presented in Table 2.29. The major criterion for the irritant category is that at least two of three tested animals have a mean score of ≥ 2.3 ≤ 4.0.

Table 2.29: Skin irritation category

Category	Criteria
Category 2: **Skin irritation**	(1) Mean value of ≥ 2.3 ≤ 4.0 for erythema/eschar or for oedema in at least 2 of 3 tested animals from gradings at 24, 48 and 72 hours after patch removal or, if reactions are delayed, from grades on 3 consecutive days after the onset of skin reactions; or (2) Inflammation that persists to the end of the observation period, normally 14 days, in at least 2 animals, particularly taking into account alopecia (limited area), hyperkeratosis, hyperplasia, and scaling; or (3) In some cases where there is pronounced variability of response among animals, with very definite positive effects related to chemical exposure in a single animal but less than the criteria above.

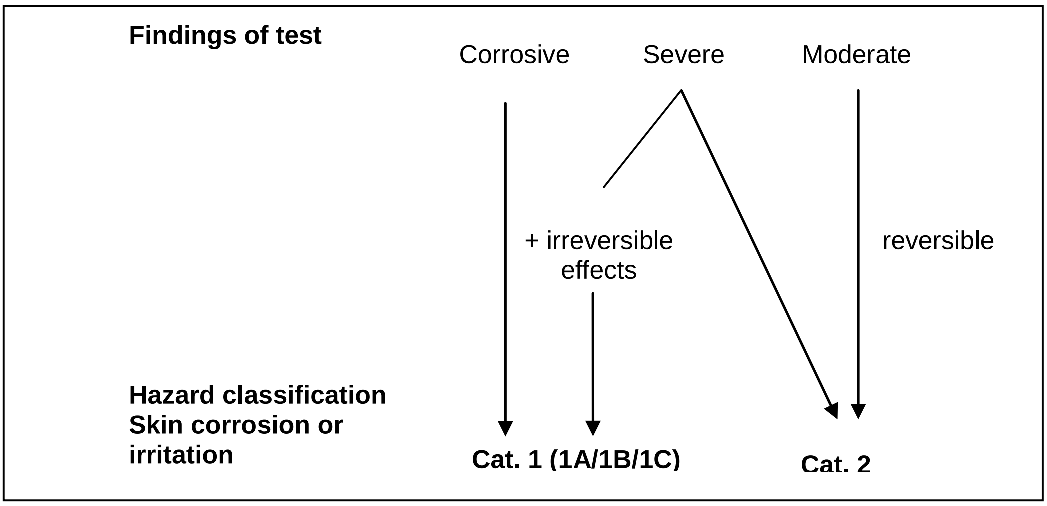
2.5.2.3 Additional decision consideration

2.5.2.3.1 In many cases, findings of test reports are given using the evaluative scale of “severe” and “moderate”, and these can be considered to correspond to categories 1 and 2 respectively.

2.5.2.3.2 Category 1 is applied to substances that cause irreversible lesions such as necrosis within observation period of Skin Corrosion/Irritation test.

2.5.2.3.3 A substance evaluated as “severe” corresponds to category 2 if reversible lesion is observed. Please refer to Figure 2.10 for guidance on determining classification based on the findings of test reports.

Figure 2.10: Evaluation scale



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2.5.2.4 Classification criteria for mixtures

2.5.2.4.1 *Classification of mixtures when data are available for the complete mixture*

2.5.2.4.1.1 The mixture shall be classified using the criteria for substances, and taking into account the testing and evaluation strategies to develop data for these hazard classes.

2.5.2.4.1.2 Unlike other hazard classes, there are alternative tests available for skin corrosivity of certain types of substances and mixtures that can give an accurate result for classification purposes, as well as being simple and relatively inexpensive to perform. A mixture is considered corrosive to skin (skin corrosive category 1) if it has a pH of 2 or less or a pH of 11.5 or greater. If consideration of alkali/acid reserve suggests the substance or mixture may not be corrosive despite the low or high pH value, then further testing shall be carried out to confirm this, preferably by use of an appropriate validated *in vitro* test.

2.5.2.4.2 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

Where the mixture itself has not been tested to determine its skin irritation/corrosion hazards, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging rules set out in paragraph 2.3.4.2.

2.5.2.4.3. *Classification of mixtures when data are available for all components or only for some components of the mixture*

2.5.2.4.3.1 The ‘relevant ingredients’ of a mixture are those which are present in concentrations ≥ 1% (w/w for solids, liquids, dusts, mists and vapours, and v/v for gases), unless there is a presumption (e.g. in the case of corrosive ingredients) that an ingredient present at a concentration < 1% can still be relevant for classifying the mixture for skin irritation/corrosion.

2.5.2.4.3.2 In general, the approach to classification of mixtures as irritant or corrosive to skin when data are available on the components, but not on the mixture as a whole, is based on the theory of additivity, such that each corrosive or irritant component contributes to the overall irritant or corrosive properties of the mixture in proportion to its potency and concentration. A weighting factor of 10 is used for corrosive components when they are present at a concentration below the generic concentration limit for classification with category 1, but are at a concentration that will contribute to the classification of the mixture as an irritant. The mixture is classified as corrosive or irritant when the sum of the concentrations of such components exceeds a concentration limit.

2.5.2.4.3.3 Table 2.30 provides the generic concentration limits to be used to determine if the mixture is considered to be an irritant or a corrosive to the skin.

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Table 2.30: Generic concentration limits of ingredients classified for skin corrosive or irritant hazard (category 1 or 2) that trigger classification of the mixture as corrosive or irritant to skin

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:			
	Skin corrosion			Skin irritation
	Category 1			Category 2
Skin corrosion category 1	≥ 5%			≥ 1% but < 5%
	1A	1B	1C	
1A	≥ 5%			
1B		≥ 5%		
1C			≥ 5%	
1A + 1B **(If 1A < 5%)**		≥ 5%		
1A + 1B + 1C **(If 1A + 1B < 5%)**			≥ 5%	
Skin irritation category 2				≥ 10%
(10 x Skin corrosion category 1A, 1B, 1C) + **Skin irritation category 2**				≥ 10%

2.5.2.4.3.4 Particular care must be taken when classifying certain types of mixtures containing substances such as acids and bases, inorganic salts, aldehydes, phenols, and surfactants. The approach explained in paragraphs 2.5.2.4.3.1 and 2.5.2.4.3.2 may not be applicable given that many of such substances are corrosive or irritant at concentrations < 1%.

2.5.2.4.3.5 For mixtures containing strong acids or bases the pH shall be used as a classification criterion (see paragraph 2.5.2.4.1.2) since pH is a better indicator of corrosion than the concentration limits of Table 2.30.

2.5.2.4.3.6 A mixture containing ingredients that are corrosive or irritant to the skin and that cannot be classified on the basis of the additivity approach (Table 2.30), due to chemical characteristics that make this approach unworkable, shall be classified as Skin corrosive category 1A, 1B or 1C if it contains ≥ 1% of an ingredient classified in category 1A, 1B or 1C respectively or as category 2 when it contains ≥ 3% of an irritant ingredient. Classification of mixtures with ingredients for which the approach in Table 2.30 does not apply is summarised in Table 2.31.

Table 2.31: Generic concentration limits of ingredients of a mixture for which the additivity approach does not apply in the classification of mixture as corrosive or irritant to skin

Ingredient:	Concentration:	Mixture classified as: Skin corrosion or irritation
Acid with pH ≤ 2	≥ 1%	Category 1
Base with pH ≥ 11.5	≥ 1%	Category 1
Other corrosive (category 1A, 1B, 1C) ingredients for which additivity does not apply	≥ 1%	Category 1
Other irritant (category 2) ingredients for which additivity does not apply, including acids and bases	≥ 3%	Category 2

2.5.2.4.3.7 On occasion, reliable data may show that the skin corrosion/irritation hazard of an ingredient will not be evident when present at a level above the generic concentration limits mentioned in Tables 2.30 and 2.31. In these cases, the mixture shall be classified according to that data. On other occasions, when it is expected that the skin corrosion/irritation hazard of an ingredient is not evident when present at a level above the generic concentration limits mentioned in Tables 2.30 and 2.31, testing of the mixture shall be considered. In those cases, the tiered weight of evidence strategy is described in Figure 2.11.

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Figure 2.11: Tiered testing and evaluation of skin corrosion and irritation potential

Step	Parameter	Finding	Conclusion
1a	Existing human or animal experience (g) →	Corrosive →	Classify as corrosive (a).
	↓ Not corrosive or no data ↓		
1b	Existing human or animal experience(g) →	Irritant →	Classify as irritant(a).
	↓ Not irritant or no data ↓		
1c	Existing human or animal experience(g) →	Not corrosive or irritant →	No further testing, not classified.
	↓ No data ↓		
2a	Structure-activity relationships →	Corrosive →	Classify as corrosive (a).
	↓ Not corrosive or no data ↓		
2b	Structure-activity relationships →	Irritant →	Classify as irritant (a).
	↓ Not irritant or no data ↓		
3	pH with buffering (c) →	pH ≤ 2 or ≥ 11.5 →	Classify as corrosive (a).
	↓ Not pH extreme or no data ↓		
4	Existing skin data in animals indicate no need for animal testing (d) →	Yes →	Possibly no further testing may be deemed corrosive/ irritant.
	↓ No indication or no data ↓		

5	Valid and accepted *in vitro* skin corrosive test (e)	Positive response	Classify as corrosive (a).
	Negative response or no data		
6	Valid and accepted *in vitro* skin irritation test (f)	Positive response	Classify as irritant (a).
	Negative response or no data		
7	*In vivo* skin corrosion test (1 animal)	Positive response	Classify as corrosive (a).
	Negative response		
8	*In vivo* skin irritation test (3 animals total) (h)	Positive response	Classify as irritant (a).
	Negative response	No further testing	No further testing, not classified.
9	When it is ethical to perform human patch testing (g)	Positive response	Classify as irritant (a).
	Not as above	Negative response	No further testing, not classified.

NOTE

(a) Classify in the appropriate harmonized category, as shown in Table 2.28;

(b) Measurement of pH alone may be adequate, but assessment of acid or alkali reserve is preferable ; methods are needed to assess buffering capacity;

(c) Pre-existing animal data should be carefully reviewed to determine if in vivo skin corrosion/irritation testing is needed. For example, testing may not be needed when a test material has not produced any skin irritation in an acute skin toxicity test at the limit dose, or produces very toxic effects in an acute skin toxicity test. In the latter case, the material would be classified as being very hazardous by the dermal route for acute toxicity; it is moot whether the material is also irritating or corrosive on the skin. It should be kept in mind in evaluating acute skin toxicity information that the reporting of skin lesions may be incomplete, testing and observations may be on a species other than the rabbit, and species may differ in sensitivity in their response;

(d) Examples of internationally accepted validated in vitro test methods for skin corrosion are OECD Test Guidelines 430 and 431;

(e) Presently there are no validated and internationally accepted in vitro test methods for skin irritation;

(f) This evidence could be derived from single or repeated exposures. There is no internationally accepted test method for human skin irritation testing, but an OECD guideline has been proposed;

(g) Testing is usually conducted in 3 animals, one coming from the negative corrosion test.

2.5.2.4.3.8 If there are data showing that (an) ingredient(s) is/are corrosive or irritant at a concentration of < 1% (corrosive) or < 3% (irritant), the mixture shall be classified accordingly.

2.5.2.5 Decision logic

The decision logic which follows is not part of the harmonized classification system but is provided here as additional guidance. It is strongly recommended that the person responsible for classification study the criteria before and during use of the decision logic.

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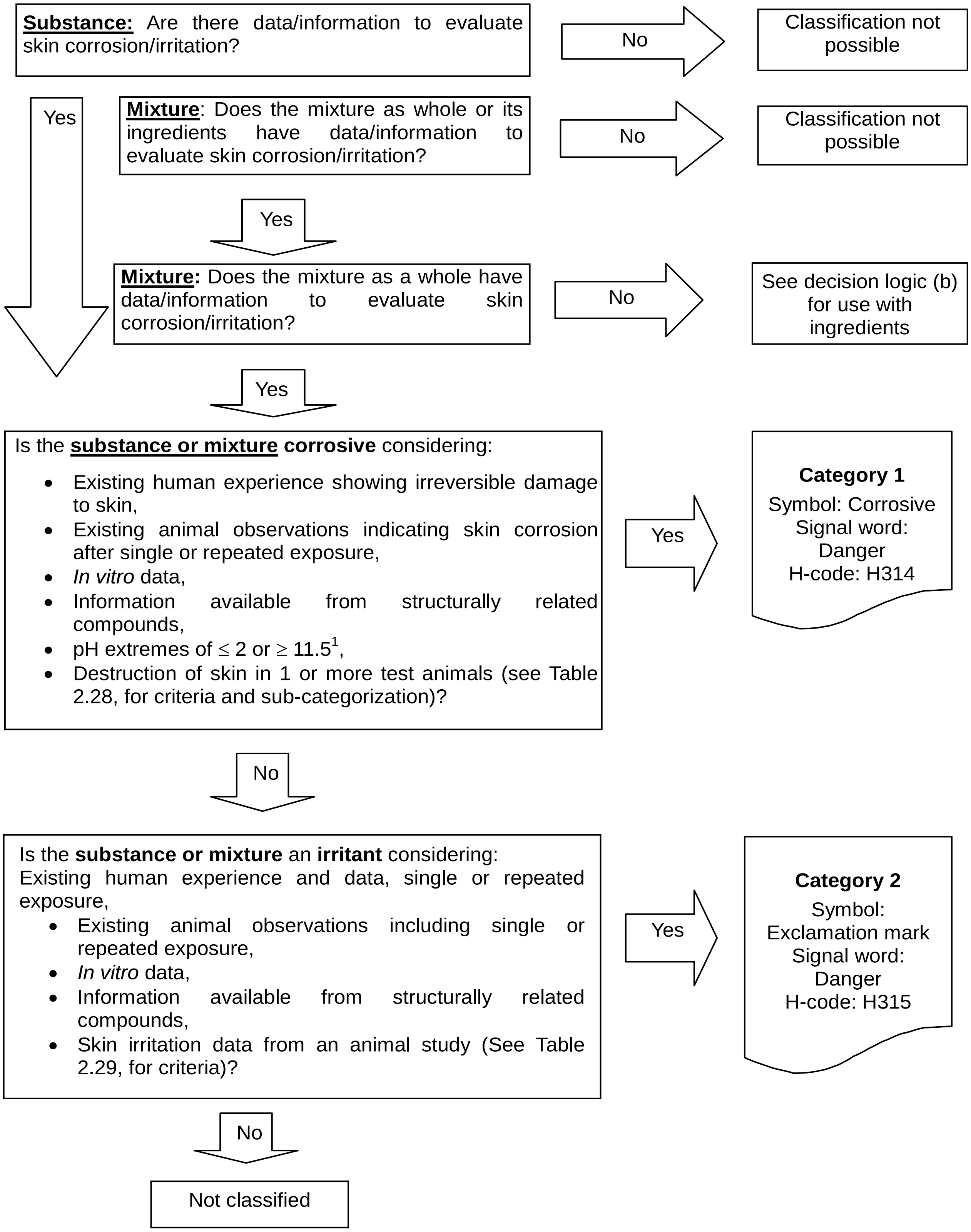
2.5.2.5.1 Decision logic (a) for skin corrosion or irritation



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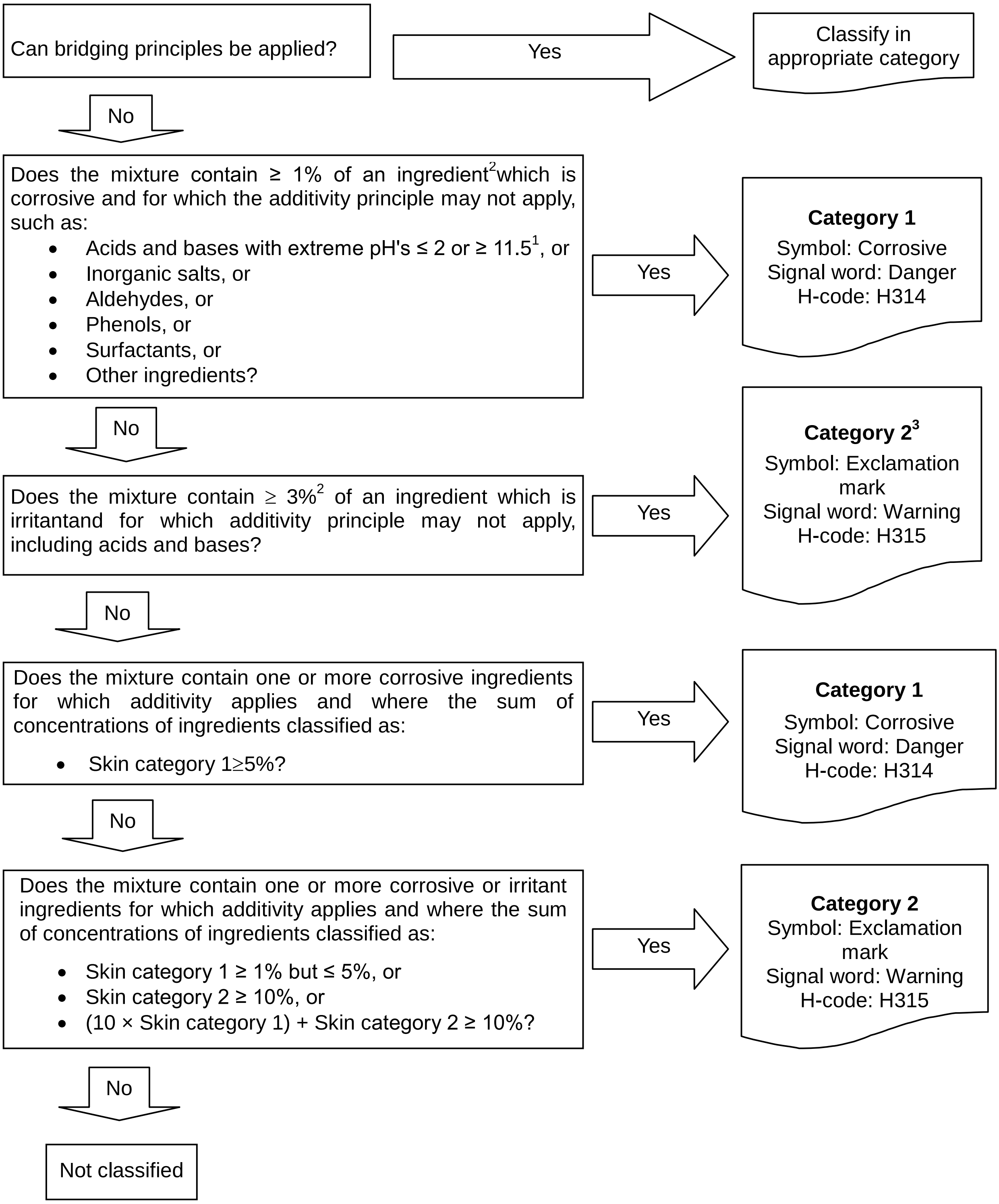
[1] *Including consideration of acid/alkali reserve capacity, if appropriate.*

2.5.2.5.2 *Decision logic (b) for skin corrosion or irritation:*



Can bridging principles be applied?

Classify in appropriate category

Does the mixture contain ≥ 1% of an ingredient[2] which is corrosive and for which the additivity principle may not apply, such as:

- Acids and bases with extreme pH's ≤ 2 or ≥ 11.5[1], or
- Inorganic salts, or
- Aldehydes, or
- Phenols, or
- Surfactants, or
- Other ingredients?

Category 1
Symbol: Corrosive
Signal word: Danger
H-code: H314

Does the mixture contain ≥ 3%[2] of an ingredient which is irritantand for which additivity principle may not apply, including acids and bases?

Category 2[3]
Symbol: Exclamation mark
Signal word: Warning
H-code: H315

Does the mixture contain one or more corrosive ingredients for which additivity applies and where the sum of concentrations of ingredients classified as:

- Skin category 1≥5%?

Category 1
Symbol: Corrosive
Signal word: Danger
H-code: H314

Does the mixture contain one or more corrosive or irritant ingredients for which additivity applies and where the sum of concentrations of ingredients classified as:

- Skin category 1 ≥ 1% but ≤ 5%, or
- Skin category 2 ≥ 10%, or
- (10 × Skin category 1) + Skin category 2 ≥ 10%?

Category 2
Symbol: Exclamation mark
Signal word: Warning
H-code: H315

Not classified

---

[1] *Including consideration of acid/alkali reserve capacity, if appropriate.*

[2] *Or where relevant < 1%, see 2.5.2.4.3.1.*

[3] *If the mixture also contains corrosive or irritant ingredient(s) for which additivity applies, move to the box below.*

2.5.2.6 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.32.

Table 2.32: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1A	R35
1B	R34
1C	-
2	R38, R36/38, R37/38, R36/37/38

2.5.2.7 Hazard communication elements

Element	**Category 1**			**Category 2**
	Category 1A	**Category 1B**	**Category 1C**	
Hazard pictogram				
Signal word	Danger			Warning
H-code: Hazard statement	H314: Causes severe skin burns and eye damage			H315: Causes skin irritation

2.5.3 Serious Eye Damage or Eye Irritation

2.5.3.1 Definition

2.5.3.1.1 Serious eye damage means the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the anterior surface of the eye, which is not fully reversible within 21 days of application.

2.5.3.1.2 Eye irritation means the production of changes in the eye following the application of test substance to the anterior surface of the eye, which are fully reversible within 21 days of application.

2.5.3.2 Classification criteria for substances

2.5.3.2.1 *Irreversible effects on the eye/serious eye damage (category 1)*

Substances that have the potential to seriously damage the eyes are classified in category 1 (irreversible effects on the eye). Substances are classified in this hazard category on the basis of the results of animal testing, in accordance with the criteria listed in Table 2.33. These observations include animals with grade 4 cornea lesions and other severe reactions

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(e.g., destruction of cornea) observed at any time during the test, as well as persistent corneal opacity, discoloration of the cornea by a dye substance, adhesion, pannus, and interference with the function of the iris or other effects that impair sight. In this context, persistent lesions are considered those which are not fully reversible within the normal observation period of 21 days. Substances are also classified in category 1 if they fulfil the criteria of corneal opacity ≥ 3 or iritis > 1.5 detected in a Draize eye test with rabbits, recognising that such severe lesions usually do not reverse within a 21-day observation period.

Table 2.33: Category for irreversible eye effects

Category	Criteria
Irreversible effects on the eye (category 1)	If when applied to the eye of an animal, a substance produce: (a) At least in one animal, effects on the cornea, iris or conjunctiva that are not expected to reverse or have not fully reversed within an observation period of normally 21 days; and/or (b) At least in 2 of 3 tested animals, a positive response of: • corneal opacity ≥ 3 and/or • iritis > 1.5 calculated as the mean scores following grading at 24, 48, and 72 hours after installation of the test material.

2.5.3.2.2 *Reversible effects on the eye/eye irritation (category 2)*

2.5.3.2.2.1 Substances that have the potential to induce reversible eye irritation are classified in category 2 (irritating to eyes). Substances are classified in this hazard category on the basis of the results of animal testing, in accordance with the criteria listed in Table 2.34.

Table 2.34: Category for reversible eye effects

Category	Criteria
Irritating to eyes (category 2)	If, when applied to the eye of an animal, a substance produces at least in 2 of 3 tested animals, a positive response of: • corneal opacity ≥ 1, and/or • iritis ≥ 1, and/or • conjunctival redness ≥ 2, and/or • conjunctival oedema (chemosis) ≥ 2 calculated as the mean scores following grading at 24, 48, and 72 hours after installation of the test material, and which fully reverses within an observation period of 21 days.

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2.5.3.2.2.2 For those substances where there is pronounced variability among animal responses, this information shall be taken into account in determining the classification.

2.5.3.3 Additional decision consideration

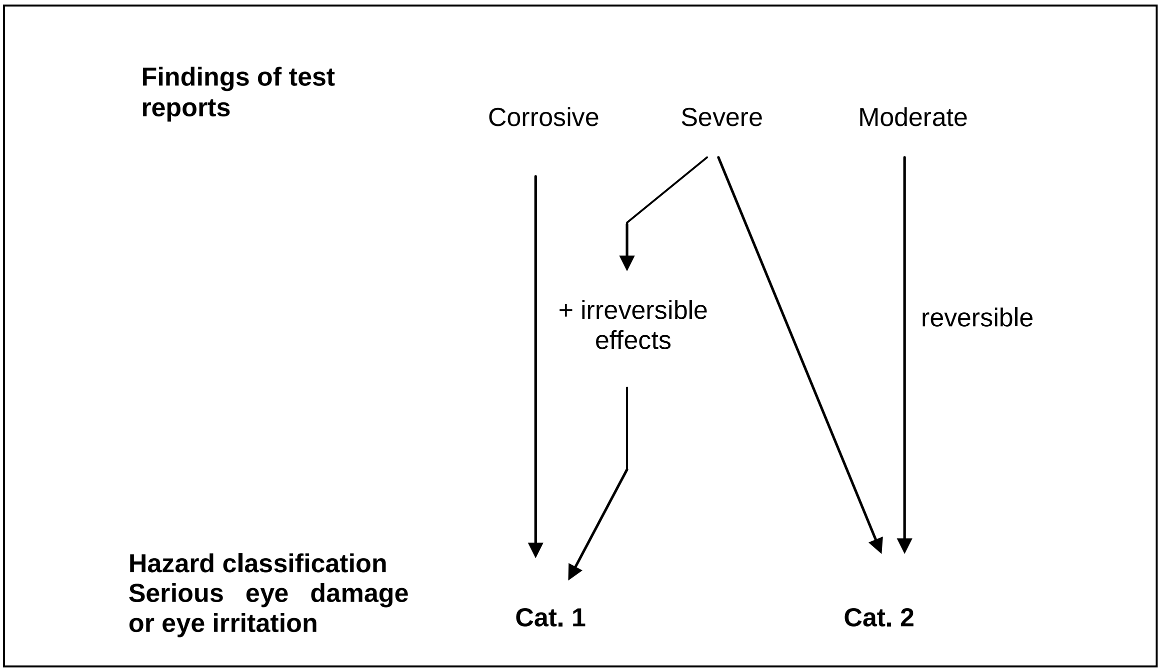
2.5.3.3.1 In many cases, findings of test reports are given using the evaluative scale of “severe” and “moderate”. These can be considered to correspond to categories 1 and 2 respectively.

2.5.3.3.2 Category 1 is applied to substances that cause irreversible effects such as on cornea and/or iris within the observation period of eye damage/eye irritation test.

2.5.3.3.3 If a substance is classified as skin corrosion category 1, the substance shall also be classified as serious eye damage category 1.

2.5.3.3.4 A substance evaluated as “severe” corresponds to category 2 if reversible effects are observed. Refer to Figure 2.12 for guidance on determining classification based on the findings of test reports.

Figure 2.12: Evaluation scale



2.5.3.4 Classification criteria for mixtures

2.5.3.4.1 Classification of mixtures when data are available for the complete mixture

2.5.3.4.1.1 The mixture will be classified using the criteria for substances, and taking into account the testing and evaluation strategies used to develop data for these hazard classes.

2.5.3.4.1.2 A mixture is considered to cause serious eye damage (category 1) if it has a pH ≤ 2.0 or ≥ 11.5. If consideration of alkali/acid reserve suggests the mixture may not have the potential to cause serious eye damage despite the low or high pH value, then further testing needs to be carried out to confirm this, preferably by use of an appropriate validated in vitro test.

2.5.3.4.2 Classification of mixtures when data are not available for the complete mixture: Bridging principles

Where the mixture itself has not been tested to determine its skin corrosivity or potential to cause serious eye damage or irritation, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging rules set out in paragraph 2.3.4.2.

2.5.3.4.3 Classification of mixtures when data are available for all components or only for some components of the mixture

2.5.3.4.3.1 The 'relevant ingredients' of a mixture are those which are present in concentrations ≥ 1% (w/w for solids, liquids, dusts, mists and vapours, and v/v for gases), unless there is a presumption (e.g. in the case of corrosive ingredients) that an ingredient present at a concentration <1% is still relevant for classifying the mixture for serious eye damage or eye irritation.

2.5.3.4.3.2 In general, the approach to classification of mixtures as seriously damaging to the eye or eye irritant when data are available on the components, but not on the mixture as a whole, is based on the theory of additivity, such that each corrosive or irritant component contributes to the overall irritant or corrosive properties of the mixture in proportion to its potency and concentration. A weighting factor of 10 is used for corrosive components when they are present at a concentration below the generic concentration limit for classification in category 1, but are at a concentration that will contribute to the classification of the mixture as an irritant. The mixture is classified as seriously damaging to the eye or eye irritant when the sum of the concentrations of such components exceeds a concentration limit.

2.5.3.4.3.3 Table 2.35 provides the generic concentration limits to be used to determine if the mixture shall be classified as serious eye damage or eye irritation.

Table 2.35: Generic concentration limits of ingredients of a mixture classified as Skin corrosive category 1 and/or eye category 1 or 2 for effects on the eye that trigger classification of the mixture for effects on the eye (category 1 or 2)

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Irreversible eye effects	Reversible eye effects
	Category 1	Category 2
Eye effects category 1 or skin corrosion category 1A, 1B, 1C	≥ 3%	≥ 1% but < 3%
Eye effects category 2		≥ 10%
(10 × eye effects category 1) + eye effects category 2		≥ 10%
Skin corrosion category 1A, 1B, 1C + eye effects category 1	≥ 3%	≥ 1% but < 3%
10 × (skin corrosion category 1 + eye effects category 1) + eye effects category 2		≥ 10%

2.5.3.4.3.4 Particular care must be taken when classifying certain types of mixtures containing substances such as acids and bases, inorganic salts, aldehydes, phenols, and surfactants. The approach explained in paragraphs 2.5.3.4.3.1 and 2.5.3.4.3.2 might not work given that many of such substances are corrosive or irritant at concentrations < 1%.

2.5.3.4.3.5 For mixtures containing strong acids or bases, the pH shall be used as classification criteria (see paragraph 2.5.3.4.1.2) since pH will be a better indicator of serious eye damage than the generic concentration limits of Table 2.35.

2.5.3.4.3.6 A mixture containing corrosive or irritant ingredients that cannot be classified based on the additivity approach (Table 2.35), due to chemical characteristics that make this approach unworkable, shall be classified as category 1 for effects on the eye if it contains ≥ 1% of a corrosive ingredient and as category 2 when it contains ≥ 3% of an irritant ingredient. Classification of mixtures with ingredients for which the approach in Table 2.35 does not apply is summarised in Table 2.36.

Table 2.36: Generic concentration limits of ingredients of a mixture for which the additivity approach does not apply, which trigger classification of the mixture as serious eye damage or eye irritation

Ingredient:	Concentration:	Mixture classified as: Serious eye damage or eye irritation
Acid with pH ≤ 2	≥ 1%	Category 1
Base with pH ≥ 11.5	≥ 1%	Category 1
Other corrosive (category 1) ingredients for which additivity does not apply	≥ 1%	Category 1
Other irritant (category 2) ingredients for which additivity does not apply, including acids and bases	≥ 3%	Category 2

2.5.3.4.3.7 On occasion, reliable data may show that the reversible/irreversible eye effects of an ingredient will not be evident when present at a level above the generic concentration limits mentioned in Tables 2.35 and 2.36. In these cases, the mixture shall be classified according to those data. On other occasions, when it is expected that the skin corrosion/irritation hazards or the reversible/irreversible eye effects of an ingredient will not be evident when present at a level above the generic concentration limits mentioned in Tables 2.35 and 2.36, testing of the mixture shall be considered. In those cases, the tiered weight of evidence strategy shall be applied.

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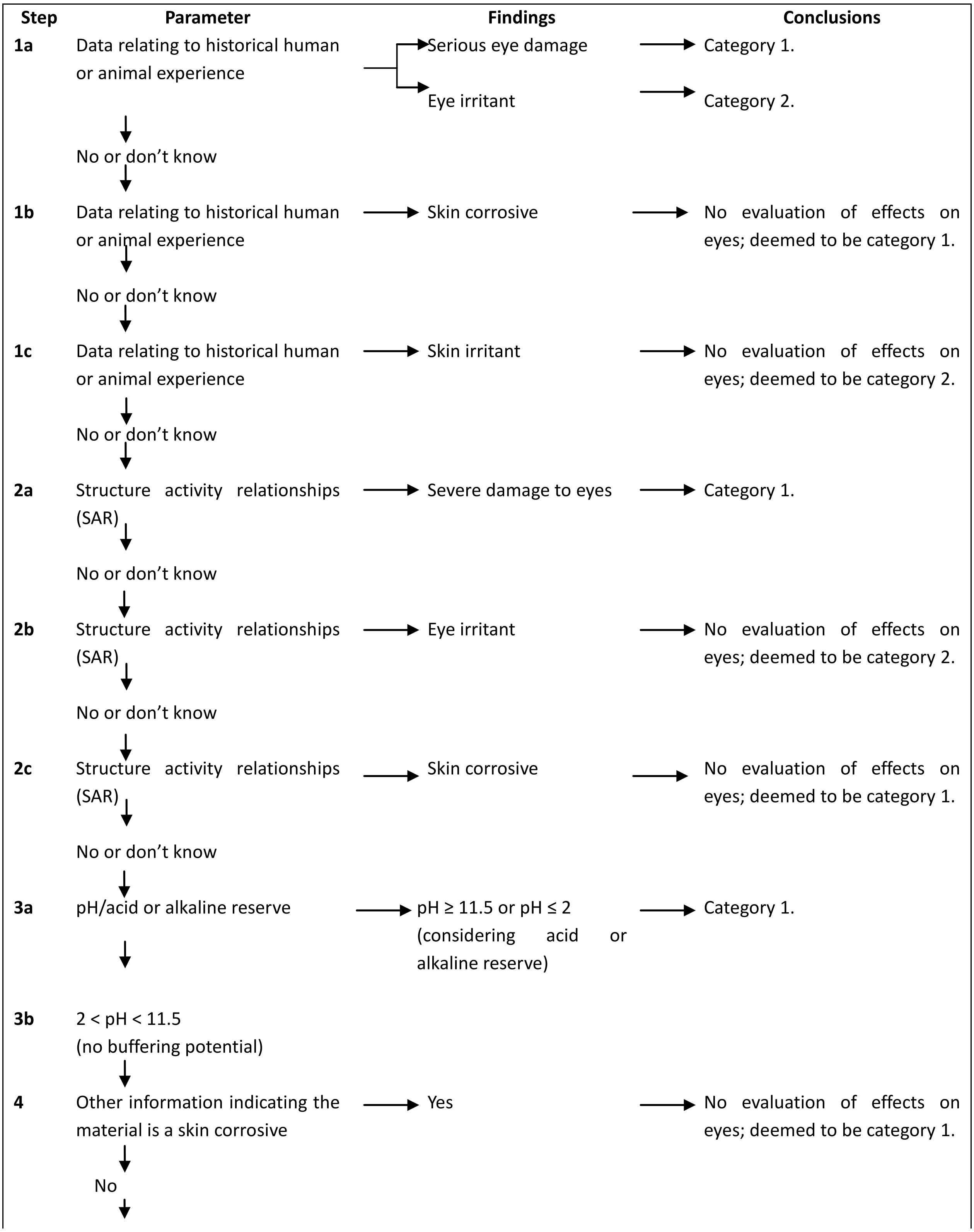
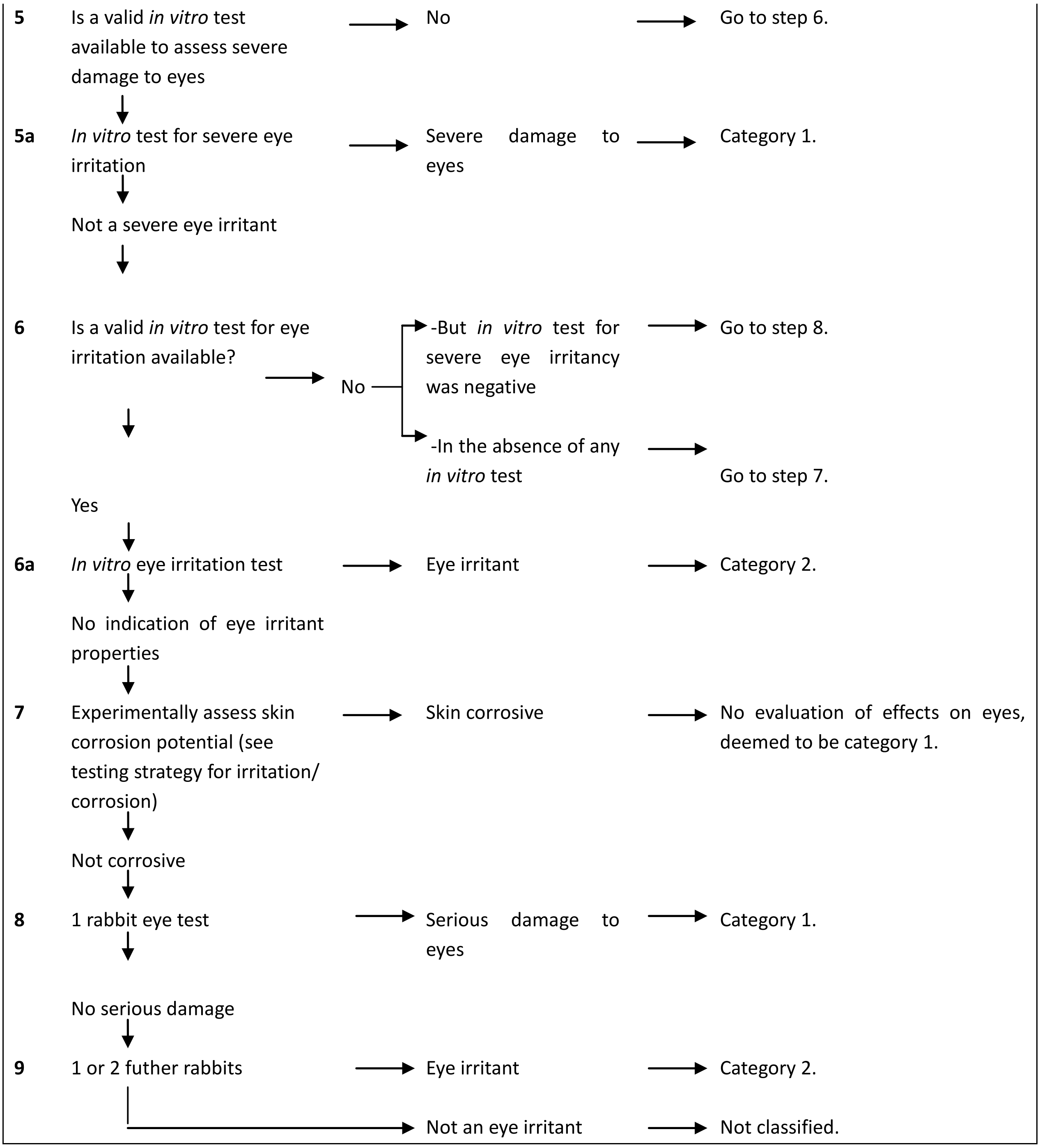
Figure 2.13: Testing and evaluation strategy for serious eye damage and eye irritation (see also testing and evaluation strategy for skin irritation/corrosion" Figure 2.11)



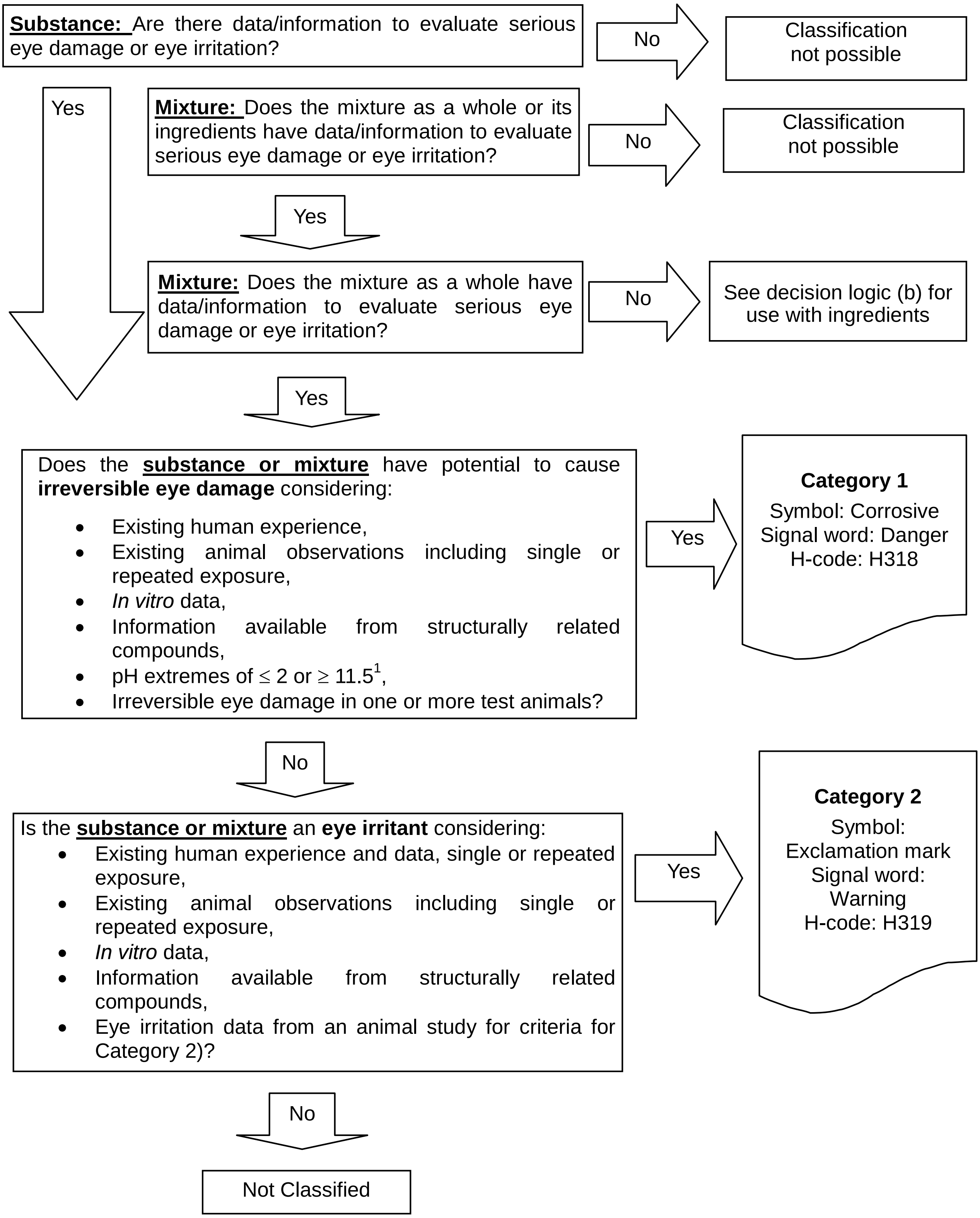
Step	Parameter	Findings	Conclusions
1a	Data relating to historical human or animal experience	Serious eye damage Eye irritant	Category 1. Category 2.
	No or don't know		
1b	Data relating to historical human or animal experience	Skin corrosive	No evaluation of effects on eyes; deemed to be category 1.
	No or don't know		
1c	Data relating to historical human or animal experience	Skin irritant	No evaluation of effects on eyes; deemed to be category 2.
	No or don't know		
2a	Structure activity relationships (SAR)	Severe damage to eyes	Category 1.
	No or don't know		
2b	Structure activity relationships (SAR)	Eye irritant	No evaluation of effects on eyes; deemed to be category 2.
	No or don't know		
2c	Structure activity relationships (SAR)	Skin corrosive	No evaluation of effects on eyes; deemed to be category 1.
	No or don't know		
3a	pH/acid or alkaline reserve	$pH \geq 11.5$ or $pH \leq 2$ (considering acid or alkaline reserve)	Category 1.
3b	$2 < pH < 11.5$ (no buffering potential)		
4	Other information indicating the material is a skin corrosive	Yes	No evaluation of effects on eyes; deemed to be category 1.
	No		



2.5.3.4.3.8 If there are data showing that (an) ingredient(s) may be corrosive or irritant at a concentration of < 1% (corrosive) or < 3% (irritant), the mixture shall be classified accordingly.

2.5.3.5 Decision logic

2.5.3.5.1 Decision logic (a) for serious eye damage or eye irritation



Substance: Are there data/information to evaluate serious eye damage or eye irritation?

Classification not possible

Mixture: Does the mixture as a whole or its ingredients have data/information to evaluate serious eye damage or eye irritation?

Classification not possible

Mixture: Does the mixture as a whole have data/information to evaluate serious eye damage or eye irritation?

See decision logic (b) for use with ingredients

Does the **substance or mixture** have potential to cause **irreversible eye damage** considering:

- Existing human experience,
- Existing animal observations including single or repeated exposure,
- *In vitro* data,
- Information available from structurally related compounds,
- pH extremes of ≤ 2 or ≥ 11.5[1],
- Irreversible eye damage in one or more test animals?

Category 1
Symbol: Corrosive
Signal word: Danger
H-code: H318

Is the **substance or mixture** an **eye irritant** considering:

- Existing human experience and data, single or repeated exposure,
- Existing animal observations including single or repeated exposure,
- *In vitro* data,
- Information available from structurally related compounds,
- Eye irritation data from an animal study for criteria for Category 2)?

Category 2
Symbol: Exclamation mark
Signal word: Warning
H-code: H319

Not Classified

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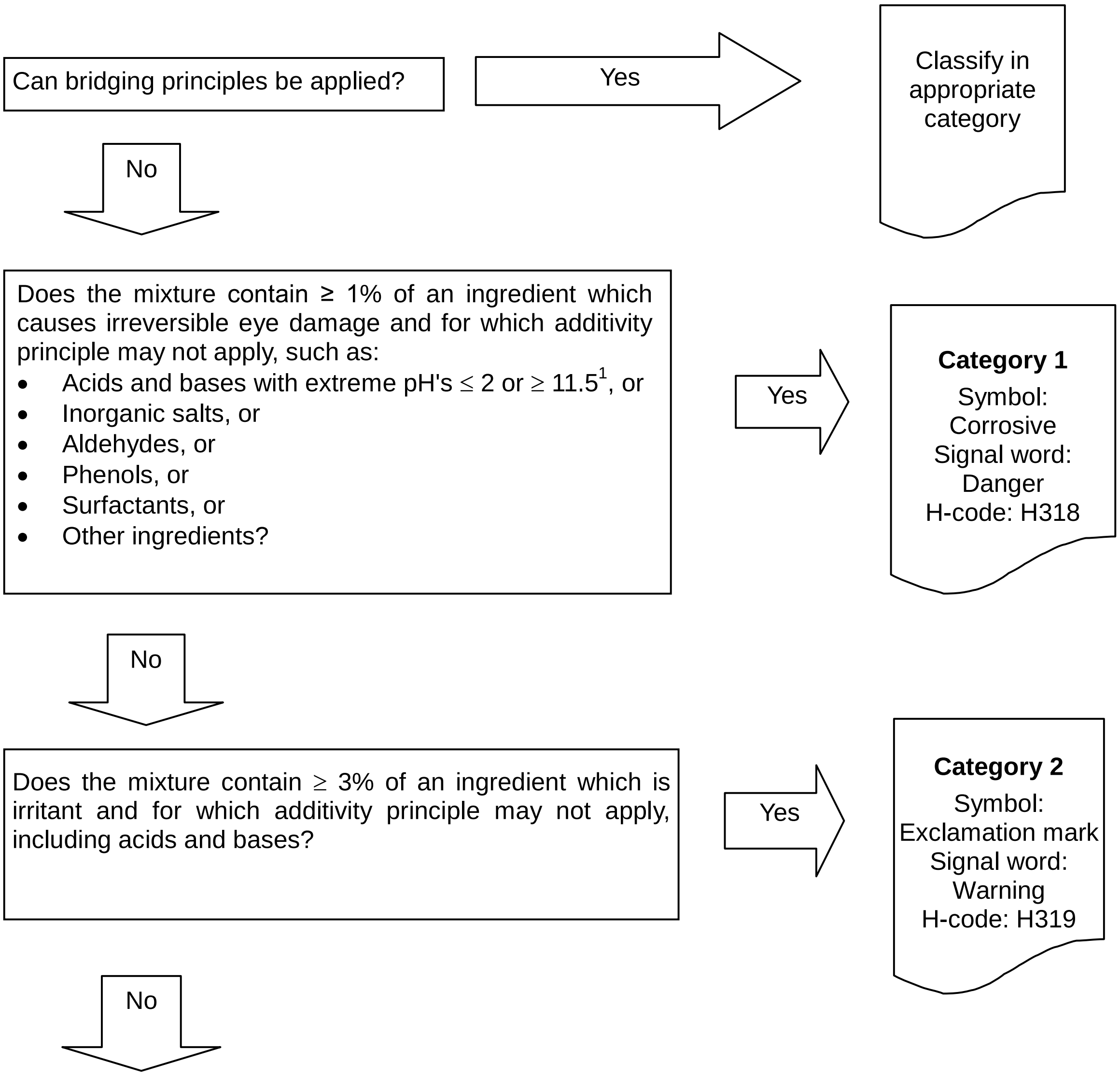
[1] *Including consideration of acid/alkali reserve capacity, if appropriate.*

2.5.3.5.2 *Decision logic (b) for serious eye damage or eye irritation*

Classification of mixtures on the basis of information/data on ingredients



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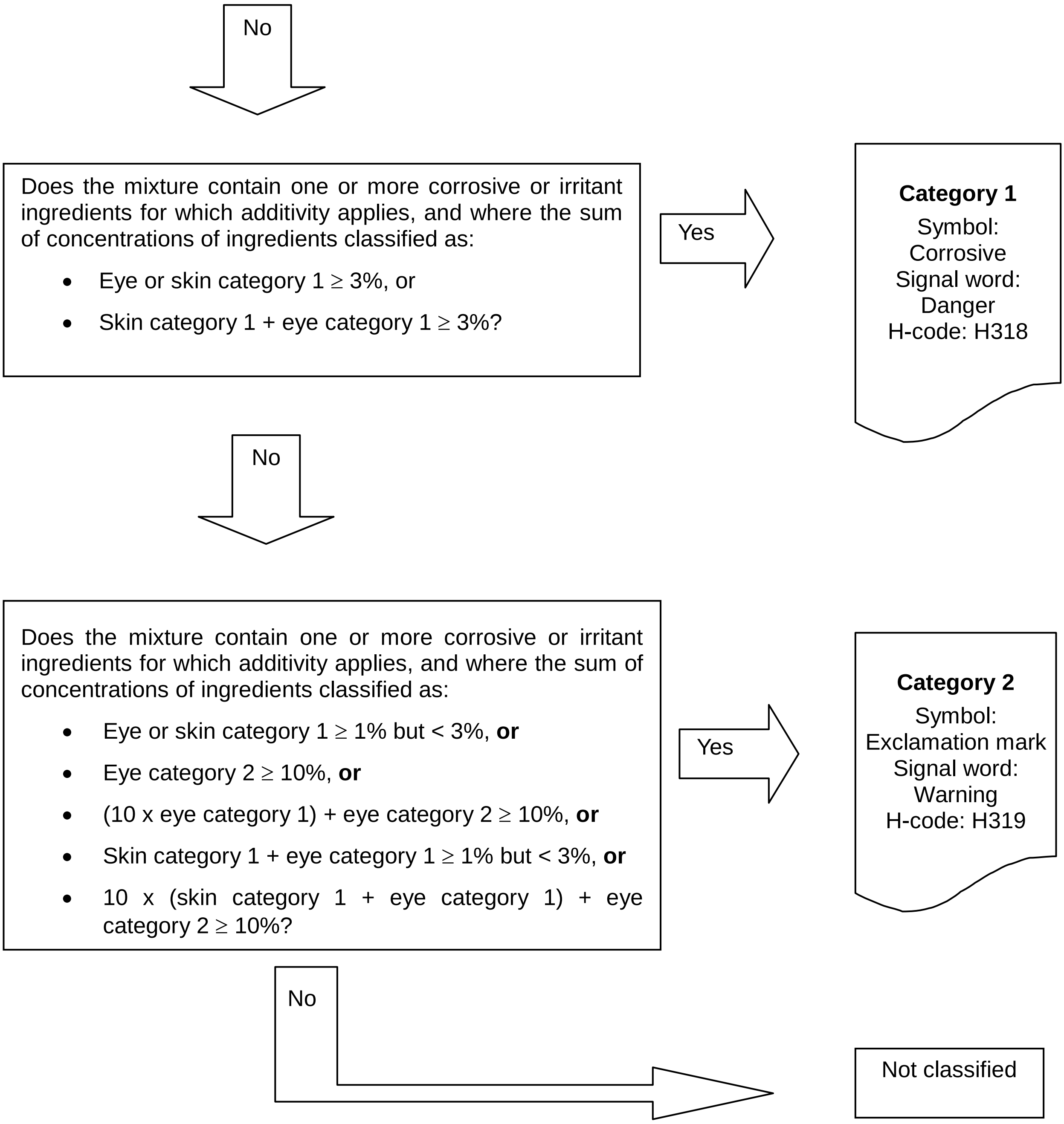
[1] *Including consideration of acid/alkali reserve capacity, if appropriate.*



Does the mixture contain one or more corrosive or irritant ingredients for which additivity applies, and where the sum of concentrations of ingredients classified as:

- Eye or skin category 1 ≥ 3%, or
- Skin category 1 + eye category 1 ≥ 3%?

Category 1
Symbol:
Corrosive
Signal word:
Danger
H-code: H318

Does the mixture contain one or more corrosive or irritant ingredients for which additivity applies, and where the sum of concentrations of ingredients classified as:

- Eye or skin category 1 ≥ 1% but < 3%, **or**
- Eye category 2 ≥ 10%, **or**
- (10 x eye category 1) + eye category 2 ≥ 10%, **or**
- Skin category 1 + eye category 1 ≥ 1% but < 3%, **or**
- 10 x (skin category 1 + eye category 1) + eye category 2 ≥ 10%?

Category 2
Symbol:
Exclamation mark
Signal word:
Warning
H-code: H319

Not classified

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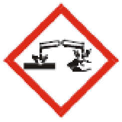
2.5.3.6 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.37.

Table 2.37: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1	R41
2	R36, R36/37, R36/38, R36/37/38

2.5.3.7 Hazard communication elements

Element	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
H-code: Hazard statement	H318: Causes serious eye damage	H319: Causes serious eye irritation

2.5.4 Respiratory Sensitization

2.5.4.1 Definition

Respiratory sensitizer means a substance that will lead to hypersensitivity of the airways following inhalation of the substance.

2.5.4.2 Classification criteria for substances

Substances shall be classified as respiratory sensitizers (category 1) in accordance with the criteria in Table 2.38.

Table 2.38: Hazard category for respiratory sensitizers

Category	Criteria
Category 1	Substances shall be classified as respiratory sensitizers (category 1) in accordance with the following criteria: (i) If there is evidence in humans that the substance can lead to specific respiratory hypersensitivity; and/or (ii) If there are positive results from an appropriate animal test.

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2.5.4.3 Classification criteria for mixtures

2.5.4.3.1 Classification of mixtures when data are available for the complete mixture

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture can be classified by weight of evidence evaluation of these data. Care shall be exercised in evaluating data on mixtures, that the dose used does not render the results inconclusive.

2.5.4.3.2 Classification of mixtures when data are not available for the complete mixture: Bridging principles

Where the mixture itself has not been tested to determine its sensitizing properties, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging rules set out in paragraph 2.3.4.2.

2.5.4.3.3 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

The mixture shall be classified as a respiratory sensitization when at least one ingredient has been classified as a respiratory sensitization and is present at or above the appropriate generic concentration limit as shown in Table 2.39 for solid/liquid and gas respectively.

Table 2.39: Generic concentration limits of ingredients of a mixture classified as respiratory sensitization that trigger classification of the mixture

Ingredient classified as:	Concentration triggering classification of a mixture as:	
	Respiratory Sensitization	
	Solid/Liquid	Gas
Respiratory Sensitizer	≥ 1.0%	≥ 0.2%

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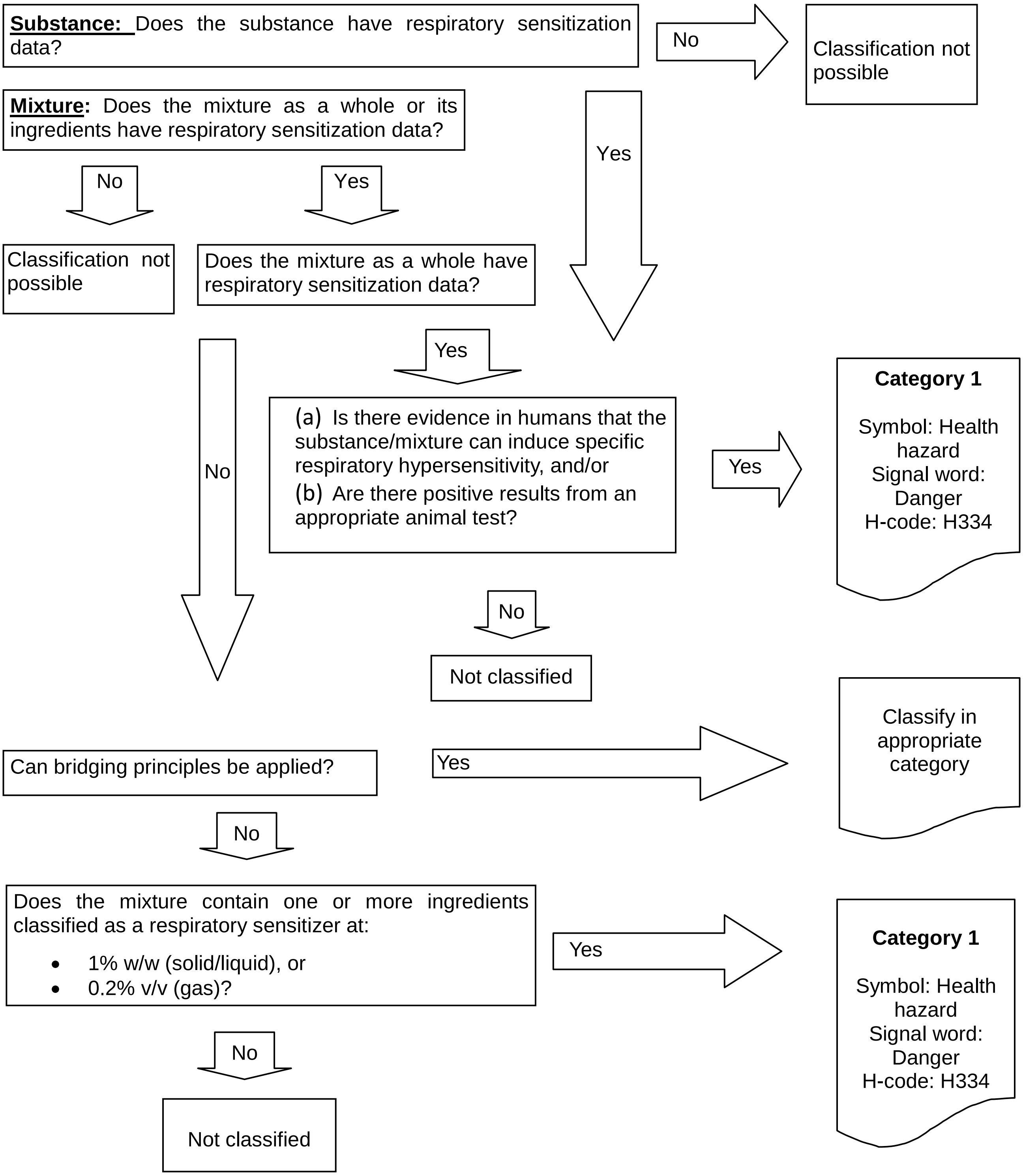
2.5.4.4 Decision logic



2.5.4.4.1 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.40.

Table 2.40: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1	R42, R42/43

2.5.4.5 Hazard communication elements

Element	Category 1
Hazard pictogram	
Signal word	Danger
H-code: Hazard statement	H334: May cause allergic or asthma symptoms or breathing difficulties if inhaled

2.5.5 Skin Sensitization

2.5.5.1 Definition

Skin sensitizer means a substance that will lead to an allergic response following skin contact.

2.5.5.2 Classification criteria for substances

2.5.5.2.1 Substances shall be classified as skin sensitization (category 1) in accordance with the criteria in Table 2.41.

Table 2.41: Hazard category for skin sensitization

Category	Criteria
Category 1	(i) If there is evidence in humans that the substance can lead to sensitization by skin contact in a substantial number of persons, or (ii) If there are positive results from an appropriate animal test.

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2.5.5.2.2 Additional Decision Considerations

2.5.5.2.2.1 For classification of a substance as a skin sensitization, evidence shall include any or all of the following:

(a) Positive data from patch testing, normally obtained in more than one dermatology clinic;

(b) Epidemiological studies showing allergic contact dermatitis caused by the substance; situations in which a high proportion of those exposed exhibit characteristic symptoms are to be looked at with special concern, even if the number of cases is small;

(c) Positive data from appropriate animal studies;

(d) Positive data from experimental studies on humans;

(e) Well-documented episodes of allergic contact dermatitis, normally obtained in more than one dermatology clinic;

(f) Severity of reaction may also be considered.

2.5.5.2.2.2 If none of the above mentioned conditions are met, the substance need not be classified as a skin sensitization. However, a combination of two or more indicators of skin sensitization as listed below may alter the decision, which shall be considered on a case-by-case basis:

(a) Isolated episodes of allergic contact dermatitis;

(b) Epidemiological studies of limited power, e.g. where chance, bias or confounders have not been ruled out fully with reasonable confidence;

(c) Data from animal tests, performed according to existing guidelines, which do not meet the criteria for a positive result but which are sufficiently close to the limit to be considered significant;

(d) Positive data from non-standard methods;

(e) Positive results from close structural analogues.

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2.5.5.3 Classification criteria for mixtures

2.5.5.3.1 Classification of mixtures when data are available for the complete mixture

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture can be classified by weight of evidence evaluation of these data. Care shall be exercised in evaluating data on mixtures, that the dose used does not render the results inconclusive.

2.5.5.3.2 Classification of mixtures when data are not available for the complete mixture: Bridging principles

Where the mixture itself has not been tested to determine its sensitizing properties, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging rules set out in paragraph 2.3.4.2.

2.5.5.3.3 Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture

The mixture shall be classified as a skin sensitization when at least one ingredient has been classified as a skin sensitization and is present at or above the appropriate generic concentration limit as shown in Table 2.42.

Table 2.42: Generic concentration limits of ingredients of a mixture classified as skin sensitization that triggers classification of the mixture

Ingredient classified as:	Concentration triggering classification of a mixture as skin sensitization:
Skin sensitization	$\geq$ 1.0%

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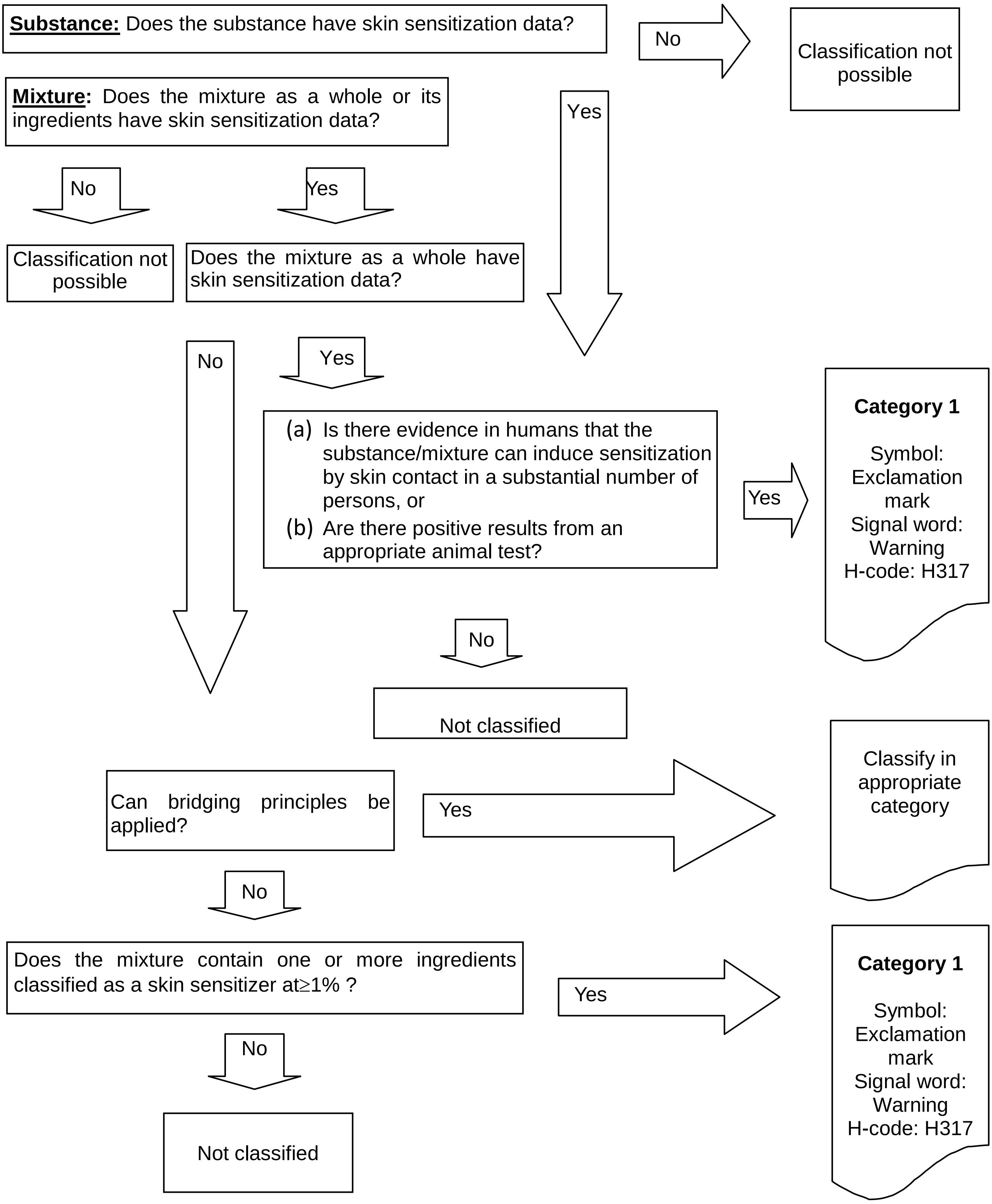
2.5.5.4 Decision logic



2.5.5.5 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.43.

Table 2.43: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1	R43, R42/43

2.5.5.6 Hazard communication elements

Element	Category 1
Hazard pictogram	
Signal word	Warning
H-code: Hazard statement	H317: May cause allergic skin reaction

2.5.6 Germ Cell Mutagenicity

2.5.6.1 Definition

2.5.6.1.1 A mutation means a permanent change in the amount or structure of the genetic material in a cell. The term ‘mutation’ applies both to heritable genetic changes that may be manifested at the phenotypic level and to the underlying DNA modifications when known (including specific base pair changes and chromosomal translocations). The term ‘mutagenic’ and ‘mutagen’ will be used for agents giving rise to an increased occurrence of mutations in populations of cells and/or organisms.

2.5.6.1.2 The more general terms ‘genotoxic’ and ‘genotoxicity’ apply to agents or processes which alter the structure, information content, or segregation of DNA, including those which cause DNA damage by interfering with normal replication processes, or which in a non-physiological manner (temporarily) alter its replication. Genotoxicity test results are usually taken as indicators for mutagenic effects.

2.5.6.2 Classification criteria for substances

2.5.6.2.1 This hazard class is primarily concerned with substances that may cause mutations in the germ cells of humans that can be transmitted to the progeny. However, the results from mutagenicity or genotoxicity tests *in vitro* and in mammalian somatic and germ cells *in vivo* are also considered in classifying substances and mixtures within this hazard class.

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2.5.6.2.2 For the purpose of classification for germ cell mutagenicity, substances are allocated to one of two categories as shown in Table 2.44.

Table 2.44: Hazard categories for germ cell mutagens

Categories	Criteria
CATEGORY 1:	Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans.
Category 1A:	Substances known to induce heritable mutations in the germ cells of humans. The classification in category 1A is based on positive evidence from human epidemiological studies.
Category 1B:	Substances to be regarded as if they induce heritable mutations in the germ cells of humans. The classification in category 1B is based on: • Positive result(s) from *in vivo* heritable germ cell mutagenicity tests in mammals; or • Positive result(s) from *in vivo* somatic cell mutagenicity tests in mammals, in combination with some evidence that the substance has potential to cause mutations to germ cells. It is possible to derive this supporting evidence from mutagenicity/genotoxicity tests in germ cells *in vivo*, or by demonstrating the ability of the substance or its metabolite(s) to interact with the genetic material of germ cells; or • Positive results from tests showing mutagenic effects in the germ cells of humans, without demonstration of transmission to progeny; for example, an increase in the frequency of aneuploidy in sperm cells of exposed people.
CATEGORY 2:	Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans. The classification in category 2 is based on positive evidence obtained from experiments in mammals and/or, in some cases, from *in vitro* experiments obtained from: • Somatic cell mutagenicity tests *in vivo*, in mammals; or • Other *in vivo* somatic cell genotoxicity tests which are supported by positive results from *in vitro* mutagenicity assays.

NOTE

Substances which are positive in in-vitro *mammalian mutagenicity assays, and which also show chemical structure activity relationship to known germ cell mutagens, shall be considered for classification as category 2 mutagens.*

2.5.6.2.3 *Specific considerations for classification of substances as germ cell mutagens*

2.5.6.2.3.1 To arrive at a classification, test results are considered from experiments determining mutagenic and/or genotoxic effects in germ and/or somatic cells of exposed animals. Mutagenic and/or genotoxic effects determined in *in-vitro* tests shall also be considered.

2.5.6.2.3.2 The system is hazard based, classifying substances on the basis of their intrinsic ability to induce mutations in germ cells. The scheme is, therefore, not meant for the (quantitative) risk assessment of substances.

2.5.6.2.3.3 The classification of individual substances shall be based on the total weight of evidence available, using expert judgement (refer paragraph 2.3.3.2). In those instances where a single well-conducted test is used for classification, it shall provide clear and unambiguously positive results. If new, well-validated tests arise, these may also be used in the total weight of evidence to be considered. The relevance of the route of exposure used in the study of the substance compared to the route of human exposure shall also be taken into account.

2.5.6.3 Classification criteria for mixtures

2.5.6.3.1 *Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture*

The mixture shall be classified as a mutagen when at least one ingredient has been classified as a category 1A, category 1B or category 2 mutagen and is present at or above the appropriate generic concentration limit as shown in Table 2.45 for category 1A, category 1B, and category 2 respectively.

Table 2.45: Generic concentration limits of ingredients of a mixture classified as germ cell mutagens that trigger classification of the mixture.

Ingredient classified as:	**Concentration limits triggering classification of a mixture as:**		
	Category 1A mutagen	**Category 1B mutagen**	**Category 2 mutagen**
Category 1A mutagen	≥ 0.1%	—	—
Category 1B mutagen	—	≥ 0.1%	—
Category 2 mutagen	—	—	≥ 1.0%

NOTE
The concentration limits in the table above apply to solids and liquids (w/w units) as well as gases (v/v units).

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2.5.6.3.2 *Classification of mixtures when data are available for the complete mixture*

Classification of mixtures will be based on available test data for the individual ingredients of the mixture using concentration limits for the ingredients classified as germ cell mutagens. On a case-by-case basis, test data on mixtures may be used for classification when demonstrating effects that have not been established from the evaluation based on the individual ingredients. In such cases, the test results for the mixture as a whole must be shown to be conclusive, taking into account the dosage and other factors such as duration, observations, sensitivity, and statistical analysis of germ cell mutagenicity test systems. Adequate documentation supporting the classification shall be retained and made available for review upon request.

2.5.6.3.3 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

Where the mixture itself has not been tested to determine its germ cell mutagenicity hazard, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the applicable bridging rules set out in paragraph 2.3.4.2.

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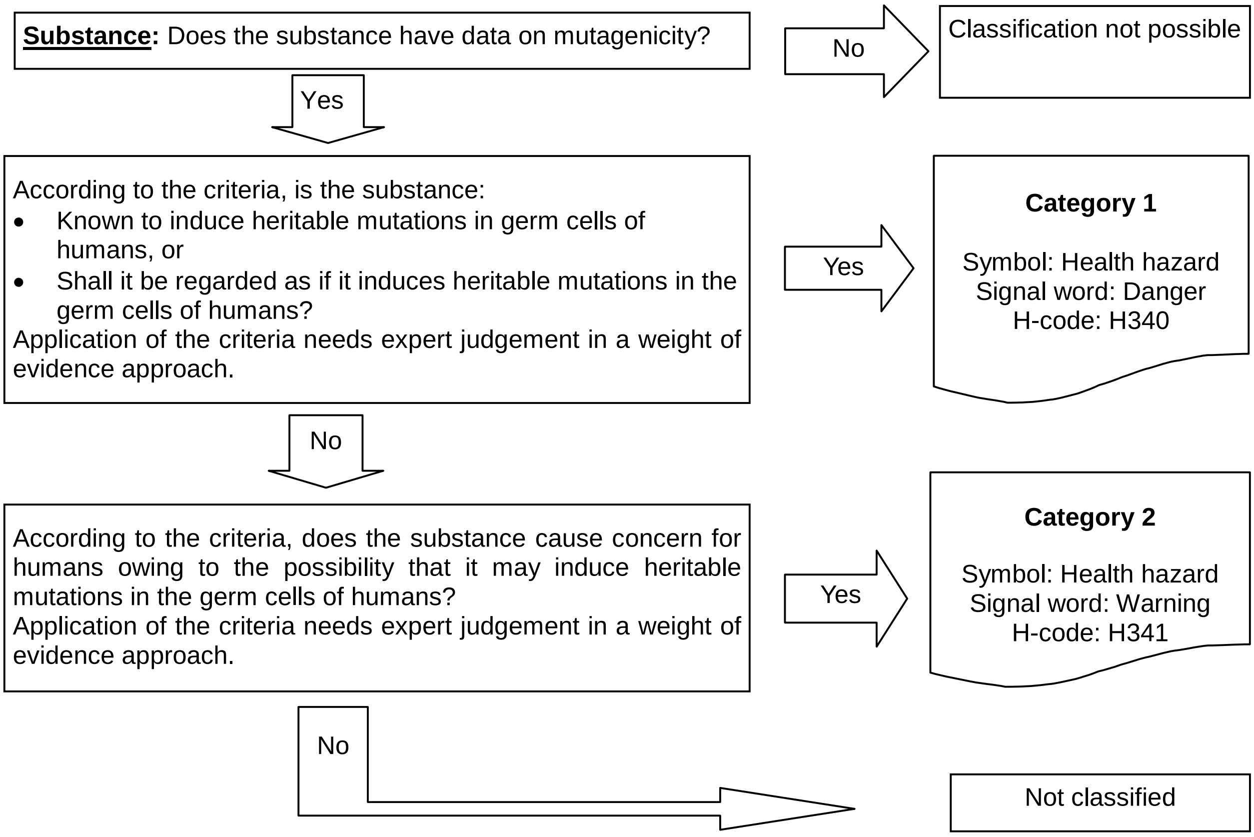
2.5.6.4 Decision logic

2.5.6.4.1 *Decision logic (a) forgerm cell mutagenicity: substances*



Substance: Does the substance have data on mutagenicity?

Classification not possible

According to the criteria, is the substance:
- Known to induce heritable mutations in germ cells of humans, or
- Shall it be regarded as if it induces heritable mutations in the germ cells of humans?

Application of the criteria needs expert judgement in a weight of evidence approach.

Category 1

Symbol: Health hazard
Signal word: Danger
H-code: H340

According to the criteria, does the substance cause concern for humans owing to the possibility that it may induce heritable mutations in the germ cells of humans?
Application of the criteria needs expert judgement in a weight of evidence approach.

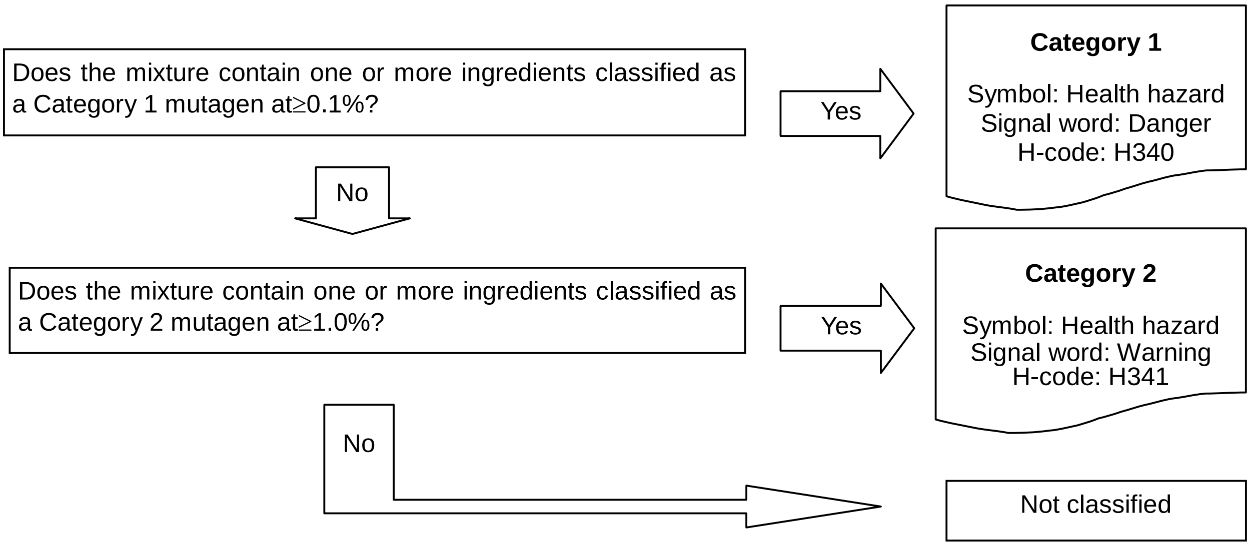
Category 2

Symbol: Health hazard
Signal word: Warning
H-code: H341

Not classified

2.5.6.4.2 *Decision logic (b) for germ cell mutagenicity:mixtures*

Mixture:
Classification of mixtures will be based on the available test data for the **individual ingredients** of the mixture, using concentration limits for those ingredients. The classification may **be modified on a case-by-case basis** based on the available test data for the mixture as a whole or based on bridging principles. See Modified classification on a case-by-case basis below.



Does the mixture contain one or more ingredients classified as a Category 1 mutagen at≥0.1%?

Category 1

Symbol: Health hazard
Signal word: Danger
H-code: H340

Does the mixture contain one or more ingredients classified as a Category 2 mutagen at≥1.0%?

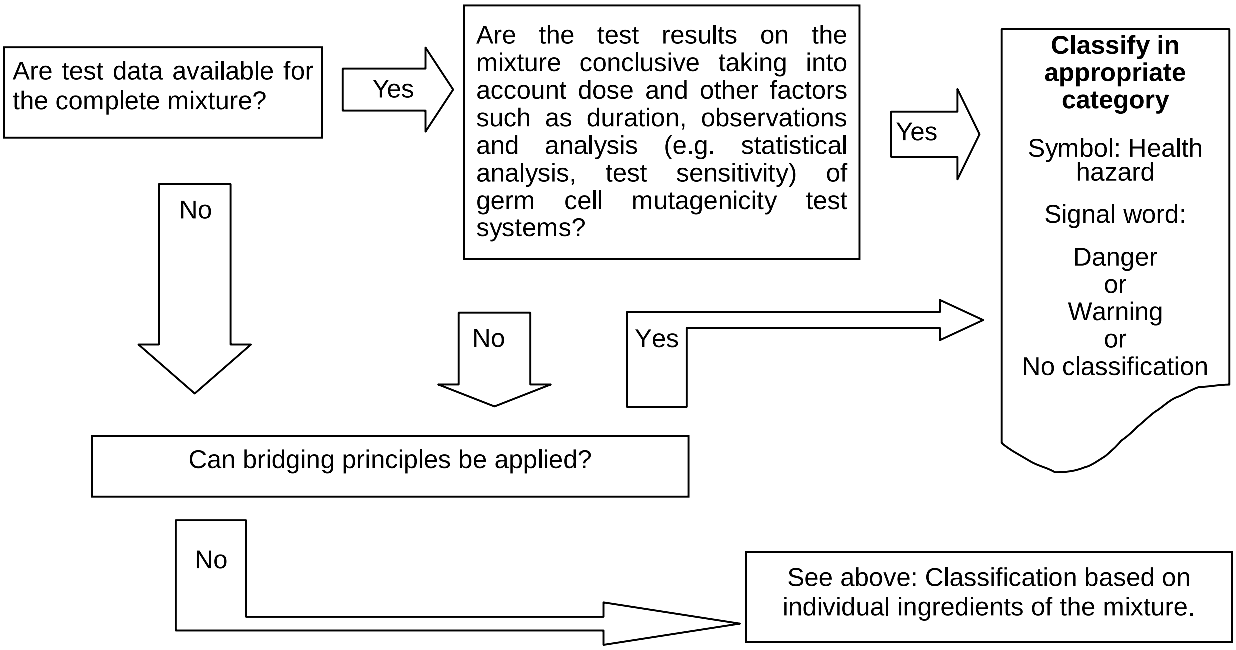
Category 2

Symbol: Health hazard
Signal word: Warning
H-code: H341

Not classified

2.5.6.4.3 Classification based on individual ingredients of the mixture

Modified classification on a case-by-case basis



2.5.6.5 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.46.

Table 2.46: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1A	Mutagen category 1; R46
1B	Mutagen category 2; R46
2	Mutagen category 3; R68

2.5.6.6 Hazard communication elements

Element	**Category 1**		**Category 2**
	1A	**1B**	
Hazard pictogram			
Signal word	Danger		Warning
H-code: Hazard statement	H340: May cause genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*		H341: Suspected of causing genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*

2.5.7 Carcinogenicity

2.5.7.1 Definition

Carcinogen means a substance or a mixture of substances which induce cancer or increase its incidence. Substances which have induced benign and malignant tumours in well-performed experimental studies on animals are considered also to be presumed or suspected human carcinogens unless there is strong evidence that the mechanism of tumour formation is not relevant for humans.

2.5.7.2 Classification criteria for substances

2.5.7.2.1 For the purpose of classification for carcinogenicity, substances are allocated to one of two categories based on the strength of evidence and additional considerations (weight of evidence). In certain instances, route-specific classification may be warranted if it can be conclusively proved that no other route of exposure exhibits the hazard.

Table 2.47: Hazard categories for carcinogens

Categories	Criteria
CATEGORY 1:	Known or presumed human carcinogens A substance is classified in category 1 for carcinogenicity based on epidemiological and/or animal data. A substance may be further distinguished as:
Category 1A:	Known to have carcinogenic potential for humans, classification is largely based on human evidence, or
Category 1B:	Presumed to have carcinogenic potential for humans, classification is largely based on animal evidence. The classification in category 1A and 1B is based on the strength of evidence together with additional considerations (refer paragraph 2.5.7.2.2). Such evidence may be derived from: (i) human studies that establish a causal relationship between human exposure to a substance and the development of cancer (known human carcinogen); or (ii) animal experiments which give sufficient (1) evidence to demonstrate animal carcinogenicity (presumed human carcinogen). In addition, on a case-by-case basis, scientific judgement may warrant a decision of presumed human carcinogenicity derived from studies showing limited evidence of carcinogenicity in humans together with limited evidence of carcinogenicity in experimental animals.
CATEGORY 2:	Suspected human carcinogens The placing of a substance in category 2 is done based on the evidence obtained from human and/or animal studies, but which is not sufficiently convincing to place the substance in category 1A or 1B, based on the strength of evidence together with other additional considerations (refer paragraph 2.5.7.2.2). Such evidence may be derived either from limited evidence of carcinogenicity in human studies or from limited evidence of carcinogenicity in animal studies.

2.5.7.2.2 *Specific considerations for classification of substances as carcinogens*

2.5.7.2.2.1 Classification as a carcinogen is made on the basis of evidence from reliable and acceptable studies and is intended to be used for substances which have an intrinsic property to cause cancer. The evaluations shall be based on all existing data, peer-reviewed published studies, and additional acceptable data.

2.5.7.2.2.2 Classification of a substance as a carcinogen is a process that involves two inter-related determinations: Evaluation of strength of evidence and consideration of all other relevant information to place substances with human cancer potential into hazard categories.

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2.5.7.3 Classification criteria for mixtures

2.5.7.3.1 *Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture*

2.5.7.3.1.1 The mixture will be classified as a carcinogen when at least one ingredient has been classified as a category 1A, category 1B or category 2 carcinogen, and is present at or above the appropriate generic concentration limit as shown in Table 2.48 for category 1A, category 1B, and category 2 respectively.

Table 2.48: Generic concentration limits of ingredients of a mixture classified as carcinogen that trigger classification of the mixture

Ingredient classified as:	**Generic concentration limits triggering classification of a mixture as:**		
	Category 1A carcinogen	**Category 1B carcinogen**	**Category 2 carcinogen**
Category 1A carcinogen	≥ 0.1%	—	—
Category 1B carcinogen	—	≥ 0.1%	—
Category 2 carcinogen	—	—	≥ 1.0%

NOTE
The concentration limits in the table above apply to solids and liquids (w/w units) as well as gases (v/v units).

2.5.7.3.2 *Classification of mixtures when data are available for the complete mixture*

Classification of mixtures will be based on available test data for the individual ingredients of the mixture using concentration limits for the ingredients classified as carcinogens. On a case-by-case basis, test data on mixtures may be used for classification when demonstrating effects that have not been established from the evaluation based on the individual ingredients. In such cases, the test results for the mixture as a whole must be shown to be conclusive, taking into account the dosage and other factors such as duration, observations, sensitivity, and statistical analysis of carcinogenicity test systems. Adequate documentation supporting the classification shall be retained and made available for review upon request.

2.5.7.3.3 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

Where the mixture itself has not been tested to determine its carcinogenic hazard, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the applicable bridging rules set out in paragraph 2.3.4.2.

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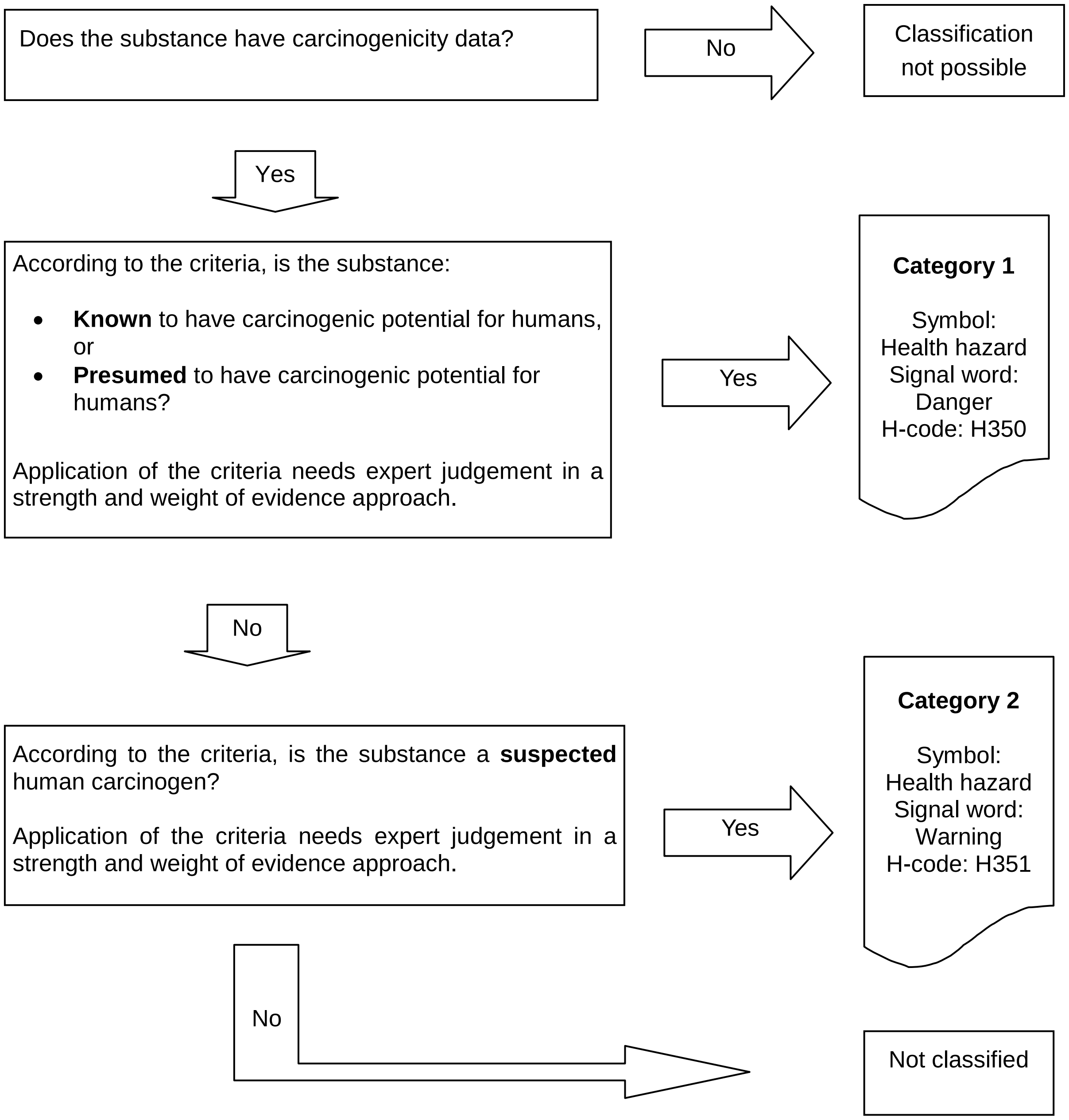
2.5.7.4 Decision logic

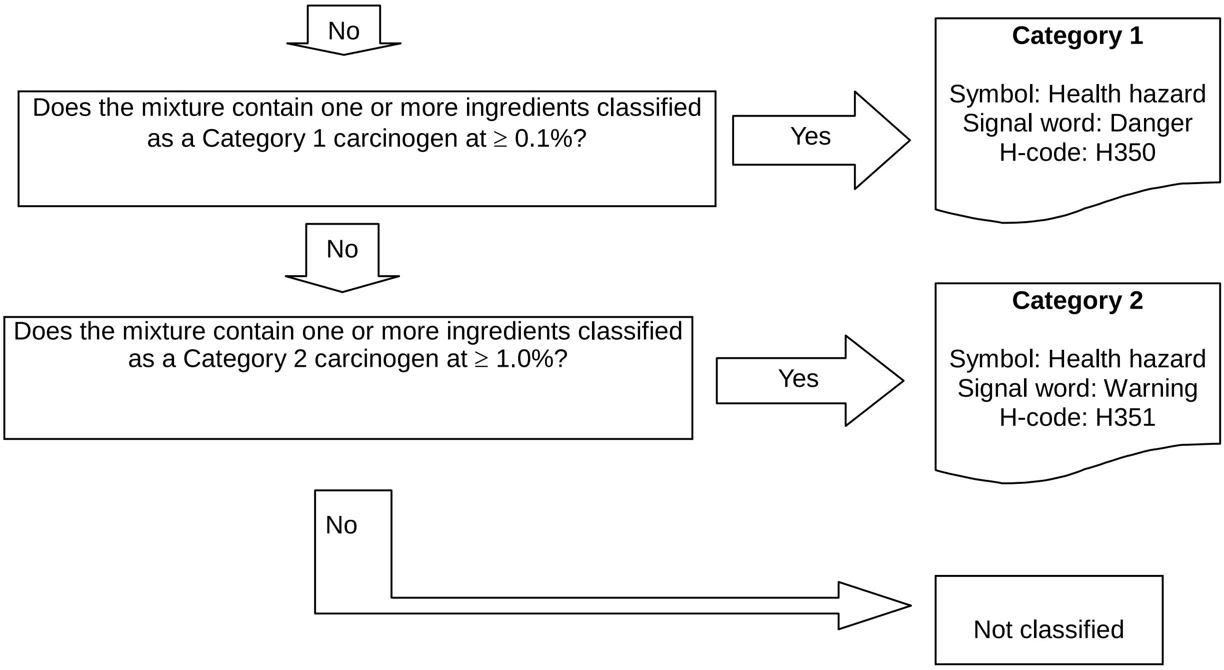
2.5.7.4.1 Decision logic for substances



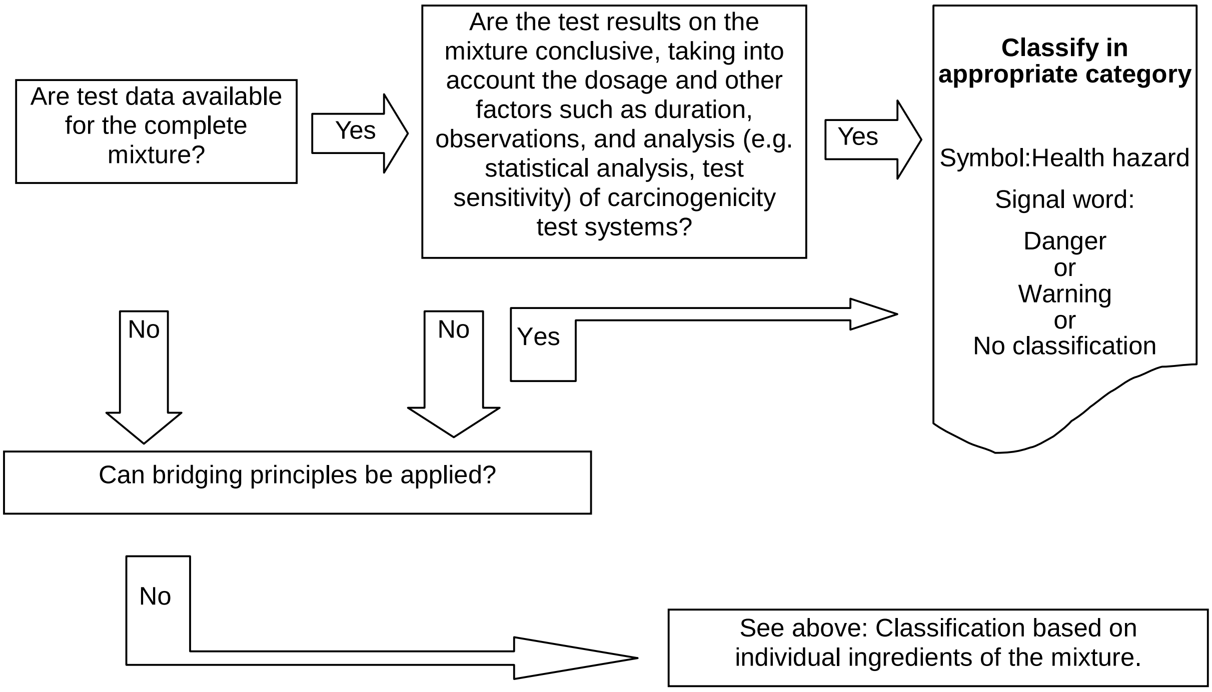
2.5.7.4.2 Decision logic for mixtures

Classification based on individual ingredients of the mixture

Classification of mixtures will be based on available test data for the **individual ingredients** of the mixture, using concentration limits for those ingredients. The classification may be **modified on a case-by-case basis** based on available test data for the mixture as a whole or based on bridging principles. See *Modified classification on a case-by-case basis below*.



Modified classification on a case-by-case basis



2.5.7.5 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EECor CPL 1997, the hazard classification may be determined by referring to Table 2.49.

Table 2.49: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1A	Carcinogenicity category 1; R45,R49
1B	Carcinogenicity category 2; R45,R49
2	Carcinogenicity category 3; R40

2.5.7.6 Hazard communication elements

Element	**Category 1**		**Category 2**
	1A	**1B**	
Hazard pictogram			
Signal word	Danger		Warning
H-code: Hazard statement	H350: May cause cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*		H351: Suspected of causing cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*

2.5.8 Reproductive Toxicity

2.5.8.1 Definition

2.5.8.1.1 Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring.

In this classification system, reproductive toxicity is sub-divided under two main headings:

(a) Adverse effects on sexual function and fertility; and
(b) Adverse effects on development of the offspring.

Some reproductive toxic effects cannot be clearly assigned to either impairment of sexual function and fertility or to developmental toxicity. Nonetheless, substances with these effects, or mixtures containing them, shall be classified as reproductive toxicants.

2.5.8.1.2 For the purpose of classification, the hazard class reproductive toxicity is differentiated into:

(a) Adverse effects;
(b) On sexual function and fertility;
(c) On development; or
(d) Effects on or via lactation.

2.5.8.2 Classification criteria for substances

2.5.8.2.1 *Hazard categories*

2.5.8.2.1.1 For the purpose of classification for reproductive toxicity, substances are allocated to one of two categories. Within each category, effects on sexual function and fertility, and on development, are considered separately. In addition, effects on lactation are also allocated to a separate hazard category.

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Table 2.50*:* Hazard categories for reproductive toxicants

Categories	Criteria
CATEGORY 1	Known or presumed human reproductive toxicant Substances are classified in category 1 for reproductive toxicity when they are known to have produced an adverse effect on sexual function and fertility or on development in humans or when there is evidence from animal studies, possibly supplemented with other information, to provide a strong presumption that the substance has the capacity to interfere with reproduction in humans. The classification of a substance is further distinguished on the basis of whether the evidence for classification is primarily from human data (category 1A) or from animal data (category 1B).
Category 1A	Known human reproductive toxicant The classification of a substance in category 1A is largely based on evidence from humans.
Category 1B	Presumed human reproductive toxicant The classification of a substance in category 1B is largely based on data from animal studies. Such data shall provide clear evidence of an adverse effect on sexual function and fertility or on development, in the absence of other toxic effects, or if occurring together with other toxic effects, the adverse effect on reproduction is considered not to be a secondary non-specific consequence of other toxic effects. However, when there is mechanistic information that raises doubt about the relevance of the effect for humans, classification in category 2 may be more appropriate.
CATEGORY 2	Suspected human reproductive toxicant Substances are classified in category 2 for reproductive toxicity when there is some evidence from humans or experimental animals, possibly supplemented with other information, of an adverse effect on sexual function and fertility or on development, and where the evidence is not sufficiently convincing to place the substance in category 1. If deficiencies in the study make the quality of evidence less convincing, category 2 could be the more appropriate classification. Such effects shall have been observed in the absence of other toxic effects, or if occurring together with other toxic effects, the adverse effect on reproduction is considered not to be a secondary non-specific consequence of the other toxic effects.

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Table 2.51: Hazard category for lactation effects

EFFECTS ON OR VIA LACTATION
Effects on or via lactation are allocated to a separate single category. It is recognised that for many substances, there is no information on the potential to cause adverse effects on the offspring via lactation. However, substances which are absorbed by women and have been shown to interfere with lactation, or which may be present (including metabolites) in breast milk in amounts sufficient to cause concern for the health of a breastfed child, shall be classified and labelled to indicate this property hazardous to breastfed child. This classification can be assigned on the: (a) Human evidence indicating a hazard to babies during the lactation period; and/or (b) Results of one or two generation studies in animals which provide clear evidence of adverse effect in the offspring due to transfer in the milk or adverse effect on the quality of the milk; and/or (c) Absorption, metabolism, distribution, and excretion studies that indicate the likelihood that the substance is present in potentially toxic levels in breast milk.

2.5.8.3 Basis of classification

2.5.8.3.1 Classification is made on the basis of the appropriate criteria, outlined above, and an assessment of the total weight of evidence. Classification as reproductive toxicity is intended to be used for substances which have an intrinsic, specific property to produce an adverse effect on reproduction, and substances shall not be so classified if such an effect is produced solely as a non-specific secondary consequence of other toxic effects.

2.5.8.3.2 The classification of a substance is derived from the hazard categories in the following order of precedence: category 1A, category 1B, category 2, and the additional category for effects on or via lactation. If a substance meets the criteria for classification into both of the main categories (for example category 1B for effects on sexual function and fertility and also category 2 for development) then both hazard differentiations shall be communicated by the respective hazard statements. Classification in the additional category for effects on or via lactation will be considered irrespective of a classification into category 1A, category 1B, or category 2.

2.5.8.3.3 In the evaluation of toxic effects on the developing offspring, it is important to consider the possible influence of maternal toxicity.

2.5.8.3.4 For human evidence to provide the primary basis for a category 1A classification, there must be reliable evidence of an adverse effect on reproduction in humans. Evidence used for classification shall ideally be from well-conducted epidemiological studies which include the use of appropriate controls, balanced assessment, and due consideration of bias or confounding factors. Less rigorous data from studies in humans shall be supplemented with adequate data from studies in experimental animals and classification in category 1B shall be considered.

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2.5.8.4 Classification criteria for mixtures

2.5.8.4.1 *Classification of mixtures when data are available for all ingredients or only for some ingredients of the mixture*

2.5.8.4.1.1 The mixture shall be classified as a reproductive toxicant when at least one ingredient has been classified as a category 1A, category 1B, or category 2 reproductive toxicant, and is present at or above the appropriate generic concentration limit as shown in Table 2.52 for category 1A, category 1B, and category 2, respectively.

2.5.8.4.1.2 The mixture shall be classified for effects on or via lactation when at least one ingredient has been classified for effects on or via lactation and is present at or above the appropriate generic concentration limit as shown in Table 2.52 for the additional category for effects on or via lactation.

Table 2.52: Generic concentration limits of ingredients of a mixture classified as reproduction toxicants or for effects on or via lactation that trigger classification of the mixture

Ingredient classified as:	Generic concentration limits triggering classification of a mixture as:			
	Category 1A reproductive toxicant	Category 1B reproductive toxicant	Category 2 reproductive toxicant	Additional category for effects on or via lactation
Category 1A reproductive toxicant	≥ 0.3%	-	-	-
Category 1B reproductive toxicant	-	≥ 0.3%	-	-
Category 2 reproductive toxicant	-	-	≥ 3.0%	
Additional category for effects on or via lactation	-	-	-	≥ 0.3%

NOTE
The concentration limits in the table above apply to solids and liquids (w/w units) as well as gases (v/v units).

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2.5.8.4.2 *Classification of mixtures when data are available for the complete mixture*

Classification of mixtures will be based on the available test data for the individual ingredients of the mixture using concentration limits for the ingredients of the mixture. On a case-by-case basis, test data on mixtures may be used for classification when demonstrating effects that have not been established from the evaluation based on the individual components. In such cases, the test results for the mixture as a whole must be shown to be conclusive, taking into account the dosage and other factors such as duration, observations, sensitivity, and statistical analysis of reproduction test systems. Adequate documentation supporting the classification shall be retained and made available for review upon request.

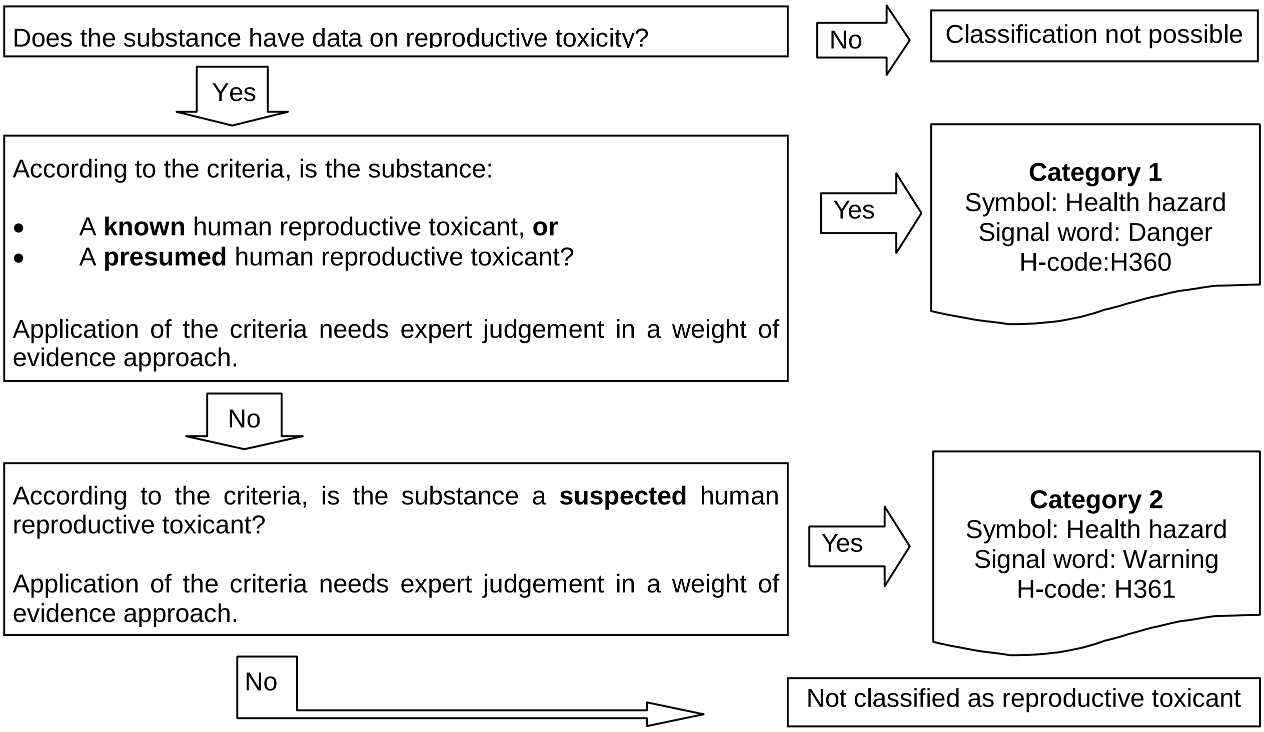
2.5.8.4.3 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

Subject to paragraph 2.5.8.4.2, where the mixture itself has not been tested to determine its reproductive toxicity, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the applicable bridging rules set out in paragraph 2.3.4.2.

2.5.8.5 Decision logic for reproductive toxicity

The decision logic which follows is not part of the harmonized classification system but is provided here as additional guidance. It is strongly recommended that the person responsible for classification study the criteria before and during use of the decision logic.

2.5.8.5.1 *Decision logic (a) for substances*



Does the substance have data on reproductive toxicity?

Classification not possible

According to the criteria, is the substance:

- A **known** human reproductive toxicant, **or**
- A **presumed** human reproductive toxicant?

Application of the criteria needs expert judgement in a weight of evidence approach.

Category 1
Symbol: Health hazard
Signal word: Danger
H-code:H360

According to the criteria, is the substance a **suspected** human reproductive toxicant?

Application of the criteria needs expert judgement in a weight of evidence approach.

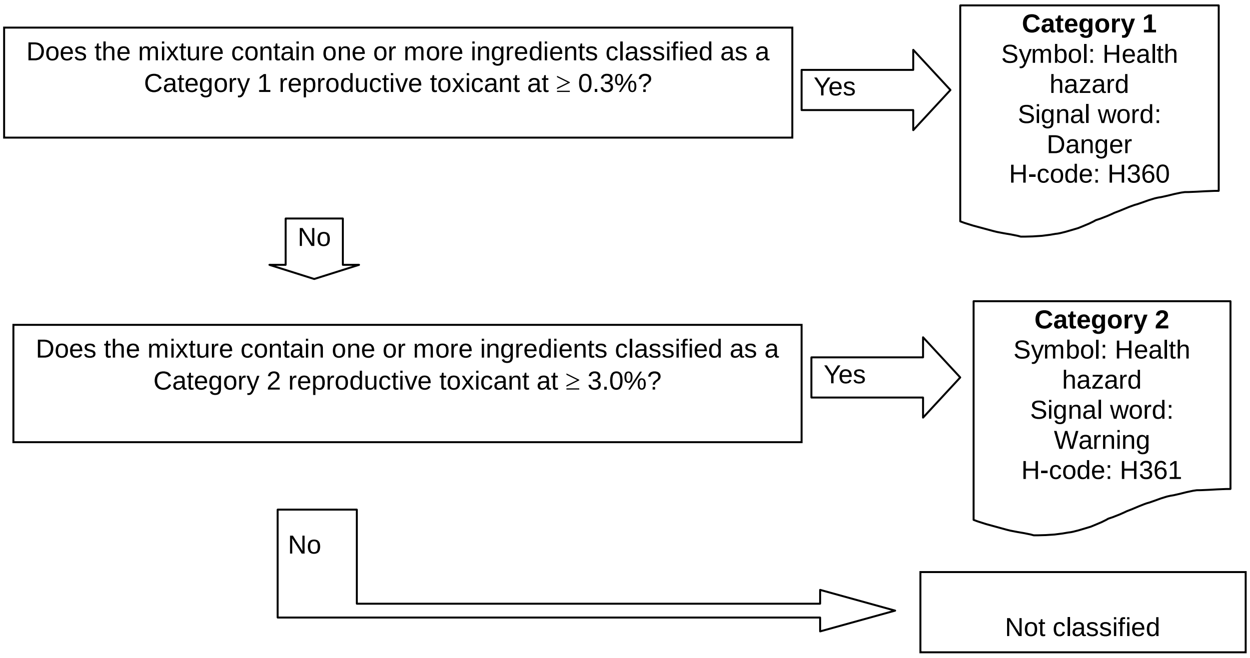
Category 2
Symbol: Health hazard
Signal word: Warning
H-code: H361

Not classified as reproductive toxicant

2.5.8.5.2. *Decision logic (b) for mixtures*

Classification based on individual ingredients of the mixture

Classification of mixtures will be based on available test data for the **individual ingredients** of the mixture, using concentration limits for those ingredients. The classification may be **modified on a case-by-case basis** based on available test data for the mixture as a whole or based on bridging principles. See *Modified classification on a case-by-case basis below*.



Does the mixture contain one or more ingredients classified as a Category 1 reproductive toxicant at ≥ 0.3%?

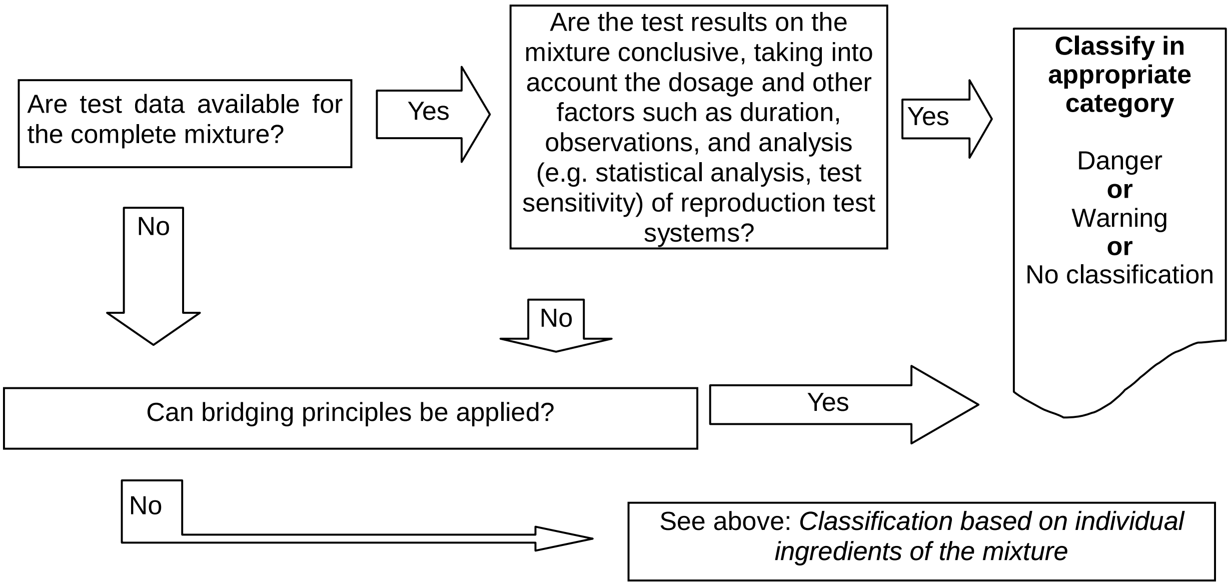
Category 1
Symbol: Health hazard
Signal word: Danger
H-code: H360

Does the mixture contain one or more ingredients classified as a Category 2 reproductive toxicant at ≥ 3.0%?

Category 2
Symbol: Health hazard
Signal word: Warning
H-code: H361

Not classified

Modified classification on a case-by-case basis



Are test data available for the complete mixture?

Are the test results on the mixture conclusive, taking into account the dosage and other factors such as duration, observations, and analysis (e.g. statistical analysis, test sensitivity) of reproduction test systems?

Classify in appropriate category

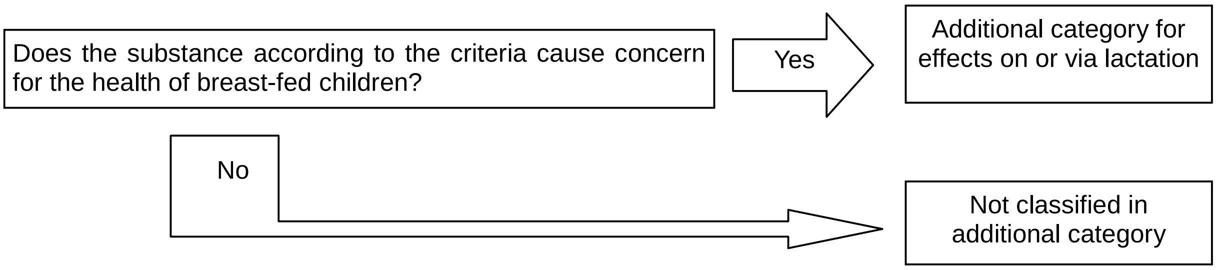
Danger
or
Warning
or
No classification

Can bridging principles be applied?

See above: *Classification based on individual ingredients of the mixture*

2.5.8.5.3 *Decision logic for effects on or via lactation*

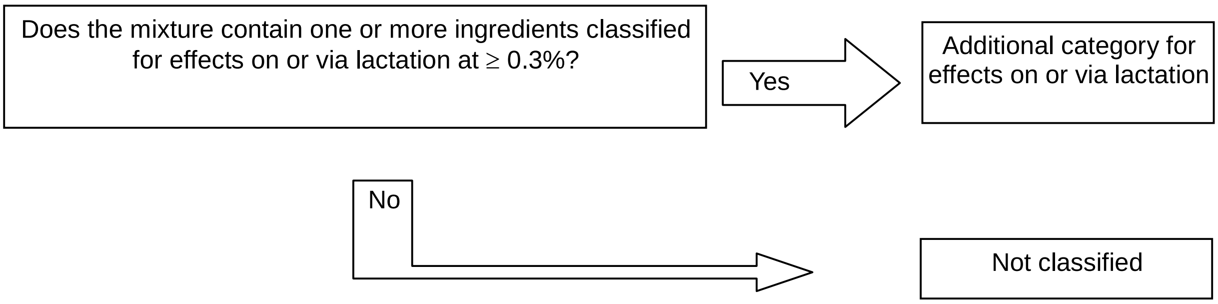
2.5.8.5.3.1 *Decision logic (c) for substances*



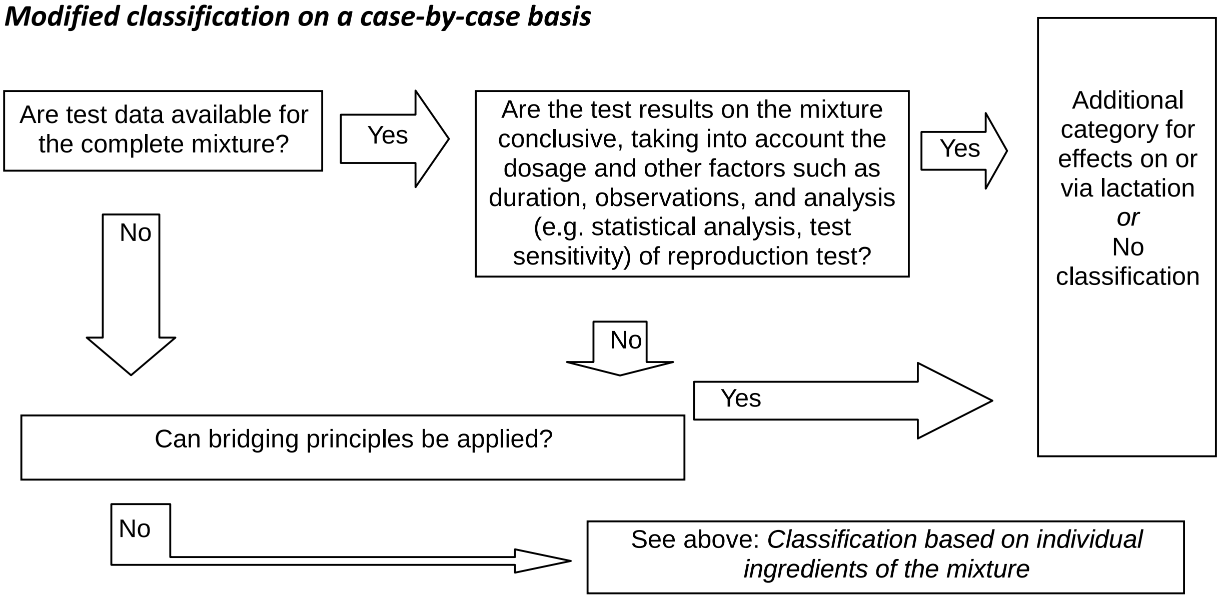
2.5.8.5.3.2 *Decision logic (d) for mixtures*

Classification based on individual ingredients of the mixture

Classification of mixtures will be based on available test data for the **individual ingredients** of the mixture, using concentration limits for those ingredients. The classification may be **modified on a case-by-case basis** based on available test data for the mixture as a whole or based on bridging principles. See *Modified classification on a case-by-case basis below*.



Modified classification on a case-by-case basis



2.5.8.6 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EEC or CPL 1997, the hazard classification may be determined by referring to Table 2.53.

Table 2.53: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1A	Reproductive toxicity category 1; R60,R61
1B	Reproductive toxicity category 2; R60, R61
2	Reproductive toxicity category 3; R62, R63

2.5.8.7 Hazard communication elements

Element	Category 1A	Category 1B	Category 2	Additional category for effects on or via lactation
Hazard pictogram				No hazard pictogram
Signal word	Danger	Danger	Warning	No signal word
H-code: Hazard statement	H360: May damage fertility or the unborn child *(state specific effect, if known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H360: May damage fertility or the unborn child *(state specific effect if, known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H361: Suspected of damaging fertility or the unborn child *(state specific effect, if known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H362: May cause harm to breast-fed children

2.5.9 Specific Target Organ Toxicity – Single Exposure

2.5.9.1 Definition

2.5.9.1.1 Specific target organ toxicity (single exposure) is defined as specific, non-lethal target organ toxicity arising from a single exposure to a substance or mixture. All significant health effects that can impair function, which may be reversible and irreversible, immediate and/or delayed, and not specifically addressed in parts 2.5.1 to 2.5.8 and 2.5.11 are included.

2.5.9.1.2 Classification identifies the substance or mixture as being a specific target organ toxicant and as such, it may present a potential for adverse health effects in people who are exposed to it.

2.5.9.1.3 Specific target organ toxicity can occur by any route that is relevant for humans, i.e. principally oral, dermal or inhalation.

2.5.9.2 Classification criteria for substances

2.5.9.2.1 Substances are classified for immediate or delayed effects separately, by the use of expert judgement on the basis of the weight of all evidence available, including the use of recommended guidance values (refer paragraph 2.5.9.2.7). Substances are then placed in category 1 or 2, depending upon the nature and severity of the effect(s) observed (Table 2.54).

2.5.9.2.2 The relevant route or routes of exposure by which the classified substance produces damage shall be identified.

2.5.9.2.3 Classification is determined by expert judgement, on the basis of the weight of all evidence available, including the guidance presented below.

2.5.9.2.4 Weight of evidence of all data, including human incidents, epidemiology, and studies conducted in experimental animals, is used to substantiate specific target organ toxic effects that merit classification.

2.5.9.2.5 The information required to evaluate specific target organ toxicity comes either from single exposure in humans, such as exposure at home, in the workplace or environmentally, or from studies conducted in experimental animals. The standard animal studies in rats or mice that provide this information are acute toxicity studies which can include clinical observations and detailed macroscopic and microscopic examination to enable the toxic effects on target tissues/organs to be identified. Results of acute toxicity studies conducted in other species may also provide relevant information.

2.5.9.2.6 In exceptional cases, based on expert judgement, it is appropriate to place certain substances with human evidence of target organ toxicity in category 2:

(a) When the weight of human evidence is not sufficiently convincing to warrant category 1 classification; and/or

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(b) Based on the nature and severity of effects.

Dose/concentration levels in humans shall not be considered in the classification and any available evidence from animal studies shall be consistent with the category 2 classification. In other words, if there are also animal data available on the substance that warrant category 1 classification, the substance shall be classified as category 1.

Table 2.54: Categories for specific target organ toxicity – single exposure

Categories	Criteria
Category 1	Substances that have produced significant toxicity in humans or that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to produce significant toxicity in humans following single exposure. Substances are classified in category 1 for specific target organ toxicity (single exposure) on the basis of: (a) Reliable and good quality evidence from human cases or epidemiological studies; or (b) Observations from appropriate studies in experimental animals in which significant and/or severe toxic effects of relevance to human health were produced at generally low exposure concentrations. Guidance dose/concentration values provided in Table 2.55 may be used as part of the weight-of-evidence evaluation.
Category 2	Substances that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to be harmful to human health following a single exposure. Substances are classified in category 2 for specific target organ toxicity (single exposure) on the basis of observations from appropriate studies in experimental animals in which significant toxic effects, of relevance to human health, were produced at generally moderate exposure concentrations. Guidance dose/concentration values in Table 2.55 may be used as guidelines for classification. In exceptional cases, human evidence can also be used to place a substance in category 2 (refer paragraph 2.5.9.2.6).
Category 3	Transient target organ effects This category only includes narcotic effects and respiratory tract irritation. These are target organ effects for which a substance does not meet the criteria to be classified in category 1 or 2 indicated above. These are effects which adversely alter human function for a short duration after exposure and from which humans may recover in a reasonable period without leaving significant alteration to structure or function. Substances are classified specifically for these effects as set out in paragraph 2.5.9.3.
NOTE *Attempts shall be made to determine the primary target organ of toxicity and to classify for that purpose, such as hepatotoxicants, neurotoxicants, etc. The data shall be carefully evaluated and, where possible, secondary effects shall not be included (e.g. a hepatotoxicant can produce secondary effects in the nervous or gastro-intestinal systems).*	

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2.5.9.2.7 Guidance values to assist with classification based on the result obtained from studies conducted in experimental animals for categories 1 and 2.

The guidance value (C) ranges for single-dose exposure which has produced significant non-lethal toxic effects are those applicable to acute toxicity testing, as indicated in Table 2.55.

Table 2.55: Guidance value ranges for single-dose exposures [(a)]

Route of exposure	**Units**	**Guidance value ranges for:**		
		Category 1	**Category 2**	**Category 3**
Oral (rat)	mg/kg body weight	C ≤ 300	2000 ≥ C > 300	Guidance Values do not apply [(b)]
Dermal (rat or rabbit)	mg/kg body weight	C ≤ 1000	2000 ≥ C > 1 000	
Inhalation (rat) gas	ppmV/4 h	C ≤ 2500	20,000 ≥ C > 2 500	
Inhalation (rat) vapour	mg/l/4 h	C ≤ 10	20 ≥ C > 10	
Inhalation (rat) dust/mist/ fume	mg/l/4 h	C ≤ 1.0	5.0 ≥ C > 1.0	

NOTE

(a) The values and ranges given in Table 2.55 are intended for guidance purposes only, i.e. to be used as part of the weight of evidence approach, and to assist with decision about classification. They are not intended as strict demarcation values.

(b) Guidance values are not provided for category 3 substances since this classification is primarily based on human data. Animal data, if available, shall be included in the weight-of-evidence evaluation.

2.5.9.3 Substances of category 3: Transient target organ effects

2.5.9.3.1 *Criteria for respiratory tract irritation*

The criteria for classifying substances as category 3 for respiratory tract irritation are:

(a) Respiratory irritant effects (characterised by localised redness, oedema, pruritis, and/or pain) that impair function with symptoms such as cough, pain, choking, and breathing difficulties are included. This evaluation will be based primarily on human data;

(b) Subjective human observations could be supported by objective measurements of clear respiratory tract irritation (RTI) (such as electrophysiological responses, biomarkers of inflammation in nasal or bronchoalveolar lavage fluids);

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(c) The symptoms observed in humans shall also be typical of those that would be produced in the exposed population rather than being an isolated idiosyncratic reaction or response triggered only in individuals with hypersensitive airways. Ambiguous reports simply of 'irritation' shall be excluded as this term is commonly used to describe a wide range of sensations, including those such as smell, unpleasant taste, a tickling sensation, and dryness, which are outside the scope of classification for respiratory irritation;

(d) There are currently no validated animal tests that deal specifically with RTI. However, useful information may be obtained from the single and repeated inhalation toxicity tests. For example, animal studies may provide useful information in terms of clinical signs of toxicity (dyspnoea, rhinitis, etc.) and histopathology (e.g. hyperemia, edema, minimal inflammation, and thickened mucous layer) which are reversible and may be reflective of the characteristic clinical symptoms described above. Such animal studies can be used as part of the weight-of-evidence evaluation;

(e) This special classification would occur only when more severe organ effects, including in the respiratory system, are not observed.

2.5.9.3.2 *Criteria for narcotic effects*

The criteria for classifying substances as category 3 for narcotic effects are:

(a) Central nervous system depression, including narcotic effects in humans such as drowsiness, narcosis, reduced alertness, loss of reflexes, lack of coordination, and vertigo are included. These effects can also be manifested as severe headache or nausea, and can lead to reduced judgement, dizziness, irritability, fatigue, impaired memory function, deficits in perception and coordination, reaction time, or sleepiness;

(b) Narcotic effects observed in animal studies may include lethargy, lack of coordination, loss of righting reflex, and ataxia. If these effects are not transient in nature, then they shall be considered to support classification for category 1 or 2 specific target organ toxicity of single exposure.

2.5.9.4 Classification criteria for mixtures

Mixtures are classified using the same criteria as for substances, or alternatively, as described below. As with substances, mixtures shall be classified for specific target organ toxicity following single exposure.

2.5.9.4.1 *Classification of mixtures when data are available for the complete mixture*

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture shall be classified by weight-of-evidence evaluation of these data. Care shall be exercised in evaluating data on mixtures, that the dose, duration, observation or analysis does not render the results inconclusive.

2.5.9.4.2 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

Where the mixture itself has not been tested to determine its specific target organ toxicity, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging principles set out in paragraph 2.3.4.2.

2.5.9.4.3 *Classification of mixtures when data are available for all components or only for some components of the mixture*

2.5.9.4.3.1 Where there is no reliable evidence or test data for the specific mixture itself, and the bridging principles cannot be used to enable classification, then classification of the mixture is based on the classification of the ingredient substances. In this case, the mixture shall be classified as a specific target organ toxicant (specific organ specified), following single exposure, when at least one ingredient has been classified as a category 1 or category 2 specific target organ toxicant and is present at or above the appropriate generic concentration limit as mentioned in Table 2.56 for categories 1 and 2, respectively.

2.5.9.4.3.2 These generic concentration limits and consequent classifications shall be applied appropriately to single-dose specific target organ toxicants.

2.5.9.4.3.3 Mixtures shall be classified for either or both single- and repeated-dose toxicity independently.

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Table 2.56: Generic concentration limits of ingredients of a mixture classified as a specific target organ toxicant that trigger classification of the mixture as category 1 or category 2

Ingredient classified as:	Generic concentration limits triggering classification of the mixture as:	
	Category 1	**Category 2**
Category 1 specific target organ toxicant	Concentration ≥ 10%	1.0% ≤ concentration < 10%
Category 2 specific target organ toxicant	-	Concentration ≥ 10%

2.5.9.4.3.4 Care shall be exercised when toxicants affecting more than one organ system are combined that the potentiation or synergistic interactions are considered, because certain substances can cause target organ toxicity at < 1% concentration when other ingredients in the mixture are known to potentiate its toxic effect.

2.5.9.4.3.5 Care shall be exercised when extrapolating toxicity of a mixture that contains category 3 ingredient(s). A generic concentration limit of 20% is appropriate. However, it shall be recognised that this concentration limit may be higher or lower depending on the category 3 ingredient(s) and that some effects, such as respiratory tract irritation, may not occur below a certain concentration while other effects, such as narcotic effects, may occur below this 20% value. Expert judgement shall be exercised.

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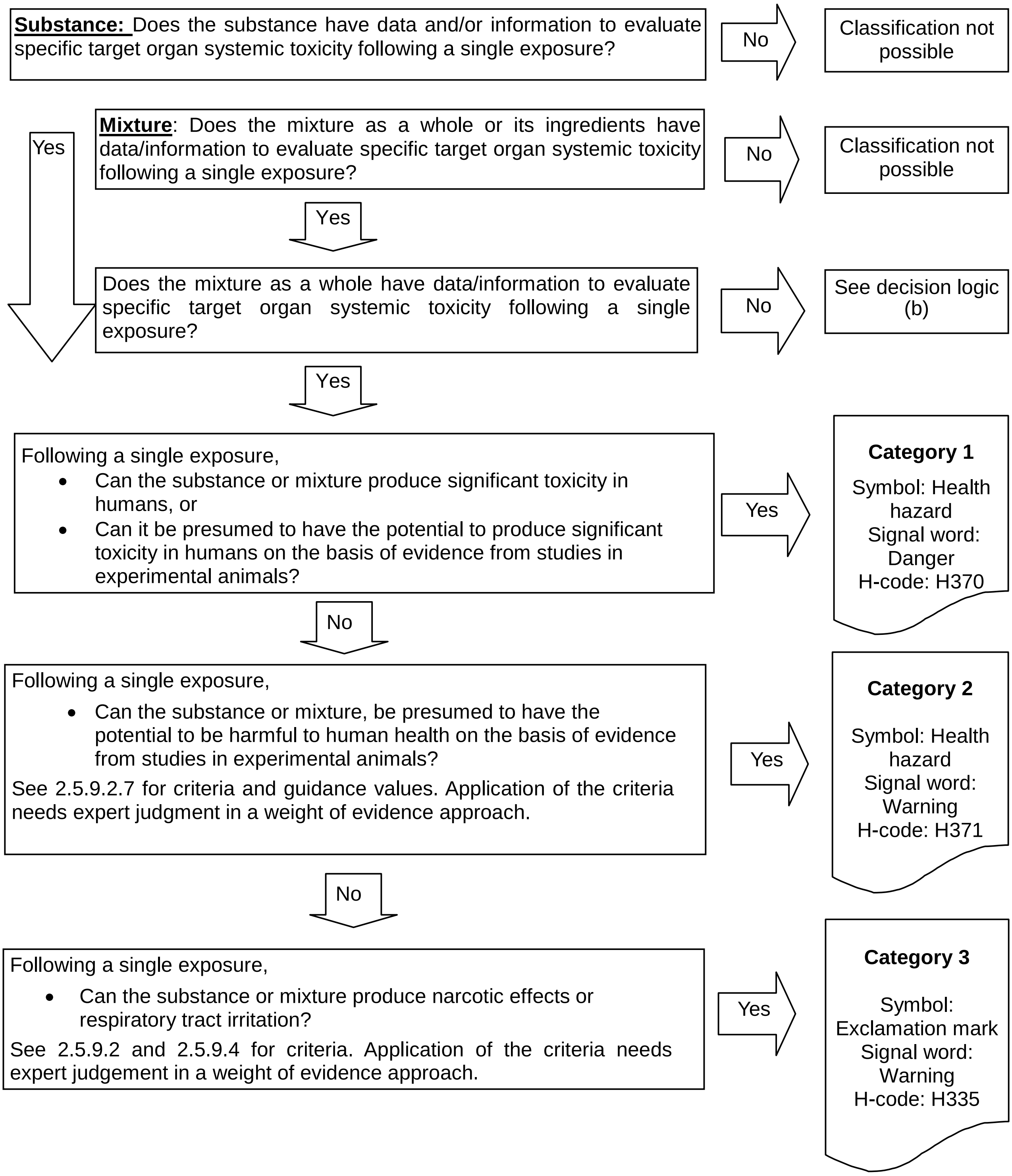
2.5.9.5 Decision logic for specific target organ systemic toxicity from single exposure

The decision logic which follows is not part of the harmonized classification system but is provided here as additional guidance. It is strongly recommended that the person responsible for classification study the criteria before and during use of the decision logic.

2.5.9.5.1 *Decision logic (a)*



Substance: Does the substance have data and/or information to evaluate specific target organ systemic toxicity following a single exposure?

No → Classification not possible

Yes ↓

Mixture: Does the mixture as a whole or its ingredients have data/information to evaluate specific target organ systemic toxicity following a single exposure?

No → Classification not possible

Yes ↓

Does the mixture as a whole have data/information to evaluate specific target organ systemic toxicity following a single exposure?

No → See decision logic (b)

Yes ↓

Following a single exposure,

- Can the substance or mixture produce significant toxicity in humans, or
- Can it be presumed to have the potential to produce significant toxicity in humans on the basis of evidence from studies in experimental animals?

Yes → **Category 1**
Symbol: Health hazard
Signal word: Danger
H-code: H370

No ↓

Following a single exposure,

- Can the substance or mixture, be presumed to have the potential to be harmful to human health on the basis of evidence from studies in experimental animals?

See 2.5.9.2.7 for criteria and guidance values. Application of the criteria needs expert judgment in a weight of evidence approach.

Yes → **Category 2**
Symbol: Health hazard
Signal word: Warning
H-code: H371

No ↓

Following a single exposure,

- Can the substance or mixture produce narcotic effects or respiratory tract irritation?

See 2.5.9.2 and 2.5.9.4 for criteria. Application of the criteria needs expert judgement in a weight of evidence approach.

Yes → **Category 3**
Symbol: Exclamation mark
Signal word: Warning
H-code: H335

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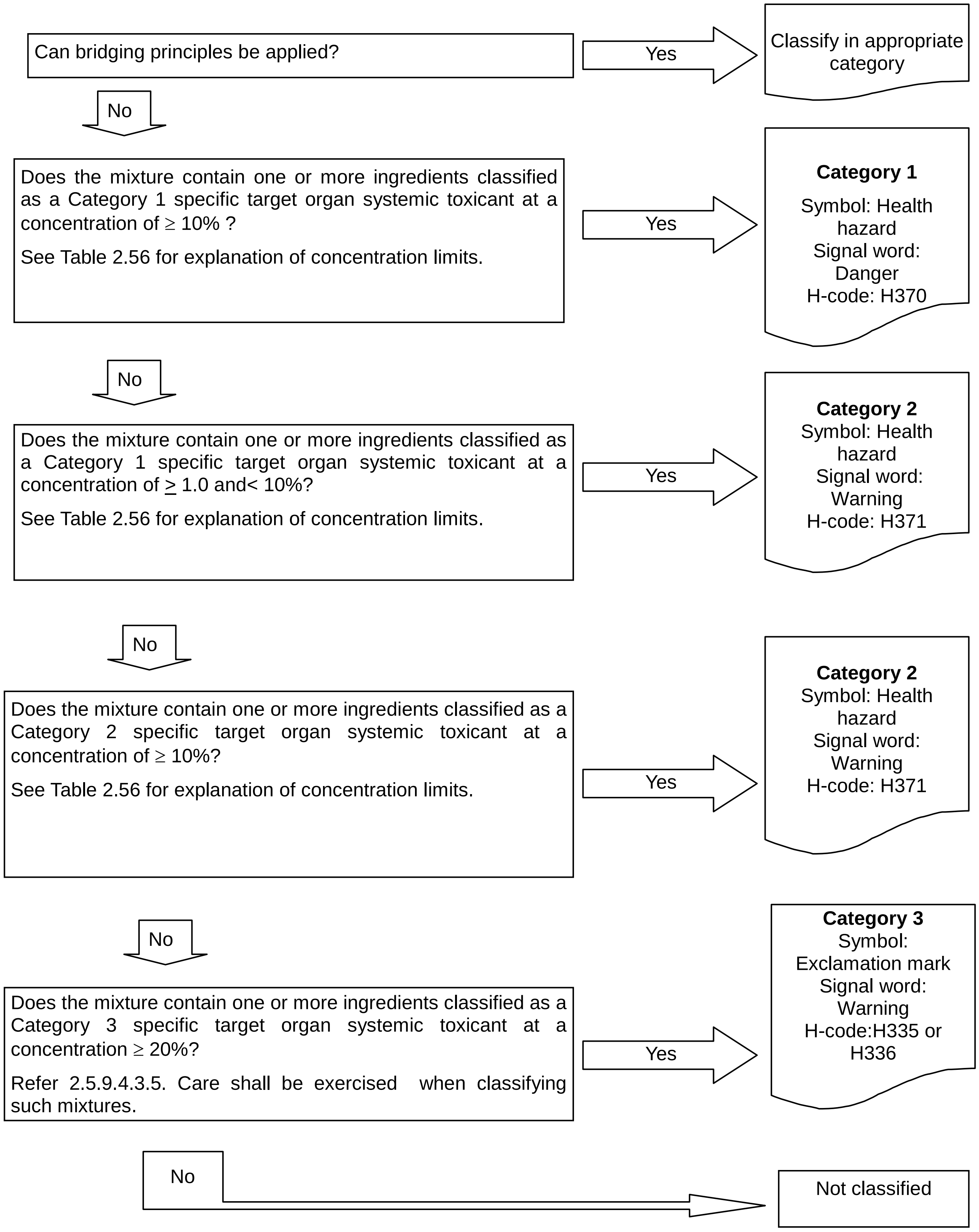
2.5.9.5.2 *Decision logic (b)*



2.5.9.6 Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

If the chemicals have been classified previously under EU Directive 67/548/EEC or CPL 1997, the hazard classification may be determined by referring to Table 2.57.

Table 2.57: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1	R39/23, R39/24, R39/25, R39/26, R39/27, R39/28
2	R68/20, R68/21, R68/22
3	R37, R67

2.5.9.7 Hazard communication elements

Element	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Warning	Warning
H-code: Hazard statement	H370: Causes damage to organs *(or state all organs affected, if known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H371: May cause damage to organs *(or state all organs affected, if known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H335: May cause respiratory irritation *(respiratory tract irritation)* or H336: May cause drowsiness or dizziness *(narcotic effects)*

2.5.10 Specific Target Organ Toxicity – Repeated Exposure

2.5.10.1 Definition

Target organ toxicity (repeated exposure) means specific, target organ toxicity arising from repeated exposure to a substance or mixture. All significant health effects that can impair function, which may be reversible and irreversible, immediate and/or delayed, are included.

2.5.10.2 Classification criteria for substances

2.5.10.2.1 Substances are classified as specific target organ toxicants following repeated exposure by the use of expert judgement on the basis of the weight of all evidence available, including the use of recommended guidance values which take into account the duration of exposure and the dose/concentration which produced the effect(s) (refer paragraph 2.5.10.3). They are placed in one of two categories, depending upon the nature and severity of the effect(s) observed (Table 2.58).

Table 2.58: Categories for specific target organ toxicity-repeated exposure

Categories	Criteria
Category 1	Substances that have produced significant toxicity in humans or that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to produce significant toxicity in humans following repeated exposure. Substances are classified in category 1 for target organ toxicity (repeat exposure) on the basis of: (a) Reliable and good quality evidence from human cases or epidemiological studies; or (b) Observations from appropriate studies in experimental animals in which significant and/or severe toxic effects, of relevance to human health, were produced at generally low exposure concentrations. Guidance dose/concentration values are provided below (see 2.5.10.3) to be used as part of the weight-of-evidence evaluation.
Category 2	Substances that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to be harmful to human health following repeated exposure. Substances are classified in category 2 for target organ toxicity (repeat exposure) on the basis of observations from appropriate studies in experimental animals in which significant toxic effects, of relevance to human health, were produced at generally moderate exposure concentrations. Guidance dose/concentration values are provided below (see 2.5.10.3) in order to help in classification. In exceptional cases, human evidence can also be used to place a substance in category 2 (see 2.5.10.2.5).

NOTE
Attempts shall be made to determine the primary target organ of toxicity and classify for that purpose, such as hepatotoxicants, neurotoxicants, etc. One shall carefully evaluate the data and, where possible, not include secondary effects (a hepatotoxicant can produce secondary effects in the nervous or gastro-intestinal systems).

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2.5.10.2.2 The relevant route or routes of exposure by which the classified substance produces damage shall be identified.

2.5.10.2.3 Classification is determined by expert judgement, on the basis of the weight of all evidence available, including the guidance presented below.

2.5.10.2.4 Weight-of-evidence of all data, including human incidents, epidemiology, and studies conducted in experimental animals, is used to substantiate specific target organ toxic effects that merit classification. This taps the considerable body of industrial toxicology data collected over the years. Evaluation shall be based on all existing data, including peer-reviewed published studies and additional acceptable data.

2.5.10.2.5 In exceptional cases, based on expert judgement, it is appropriate to place certain substances with human evidence of specific target organ toxicity in category 2:

(a) When the weight of human evidence is not sufficiently convincing to warrant category 1 classification; and/or

(b) Based on the nature and severity of effects.

Dose/concentration levels in humans shall not be considered in the classification and any available evidence from animal studies shall be consistent with the category 2 classification. In other words, if there are also animal data available on the substance that warrant category 1 classification, the substance shall be classified as category 1.

2.5.10.3 Guidance values to assist with classification based on the results obtained from studies conducted in experimental animals

2.5.10.3.1 The guidance values refer to effects seen in a standard 90-day toxicity study conducted in rats. They can be used as a basis to extrapolate equivalent guidance values for toxicity studies of greater or lesser duration, using dose/exposure time extrapolation similar to Haber's rule for inhalation, which states essentially that the effective dose is directly proportional to the exposure concentration and the duration of exposure. The assessment shall be done on a case-by-case basis; for a 28-day study the guidance values in Table 2.59 is increased by a factor of three.

2.5.10.3.2 Thus, classification in category 1 is applicable when significant toxic effects observed in a 90-day repeated dose study conducted in experimental animals are seen to occur at or below the guidance values (C) as indicated in Table 2.59.

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Table 2.59: Guidance values to assist in category 1 classification

Route of exposure	Units	Guidance values (dose/concentration)
Oral (rat)	mg/kg body weight/day	C ≤ 10
Dermal (rat or rabbit)	mg/kg body weight/day	C ≤ 20
Inhalation (rat) gas	ppmV/6 h/day	C ≤ 50
Inhalation (rat) vapour	mg/litre/6 h/day	C ≤ 0.2
Inhalation (rat) dust/mist/fume	mg/litre/6 h/day	C ≤ 0.02

2.5.10.3.3 Classification in category 2 is applicable, when significant toxic effects observed in a 90-day repeated-dose study conducted in experimental animals are seen to occur within the guidance value ranges as indicated in Table 2.60.

Table 2.60: Guidance values to assist in category 2 classification

Route of Exposure	Units	Guidance Value Range: (dose/concentration)
Oral (rat)	mg/kg body weight/day	10 < C ≤ 100
Dermal (rat or rabbit)	mg/kg body weight/day	20 < C ≤ 200
Inhalation (rat) gas	ppmV/6 h/day	50 < C ≤ 250
Inhalation (rat) vapour	mg/litre/6 h/day	0.2 < C ≤ 1.0
Inhalation (rat) dust/mist/fume	mg/litre/6 h/day	0.02 < C ≤ 0.2

2.5.10.3.4 The guidance values and ranges mentioned in Table 2.59 and Table 2.60 are intended only for guidance purposes, i.e. to be used as part of the weight-of-evidence approach, and to assist with decisions about classification. They are not intended as strict demarcation values.

2.5.10.4 Other considerations

2.5.10.4.1 When a substance is characterised only by use of animal data (typical of new substances, but also true for many existing substances), the classification process includes reference to dose/concentration guidance values as one of the elements that contribute to the weight of evidence approach.

2.5.10.4.2 When well-substantiated human data are available showing a specific target organ toxic effect that can be reliably attributed to repeated or prolonged exposure to a substance, the substance shall normally be classified. Positive human data, regardless of probable dose, predominates over animal data. Thus, if a substance is unclassified because no specific target organ toxicity was seen at or below the dose/concentration guidance value for animal testing, and if subsequent human incident data become available showing a specific target organ toxic effect, the substance shall be classified.

2.5.10.4.3 A substance that has not been tested for specific target organ toxicity may, where appropriate, be classified on the basis of data from a validated structure activity relationship and expert judgement-based extrapolation from a structural analogue that has previously been classified together with substantial support from consideration of other important factors such as formation of common significant metabolites.

2.5.10.4.4 Saturated vapour concentration shall be considered, where appropriate, as an additional element to provide for specific health and safety protection.

2.5.10.5 Classification criteria for mixtures

Mixtures are classified using the same criteria as for substances, or alternatively, as described below. As with substances, mixtures shall be classified for specific target organ toxicity following repeated exposure.

2.5.10.5.1 *Classification of mixtures when data are available for the complete mixture*

When reliable and good quality evidence from human experience or appropriate studies in experimental animals, as described in the criteria for substances, is available for the mixture, then the mixture shall be classified by weight-of-evidence evaluation of these data. Care shall be exercised in evaluating data on mixtures, that the dose, duration, observation or analysis does not render the results inconclusive.

2.5.10.5.2 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

Where the mixture itself has not been tested to determine its specific target organ toxicity, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazards of the mixture, these data shall be used in accordance with the bridging principles set out in paragraph 2.3.4.2.

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2.5.10.5.3 *Classification of mixtures when data are available for all components or only for some components of the mixture*

2.5.10.5.3.1 Where there is no reliable evidence or test data for the specific mixture itself, and the bridging principles cannot be used to enable classification, then classification of the mixture is based on the classification of the ingredient substances. In this case, the mixture shall be classified as a specific target organ toxicant (specific organ specified), following a single exposure, repeat exposure or both when at least one ingredient has been classified as a category 1 or category 2 specific target organ toxicant and is present at or above the appropriate generic concentration limit as laid out in Table 2.61 for categories 1 and 2 respectively.

Table 2.61: Generic concentration limits of ingredients of a mixture classified as a specific target organ toxicant that trigger classification of the mixture

Ingredient classified as:	**Generic concentration limits triggering classification of the mixture as:**	
	Category 1	**Category 2**
Category 1 **specific target organ toxicant**	Concentration ≥ 10%	1.0% ≤ concentration <10%
Category 2 **specific target organ toxicant**	-	Concentration ≥ 10%

2.5.10.5.3.2 These generic concentration limits and consequent classifications apply to repeated-dose target organ toxicants.

2.5.10.5.3.3 Mixtures shall be classified for either or both single- and repeated-dose toxicity independently.

2.5.10.5.3.4 Care shall be exercised when toxicants affecting more than one organ system are combined that the potentiation or synergistic interactions are considered, because certain substances can cause target organ toxicity at < 1% concentration when other ingredients in the mixture are known to potentiate its toxic effect.

2.5.10.6Decision logic for specific target organ systemic toxicity following repeated exposure

The decision logic which follows is not part of the harmonized classification system but is provided here as additional guidance. It is strongly recommended that the person responsible for classification study the criteria before and during use of the decision logic.

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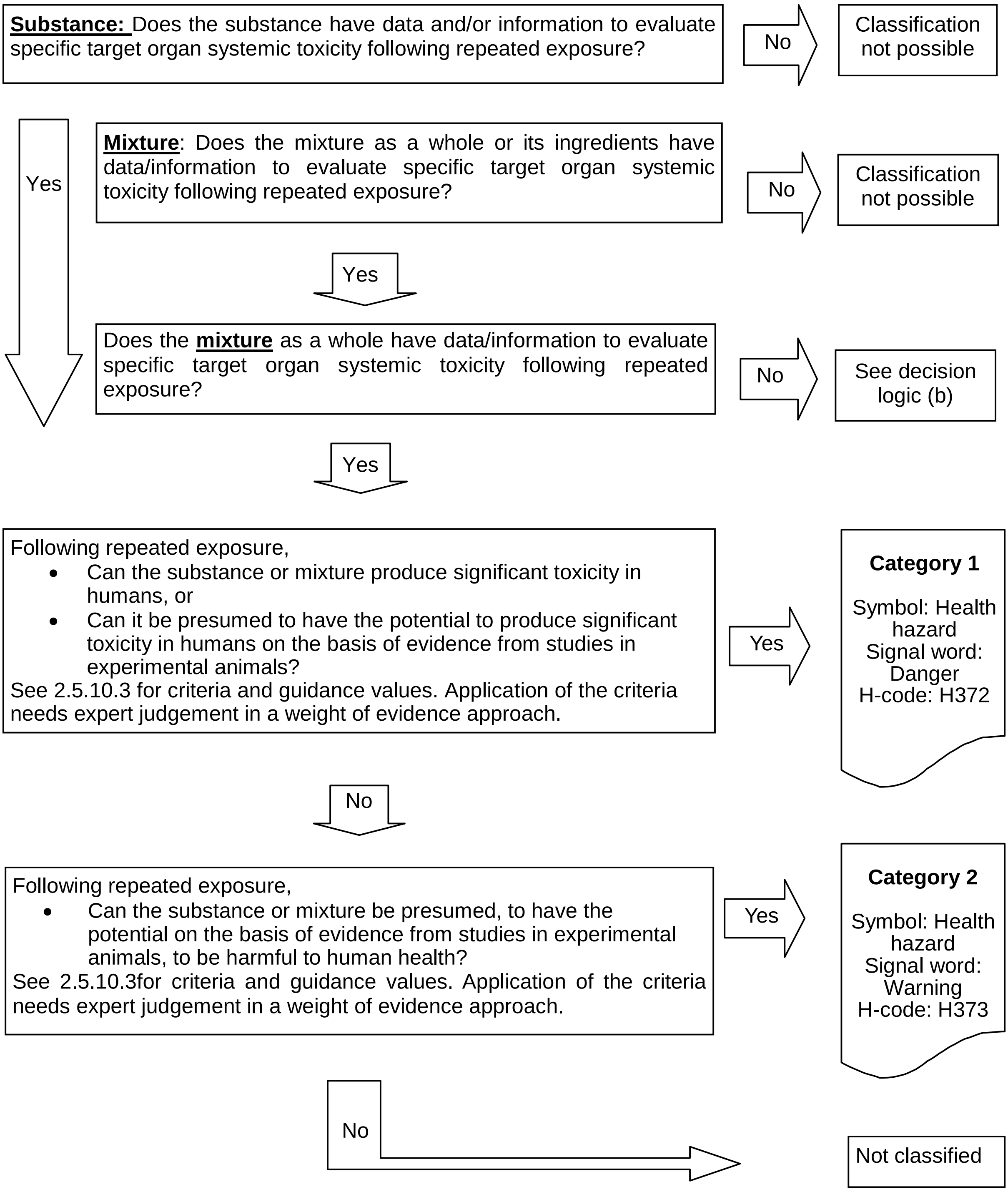
2.5.10.6.1 *Decision logic (a)*



Substance: Does the substance have data and/or information to evaluate specific target organ systemic toxicity following repeated exposure?

Classification not possible

Mixture: Does the mixture as a whole or its ingredients have data/information to evaluate specific target organ systemic toxicity following repeated exposure?

Classification not possible

Does the **mixture** as a whole have data/information to evaluate specific target organ systemic toxicity following repeated exposure?

See decision logic (b)

Following repeated exposure,
- Can the substance or mixture produce significant toxicity in humans, or
- Can it be presumed to have the potential to produce significant toxicity in humans on the basis of evidence from studies in experimental animals?

See 2.5.10.3 for criteria and guidance values. Application of the criteria needs expert judgement in a weight of evidence approach.

Category 1

Symbol: Health hazard
Signal word: Danger
H-code: H372

Following repeated exposure,
- Can the substance or mixture be presumed, to have the potential on the basis of evidence from studies in experimental animals, to be harmful to human health?

See 2.5.10.3for criteria and guidance values. Application of the criteria needs expert judgement in a weight of evidence approach.

Category 2

Symbol: Health hazard
Signal word: Warning
H-code: H373

Not classified

Continued on next page

2.5.10.6.2 *Decision logic (b)*

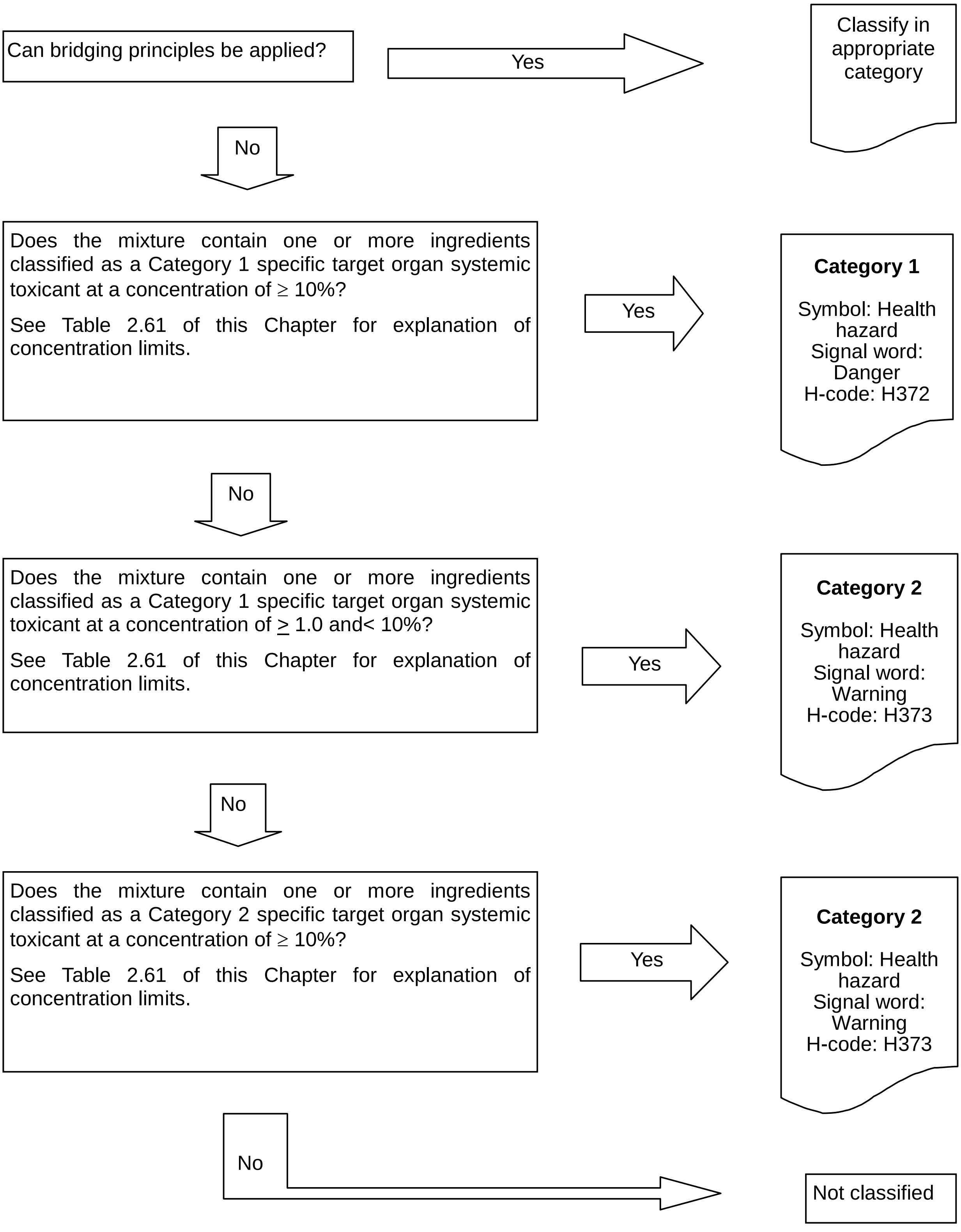


Table 2.61A: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1	R48/23, R48/24, R48/25
2	R48/20, R48/21, R48/22

2.5.10.7 Hazard communication elements

Element	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
H-code: Hazard statement	H372: Causes damage to organs *(state all organs affected, if known)* through prolonged or repeated exposure *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H373: May cause damage to organs *(state all organs affected, if known)* through prolonged or repeated exposure *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*

2.5.11 Aspiration Hazard

2.5.11.1 Definition

2.5.11.1.1 'Aspiration' means the entry of a liquid or solid substance or mixture directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system.

2.5.11.1.2 Aspiration toxicity includes severe acute effects, such as chemical pneumonia, varying degrees of pulmonary injury or death, following aspiration.

2.5.11.2 Specific considerations

2.5.11.2.1 A review of the medical literature on chemical aspiration revealed that some hydrocarbons (petroleum distillates) and certain chlorinated hydrocarbons have been shown to pose an aspiration hazard in humans.

2.5.11.2.2 The classification criteria refer to kinematic viscosity. The following provides the conversion between dynamic and kinematic viscosity:

$$Kinematic\ viscosity\left(\frac{mm^2}{s}\right) = \frac{Dynamic\ viscosity\ (mPa\ s)}{Density\ (g/cm^3)}$$

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2.5.11.3 Classification criteria for substances

Table 2.62: Hazard category for aspiration toxicity

Category	Criteria
Category 1	Substances known to cause human aspiration toxicity hazards or to be regarded as if they cause human aspiration toxicity hazard. A substance is classified in category 1: (a) Based on reliable and good quality human evidence; or (b) If it is a hydrocarbon and has a kinematic viscosity ≤ 20.5 mm^2/s, measured at 40^oC.

NOTE
Substances in category 1 include but are not limited to certain hydrocarbons, turpentine, and pine oil.

2.5.11.4 Classification criteria for mixtures

Classification when data are available for the complete mixture. A mixture is classified in category 1 based on reliable and good quality human evidence.

2.5.11.4.1 Classification when data are not available for the complete mixture: Bridging principles

Where the mixture itself has not been tested to determine its aspiration toxicity, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterise the hazard of the mixture, these data shall be used in accordance with the bridging principles set out in paragraph 2.3.4.2. However, in the case of application of the dilution bridging principle, the concentration of aspiration toxicant(s) shall be 10% or more.

2.5.11.4.2 Classification when data are available for all components or only some components of the mixture

2.5.11.4.2.1 A mixture which contains ≥ 10% of a substance or substances classified in category 1, and has a kinematic viscosity of 20.5 mm^2 /s or less, measured at 40^oC, shall be classified in category 1.

2.5.11.4.2.2 In the case of a mixture which separates into two or more distinct layers, one of which contains ≥ 10% of a substance or substances classified in category 1 and has a kinematic viscosity of ≤ 20.5 mm^2 /s, measured at 40^oC, then the entire mixture is classified in category 1.

2.5.11.5 Decision logic for aspiration toxicity

The decision logic which follows is not part of the harmonized classification system but is provided here as additional guidance. It is strongly recommended that the person responsible for classification study the criteria before and during use of the decision logic.

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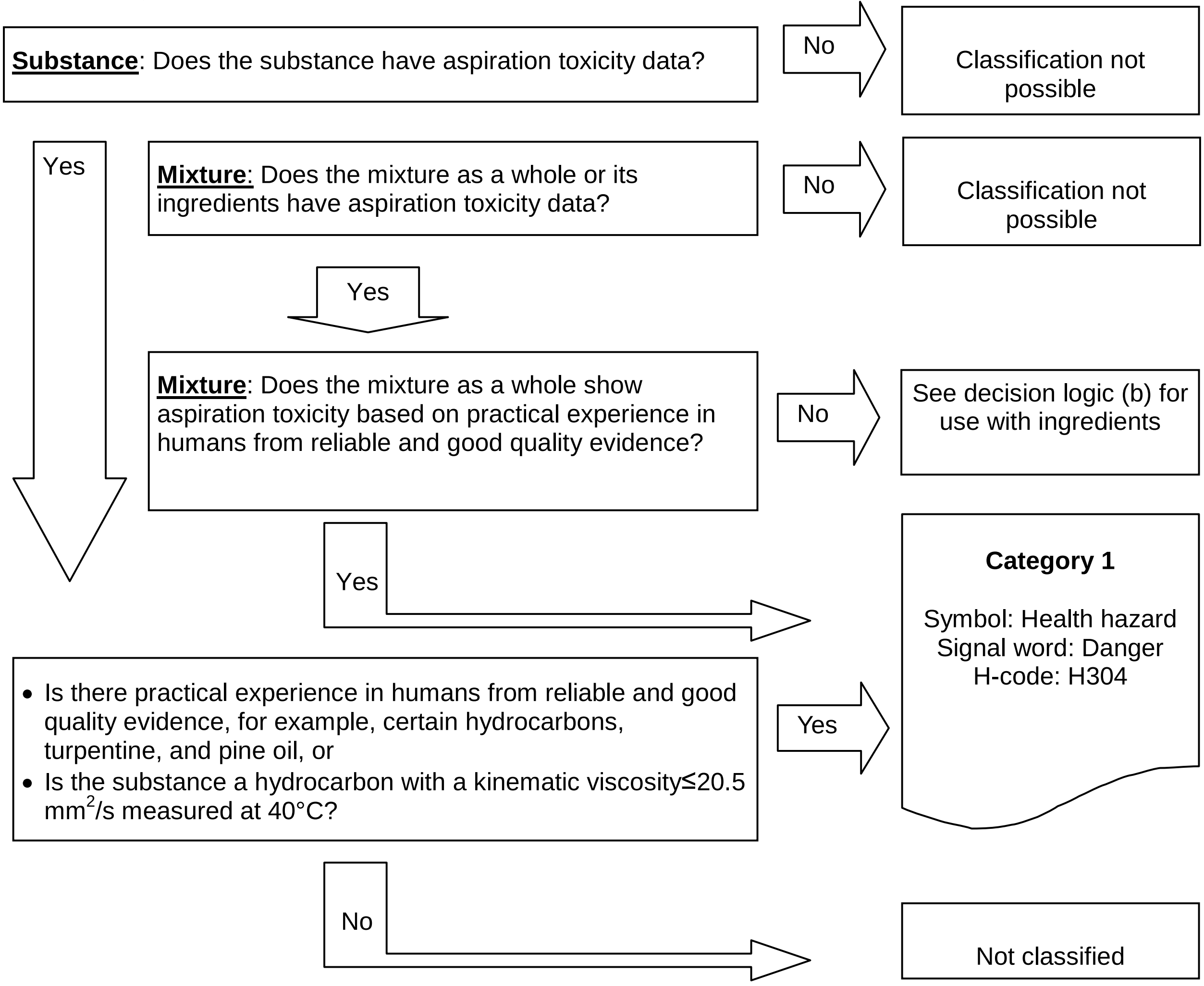
2.5.11.5.1 Decision logic for aspiration toxicity

Decision logic (a)



Decision logic (b) for aspiration toxicity

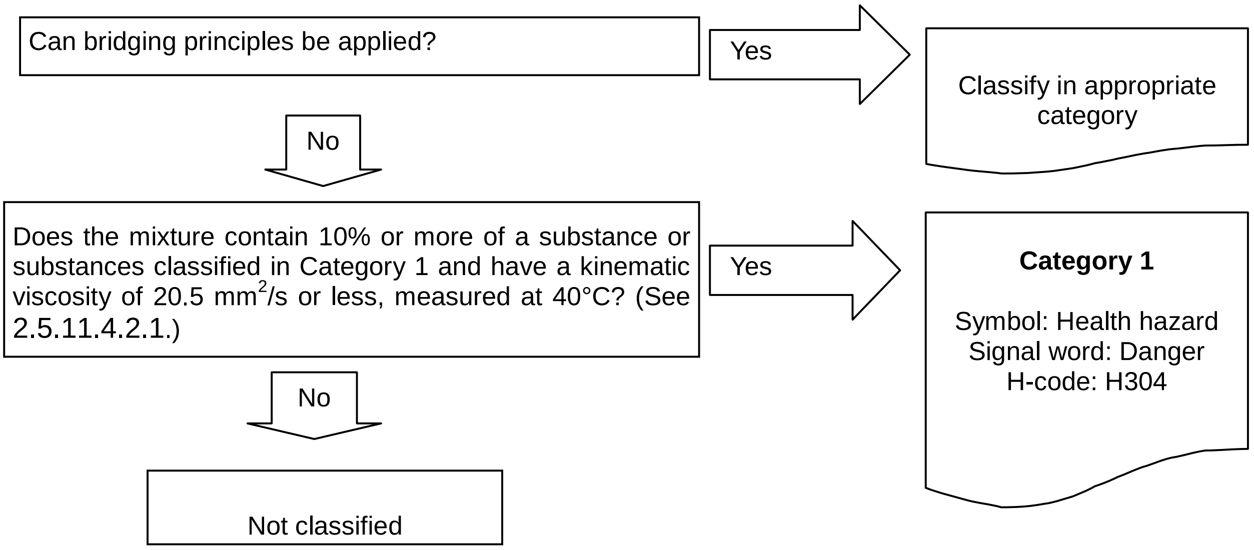


Table 2.62A: Translation from previously classified chemicals under EU Directive 67/548/EEC or CPL 1997

Category	EU Directive/CPL
1	R65

2.5.11.6 Hazard communication elements

Element	Category 1
Hazard pictogram	
Signal word	Danger
H-code: Hazard statement	H304: May be fatal if swallowed and enters airways

2.6 Environmental Hazards

The Regulations has stipulated three hazard classes for environmental hazard, which are:

(a) Hazardous to the aquatic environment – acute hazard;
(b) Hazardous to the aquatic environment – chronic hazard; and
(c) Hazardous to the ozone layer.

2.6.1 Hazardous to the Aquatic Environment

2.6.1.1 Definition

“Acute aquatic toxicity” means the intrinsic property of a substance to be injurious to an organism in a short-term exposure to that substance;

“Acute hazard” means the hazard of a chemical caused by its acute toxicity to an organism during a short-term aquatic exposure to that chemical;

“Availability” of a substance means the extent to which this substance becomes a soluble or a disaggregate species. For metal availability, the extent to which the metal ion portion of a metal (M^o) compound can disaggregate from the rest of the compound (molecule);

“Bioavailability” (or biological availability) means the extent to which a substance is taken up by an organism, and distributed to an area within the organism. It is dependent upon the physico-chemical properties of the substance, anatomy and physiology of the organism, pharmacokinetics, and route of exposure. Availability is not a prerequisite for bioavailability;

“Bioaccumulation” means the net result of uptake, transformation, and elimination of a substance in an organism due to all routes of exposure (i.e. air, water, sediment/soil, and food);

"Bioconcentration" means the net result of uptake, transformation, and elimination of a substance in an organism due to waterborne exposure;

"Chronic aquatic toxicity" means the intrinsic property of a substance to cause adverse effects to aquatic organisms during exposures which are determined in relation to the life-cycle of the organism;

"Chronic hazard" means the hazard of a chemical caused by its chronic toxicity following long-term exposure in the aquatic environment;

"Degradation" means the decomposition of organic molecules to smaller molecules and eventually to carbon dioxide, water, and salts;

"EC_x" means the concentration associated with x% response; and

"NOEC" (No Observed Effect Concentration) means the test concentration immediately below the lowest tested concentration with statistically significant adverse effect. The NOEC has no statistically significant adverse effect compared to the control.

2.6.1.2 Classification criteria for substances

2.6.1.2.1 The core classification system for substances consists of one acute classification category and three chronic classification categories. The acute and the chronic classification categories are applied independently. The criteria for classification of a substance in acute category 1 are defined on the basis of acute aquatic toxicity data only (EC_{50} or LC_{50}). The criteria for classification of a substance into the chronic categories combine two types of information, i.e. acute aquatic toxicity data and environmental fate data (degradability and bioaccumulation data).

2.6.1.2.2 The system also introduces a 'safety net' classification (referred to as chronic category 4) for use when the data available do not allow classification under the formal criteria but there are nevertheless some grounds for concern (refer example in Table 2.63).

2.6.1.2.3 The system for classification recognizes that the core intrinsic hazard to aquatic organisms is represented by both the acute and chronic toxicity of a substance. Separate hazard categories are defined for both properties representing a gradation in the level of hazard identified. The lowest of the available toxicity values shall normally be used to define the appropriate hazard category. There are circumstances, however, when the weight-of-evidence approach is appropriate.

2.6.1.2.4 The principal hazard of a 'hazardous to the aquatic environment' substance is defined by chronic toxicity, although acute toxicity at $L(E)C_{50}$ levels ≤ 1 mg/l are also considered hazardous. The intrinsic properties of a lack of rapid degradability and/or the potential to bioconcentrate in combination with acute toxicity are used to assign a substance to a chronic hazard category.

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2.6.1.2.5 Substances with acute toxicities well below 1 mg/l contribute as components of a mixture to the toxicity of the mixture even at a low concentration and shall normally be given increased weight in applying the summation of classification approach (refer note 1 of Table 2.63 and 2.6.1.3.5.5).

2.6.1.2.6 Acute aquatic toxicity

Acute aquatic toxicity would normally be determined using a fish 96-hour LC_{50} (OECD Test Guideline 203 or equivalent), a crustacean species 48-hour $EC5_{50}$ (OECD Test Guideline 202 or equivalent), and/or an algae species 72- or 96-hour EC_{50} (OECD Test Guideline 201 or equivalent). These species are considered as surrogate for all aquatic organisms and data on other species such as Lemna may also be considered if the test methodology is suitable.

2.6.1.2.7 Chronic aquatic toxicity

Chronic toxicity data are less available than acute data and the range of testing procedures is less standardized. Data generated according to the OECD Test Guidelines 210 (Fish Early Life Stage), or 211 (Daphnia Reproduction) and 201 (Algal Growth Inhibition) can be accepted. Other validated and internationally accepted tests could also be used. The NOECs or other equivalent EC_x shall be used.

2.6.1.2.8 Bioaccumulation potential

The potential for bioaccumulation would normally be determined by using the octanol/water partition coefficient, usually reported as a log K_{ow} determined by OECD Test Guideline 107 or 117. While this represents a potential to bioaccumulate, an experimentally determined Bioconcentration Factor (BCF) provides a better measure and shall be used in preference when available. A BCF shall be determined according to OECD Test Guideline 305.

2.6.1.2.9 Rapid degradability

2.6.1.2.9.1 Environmental degradation may be biotic or abiotic (e.g. hydrolysis) and the criteria used reflect this fact. Ready biodegradation can most easily be defined using the biodegradability tests (A-F) of OECD Test Guideline 301. A pass level in these tests can be considered as indicative of rapid degradation in most environments. These are freshwater tests and thus, the use of the results from OECD Test Guideline 306, which is more suitable for marine environments, has also been included. Where such data are not available, a BOD (5 days)/COD ratio ≥ 0.5 is considered as indicative of rapid degradation.

2.6.1.2.9.2 Abiotic degradation such as hydrolysis, primary degradation, both abiotic and biotic, degradation in non-aquatic media, and proven rapid degradation in the environment may all be considered in defining rapid degradability.

2.6.1.2.10 The criteria for classifying and categorizing substances as ‘hazardous to the aquatic environment’ are summarized in Table 2.63.

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Table 2.63: Categories for substances hazardous to the aquatic environment *(NOTE 1)*

(a) Acute hazard*(NOTE 2)*	
Category 1 96-hr LC_{50} (for fish) 48-hr EC_{50} (for crustacean) 72- or 96-hr ErC_{50} (for algae or other aquatic plants)	 ≤ 1 mg/l and/or ≤ 1 mg/l and/or ≤ 1 mg/l *(NOTE 3)*
(b) Chronic hazard*(NOTE 2)* (i) Non-rapidly degradable substances *(NOTE 4)* for which there are adequate chronic toxicity data available	
Category 1 Chronic NOEC or EC_x (for fish) Chronic NOEC or EC_x (for crustacean) Chronic NOEC or EC_x (for algae or other aquatic plants) Category 2 Chronic NOEC or EC_x (for fish) Chronic NOEC or EC_x (for crustacean) Chronic NOEC or EC_x (for algae or other aquatic plants)	 ≤ 0.1 mg/l and/or ≤ 0.1 mg/l and/or ≤ 0.1 mg/l ≤ 1 mg/l and/or ≤ 1 mg/l and/or ≤ 1 mg/l
(ii) Rapidly degradable substances for which there are adequate chronic toxicity data available	
Category 1 Chronic NOEC or ECx (for fish) Chronic NOEC or ECx (for crustacean) Chronic NOEC or ECx (for algae or other aquatic plants) Category 2 Chronic NOEC or ECx (for fish) Chronic NOEC or ECx (for crustacean) Chronic NOEC or ECx (for algae or other aquatic plants) Category 3 Chronic NOEC or ECx (for fish) Chronic NOEC or ECx (for crustacean) Chronic NOEC or ECx (for algae or other aquatic plants)	 ≤ 0.01 mg/l and/or ≤ 0.01 mg/l and/or ≤ 0.01 mg/l ≤ 0.1 mg/l and/or ≤ 0.1 mg/l and/or ≤ 0.1 mg/l ≤ 1 mg/l and/or ≤ 1 mg/l and/or ≤ 1 mg/l
(iii) Substances for which adequate chronic toxicity data are not available	

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<u>Category 1</u> 96-hr LC_{50} (for fish) 48-hr EC_{50} (for crustacean) 72- or 96-hr ErC_{50} (for algae or other aquatic plants) and the substance is not rapidly degradable and/or the experimentally determined BCF ≥ 500 (or, if absent, the log $K_{ow} \geq 4$). *(NOTES 4 and 5)*	 ≤ 1 mg/l and/or ≤ 1 mg/l and/or ≤ 1 mg/l *(NOTE 3)*
<u>Category 2</u> 96-hr LC_{50} (for fish) 48-hr EC_{50} (for crustacean) 72- or 96-hr ErC_{50} (for algae or other aquatic plants) and the substance is not rapidly degradable and/or the experimentally determined BCF ≥ 500 (or, if absent, the log $K_{ow} \geq 4$). *(NOTES 4 and 5)*	 > 1 but ≤ 10 mg/l and/or > 1 but ≤ 10 mg/l and/or > 1 but ≤ 10 mg/l *(NOTE 3)*
<u>Category 3</u> 96-hr LC_{50} (for fish) 48-hr EC_{50} (for crustacean) 72- or 96-hr ErC_{50} (for algae or other aquatic plants) and the substance is not rapidly degradable and/or the experimentally determined BCF ≥ 500 (or, if absent, the log $K_{ow} \geq 4$). *(NOTES 4 and 5)*	 > 10 but ≤ 100 mg/l and/or > 10 but ≤ 100 mg/l and/or > 10 but ≤ 100 mg/l *(NOTE 3)*
(c) "Safety net" classification <u>Category 4</u> Poorly soluble substances for which no acute toxicity is recorded at levels up to the water solubility, and which are not rapidly degradable and have a log $K_{ow} \geq 4$, indicating a potential to bioaccumulate, will be classified in this category unless other scientific evidence exists showing classification to be unnecessary. Such evidence would include an experimentally determined BCF < 500, or a chronic toxicity NOECs > 1 mg/l, or evidence of rapid degradation in the environment.	

NOTE 1
The organisms of fish, crustacean, and algae are tested as surrogate species covering a range of trophic levels and taxa, and the test methods are highly standardized. Data on other organisms may also be considered, however, provided they represent equivalent species and test endpoints.

NOTE 2
When classifying substances as acute category 1 and/or chronic category 1, it is necessary at the same time to indicate an appropriate M factor to apply the summation method.

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NOTE 3

Where the algal toxicity ErC_{50} [= EC_{50} (growth rate)] falls more than 100 times below the next most sensitive species and results in a classification based solely on this effect, consideration shall be given to whether this toxicity is representative of the toxicity to aquatic plants. Where it can be shown that this is not the case, professional judgement shall be used in deciding if classification shall be applied. Classification shall be based on the ErC_{50}. In circumstances where the basis of the EC_{50} is not specified and no ErC_{50} is recorded, classification shall be based on the lowest EC_{50} available.

NOTE 4

Lack of rapid degradability is based on either a lack of ready biodegradability or other evidence of lack of rapid degradation. When no useful data on degradability are available, either experimentally determined or estimated data, the substance shall be regarded as not rapidly degradable.

NOTE 5

Potential to bioaccumulate, based on an experimentally derived BCF ≥ 500 or, if absent, a log $K_{ow} \geq 4$, provided log K_{ow} is an appropriate descriptor for the bioaccumulation potential of the substance. Measured log K_{ow} values take precedence over estimated values and measured BCF values take precedence over log K_{ow} values.

2.6.1.3 Classification criteria for mixtures

2.6.1.3.1 The classification system for mixtures covers all classification categories which are used for substances, i.e. acute category 1 and chronic categories 1 to 4. In order to make use of all available data for purposes of classifying the aquatic environmental hazards of the mixture, the following is applied where appropriate:

The 'relevant components' of a mixture are those which are classified as 'acute category 1' or 'chronic category 1' and present in a concentration of 0.1% (w/w) or greater, and those which are classified as 'chronic category 2', 'chronic category 3' or 'chronic category 4' and present in a concentration of 1% (w/w) or greater, unless there is a presumption (such as in the case of highly toxic components (see 2.6.1.3.5.5.5)) that a component present in a lower concentration can still be relevant for classifying the mixture for aquatic environmental hazards. Generally, for substances classified as 'acute category 1' or 'chronic category 1', the concentration to be taken into account is (0.1/M)%.

2.6.1.3.2 The approach for classification of aquatic environmental hazards is tiered, and is dependent upon the type of information available for the mixture itself and for its components. Figure 2.14 outlines the process to be followed. Elements of the tiered approach include:

(a) Classification based on tested mixtures;
(b) Classification based on bridging principles; and
(c) The use of 'summation of classified components' and/or 'additivity formula'.

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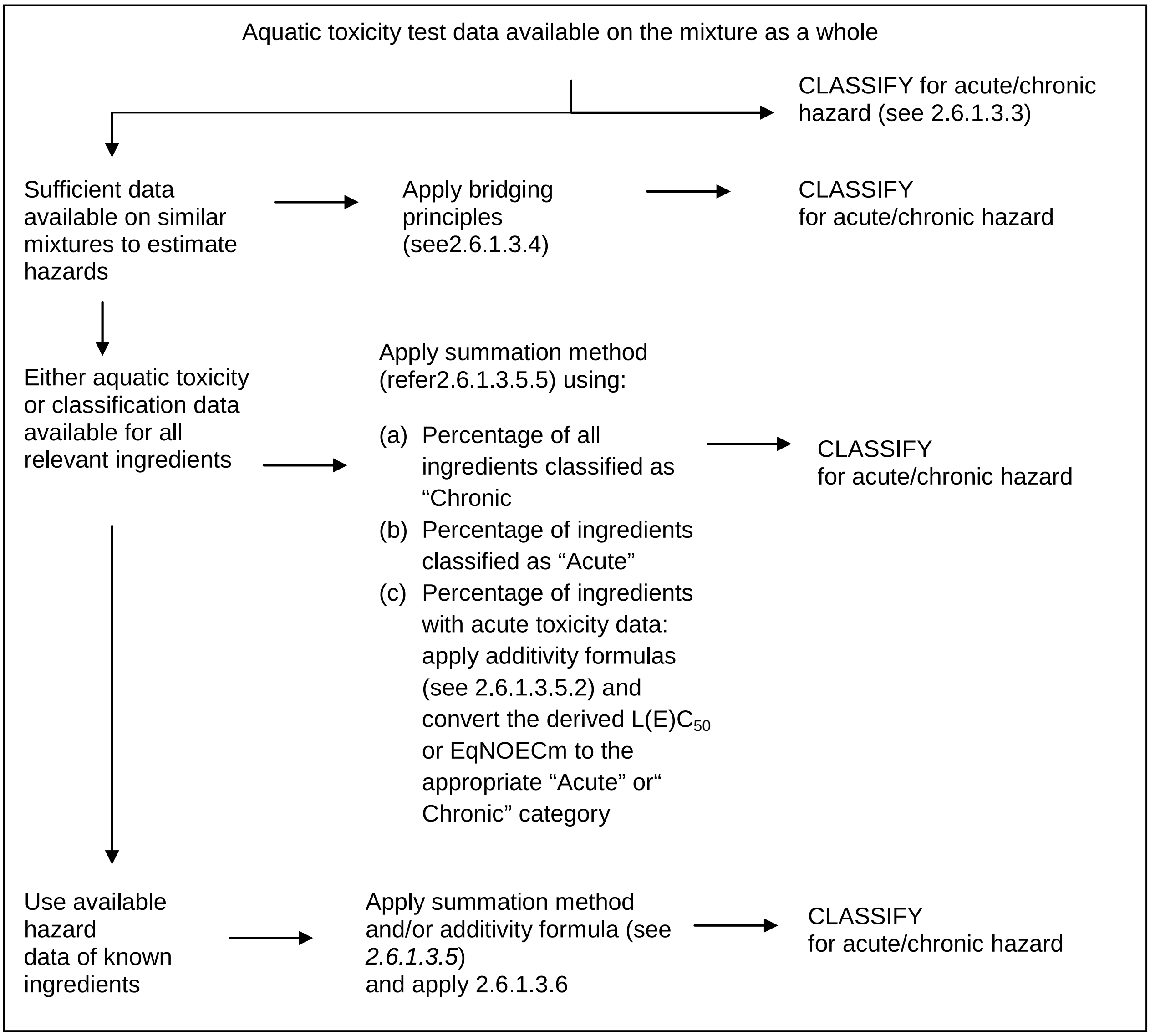
Figure 2.14: Tiered approach to classification of mixtures for acute and chronic aquatic environmental hazards



2.6.1.3.3 *Classification of mixtures when data are available for the complete mixture*

2.6.1.3.3.1 When the mixture as a whole has been tested to determine its aquatic toxicity, it is classified according to the criteria that have been agreed for substances, but only for acute hazard. The classification is normally based on the data for fish, crustacean, and algae/plants. Classification of mixtures by using LC_{50} or EC_{50} data for the mixture as a whole is not possible for chronic categories since both toxicity data and environmental fate data are needed, and there are no degradability and bioaccumulation data for mixtures as a whole. It is not possible to apply the criteria for chronic classification because the data from degradability and bioaccumulation tests of mixtures cannot be interpreted; they are meaningful only for single substances.

2.6.1.3.3.2 When there is acute toxicity test data (LC_{50} or EC_{50}) available for the mixture as a whole, these data as well as information with respect to the classification of components for chronic hazard shall be used to complete the classification for tested mixtures as follows. When chronic toxicity data (NOEC) is also available, this shall be used too.

2.6.1.3.3.3 *Classification for acute hazard*

(a) When there are adequate acute toxicity test data (LC_{50} or EC_{50}) available for the mixture as a whole showing $L(E)C_{50} \leq 1$ mg/l:

Classify the mixture in accordance with Table 2.63 (a).

(b) When there are acute toxicity test data (LC_{50} (s) or EC_{50} (s) available for the mixture as a whole showing $L(E)C_{50}$ (s) >1 mg/l, the mixture is not classified as acute hazard.

2.6.1.3.3.4 *Classification for chronic hazard*

(a) When there are adequate chronic toxicity data (EC_x or NOEC) available for the mixture as a whole showing EC_x or NOEC of the tested mixture ≤ 1mg/l:

(i) Classify the mixture as chronic category 1, 2, or 3 in accordance with Table 2.63 (b)(ii) (rapidly degradable) if the available information allows the conclusion that all relevant ingredients of the mixture are rapidly degradable; or

(ii) Classify the mixture as chronic category 1, 2, or 3 in accordance with Table 2.63 (b)(i) (non-rapidly degradable);

(b) When there are adequate chronic toxicity data (EC_x or NOEC) available for the mixture as a whole showing EC_x(s) or NOEC(s) of the tested mixture > 1 mg/l or above the water solubility:

No need to classify for chronic hazard, unless there are reasons for concern.

2.6.1.3.3.5 *Classification for chronic category 4*

If there are reasons for concern:

Classify the mixture as chronic category 4 (safety net classification) in accordance with Table 2.63 (c).

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2.6.1.3.4 *Classification of mixtures when data are not available for the complete mixture: Bridging principles*

2.6.1.3.4.1 Where the mixture itself has not been tested to determine its aquatic environmental hazard, but there are sufficient data on the individual ingredients and similar tested mixtures to adequately characterize the hazards of the mixture, this data will be used in accordance with the following agreed bridging principles. This ensures that the classification process uses the available data to the greatest extent possible in characterizing the hazards of the mixture without the necessity for additional testing in animals.

2.6.1.3.4.2 Dilution

Where a new mixture is formed by diluting a tested mixture or a substance with a diluent which has an equivalent or lower aquatic hazard classification than the least toxic original ingredient and which is not expected to affect the aquatic hazards of other ingredients, then the resulting mixture may be classified as equivalent to the original tested mixture or substance. Alternatively, the method explained in 2.6.1.3.5 could be applied.

2.6.1.3.4.3 Batching

The aquatic hazard classification of a tested production batch of a mixture can be assumed to be substantially equivalent to that of another untested production batch of the same commercial product when produced by or under the control of the same manufacturer, unless there is reason to believe there is significant variation such that the aquatic hazard classification of the untested batch has changed. If the latter occurs, a new classification is necessary.

2.6.1.3.4.4 Concentration of mixtures which are classified with the most severe classification categories (chronic category 1 and acute category 1)

If a tested mixture is classified as chronic category 1 and/or acute category 1, and the ingredients of the mixture which are classified as chronic 1 and/or acute 1 are further concentrated, the more concentrated untested mixture shall be classified with the same classification category as the original tested mixture without additional testing.

2.6.1.3.4.5 Interpolation within one toxicity category

For three mixtures (A, B, and C) with identical ingredients, where mixtures A and B have been tested and are in the same toxicity category and where untested mixture C has the same toxicologically active ingredients as mixtures A and B but has concentrations of toxicologically active ingredients intermediate to the concentrations in mixtures A and B, then mixture C is assumed to be in the same toxicity category as A and B.

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2.6.1.3.4.6 Substantially similar mixtures

Given the following:

(a) Two mixtures: (i) A+B;
(ii) C+B;

(b) The concentration of ingredient B is essentially the same in both mixtures;

(c) The concentration of ingredient A in mixture (i) equals that of ingredient C in mixture (ii);

(d) Data on aquatic hazards for A and C are available and are substantially equivalent, i.e. they are in the same hazard category and are not expected to affect the aquatic toxicity of B.

If mixture (i) or (ii) is already classified based on test data, then the other mixture can be assigned the same hazard category.

2.6.1.3.5 Classification of mixtures when toxicity data are available for all ingredients or only for some ingredients of the mixture

2.6.1.3.5.1 The classification of a mixture is based on the summation of the classification of its components. The percentage of components classified as 'acute' or 'chronic' is fed straight in to the summation method. Details of the summation method are described in 2.6.1.3.5.5.

2.6.1.3.5.2 Mixtures can be made of a combination of both ingredients that are classified (as acute category 1 and/or chronic category 1, 2, 3, 4) and those for which adequate toxicity test data is available. When adequate toxicity data are available for more than one ingredient in the mixture, the combined toxicity of those ingredients may be calculated using the following additivity formulas (a) or (b), depending on the nature of the toxicity data:

(a) $$\frac{\sum \mathrm{Ci}}{\mathrm{L(E)C}_{50_\mathrm{m}}} = \sum_{n} \frac{\mathrm{Ci}}{\mathrm{L(E)C}_{50_i}}$$

where:

Ci = *concentration of component i (weight percentage)*

$L(E)C_{50i}$ = *(mg/l)* LC_{50} *or* EC_{50} *for component i*

n = *number of components*

$L(E)C_{50m}$ = $L(E)\ C_{50}$ *of the part of the mixture with test data*

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The calculated toxicity may be used to assign that portion of the mixture an acute hazard category which is then subsequently used in applying the summation method;

(b) $$\frac{\sum \mathrm{Ci} + \sum \mathrm{Cj}}{\mathrm{EqNOEC}_{\mathrm{m}}} = \sum_{n} \frac{\mathrm{Ci}}{\mathrm{NOEC}_{\mathrm{i}}} + \sum_{n} \frac{\mathrm{Cj}}{0.1\mathrm{xNOECj}}$$

where:

C_i = *concentration of ingredient i (weight percentage) covering the rapidly degradable ingredients*

C_j = *concentration of ingredient j (weight percentage) covering the non-rapidly degradable ingredients*

$NOEC_i$ = *NOEC (or other recognized measures for chronic toxicity) for ingredient i covering the rapidly degradable ingredients, in mg/l*

$NOEC_j$ = *NOEC (or other recognized measures for chronic toxicity) for ingredient j covering the non-rapidly degradable ingredients, in mg/l*

n = *number of ingredients, and i and j are running from 1 to n*

$EqNOEC_m$ = *Equivalent NOEC of the part of the mixture with test data*

The equivalent toxicity thus reflects the fact that non-rapidly degrading substances are classified one hazard category level more "severe" than rapidly degrading substances.

The calculated equivalent toxicity may be used to assign that portion of the mixture a chronic hazard category, in accordance with the criteria for rapidly degradable substances (Table 2.63 (b)(ii)), which is then subsequently used in applying the summation method.

2.6.1.3.5.3 When applying the additivity formula for part of the mixture, it is preferable to calculate the toxicity of this part of the mixture using for each substance toxicity values that relate to the same taxonomic group (i.e. fish, daphnia, algae or equivalent) and then to use the highest toxicity (lowest value) obtained (i.e. use the most sensitive of the three taxonomic groups). However, when toxicity data for each component are not available in the same taxonomic group, the toxicity value of each component is selected in the same manner that toxicity values are selected for the classification of substances, i.e. the higher toxicity (from the most sensitive test organism) is used. The calculated acute and chronic toxicity is then used to classify this part of the mixture as acute category 1 and/or chronic category 1, 2 or 3 using the same criteria described for substances.

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2.6.1.3.5.4 If a mixture is classified in more than one way, the method yielding the more conservative result shall be used.

2.6.1.3.5.5 Summation method

2.6.1.3.5.5.1 In the case of the ingredient classification categories of chronic category 1 to chronic category 3, the underlying toxicity criteria from one category to another differ by a factor of 10. Ingredients with a classification in a high toxicity band may therefore contribute to the classification of a mixture in a lower band. The calculation of these classification categories therefore needs to consider the contribution of all ingredients classified under chronic category 1 to chronic category 3 together.

2.6.1.3.5.5.2 When a mixture contains ingredients classified as acute category 1 or chronic category 1, attention shall be paid to the fact that such ingredients, when their acute toxicity is well below 1 mg/l and/or chronic toxicity is well below 0.1 mg/l (if non-rapidly degradable) and 0.01 mg/l (if rapidly degradable) contribute to the toxicity of the mixture even at a low concentration. Active ingredients in pesticides, as well as in some other substances like organometallic compounds often possess such high aquatic toxicity. Under these circumstances the application of the normal /concentration limits may lead to an “under-classification” of the mixture. Therefore, multiplying factors shall be applied to account for highly toxic ingredients.

2.6.1.3.5.5.3 *Classification procedure*

In general, a more severe classification for mixtures overrides a less severe classification, e.g. a classification for chronic toxicity with chronic category 1 overrides a classification with chronic category 2. As a consequence, in this example, the classification procedure is already completed if the result of the classification is chronic category 1. A more severe classification than chronic Category 1 is not possible. Therefore, it is not necessary to undergo further classification procedure.

2.6.1.3.5.5.4 *Classification for acute category 1*

2.6.1.3.5.5.4.1 First, all components classified as acute category 1 is considered. If the sum of these components is ≥ 25%, the whole mixture is classified as acute category 1.

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2.6.1.3.5.5.4.2 The classification of mixtures for acute hazards, based on this summation of classified components, is summarized in Table 2.64.

Table 2.64: Classification of a mixture for acute hazards, based on summation of classified components

Sum of components classified as:	Mixture is classified as:
Acute category 1 × M [(a)]≥ 25%	Acute category 1
[(a)] For explanation of the M-factor, see 2.6.1.3.5.5.5.	

2.6.1.3.5.5.5 *Classification for chronic categories 1, 2, 3 and 4*

2.6.1.3.5.5.5.1 First, all components classified as chronic category 1 is considered. If the sum of these components multiplied by their corresponding M-factors is ≥ 25% the mixture is classified as chronic category 1. If the result of the calculation is a classification of the mixture as chronic category 1 the classification process is completed.

2.6.1.3.5.5.5.2 In cases where the mixture is not classified as chronic category 1, classification of the mixture as chronic category 2 is considered. A mixture is classified as chronic category 2 if 10 times the sum of all components classified as chronic category 1 multiplied by their corresponding M-factors plus the sum of all components classified as chronic category 2 is ≥ 25%. If the result of the calculation is a classification of the mixture as chronic category 2, the classification process is completed.

2.6.1.3.5.5.5.3 In cases where the mixture is not classified either as chronic category 1 or chronic category 2, classification of the mixture as chronic category 3 is considered. A mixture is classified as chronic category 3 if 100 times the sum of all components classified as chronic category 1 multiplied by their corresponding M-factors plus 10 times the sum of all components classified as chronic category 2 plus the sum of all components classified as chronic category 3 is ≥ 25%.

2.6.1.3.5.5.5.4 If the mixture is still not classified in chronic category 1, 2, or 3, classification of the mixture as chronic category 4 shall be considered. A mixture is classified as chronic category 4 if the sum of the percentages of components classified as chronic category 1, 2, 3, and 4 is ≥ 25%.

2.6.1.3.5.5.5.5 The classification of mixtures for chronic hazards, based on this summation of classified components, is summarized in Table 2.65.

Table 2.65: Classification of a mixture for chronic hazards, based on summation of classified components

Sum of components classified as:	**Mixture is classified as:**
Chronic category 1 × M (a)≥ 25%	Chronic category 1
(M × 10 × chronic category 1) + chronic category 2 ≥ 25%	Chronic category 2
(M × 100 × chronic category 1) + (10 × chronic category 2) + chronic category 3 ≥ 25%	Chronic category 3
Chronic category 1 + chronic category 2 + chronic category 3 + chronic category 4 ≥ 25%	Chronic category 4
(a) For explanation of the M-factor, see 2.6.1.3.5.5.5.	

2.6.1.3.5.5.6 *Mixtures with highly toxic ingredients*

Acute category 1 or chronic category 1 ingredients with acute toxicities well below 1 mg/l and/or chronic toxicities well below 0.1 mg/l (if non-rapidly degradable) and 0.01 mg/l (if rapidly degradable) may influence the toxicity of the mixture and shall be given increased weight in applying the summation method. When a mixture contains ingredients classified as acute or chronic category 1, the tiered approach described in 2.6.1.3.5.5.4 and 2.6.1.3.5.5.5 shall be applied using a weighted sum by multiplying the concentrations of acute category 1 and chronic category 1 ingredients by a factor, instead of merely adding up the percentages.

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This means that the concentration of “acute category 1” in the left column of Table 2.64 and the concentration of “chronic category 1” in the left column of Table 2.65 are multiplied by the appropriate multiplying factor. The multiplying factors to be applied to these ingredients are defined using the toxicity value, as summarized in Table 2.66. Therefore, in order to classify a mixture containing acute/chronic category 1 ingredients, the classifier needs to be informed of the value of the M-factor in order to apply the summation method. Alternatively, the additivity formula (see 2.6.1.3.5.2) may be used when toxicity data are available for all highly toxic ingredients in the mixture and there is convincing evidence that all other ingredients, including those for which specific acute and/or chronic toxicity data are not available, are of low or no toxicity and do not significantly contribute to the environmental hazard of the mixture.

Table 2.66: Multiplying factors for highly toxic components of mixtures

Acute toxicity	**M-factor**	**Chronic toxicity**	**M-factor**	
L(E)C$_{50}$ value		**NOEC value**	**NRD[a] ingredients**	**RD[b] ingredients**
$0.1 < L(E)\ C_{50} \leq 1$	1	$0.01 < NOEC \leq 0.1$	1	-
$0.01 < L(E)\ C_{50} \leq 0.1$	10	$0.001 < NOEC \leq 0.01$	10	1
$0.001 < L(E)\ C_{50} \leq 0.01$	100	$0.0001 < NOEC \leq 0.001$	100	10
$0.0001 < L(E)\ C_{50} \leq 0.001$	1000	$0.00001 < NOEC \leq 0.0001$	1000	100
$0.00001 < L(E)\ C_{50} \leq 0.0001$	10000	$0.000001 < NOEC \leq 0.00001$	10000	1000
(continue in factor 10 intervals)		(continue in factor 10 intervals)		

[a] Non-rapidly degradable
[b] Rapidly degradable

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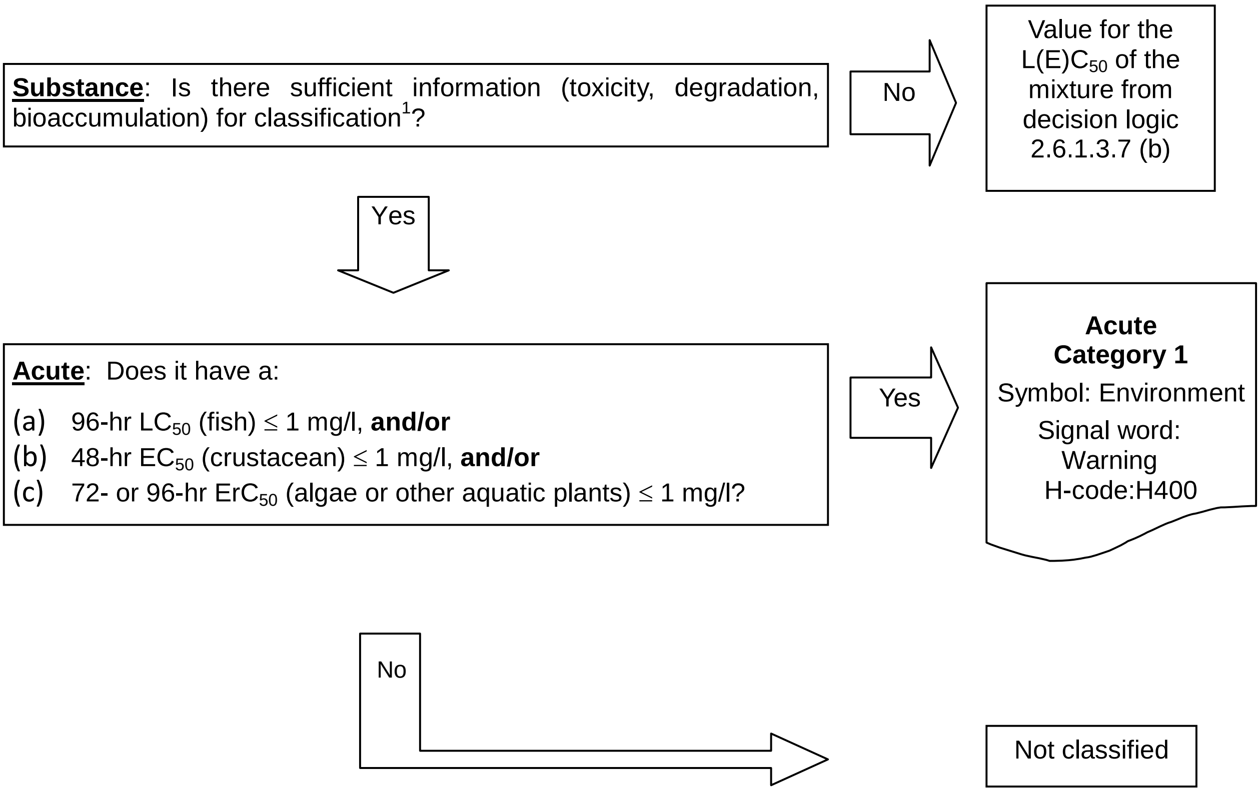
2.6.1.3.6. *Classification of mixtures with components without any useable information*

In the event that no useable information on acute and/or chronic (long-term) aquatic hazard is available for one or more relevant components, it is concluded that the mixture cannot be attributed to one or more definitive hazard categories. In this situation, the mixture shall be classified based on the known components only, with the additional statement in the SDS that: 'Contains x% of components with unknown hazards to the aquatic environment'.

2.6.1.3.7 *Decision logic*

(a) **Decision logic for substances and mixtures hazardous to the aquatic environment – acute hazard.**



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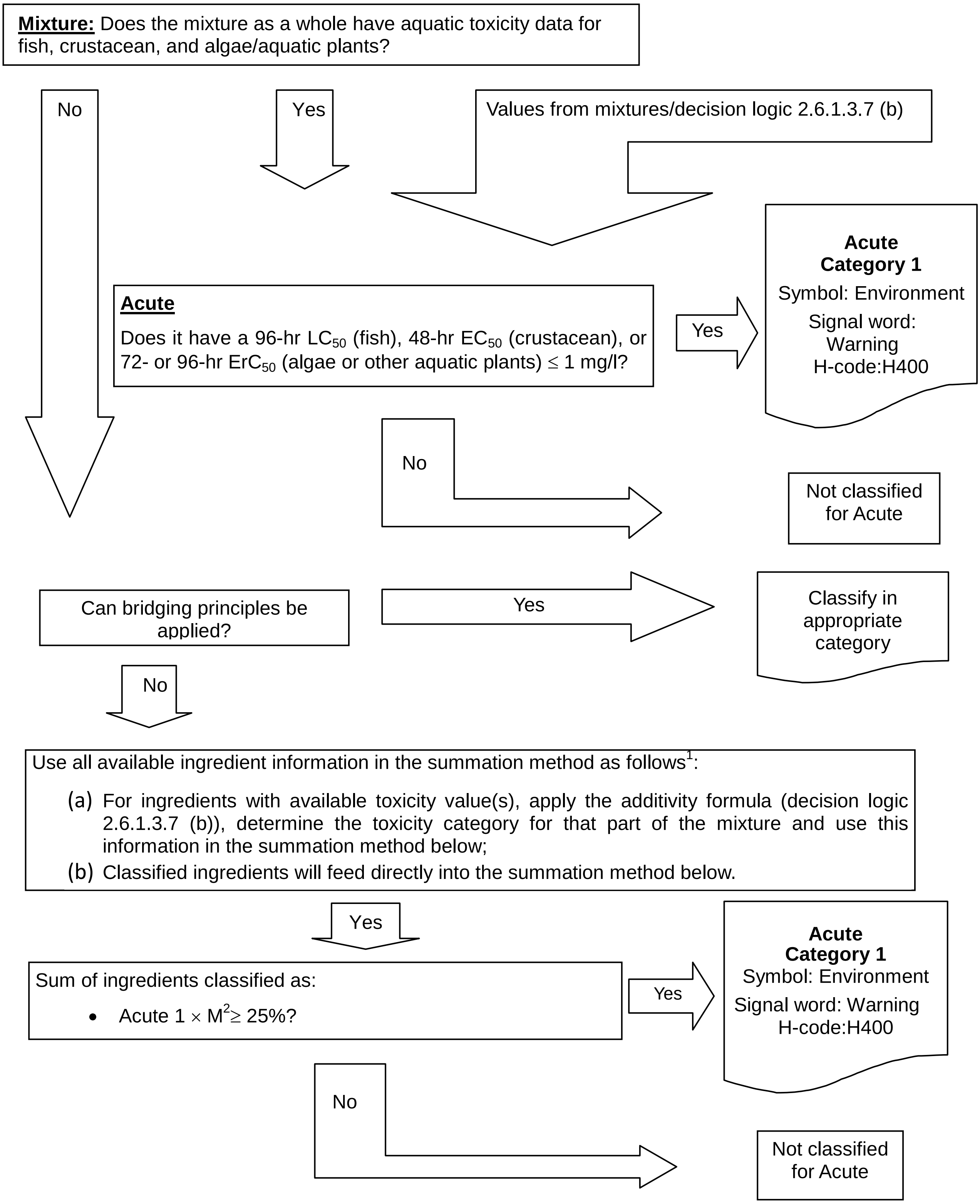

Mixture: Does the mixture as a whole have aquatic toxicity data for fish, crustacean, and algae/aquatic plants?

Values from mixtures/decision logic 2.6.1.3.7 (b)

Acute

Does it have a 96-hr LC_{50} (fish), 48-hr EC_{50} (crustacean), or 72- or 96-hr ErC_{50} (algae or other aquatic plants) $\leq$ 1 mg/l?

Acute Category 1
Symbol: Environment
Signal word: Warning
H-code:H400

Not classified for Acute

Can bridging principles be applied?

Classify in appropriate category

Use all available ingredient information in the summation method as follows[1]:

(a) For ingredients with available toxicity value(s), apply the additivity formula (decision logic 2.6.1.3.7 (b)), determine the toxicity category for that part of the mixture and use this information in the summation method below;

(b) Classified ingredients will feed directly into the summation method below.

Sum of ingredients classified as:

- Acute 1 × $M^2 \geq 25\%$?

Acute Category 1
Symbol: Environment
Signal word: Warning
H-code:H400

Not classified for Acute

---

[1] If not all ingredients have information, include the statement “x% of the mixture consists of ingredients(s) of unknown hazards to the aquatic environment” on the label. Alternatively, in the case of a mixture with highly toxic ingredients, if toxicity values are available for these highly toxic ingredients and all other ingredients do not significantly contribute to the hazard of the mixture, then the additivity formula may be applied (see 2.6.1.3.5.2). In this case and other cases where toxicity values are available for all ingredients, the acute classification may be made solely on the basis of the additivity formula.

[2] For explanation of M-factor refer 2.6.1.3.5.5.5.

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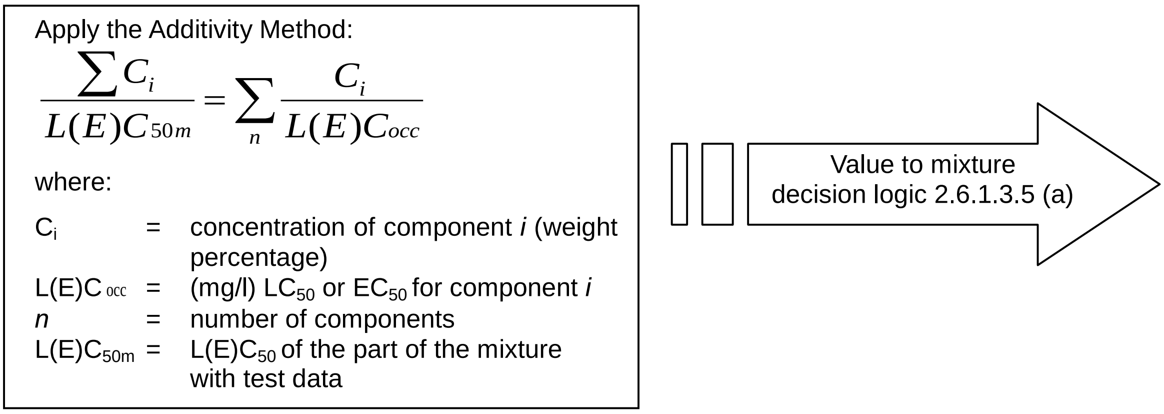
(b) Decision logic for mixtures (additivity formula)



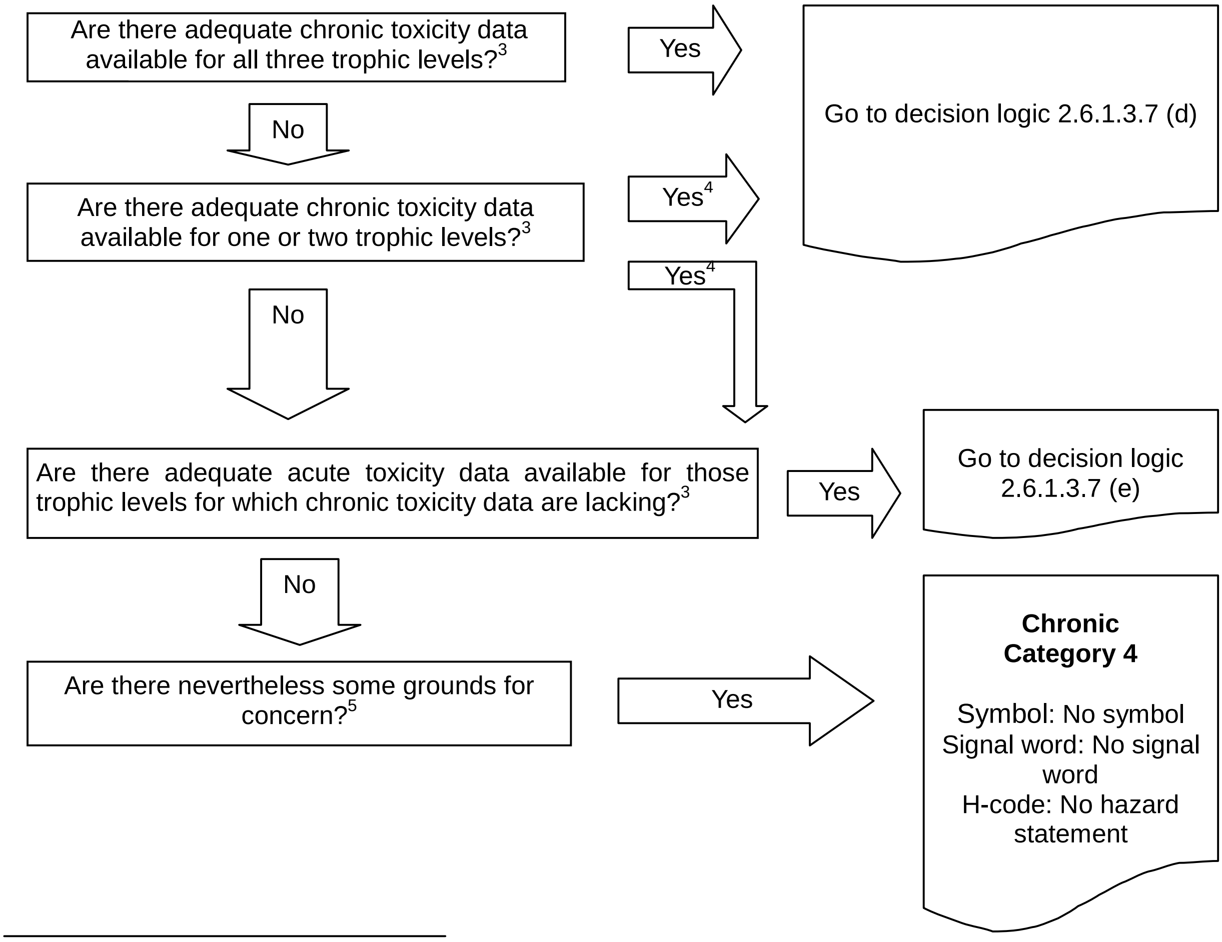
Apply the Additivity Method:

$$\frac{\sum C_i}{L(E)C_{50m}} = \sum_n \frac{C_i}{L(E)C_{occ}}$$

where:

C_i = concentration of component i (weight percentage)
$L(E)C_{occ}$ = (mg/l) LC_{50} or EC_{50} for component i
n = number of components
$L(E)C_{50m}$ = $L(E)C_{50}$ of the part of the mixture with test data

(c) Decision logic for substances hazardous to the aquatic environment – chronic hazard.



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[3] Data are preferably to be derived using internationally harmonized test methods (e.g. OECD Test Guidelines or equivalent) according to the principles of good laboratory practices (GLP), but data from other test methods such as national methods may also be used where they are considered as equivalent.

[4] Follow the flow chart in both ways and choose the most stringent classification outcome.

[5] Note that the system also introduces a “safety net” classification (referred to as chronic category 4) for use when the data available do not allow classification under the formal criteria, but there are, nevertheless, some concern.

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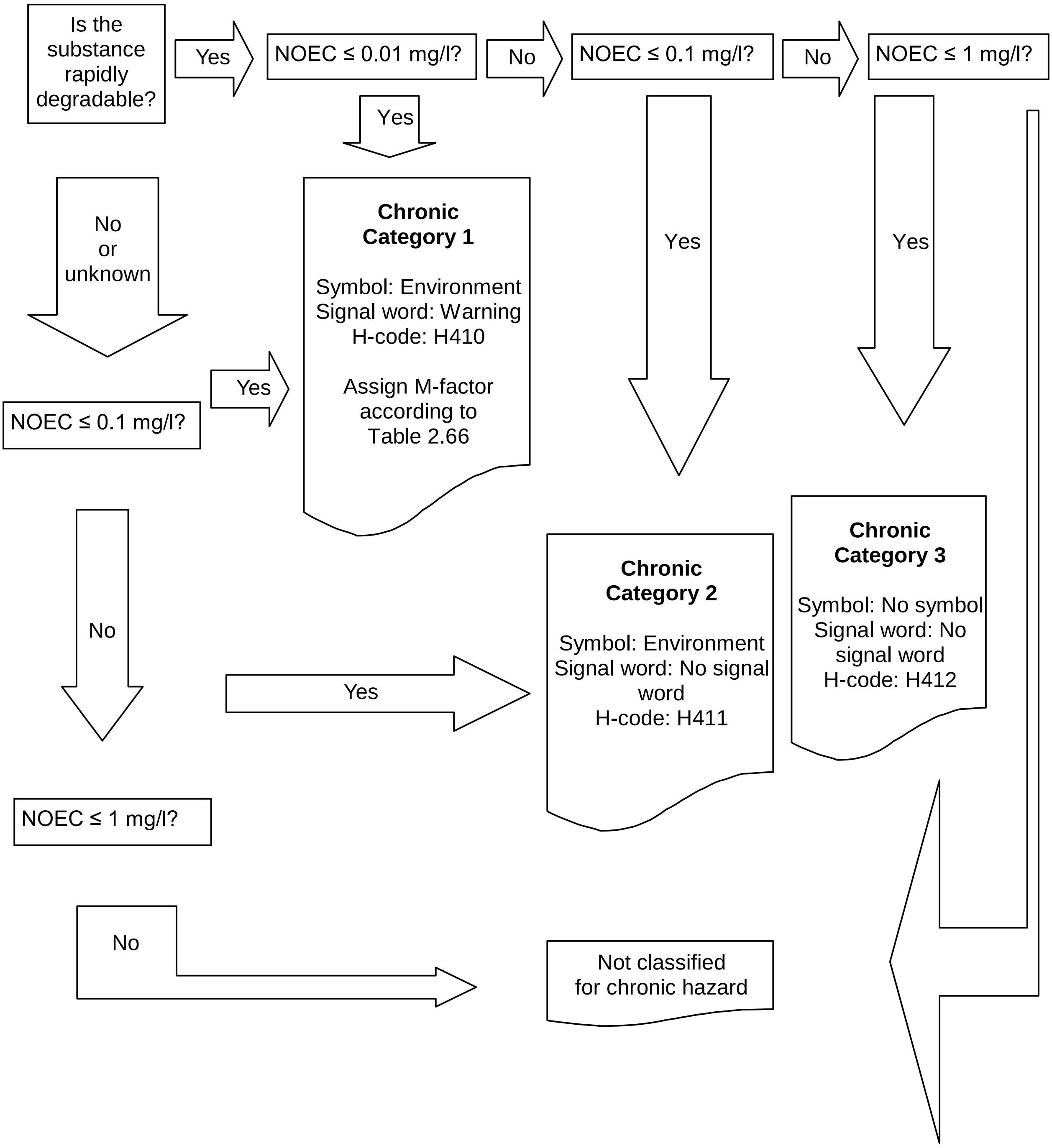
(d) Decision logic for substance hazardous to the aquatic environment - chronic hazard (when adequate chronic toxicity data are available for all three trophic levels) [3]



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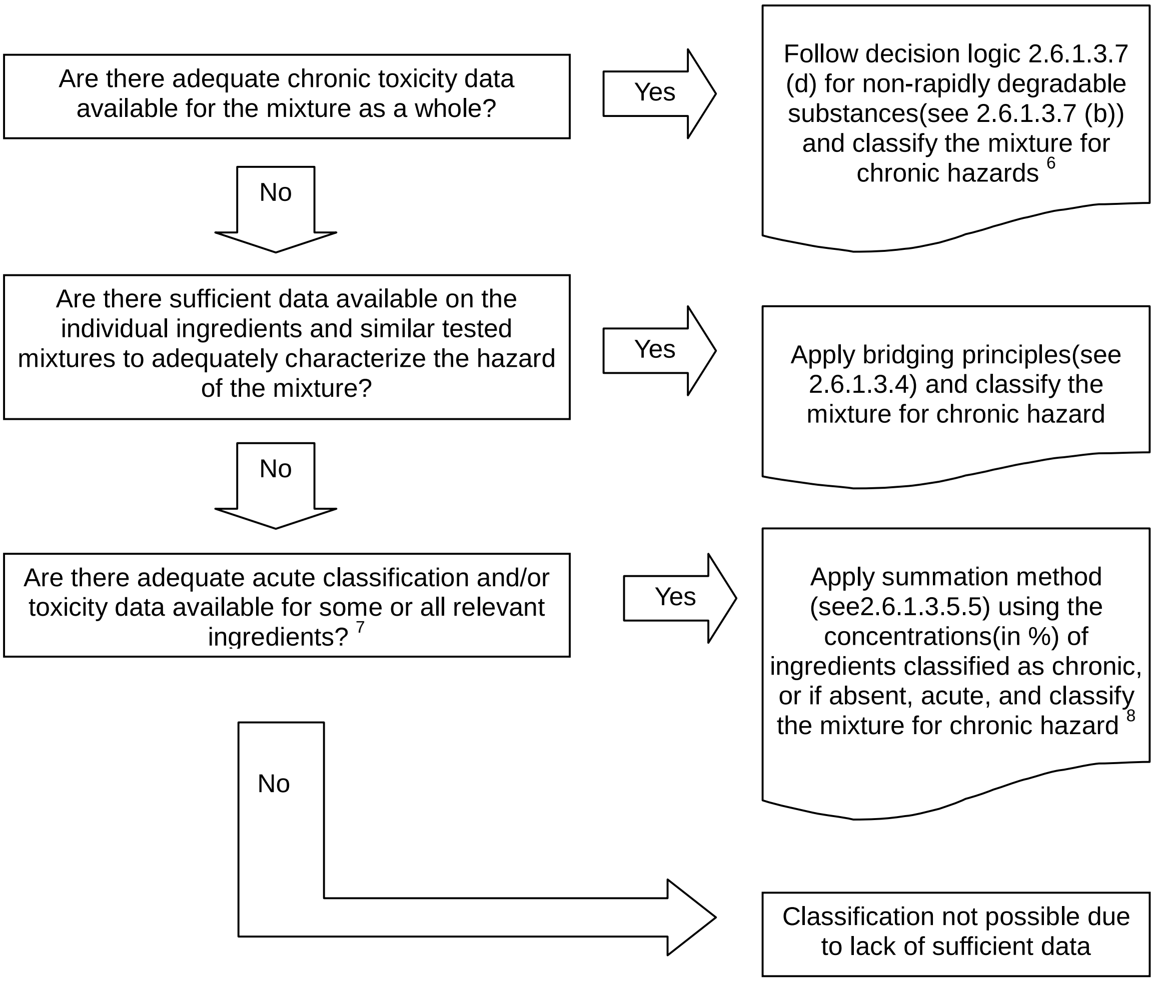
[3] Data are preferably to be derived using internationally harmonized test methods (e.g. OECD Test Guidelines or equivalent) according to the principles of good laboratory practices (GLP), but data from other test methods such as national methods may also be used where they are considered as equivalent.

(e) Decision logic for mixture hazardous to the aquatic environment – chronic hazard



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[6] Degradability and bioaccumulation tests for mixtures are not used as they are usually difficult to interpret, and such tests may be meaningful only for single substances. The mixture is therefore, by default, regarded as non-rapidly degradable. However, if the available information allows the conclusion that all relevant ingredients of the mixture are rapidly degradable the mixture can, for classification purposes, be regarded as rapidly degradable.

[7] In the event that no useable information on acute and/or chronic aquatic toxicity is available for one or more relevant ingredients, it is concluded that the mixture cannot be attributed (a) definitive hazard category(ies). In this situation, the mixture shall be classified based on the known ingredients only, with the additional statement that: "×% of the mixture consists of ingredient(s) of unknown hazards to the aquatic environment".

[8] When adequate toxicity data are available for more than one ingredient in the mixture, the combined toxicity of those ingredients may be calculated using the additivity formula (a) or (b) in 2.6.1.3.5.2, depending on the nature of the toxicity data. The calculated toxicity may be used to assign that portion of the mixture an acute or chronic hazard category which is then subsequently used in applying the summation method. (It is preferable to calculate the toxicity of this part of the mixture using for each ingredient a toxicity value that relates to the same taxonomic group (e.g. fish, crustacean, or algae) and then to use the highest toxicity (lowest value) obtained (i.e. use the most sensitive of the three groups) (see 2.6.1.3.5.3)).

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2.6.1.3.8 Hazard communication elements

Element	**Acute**	**Chronic**			
	Category 1	**Category 1**	**Category 2**	**Category 3**	**Category 4**
Hazard pictogram				No hazard pictogram	No hazard pictogram
Signal word	Warning	Warning	No signal word	No signal word	No signal word
H-code: Hazard statement	H400: Very toxic to aquatic life	H410: Very toxic to aquatic life with long lasting effects	H411: Toxic to aquatic life with long lasting effects	H412: Harmful to aquatic life with long lasting effects	H413: May cause long lasting harmful effects to aquatic life

2.6.2 Hazardous to the Ozone Layer

2.6.2.1 Definition

"Substance hazardous to the ozone layer" means a substance which, on the basis of the available evidence concerning its properties and its predicted or observed environmental fate and behavior may present a danger to the structure and/or the functioning of the stratospheric ozone layer.

"Montreal Protocol" is the Montreal Protocol on Substances that Deplete the Ozone Layer as either adjusted and/or amended by the Parties to the Protocol.

2.6.2.2 Classification criteria for substances and mixtures

A substance or mixture shall be classified as category 1 according to the following table:

Table 2.66: Criteria for substances and mixtures hazardous to the ozone layer

Category	**Criteria**
1	Any of the controlled substances listed in Annexes to the Montreal Protocol; or Any mixture containing at least one ingredient listed in the Annexes to the Montreal Protocol, at a concentration ≥ 0.1%.

NOTE
Extract of the Annexes A, B and C of controlled substances under the Montreal Protocol is appended in Appendix 2.2.

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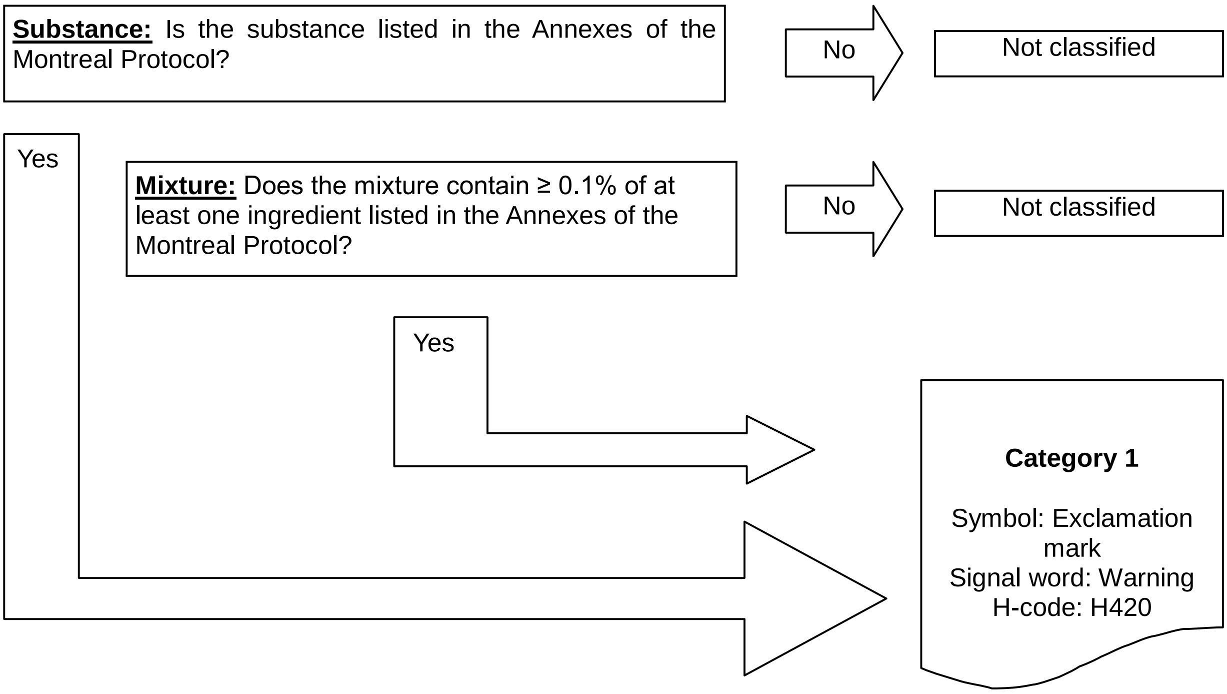
2.6.2.3 Decision logic for substances and mixtures hazardous to the ozone layer



Substance: Is the substance listed in the Annexes of the Montreal Protocol?

Mixture: Does the mixture contain ≥ 0.1% of at least one ingredient listed in the Annexes of the Montreal Protocol?

Category 1

Symbol: Exclamation mark
Signal word: Warning
H-code: H420

2.6.2.4 Hazard communication elements

Element	Category 1
Hazard pictogram	
Signal word	Warning
H-code: Hazard statement	H420: Harms public health and the environment by destroying ozone in the upper atmosphere

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2.7 Classification Record

2.7.1 The Regulations have stipulated that the principal supplier shall maintain a record of classification which shall be produced for inspection when directed by an occupational safety and health officer.

2.7.2 The classification record shall be in the following format:

A.1 Identification of chemicals

a) Name of chemicals	
b) CAS number	
c) Synonyms	
d) Molecular formula (if any)	
e) Structural formula (if any)	
f) Purity[1]	
g) Significant impurities or additives[2]	
h) Known uses	

[1] *(w/w) for solids, liquids, dusts, mists and vapours, and (v/v) for gases*
[2] *Only those contributing to the hazard classification*

A.2 Classification Result

	Classification	**Justification[3]**	**Data Source[4]**
Physical			
Health			
Environment			
Remark	Date of classification: Name of classifier & position: Approved by:		

[3] *Observation or test data for the classification decision*
[4] *Primary source of data (refer to 2.3.5)*

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Revision

	Classification	Justification	Data Source
Physical			
Health			
Environment			
Remark	Date revised: Name of classifier & position: Approved by:		

2.7.3 Where the name of chemicals and the concentration ingredients of mixture constitute CBI, the requirements as specified in the Part 4 of this ICOP could be applied.

2.7.4 Samples of completed classification record for a substance and a mixture can be found in Appendix 2.3.

2.7.5 Classification record shall be kept as long as the chemical is being supplied.

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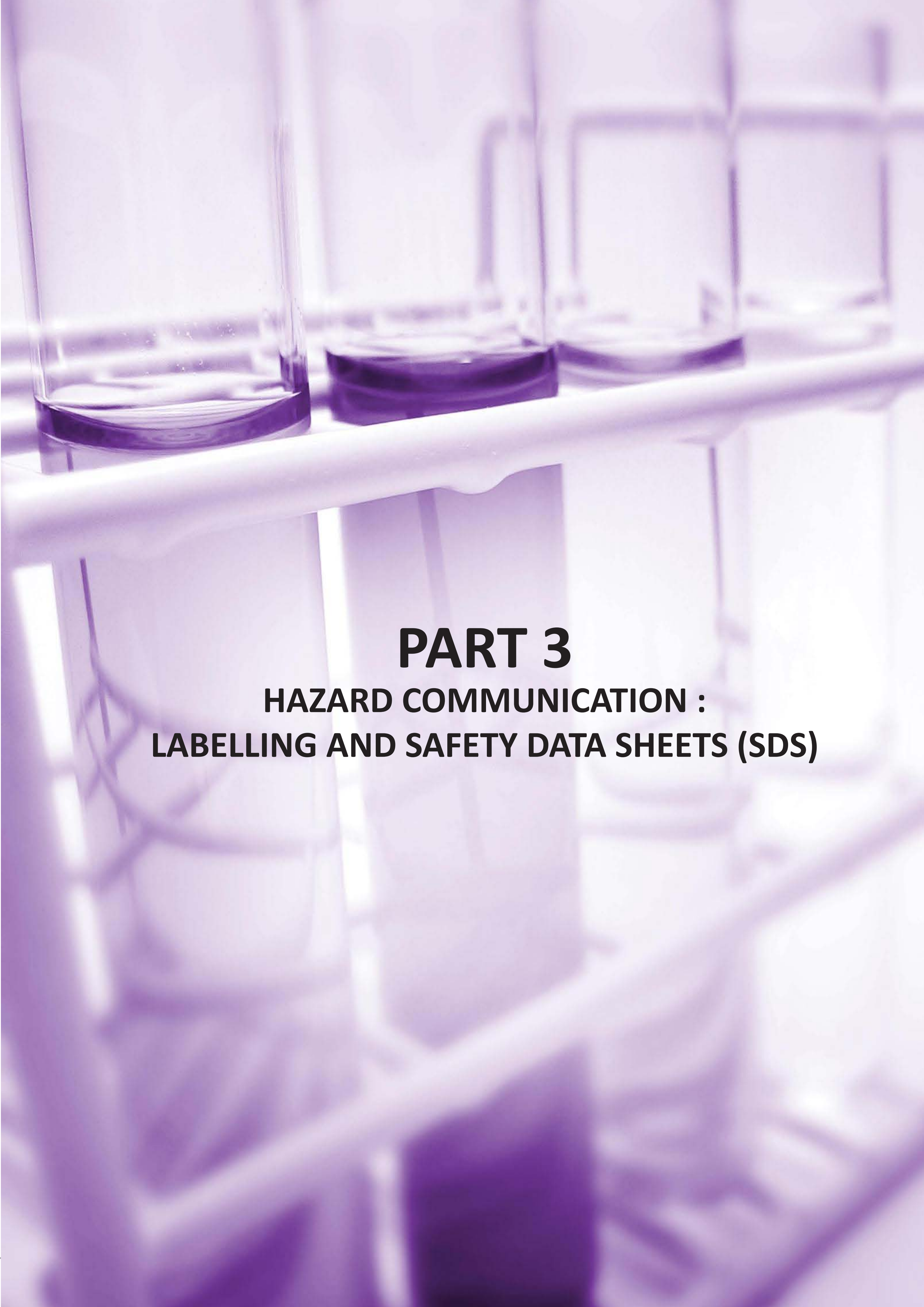

PART 3

HAZARD COMMUNICATION :
LABELLING AND SAFETY DATA SHEETS (SDS)

PART 3

HAZARD COMMUNICATION: LABELLING AND SAFETY DATA SHEETS (SDS)

3.1 Introduction

Hazard communication means the communication of hazard information to the users of chemicals by means of labelling, SDS and training. However, this ICOP will only address requirements pertaining to labelling and SDS.

This Part provides guidance for the preparation of label and SDS in compliance to the Regulations.

3.2 Labelling Requirements

The following sections describe the procedures for preparing label comprising the following:

(a) Information on a label;
(b) Multiple hazards and precedence of information;
(c) Arrangements for presenting the label elements;
(d) Special labelling arrangements;
(e) Miscellaneous.

3.2.1 Information on a label

Under sub-regulation 8(1) of the Regulations, the supplier is required to label every packaging of hazardous chemical legibly and indelibly containing the following information:

(a) Product identifier;
(b) Supplier identification;
(c) Signal word;
(d) Hazard statement;
(e) Hazard pictogram; and
(f) Precautionary statement.

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3.2.1.1 Product identifier

3.2.1.1.1 A product identifier used on the label shall match with the product identifier used in the SDS.

3.2.1.1.2 The product identifier for a substance shall consist of at least the following:

(a) If the substance is included in the list of classified chemical in Part 1 of this ICOP, a name and CAS number as given therein;

(b) If the substance is not included in Part 1 of this ICOP:

- (i) the IUPAC name/Nomenclature; and
- (ii) the CAS number (if any)

(c) If the CAS number is not available, the name set out in the IUPAC Nomenclature or another international chemical name(s).

3.2.1.1.3 The product identifier for a mixture shall be the trade name of the designation of the mixture;

(Note: For mixture, the trade name shall match with the trade name used on the SDS)

3.2.1.2 Supplier identification

3.2.1.2.1 The name, address and telephone number of the supplier of the hazardous chemicals shall be provided on the label.

3.2.1.2.2 The telephone number may include the local emergency telephone number (24 hours) in Malaysia (including area code) where advice can be obtained.

3.2.1.2.3 If the hazardous chemical is imported, the foreign manufacturer's contact number (24 hours) may be included for advice during an emergency.

3.2.1.3 Signal word

3.2.1.3.1 The signal words used in the Regulations are "Danger" and "Warning".

3.2.1.3.2 "Danger" is used for the more severe hazard categories, while "Warning" is used for the less severe. Only one signal word shall appear on the label. If the signal word "Danger" applies, the signal word "Warning" shall not appear on the label.

3.2.1.3.3 The letter and numeral are to be in print and the font size shall not be smaller than 7 points. The letters and numerals shall be black in colour.

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3.2.1.4 Hazard statement

3.2.1.4.1 The hazard statement describes the nature of the hazards of hazardous chemical, including, where appropriate, the degree of hazard as specified in First Schedule of the Regulations.

3.2.1.4.2 The hazard statement code (H-code) is assigned to each of the hazard statement applicable to the hazard categories specified under the Regulations. The H-codes are intended to be used for reference purposes. They are not part of the hazard statement text and shall not be used to replace it. The H-codes are listed in Appendix 3.1.

3.2.1.4.3 If a hazardous chemical is classified within several hazard classes, all hazard statements resulting from the classification shall be used on a label unless there is evidence of duplication or redundancy. However, a combination of hazard statements shall be used instead of the corresponding individual statements. List of combined hazard statement is given in Third Schedule in the Regulations.

3.2.1.4.4 The letter and numeral are to be in print and the font size shall not be smaller than 7 points. The letters and numerals shall be black in colour.

3.2.1.5 Hazard pictogram

3.2.1.5.1 A hazard pictogram consists of a symbol and a border. The hazard pictogram shall have a black symbol on a white background with a red border sufficiently wide to be clearly visible.

3.2.1.5.2 All hazard pictogram used in the label shall be in diamond shape with the sides tilted at 45° to the horizontal.

3.2.1.5.3 The list of hazard pictograms is given in Table 3.1.

3.2.1.5.4 The size of hazard pictogram is one fifteenth of the surface area of the label but the minimum area is not less than 100 mm^2 (10 mm x 10 mm).

3.2.1.5.5 For the purpose of determining the size of the pictogram on the label, the label surface area to be considered is the surface area that contains information specified in sub-regulation 8 (1) and (2).

3.2.1.5.6 For the packaging covered by the UNRTDG**,** Model Regulations, if the hazard pictogram relate to the same hazard as in the UNRTDG, Model Regulations, the supplier may choose to use either the hazard pictogram required by the Regulations or the UNRTDG pictogram on the packaging.

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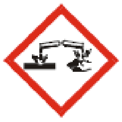
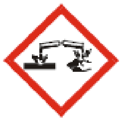
Table 3.1 : Description of symbol and hazard pictogram

Physical Hazard		Health Hazard		Environmental Hazard	
Description of symbol	**Hazard pictogram**	**Description of symbol**	**Hazard pictogram**	**Description of symbol**	**Hazard pictogram**
Flame		Skull and crossbones		Environment	
Flame over circle		Exclamation mark		Exclamation mark	
Exploding bomb		Health hazard			
Corrosion		Corrosion			
Gas cylinder					

3.2.1.6 Precautionary statement

3.2.1.6.1 The precautionary statement describes the recommended measures that shall be taken to minimise or prevent adverse effects resulting from exposure to hazardous chemicals.

3.2.1.6.2 Precautionary statement consists of precautionary statement covering:

(a) **Prevention** statements refer to precautions to be taken to prevent an accident or exposure;
(b) **Response** statements refer to instructions in case of an accident;
(c) **Storage** statements refer to instructions for safe storage of the chemical; and
(d) **Disposal** statements refer to appropriate disposal instructions.

3.2.1.6.3 The precautionary statement assigned was based on the hazard classification of the hazardous chemicals and shall be selected from those set out in Appendix 3.2.

3.2.1.6.4 To provide flexibility, a combination of precautionary statements is encouraged to save label space and improve the readability of phrases. Combination of phrases can also be useful for different types of hazard where the precautionary behaviour is similar. List of combined precautionary statement is given in Appendix 3.2.

3.2.1.6.5 Not more than six precautionary statements shall appear on the label, unless necessary to reflect the nature and the severity of the hazards. Redundant information may be omitted. Where a hazard classification results in duplicate precautionary statements, the information shall only appear once. For example, where the precautionary statements “wear face protection” and “wear gloves and face protection” are specified, then only the latter statement shall appear on the label as it relates to the more stringent protective measures.

3.2.1.6.6 Where a chemical is classified for a number of health hazards, generally the most stringent set of the precautionary statements shall be selected. This applies mainly for the preventive measures. With respect to statement concerning “response”, rapid action may be crucial. For example if a chemical is carcinogenic and acutely toxic then the first aid measures for acute toxicity will take precedence over those for longer term effects. In addition, medical attention to delayed health effects may be required in cases of incidental exposure, even if not associated with immediate symptoms of intoxication.

3.2.1.6.7 The letter and numeral are to be in print and the font size shall not be smaller than 7 points. The letters and numerals shall be black in colour.

3.2.2 Multiple hazards and precedence of information

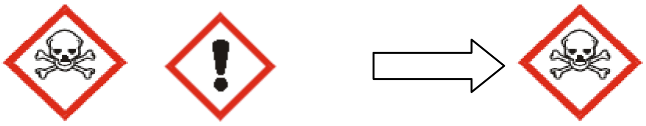
3.2.2.1 Rules of precedence for the allocation of hazard pictogram

3.2.2.1.1 If the chemicals are classified within several hazard classes or differentiations of a hazard class, the following rules of precedence shall apply.

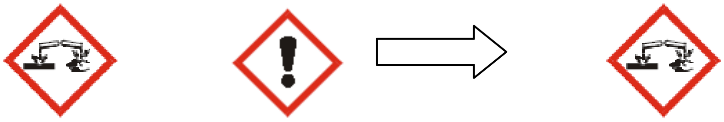
3.2.2.1.2 For physical hazards, if the hazard pictograms of ‘exploding bomb’, ‘flame’ and ‘flame over circle’ are applicable, the hazard pictogram of ‘exploding bomb’ shall be used and the use of the hazards pictograms of ‘flame’ and ‘flame over circle’ shall be optional, except in the cases where the use of more than one of these hazard pictograms are compulsory. In cases where the ‘exploding bomb’ and ‘flame’ symbols apply, as for self reactive chemical type B and organic peroxides type B, both hazard pictograms are compulsory.

3.2.2.1.3 For health hazards:

(a) If the hazard pictograms of “skull and crossbones” and “exclamation mark” are applicable, the hazard pictogram of “skull and crossbones” shall be used and the “exclamation mark” symbol shall not appear.



(b) If the hazard pictograms of “corrosion” and “exclamation mark” in the case of skin irritation* or eye irritation* hazard class are applicable, the hazard pictogram of “corrosion” shall be used and the hazard pictogram of “exclamation mark” shall not appear.



(c) If the hazard pictogram of “health hazard” in the case of respiratory sensitization hazard class and hazard pictogram of “exclamation mark” in the case of skin sensitization, skin irritation* or eye irritation* hazard class are applicable, the hazard pictogram of “health hazard” shall be used and the hazard pictogram of “exclamation mark” shall not appear.

			
Respiratory sensitization	Skin sensitization	→	
	Skin irritation*		
	Eye irritation*		
	Skin sensitization& skin irritation*		
	Skin sensitization& eye irritation*		
	Skin sensitization& skin irritation* & eye irritation*		

NOTE:
Skin irritation may refer to the hazard class of skin corrosion or irritation category 2.
Eye irritation may refer to the hazard class of serious eye damage or eye irritation category 2.

3.2.2.2 The precedence for allocation of hazard statements

3.2.2.2.1 If the chemicals are classified within several hazard classes or differentiations of a hazard class, all hazard statements resulting from the classification shall appear on the label, unless there is evident duplication or redundancy.

3.2.2.2.2 In the case of evident duplication or redundancy, the following rules of precedence shall apply:

(a) If hazard statement H410 “Very toxic to aquatic life with long lasting effects” is assigned, the statement H400 “Very toxic to aquatic life” shall not appear on the label;

(b) The hazard statement H314 “Causes severe skin burns and eye damage” is assigned, the statement H318 “Causes serious eye damage” shall not appear on the label.

.2.3 Arrangements for presenting the label elements

3.2.3.1 Location of information on the label

3.2.3.1.1 Details of the label elements for each hazard classes are given in Appendix 3.3.

3.2.3.1.2 Example of layout for the presentation of information on the label is in Appendix 3.4.

3.2.3.2 Supplemental information

3.2.3.2.1 The supplemental information is optional. However, its use shall be limited to the following circumstances:

(a) The supplementary information provides further detail and does not contradict or cast doubt on the validity of the hazard information; or

(b) The supplementary information provides information about hazards not yet incorporated into the Regulations.

3.2.3.2.2 Statements such as “non-toxic”, “non-harmful”, “non-polluting”, “ecological” or any other statements indicating that chemicals is not hazardous or any other statements that are inconsistent with the classification of that chemicals shall not appear on the label or packaging of any chemicals.

3.2.3.3 Use of colour outside hazard pictograms

In addition to its use in hazard pictograms, colour can be used on other area of the label to implement other labelling requirements such as the use of the pesticide bands, for signal words and hazard statements or as a background to them.

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3.2.4 Special Labelling Arrangements

3.2.4.1 If the size of container or package is 125 ml or below, the label may contain at least the following information:

(a) Product identifier;

(b) Statement which reads: “read Safety Data Sheet before use”;

(c) Name, address and telephone number of the supplier;

(d) Hazard pictogram; and

(e) Signal word.

3.2.4.2 Example of layout for the presentation of information on the label is in Appendix 3.4.

3.2.5 Affixing and tagging of Label

3.2.5.1 The label shall be firmly affixed to one or more surfaces of the packaging so that the label can be read horizontally when the container is set down in its normal position. The packaging may be a container or contains another container.

3.2.5.2 If the packaging of a hazardous chemical is a container of 125 ml in size or below, the label shall be affixed in such manner deemed reasonable by the supplier.

3.2.5.3 If it is not practicable to affix a label to a packaging of a hazardous chemical due to the nature of the container, the packaging shall be tagged with the label.

3.2.6 Miscellaneous

3.2.5.1 Background colour of a label is either white or a light colour which will not camouflage the text.

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3.3 SDS

SDS is an up-to date hand-out or information sheet containing relevant information pertaining to the hazardous chemicals which is vital for establishing arrangements in the safe use of the chemicals at work. The SDS should aim at achieving the following objectives:

(a) to make users of hazardous chemicals understand safety recommendations and the rationale for these recommendations;

(b) to create awareness among users of hazardous chemicals of the consequences of failure to comply with the recommendations;

(c) to ensure that users of hazardous chemicals recognize the symptoms of overexposure; and

(d) to encourage the users of hazardous chemicals to provide inputs in establishing strategies and recommendations for the safe use of the hazardous chemicals.

3.4 SDS Requirements

3.4.1 Under sub-regulation 13 (1) of the Regulations, a supplier shall furnish an up-to-date SDS to a chemical recipient for each hazardous chemical supplied.

3.4.2 The supplier shall also furnish an SDS for mixtures (even though it is not classified as hazardous) containing hazardous substances at concentrations as specified in the Fifth Schedule of the Regulations and given in Table 3.2.

Table 3.2: Cut-off values for each health and environmental hazard class

Hazard Class	Cut-off Values
Acute toxicity	at 1.0% or more (≥ 1.0%)
Skin corrosion or irritation	at 1.0% or more (≥ 1.0%)
Serious eye damage or eye irritation	at 1.0% or more (≥ 1.0%)
Respiratory sensitization	at 0.1% or more (≥ 0.1%)
Skin sensitization	at 0.1% or more (≥0.1%)
Germ cell mutagenicity (category 1)	at 0.1% or more (≥ 0.1%)
Germ cell mutagenicity (category 2)	at 1.0% or more (≥ 1.0%)
Carcinogenicity	at 0.1% or more (≥ 0.1%)
Reproductive toxicity	at 0.1% or more (≥ 0.1%)
Specific target organ toxicity – single exposure	at 1.0% or more (≥ 1.0%)
Specific target organ toxicity – repeated exposure	at 1.0% or more (≥ 1.0%)
Aspiration hazard	at 10% or more (≥ 10%)
Hazardous to the aquatic environment	at 1.0% or more (≥ 1.0%)

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3.4.3 The SDS shall be written both in national language and English language.

3.4.4 The information provided on the SDS shall be arranged in a format which is specified under sub-regulation 13 (2) of the Regulations.

3.5 SDS Format

The SDS shall be presented using the following headings in the order given below:

(a) Section 1: Identification of the hazardous chemical and of the supplier;

(b) Section 2: Hazard identification;

(c) Section 3: Composition and information of the ingredients of the hazardous chemical;

(d) Section 4: First-aid measures;

(e) Section 5: Fire-fighting measures;

(f) Section 6: Accidental release measures;

(g) Section 7: Handling and storage;

(h) Section 8: Exposure controls and personal protection;

(i) Section 9: Physical and chemical properties;

(j) Section 10: Stability and reactivity;

(k) Section 11: Toxicological information;

(l) Section 12: Ecological information;

(m) Section 13: Disposal information;

(n) Section 14: Transportation information;

(o) Section 15: Regulatory information; and

(p) Section 16: Other information.

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3.6 Minimum information

Minimum information for an SDS is provided in the table below.

Table 3.3: Minimum information for SDS

Section	Title of Section	Minimum Information
1.	Identification of the hazardous chemical and of the supplier	(a) Product identifier; (b) Other means of identification; (c) Recommended use of the chemical and restrictions on use; (d) Details of principal suppliers (including name, address, phone number, etc.); (e) Emergency phone number.
2.	Hazard identification	(a) Classification of the substance/mixture and any nation or regional information; (b) Label elements (hazard pictogram or symbol, signal word, hazard statement and precautionary statements). Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or name of the symbols e.g. ‘flame’ , ‘ skull and crossbones’; (c) Other hazards which do not result in classification (e.g. dust explosion hazard) or are not covered by the Regulations.
3.	Composition and information of the ingredients of the hazardous chemical	**Substance** (a) Chemical identity; (b) Common name, synonyms, etc; (c) CAS number and other unique identifiers; (d) Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. **Mixture** The chemical identity and concentration or concentration ranges of all ingredients which are hazardous and are present at or above cut-off value.
4.	First-aid measures	(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e. inhalation, skin and eye contact and ingestion; (b) Most important symptoms/effects, acute and delayed; (c) Indication of immediate medical attention and special treatment needed, if necessary.

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5.	Fire-fighting measures	(a) Suitable (and unsuitable) extinguishing media; (b) Specific hazards arising from the chemical (e.g. nature of any combustion hazardous products); (c) Special protective equipment and precautions for fire-fighters.
6.	Accidental release measures	(a) Personal precautions, protective equipment and emergency procedures; (b) Environmental precautions; (c) Methods and material for containment and cleaning.
7.	Handling and storage	(a) Precautions for safe handling; (b) Conditions for safe storage, including any incompatibilities.
8.	Exposure controls and personal protection	(a) Control parameters e.g. permissible exposure limit and biological limit values; (b) Appropriate engineering controls; (c) Individual protection measures, such as personal protective equipment.
9.	Physical and chemical properties	(a) Appearance (physical state, colour, etc.); (b) Odour; (c) Odour threshold; (d) pH; (e) Melting point/freezing point; (f) Initial boiling point and boiling range; (g) Flash point; (h) Evaporation rate; (i) Flammability (solid, gas); (j) Upper/lower flammability or explosive limits; (k) Vapour pressure; (l) Vapour density; (m) Relative density; (n) Solubility(ies); (o) Partition coefficient : n-octanol/water; (p) Auto-ignition temperature; (q) Decomposition temperature; (r) Viscosity.
10.	Stability and reactivity	(a) Reactivity; (b) Chemical stability; (c) Possibility of hazardous reactions; (d) Condition to avoid (e.g. static discharge, shock or vibration); (e) Incompatible materials; (f) Hazardous decomposition products.

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11.	Toxicological information	Concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including (a) Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); (b) Symptoms related to the physical, chemical and toxicological characteristics; (c) Delayed and immediate effects and also chronic affects from short and long term exposure; (d) Numerical measures of toxicity (such as acute toxicity estimates).
12.	Ecological information	(a) Ecotoxicity (aquatic and terrestrial, where available); (b) Persistence and degradability; (c) Bioaccumulative potential; (d) Mobility in soil; (e) Other adverse effects.
13.	Disposal information	Description of waste residues and information on their safe handling and method of disposal, including the disposal of any contaminated packaging.
14.	Transportation information	(a) UN number; (b) UN proper shipping name; (c) Transport hazard class(es); (d) Packing group, if applicable; (e) Environmental hazards (e.g. marine pollutant (Yes/No); (f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code); (g) Special precautions which a user needs to be aware of, or needs to comply with, in connection either within or outside their premises.
15.	Regulatory information	Safety, health and environmental regulations specific for the product in question.
16.	Other information	(a) Date of preparation of the SDS; (b) Date of revision of the SDS; (c) Key literature references and sources for data used to compile the SDS; (d) Key/legend to the abbreviations and acronyms used in the SDS; (e) Other information deems necessary by a supplier.

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3.7 Guidance on Preparation of SDS

The following describes the information requirements for each section in the SDS and provides guidance based on the minimum information provided in Table 3.3.

3.7.1 Section 1: Identification of the hazardous chemical and of the supplier

Identify the hazardous chemical and provide the name of the supplier, recommended uses, and contact details of the supplier, including an emergency contact number.

3.7.1.1 Product identifier

3.7.1.1.1 The product identifier is the name of the hazardous chemical. If one generic SDS is used to cover several minor variants of a substance or mixture of chemicals, all product identifiers must be listed in the SDS.

3.7.1.1.2 The product identifier for a substance shall consist of at least the following:

(a) If the substance is included in Part 1 of this ICOP, a name and CAS number as given therein;

(b) If the substance is not included in Part 1 of this ICOP:

i) The IUPAC name/nomenclature; and

ii) The CAS number

(c) If the CAS number is not available, the name set out in the IUPAC nomenclature or other international chemical name(s).

3.7.1.1.3 The product identifier for a mixture shall be the trade name of the mixture.

NOTE
For mixtures, the trade name shall match with the trade name used on the label.

3.7.1.2 Other means of identification

The hazardous chemical shall be identified by its chemical name and by alternative names, numbers, company product codes or other unique identifiers. Other names or synonyms by which the hazardous chemical is labelled or commonly known shall be provided in this section.

3.7.1.3 Recommended use of the chemical and restrictions on use

The recommended or intended use of the hazardous chemical, including a brief description of what it actually does, shall be provided. For example, flame retardant, anti-oxidant, etc. Restrictions on use shall as far as possible be stated, including non-statutory recommendations for use of the chemical by the supplier.

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3.7.1.4 Supplier details (including name, address, phone number, etc.)

(a) The name, full address, and phone number(s) of the principal supplier of the hazardous chemical shall be included in the SDS exactly as found on the label;

(b) The telephone number may include the local emergency telephone number (24 hours) in Malaysia (including area code) where advice can be obtained; and

(c) If the hazardous chemical is imported, the foreign manufacturer's contact number (24 hours) may be included for advice during an emergency.

3.7.2 Section 2: Hazard identification

Information under this section shall describe the hazards of the hazardous chemical and the appropriate label elements associated with those hazards. Information on hazards arising during use shall also be provided in this section. The information shall include a hazard statement explaining in simple terms all the hazards of the hazardous chemical.

3.7.2.1 Classification of the hazardous chemical

(a) The classification of the hazardous chemical shall be included, as determined by Parts 1 and 2 of this ICOP.

For example:

Flammable liquid category 1
Acute toxicity (oral) category 3

(b) Where an SDS is prepared for a chemical that is not classified as hazardous, it is recommended that a statement is included.

For example:

Not classified as a hazardous chemical.

3.7.2.2 Label elements

(a)The following label elements shall be provided in accordance with the hazardous chemicals classification:

- Hazard pictogram or symbol;
- Signal word;
- Hazard statement(s); and
- Precautionary statement(s).

(b) Although not mandatory in the SDS, hazard pictograms (or hazard symbols) may be provided as a graphical reproduction in black and white where an SDS is intended to be distributed via hard copy or through a database system.

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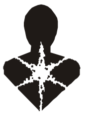
(c) Hazard pictograms shall meet the following sizing specification to avoid stretching or having oversized hazard pictograms on the SDS: At least 1 cm x 1 cm and less than 2 cm x 2 cm.

(d) Dangerous goods class labels may also be used. However, graphical elements shall not be duplicated. Where a hazard pictogram appears, the equivalent dangerous goods class label shall not be used, and vice versa.

(e) Hazard symbols may be provided as a graphical reproduction of the symbols in black and white or the name of the symbol e.g. flame, skull and crossbones (Refer to Table 3.4).

Table 3.4: Symbols and names of symbols

Symbols	Name of Symbol
	Exploding bomb
	Flame
	Oxidizing
	Corrosion
	Skull and crossbones
	Health hazard
	Exclamation
	Environment
	Gas cylinder

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3.7.2.3 Other hazards that do not result in classification

The SDS shall provide information on other hazards which do not result in classification according to Parts 1 and 2 but can contribute to the overall hazards of the chemical, for example, formation of air contaminants during hardening or processing, dust explosion hazards, suffocation, freezing, or environmental effects such as hazards to soil-dwelling organisms.

3.7.3 Section 3: Composition and information of the ingredients of the hazardous chemical

Identify the ingredient(s) of the hazardous chemical in this section. This includes identifying impurities and stabilising additives which contribute to the classification of the hazardous chemical.

3.7.3.1 Supplier may omit information on the name of a hazardous chemicals or the composition and ingredients of a hazardous chemicals if the information constitutes confidential business information.

If the information is omitted, such information shall be replaced with generic name of the hazardous chemicals or allowable concentration range of the ingredients of the hazardous chemical. Refer to Part 4 of this ICOP for further detail.

3.7.4 Section 4: First-aid measures

3.7.4.1 The SDS must provide first-aid instructions by relevant routes of exposure. Use subheadings to indicate the procedure for each route (for example, inhalation, skin, eye, and ingestion). Describe expected immediate and delayed symptoms.

3.7.4.2 The following advice, where applicable, shall be provided:

(a) Immediate medical attention is required;

(b) Known antidotes shall be available for administration by persons trained in their use as part of the recommended first aid procedure;

(c) Delayed effects can be expected after exposure;

(d) Movement of the exposed individual from the area to fresh air is recommended;

(e) Removal and handling of clothing and shoes from the individual is recommended;

(f) Personal protective equipment (PPE) for first-aid responders is recommended; and

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(g) There is a risk that first responders may be exposed to risks from individuals who have ingested hazardous chemicals. For example, organophosphates.

3.7.4.3 Any information on specific first aid facilities, such as shower or eyewash that are necessary in a workplace where the particular hazardous chemical is used, must also be included here.

3.7.4.4 If the hazardous chemical is additionally a scheduled poison, the first aid advice shall be consistent with that required by the National Poison Centre.

3.7.4.5 Relevant information on the most important symptoms/effects, acute, delayed and aggravated medical conditions caused from exposure must be provided to enable first aid to be administered.

3.7.4.6 If applicable information on clinical testing and medical monitoring for delayed effects, specific details on antidotes (where they are known) and contraindications are recommended for inclusion under this heading.

3.7.5 Section 5: Fire-fighting measures

This section shall include information on the requirements for fighting a fire caused by hazardous chemicals, or arising in its vicinity.

3.7.5.1 Suitable extinguishing media

Information on the appropriate type of extinguishers or fire fighting agents shall be provided. In addition, indicate whether any extinguishers are inappropriate for a particular situation involving hazardous chemicals.

3.7.5.2 Physicochemical hazards arising from the chemical

Advice shall be provided on specific hazards that may arise from the chemical (such as explosive properties or hazardous combustion products that form when the hazardous chemical burns) relevant to its physical properties. For example:

(a) “May produce toxic fumes and carbon monoxide if burning”; or
(b) “Produces oxides of sulphur and nitrogen on combustion”; or
(c) “There may be an evolution of flammable gas when wetted”.

3.7.5.3 Special protective equipment and precautions for fire fighters

3.7.5.3.1 Advice on any precaution to be taken during fire-fighting shall be provided. For example, “Keep containers cool with water spray”.

3.7.5.3.2 Advice on appropriate protective equipment for fire-fighters shall be provided. For example, boots, overalls, gloves, eye and face protection, and breathing apparatus. The relevant emergency services authority shall be contacted for specific advice if unsure of appropriate fire fighting precautions or protective equipment.

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3.7.5.3.3 Where available, the Hazchem code shall be provided in this section for information on emergency services. The Hazchem code for bulk dangerous goods provides coded information on the fire-fighting medium to be used such as whether water shall be used as a fire-fighting agent, as this will be the first response of fire-fighters. This includes information on clothing and equipment for personal protection, the risk of violent reaction or explosion, spillage action, and whether evacuation shall be considered in the event of an incident with the material.

3.7.6 Section 6: Accidental release measures

The appropriate information to respond to spills, leaks, or releases in order to prevent or minimise the adverse effects on people, property, and the environment in the vicinity of the workplace shall be provided. Distinguish between responses for large and small spills where the spill volume has a significant impact on the hazard or response.

3.7.6.1 Personal precautions, protective equipment, and emergency procedures

Advice related to spills or release of hazardous chemicals must be provided on:

(a) Use of suitable protective equipment (including personal protective equipment) to prevent contamination of skin, eyes, and personal clothing;
(b) Removal of ignition sources and provision of sufficient ventilation;
(c) Emergency procedures such as the necessity to evacuate the danger area or to consult an expert.

3.7.6.2 Environmental precautions

It is recommended that advice be provided on any precautions related to accidental spills and release of the hazardous chemical that may impact the environment, such as keeping away from drains, surface and ground water. Contamination of the environment can give rise to indirect human chemical exposures within and outside of workplaces.

3.7.6.3 Methods and materials for containment and cleaning up

Appropriate advice on how to contain and clean up a spill shall be provided. Appropriate containment techniques may include:

(a) Bunding[9], covering of drains; and
(b) Capping procedures[10].

Appropriate clean up procedures may include:
(a) Neutralisation techniques;
(b) Decontamination techniques;
(c) Adsorbent materials;
(d) Cleaning techniques;

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[9] A **bund** is a provision of liquid collection facilities which, in the event of any leak or spillage from tanks or pipework, will capture well in excess of the volume of liquids held. For example, an embankment. Bunded areas shall drain to a capture tank which shall have facilities for water/oil separation.
[10] i.e. providing a cover or protection (for example, to prevent damage or spillage).

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(e) Vacuuming techniques; and
(f) Equipment required for containment/clean up (includes the use of non-sparking tools and equipment, where applicable).

Recommended clean up procedures shall also take into account disposal considerations detailed under Section 13 of the SDS (see Section 13 for further information).

3.7.7 Section 7: Handling and storage

This section of the SDS shall provide guidance on safe handling and storage practices that minimise risks. The hazardous chemical precautions must be appropriate to the intended use of the chemical and to its unique properties.

3.7.7.1 Precautions for safe handling

Advice shall be provided that:

(a) Allows safe handling of hazardous chemicals (for example, avoidance of spills);
(b) Prevents inappropriate handling of incompatible hazardous chemicals; and
(c) Minimises the release of hazardous chemicals outside of the workplace.

General warnings on what practices to avoid or restrict shall also be included in this section. It is recommended that this section provides advice on general hygiene. For example:

(a) "Eating, drinking, and smoking in work areas are prohibited";
(b) "Wash hands after use"; and
(c) "Remove contaminated clothing and protective equipment before entering eating areas".

3.7.7.2 Conditions for safe storage, including any incompatibilities

This section shall provide advice consistent with the physical and chemical properties in *Section 9: Physical and chemical properties* and *Section 10: Stability and reactivity*. Advice shall be provided on specific storage requirements, including:

(a) How to avoid:
  (i) Explosive atmospheres;
  (ii) Corrosive conditions;
  (iii) Flammability hazards;
  (iv) Incompatible substances or mixtures;
  (v) Evaporative conditions; and
  (vi) Potential ignition sources (including electrical equipment).

(b) How to control the effects of:
  (i) Weather conditions;
  (ii) Ambient pressure;
  (iii) Temperature;
  (iv) Sunlight;
  (v) Humidity; and
  (vi) Vibration.

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(c) How to maintain the integrity of the hazardous chemical by the use of:
  (i) Stabilisers; and
  (ii) Anti-oxidants.

(d) Other advice, including:
  (i) Ventilation requirements for storage facilities;
  (ii) Specific designs for storage rooms/vessels;
  (iii) Quantity limits under storage conditions;
  (iv) Packaging compatibilities; and
  (v) Warnings if water shall not be used as a fire-fighting agent. For example, “Ensure that fire-fighting water cannot reach water-sensitive chemicals. If necessary, provide protective cabinets with appropriate labelling”.

3.7.8 Section 8: Exposure controls and personal protection

For the purposes of this section, “exposure control” means the full range of specific protection and prevention measures to be taken during use in order to minimise personal exposure to the hazardous chemical. Advice shall be provided on the measures to be taken to minimise exposure to the hazardous chemical and, in any case, to keep exposure well below the relevant Permissible Exposure Limit (PEL).

3.7.8.1 Control parameters

3.7.8.1.1 *Exposure monitoring*

(a) Advice shall be provided on what measures to be taken to minimise exposure to hazardous chemicals and, in any case, keep exposure well below the relevant PEL. The PEL represent airborne concentrations of individual chemical substances which, according to current knowledge, shall neither impair the health of, nor cause undue discomfort to, nearly all workers.

(b) PEL is expressed as a Time-Weighted Average (TWA) concentration of that substance over an eight-hour working shift, Short-Term Exposure Limits (STEL) or ceiling limit.

(c) If air contaminants are generated when using the hazardous chemical as intended, PEL for these shall also be listed.

(d) Where there is no Malaysian PEL as stipulated under the Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000, internationally recognized exposure standards or exposure standard from other countries shall be used, if available. Examples of international standards or limits include those of the Health and Safety Executive (HSE) in the United Kingdom, American Conference of Governmental Industrial Hygienists (ACGIH) or *Maximale Arbeitsplatzkonzentrationen* (German MAK).

(e) Regardless of the exposure standard (if any), this section shall detail controls to be implemented in a workplace to keep personal exposure to the minimum practicable.

(f) Where a chemical is classified as a carcinogen, recommendations on substitution or isolation of the chemical from the workplace shall be included in this section of the SDS.

3.7.8.1.2 *Biological monitoring*

Where available, list the biological limit values, including notations, for a substance and for each of the ingredients of the mixture. The source of the biological limit value shall be stated in the SDS. When listing biological limit values, use the chemical identity as specified in Section 3.

3.7.8.2 Appropriate engineering controls

This section of the SDS must include a description of appropriate exposure control measures relating to the intended modes of use of the hazardous chemical. Sufficient information shall be provided to enable a proper risk assessment to be carried out. Indicate when special engineering controls are necessary, and specify which type. For example:

(i) "Maintain air concentration below permissible exposure limit", using engineering controls if necessary";
(ii) "Use only in a well-ventilated area";
(iii) "Use local exhaust ventilation when";
(iv) "Use only in an enclosed system";
(v) "Use only in spray paint booth or enclosure";
(vi) "Use mechanical handling to reduce human contact with materials"; or
(vii) "Use explosive dust handling controls".

The information in this section shall complement that provided in *Section 7: Handling and storage* of the SDS.

3.7.8.3 Individual protection measures, such as PPE

3.7.8.3.1 Consistent with good occupational hygiene practices, PPE shall only be used when other control measures have been found not to be practicable, including engineering controls, ventilation, and isolation. This section of the SDS may include information on PPE, provided that this section clearly recommends other controls to minimise exposure to the hazardous chemical.

3.7.8.3.2 Where PPE is recommended to minimise the potential for illness or injury due to exposure from hazardous chemicals, information in this section shall include:

(a) Eye/face protection – specify the type of eye protection (safety glasses, goggles and/or face shield) required, and any specific properties (degree of impact protection, splash resistance, etc) required based on the hazard of the hazardous chemical and potential for contact;

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(b) Skin protection – specify the protective equipment to be worn (for example, types of gloves, boots, bodysuits) and any specific requirements for each (for example, cotton, PVC, nitrile, etc.) based on the hazards associated with the hazardous chemical and the potential for contact. Special requirements shall exist for gloves or other protective clothing to prevent exposure. Where relevant, this shall be clearly stated. For example, when using "PVC gloves" or "nitrile rubber gloves", the thickness and breakthrough time of the glove material shall be stated as this is critical to prevent exposure.

(c) Respiratory protection – specify appropriate types of respiratory protection based on the hazard and potential for exposure. For example, air-purifying respirators (and specific respiration filter required) or air-line respirator or breathing apparatus. Vague information such as 'use face mask' is not acceptable, whereas 'use half-face filter respirator suitable for organic vapours' would be acceptable; and

(d) Thermal hazards – when specifying protective equipment to be worn for materials that represent a thermal hazard, special consideration shall be given to the construction of the PPE so as to avoid adding to the thermal load of the wearer.

3.7.8.3.3 Consideration shall also be given to the possible reduction in effectiveness of PPE and/or the possible detrimental effects of hazardous chemicals on some materials from which items of PPE may be constructed. For example, the use of synthetic clothing for protection against corrosive hazardous chemicals.

Refer to *Section 5: Fire fighting measures* of the SDS for specific fire/chemical PPE advice.

3.7.9 Section 9: Physical and chemical properties

Describe the empirical data of the hazardous chemical in this section.

3.7.9.1 The data included in this section applies to the hazardous chemical as supplied. If the hazardous chemical is a mixture, the physicochemical data shall describe the mixture.

3.7.9.2 The following properties shall be included and the appropriate units of measure and/or reference conditions must be specified. If relevant for the interpretation of the numeric value, the method of the determination may also be provided (for example, for flash point, open-cup/closed-cup):

(a) Appearance (physical state, colour, etc.);
(b) Odour;
(c) Odour threshold, if applicable;
(d) pH;
(e) Melting point/freezing point;
(f) Initial boiling point and boiling range;
(g) Flash point;

(h) Evaporation rate, if applicable;
(i) Flammability (solid, gas);
(j) Upper/lower flammability or explosive limits;
(k) Vapour pressure;
(l) Vapour density;
(m) Relative density;
(n) Solubility(ies);
(o) Partition coefficient: n-octanol/water;
(p) Auto-ignition temperature;
(q) Decomposition temperature; and
(r) Viscosity.

3.7.9.3 Where no information about specific characteristics or data is not available, a statement shall be included to that effect.

3.7.10 Section 10: Stability and reactivity

This section shall contain information on:
(a) Reactivity.
(b) Chemical stability.
(c) Possibility of hazardous reaction.
(d) Conditions to avoid.
(e) Incompatible materials.
(f) Hazardous decomposition products.

3.7.10.1 Reactivity

3.7.10.1.1 This section shall describe the reactivity hazards of the hazardous chemical, including the conditions under which hazardous reactions may occur.

3.7.10.1.2 For example:

(a) Whether the hazardous chemical will react or polymerise;
(b) The release of excess pressure or heat;
(c) Flame propagation or burning rate of solid materials;
(d) Properties of both flammable and non-flammable materials that may initiate or uniquely contribute to the intensity of a fire;
(e) Potential for dust explosion;
(f) Reactions that release flammable or toxic gases or vapours;
(g) Fast or intensely burning characteristics; and
(h) Non-flammables that could contribute to unusual hazards to a fire, such as strong oxidising and reducing agents or peroxide fumes.

3.7.10.1.3 Specific test data for the hazardous chemical as a whole shall be provided, where available. Information shall also be based on general data for the class or family of chemical if such data adequately represent the anticipated hazard of the hazardous chemical.

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3.7.10.1.4 If data for mixtures are not available, ingredient data shall be provided. In determining incompatibility, the substances, containers and contaminants that the hazardous chemical might be exposed to during transportation, storage, and use shall be considered.

3.7.10.2 Chemical stability

If the hazardous chemical is stable or unstable under normal ambient and anticipated storage and handling conditions of temperature and pressure this information shall be provided under this heading of the SDS. Describe any stabilisers which are or may be, used to maintain the product. Indicate the safety significance of any change in the physical appearance of the product which will result if the stabiliser, phlegmatiser, etc. are compromised.

3.7.10.3 Possibility of hazardous reactions

If relevant, state if the substance or mixture will react or polymerise, release excess pressure or heat, or create other hazardous conditions. Describe under what conditions the hazardous reactions may occur.

3.7.10.4 Conditions to avoid

List conditions such as temperature, pressure, shock, static discharge, vibrations or other physical stresses that might result in a hazardous situation such as those listed under paragraph 3.7.10.1.2.

3.7.10.5 Incompatible materials

Under this section, classes of chemicals or specific substances with which the hazardous chemical could react to produce a hazardous situation, such as explosion, release of toxic or flammable materials, or liberation of excessive heat, shall be listed. For example, acids are incompatible with alkalis as the reaction produces excessive heat.

3.7.10.6 Hazardous decomposition products

Under this section, known and reasonably anticipated hazardous decomposition products produced as a result of use, storage and heating or reaction with another material, including the production of flammable, toxic and asphyxiating gases shall be listed. Advice shall be provided about what shall be done if an unstable state is achieved. Hazardous combustion products shall be included in Section 5 of the SDS.

3.7.11 Section 11: Toxicological information

This section is to be used primarily by medical professionals, occupational health and safety professionals, and toxicologists and shall include information relevant to the health hazard category assigned to the chemical. Care shall be taken, however, to express the information in a simple manner comprehensible to non-experts. As a result, it is recommended that the SDS writer obtain expert toxicological advice in preparation of this section of the SDS. A concise but complete and comprehensible description of the various toxicological (health) effects consistent with hazard classification, and the available data used to identify those effects, must be provided.

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3.7.11.1 The relevant hazards, for which data must be provided, are:

(a) Acute toxicity;
(b) Skin corrosion or irritation;
(c) Serious eye damage or eye irritation;
(d) Respiratory sensitization;
(e) Skin sensitization;
(f) Germ cell mutagenicity;
(g) Carcinogenicity;
(h) Reproductive toxicity;
(i) Specific target organ toxicity (STOT) – single exposure;
(j) Specific target organ toxicity (STOT) – repeated exposure; and
(k) Aspiration hazard.

3.7.11.2 Other non-classifiable hazards may be included for completion (for example, dust explosion hazards).

3.7.11.3 If data for any of these hazards are not available, they shall still be listed in the SDS with a statement that data is not available.

3.7.11.4 The data included in this section shall apply to the hazardous chemical as used in the workplace. The toxicological data shall be relevant to the mixture. Where information on the mixture is not available, then information on the toxicological properties of the hazardous ingredients above the concentration limit in the mixture shall be provided. If bridging principles are used, the type of bridging principles shall be stated in this section.

3.7.11.5 The health effects included in the SDS shall be consistent with those described in the studies used for the classification of the hazardous chemical.

3.7.11.6 General statements such as “Toxic” with no supporting data or “Safe if properly used” are not acceptable as they may be misleading and do not provide a description of health effects. Phrases such as “not relevant”, or leaving blank spaces in the health effects section can lead to confusion and misunderstanding and shall not be used. For health effects where information is not available, this shall be clearly stated. Health effects shall be described accurately and relevant distinctions made. For example, allergic contact dermatitis and irritant contact dermatitis shall be distinguished from each other.

3.7.11.7 Where there is a substantial amount of test data on hazardous chemicals, it shall be desirable to summarise the results, for example, by grouping toxicological data according to route of exposure.

3.7.11.8 Information shall also be provided on the relevant negative data. Information to support negative test results shall be provided (for example, “Carcinogenicity studies in rats have shown no significant increase in the incidence of cancer”.).

3.7.11.9 The toxicological data for hazards described in paragraph 3.7.11.1 shall contain concise but complete and comprehensible description of the various toxicological (health) effects and the available data used to identify those effects, including:

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(a) Information on possible routes of exposure

This section shall provide information on the possible routes of exposure and the effects of the hazardous chemical via each route of exposure, that is, through ingestion (swallowing), inhalation or skin/eye exposure. A statement shall be made if health effects are not known. Statements such as, “Ingestion is not expected to occur” or “Ingestion shall be avoided”, are not acceptable.

Information on all routes of exposure shall be provided as it is not possible for the writer to predict how a chemical will be used in a workplace, or the most likely exposure.

(b) Early onset symptoms related to exposure

This section shall describe early symptoms associated with exposure to the hazardous chemical, its ingredients or known by-products. Provide information on the symptoms related to the physical, chemical, and toxicological characteristics of the hazardous chemical following exposure related to the intended uses. Describe the first symptoms at the lowest exposures through to the consequences of severe exposure; for example, “headaches and dizziness may occur, proceeding to fainting or unconsciousness; large doses may result in coma and death”.

(c) Delayed health effects from exposure

Information shall be provided on whether delayed or immediate effects can be expected after short- or long-term exposure consistent with the classification of the chemical. Also provide information on acute and chronic health effects relating to human exposure to the hazardous chemical. Where human data are not available, animal data shall be summarised and the species clearly identified. It shall be indicated in the SDS whether toxicological data is based on human or animal data. Classifications or studies from government or international agencies shall be used; for example “has been classified as a probable human carcinogen by the International Agency for Research on Cancer (IARC)”. Where data on chronic effects is not available it is recommended that the SDS take a precautionary approach to health effects from exposure.

(d) Numerical measures of toxicity

Where available, provide information on the dose, concentration or conditions of exposure that may cause adverse health effects. Where appropriate, doses shall be linked to symptoms and effects, including the period of exposure likely to cause harm. For example, 10 ppm respiratory irritation, 250 – 300 ppm difficulty in breathing, 500 ppm unconsciousness leading to death after 30 minutes. Where exposure levels are not known, the SDS shall take a precautionary approach to exposure levels.

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(e) Interactive effects

Information on interactions shall be included if known. For example:
(i) If symptoms are exacerbated by drinking alcohol, taking medication or smoking;
(ii) If pre-existing medical conditions such as asthma, high blood pressure or a predisposition to allergic reactions may place an individual at an increased risk.

(f) Where specific chemical data are not available

It may not always be possible to obtain information on the hazards of a hazardous chemical. In cases where data on the specific hazardous chemical are not available, data on the chemical functional group, if appropriate, shall be used. Where generic data are used or where data are not available, this shall be stated clearly in the SDS.

(g) Mixtures of chemicals

(i) If a mixture has not been tested for its health effects as a whole, then information on each ingredient listed in Section 3 of the SDS shall be provided.

(ii) Ingredients may interact with each other in the body resulting in different rates of absorption, metabolism, and excretion. As a result, the toxic actions may be altered and the overall toxicity of the mixture may be different from its ingredients.

(iii) It is necessary to consider whether the concentration of each ingredient is sufficient to contribute to the overall health effects of the mixture. The information on toxic effects shall be presented for each ingredient, except:

- If the information is duplicated, in which case it is not necessary to list this more than once. For example, if two ingredients both cause vomiting and diarrhoea, it is not necessary to list this twice. Overall, the mixture is described as causing vomiting and diarrhoea;

- If it is unlikely that these effects will occur at the concentrations present. For example, when a mild irritant is diluted in a non-irritating solution, there comes a point where the overall mixture would be unlikely to cause irritation.

(iv) Predicting the interactions between ingredients is extremely difficult, and where information on interactions is not available, assumptions shall not be made and instead the health effect of each ingredient shall be listed separately.

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3.7.12 Section 12: Ecological information

This section shall contain information on:

(a) Ecotoxicity (aquatic and terrestrial, where available);
(b) Persistence and degradability;
(c) Bioaccumulative potential;
(d) Mobility in soil; and
(e) Other adverse effects.

3.7.12.1 If a hazardous chemical has been classified as environmentally hazardous, then this information shall be included in the SDS. This information can assist in handling spills and evaluating waste treatment practices and shall clearly indicate species, media, units, test duration and test conditions. Where information is not available, this shall be stated.

3.7.12.2 Some ecotoxicological properties are substance specific, i.e. bioaccumulation, persistence, and degradability. The information shall, therefore, be given, where available and appropriate, for each substance of the mixture.

(a) Ecotoxicity

Information on ecotoxicity may be provided using data from tests performed on aquatic organisms. This shall include relevant available data on both acute and chronic aquatic toxicity for fish, crustaceans, algae, and other aquatic plants. Where the hazardous chemical has inhibitory effects on the activity on micro-organismas, the possible impact on sewage treatment plants shall be mentioned.

(b) Persistence and degradability

Persistence and degradability is the potential for the hazardous chemical (or hazardous ingredients of a mixture) to degrade in the environment, either through biodegradation or other processes, such as oxidation or hydrolysis. Test results relevant to assess persistence and degradability may be given where available. If degradation half-lives are quoted it shall be indicated whether these half-lives refer to mineralisation or to primary degradation. The potential of the hazardous chemical (or hazardous ingredients of a mixture) to degrade in sewage treatment plants may also be mentioned.

(c) Bioaccumulative potential

Bioaccumulation is the potential for the hazardous chemical (or hazardous ingredients of a mixture) to accumulate in biota and, possibly pass through the food chain. Test results relevant to assess the bioaccumulative potential shall be given. This may include reference to the octanol-water partition coefficient (K_{ow}) and bioconcentration factor (BCF), if available.

(d) Mobility in soil

Mobility in soil is the potential of a hazardous chemical (or hazardous ingredients of a mixture), if released to the environment, to move under natural forces to the groundwater or to a distance from the site of release. The potential for mobility in soil may be given where available. Information on mobility can be determined from relevant mobility data such as adsorption

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studies or leaching studies. For example, soil organic carbon partition coefficient (K_{oc})values can be predicted from octanol/water partition coefficients (K_{ow}). Leaching and mobility can be predicted from models.

NOTE
Where real data on the hazardous chemical is available, this data shall take precedence over models and predictions.

(e) Other adverse effects

Information on any other adverse effects to the environment may be included where available, such as environmental fate (exposure), ozone depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential.

3.7.13 Section 13: Disposal information

This section shall provide description on waste residues and information on their safe handling and method of disposal, including the disposal of any contaminated packaging.

Disposal Methods

3.7.13.1 This section of the SDS must provide information for proper disposal, recycling or reclamation of the hazardous chemical and, where relevant, its container, to assist in the determination of safe and environmentally preferred waste management options, consistent with Environmental Quality Act 1974 and relevant regulations under the Act. For the safety of persons conducting disposal, recycling or reclamation activities, refer to the information in Section 8 of the SDS.

3.7.13.2 The disposal methods shall:

(a) Specify disposal containers and methods;
(b) Discuss physical/chemical properties that may affect disposal options;
(c) Discourage sewage disposal; and
(d) Where appropriate, identify any special precautions for incineration or landfill.

3.7.13.3 These methods of disposal apply not only to the chemical product (residual waste) but also to any contaminated containers or packaging.

3.7.13.4 Consideration shall be given to the relevance of disposal advice provided on the SDS so that it applies to the material as manufactured. Processing, use or contamination may make the information inappropriate, inaccurate, or incomplete.

NOTE
Information on the disposal of chemicals can be obtained from the Department of Environment.

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3.7.14 Section 14: Transportation information

This section shall include this information:

(a) UN number;
(b) UN proper shipping name;
(c) Transport hazard class(es);
(d) Packing group, if applicable;
(e) Environmental hazards (e.g. marine pollutant (Yes/No);
(f) Transport in bulk (according to Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) and the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code));
(g) Special precautions which a user needs to be aware of, or needs to comply with, in connection either within or outside their premises.

3.7.14.1 This section of the SDS shall provide basic classification information for the transportation or shipment of a hazardous chemical by road, rail, sea or air as required by relevant transport regulations. Where information is not available or relevant, this shall be stated.

(a) UN number

This section shall provide the UN number (i.e. four-figure identification number of the substance or article) listed in the UNRTDG.

(b) Proper shipping name or technical name

Provide the Proper Shipping Name or Technical Name from the UNRTDG. For hazardous chemicals, the Proper Shipping Name or Technical name shall be provided in this sub-section if it has not appeared as the product identifier or national or regional identifiers.

(c) Transport hazard class(es)

This section shall provide the transport class/division (and subsidiary risks) assigned to the hazardous chemical according to the most predominant hazards that they present in accordance with the UNRTDG.

(d) Packing Group, if applicable

The Packing Group number from the UNRTDG shall be provided, if applicable. The Packing Group number is assigned to certain substances in accordance with their degree of hazard. Packing Group I is the highest hazard and Packing Group III the lowest.

(e) Environmental hazards for transport purposes

This section shall indicate whether the hazardous chemical is a known marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code), and if so, whether it is a “marine pollutant” or a “severe marine pollutant”. Also it is recommended that the SDS indicates whether the substance or mixture is classified as having an acute aquatic toxicity hazard as required by the UNRTDG.

(f) Special precautions for user

Information on any special precaution which a user needs to be aware of, or needs to comply with in connection with transport shall be provided. Any other special requirements (for example, hazards such as shock sensitivity, specific storage requirements during transit/warehousing or overseas regulatory transport requirements if the hazardous chemical is for export) shall be stated here, as relevant to transport of the chemical.

(g) Additional information

Additional information, for example information required by overseas regulatory agencies or relevant regulations for the transport of goods by other modes, shall be included here.

(h) Hazchem or Emergency Action Code

The relevant Hazchem (or Emergency Action) Code shall be provided as specified in the UNRTDG.

3.7.15 Section 15: Regulatory information

This section shall describe any other regulatory information on the hazardous chemical that is not provided elsewhere in the SDS, for example whether the hazardous chemical is subject to the following international agreements:

(a) Montreal Protocol(Ozone Depleting Substances)[11]; or
(b) Stockholm Convention(Persistent Organic Pollutants)[12]; or
(c) Rotterdam Convention (Prior Informed Consent)[13]; or
(d) Basel Convention (Hazardous Waste)[14].

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[11] Montreal Protocol means the Montreal Protocol on Substances that Deplete the Ozone Layer, as either adjusted and/or amended.

[12] Stockholm Convention means the Stockholm Convention on persistent organic pollutants.

[13] Rotterdam Convention means the Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade.

[14] Basel Convention means the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

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3.7.15.1 Safety, health, and environmental regulations specific for the hazardous chemical in question

Other regulatory information shall also be included here, for example whether the substance is covered by the following regulations:

(a) OSHA 1994 and relevant regulations;
(b) Factories and Machinery Act 1967 and relevant regulations;
(c) Petroleum (Safety Measures) Act 1984;
(d) Environmental Quality Act 1974 and regulations;
(e) Pesticides Act 1974 and regulations;
(f) Motor Vehicles (Construction and Use) (Vehicles Carrying Petroleum Products) Rules, 1965 – L.N. 405/65 under Road Transport Act, 1987;
(g) Motor Vehicles (Construction, Equipment and Use) (Use Of Liquefied Petroleum Gas Fuel System In Motor Vehicles) Rules 1982 - P.U. (A) 392/82 under Road Transport Act, 1987.

3.7.16 Section 16: Other information

This section shall include the following information:

(a) Date of preparation and revision of the SDS;

(b) When revisions are made to an SDS, unless it has been indicated elsewhere, clearly indicate where the changes have been made to the previous version of the SDS. Suppliers shall maintain an explanation of the changes and be willing to provide it upon request;
(c) Key literature references and sources for data used to compile the SDS; and
(d) Key/legend to the abbreviations and acronyms used in the SDS.

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PART 4

CONFIDENTIAL BUSINESS INFORMATION (CBI)

PART 4

CONFIDENTIAL BUSINESS INFORMATION (CBI)

4.1 General Principles

The CBI shall be consistent with the following general principles:

(a) For information otherwise required on chemical inventory or SDS, CBI claims shall be limited to the names of chemicals and their concentrations in mixtures. All other information shall be disclosed in the inventory and SDS, as required;

(b) Where CBI has been withheld, the inventory or SDS shall so indicate; and

(c) CBI shall be disclosed to the Director-General of Occupational Safety and Health upon request. The confidentiality of the information received is protected under Section 67 of OSHA 1994.

4.2 CBI Requirements

4.2.1 A generic name may be used to describe a hazardous ingredient if the identity of the ingredient is commercially confidential.

4.2.2 Where the exact concentration of an ingredient is CBI, the concentration of the ingredient shall be disclosed using the following allowable concentration range or a narrower range.

Allowable concentration range for ingredients claimed as CBI

<1%
1 to <3%
3 to <5%
5 to <10%
10 to <30%
30 to 60%
>60%

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Example:

For an ingredient present at 35%, the allowable concentration range is 30 – 60%; however a narrower range of 30 – 40% can be used.

4.2.3 Where the classification of the hazardous chemical is based on the ingredients, rather than the product as a whole, the classification must be based on the highest concentration provided in the SDS. That is, for an ingredient present in a mixture at 35% w/w that has been disclosed in the SDS as 30-60%, the mixture must be classified as if it contains 60% of the ingredient. However, this does not apply where the hazard classification has been determined from tests on the mixture.

4.3 Guides for Selecting Generic Names

This guide describes the procedure for naming hazardous chemicals and the division of substances into families. The families are defined in the following manner:

(a) Inorganic or organic substances whose properties are identified by having a common chemical element as their chief characteristic. The family name is derived from the name of the chemical element. These families are identified as in 4.3.2.1 below by the atomic number of the chemical element (001 to 103); and

(b) Organic substances whose properties are identified by having a common functional group as their chief characteristic.

- (i) The family name is derived from the functional group name; and
- (ii) These families are identified by the number convention found in 4.3.2.2 (601 to 650).

(c) Sub-families bringing together substances with a common specific character have been added in certain cases.

4.3.1 Establishing the Generic Name

4.3.1.1 General Principles

In selecting a generic name, the following approach is adopted:

(a) Identity of the functional groups and chemical elements present in the molecule; and

(b) Determine the most important functional groups and chemical elements, which contribute to its properties.

NOTE
The identified functional groups and elements taken into account are the names of the families and sub-families set out in 4.3.2 in the form of a (non-restrictive) list.

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4.3.1.2 Practical application

After having conducted a search to see if the substance belongs to one or more families or sub-families on the list, the generic name can be established in the following way:

(a) If the name of a family or sub-family is sufficient to characterise the chemical elements or important functional groups, this name will be chosen as the generic name.

Examples:

Name	**Family** **sub-family**	**Generic Name**
1,4-dihydoxybenzene	604: Phenols and derivatives	Phenol derivative
Butanols	603: Alcohols and derivatives Aliphatic alcohols	Aliphatic alcohol
2-isopropoxyethanol	603: Alcohols and derivatives Glycoethers	Glycolether
Methacrylate	607: Organic acids and derivatives Acrylates	Acrylate

(b) If the name of a family or sub-family is not sufficient to characterise the chemical elements of important functional groups, the generic name shall be a combination of the corresponding different family or sub-family names.

Examples:

Name	**Family** **sub-family**	**Generic Name**
Lead hexafluorosilicate	009: Fluorine compounds Inorganic fluorides 082: Lead compounds Lead compounds	Inorganic lead fluoride
Chlorobenzene	602: Halogenated hydrocarbons Halogenated aromatic compounds 017: Chlorine compounds	Chlorinated aromatic compounds
2,3,6-trichlorophenylacetic acid	607: Organic acids Halogenated aromatic acids 017: Chlorine compounds	Chlorinated aromatic acid
1-chloro-1-nitropropane	610: Chloronitrated derivatives 601: Hydrocarbons Aliphatic hydrocarbons	Chloronitrated aliphatic hydrocarbon
Tetrapropyl dithiopyrophosphate	015: Phosphorus compounds Phosphoric esters 016:Sulphur compounds	Thiophosphoric ester

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(c) In the case of certain elements, notably metals, the name of the family or sub-family may be indicated by the words 'organic' or 'inorganic'.

Examples:

Name	**Family** **sub-family**	**Generic Name**
Dimercury dichloride	080: Mercury compounds	Inorganic mercury compound
Barium acetate	056: Barium compounds	Organic barium compound
Ethyl nitrite	007: Nitrogen compounds Nitrites	Organic nitrite
Sodium hydrosulphite	016: Sulphur compounds	Inorganic sulphur compound

4.3.2 Division of Substances into Families and Sub-Families

4.3.2.1 Chemical elements

Family No.	**Families** **Sub-Families**
001	Hydrogen compounds Hydrides
002	Helium compounds
003	Lithium compounds
004	Beryllium compounds
005	Boron compounds Boranes Borates
006	Carbon compounds Carbamates Inorganic carbon compounds Salts of hydrogen cyanide Urea and derivatives
007	Nitrogen compounds Quaternary ammonium compounds Acid nitrogen compounds Nitrates Nitrites
008	Oxygen compounds
009	Fluorine compounds Inorganic fluorides
010	Neon compounds
011	Sodium compounds

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Family No.	Families Sub-Families
012	Magnesium compounds Organometallic magnesium derivatives
013	Aluminium compounds Organometallic aluminium derivatives
014	Silicon compounds Silicones Silicates
015	Phosphorus compounds Acid phosphorus compounds Phosphonium compounds Phosphoric esters Phosphates Phosphites Phosphoramides and derivates
016	Sulphur compounds Acid sulphur compounds Mercaptans Sulphates Sulphites
017	Chlorine compounds Chlorates Perchlorates
018	Argon compounds
019	Potassium compounds
020	Calcium compounds
021	Scandium compounds
022	Titanium compounds
023	Vanadium compounds
024	Chromium compounds Chromium VI compounds
025	Manganese compounds
026	Iron compounds
027	Cobalt compounds
028	Nickel compounds
029	Copper compounds
030	Zinc compounds Organometallic zinc derivatives
031	Gallium compounds
032	Germanium compounds
033	Arsenic compounds
034	Selenium compounds
035	Bromine compounds
036	Krypton compounds
037	Rubidium compounds
038	Strontium compounds

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Family No.	Families Sub-Families
039	Yttrium compounds
040	Zirconium compounds
041	Niobium compounds
042	Molybdenum compounds
043	Technetium compounds
044	Ruthenium compounds
045	Rhodium compounds
046	Palladium compounds
047	Silver compounds
048	Cadmium compounds
049	Indium compounds
050	Tin compounds Organometallic tin derivates
051	Antimony compounds
052	Tellurium compounds
053	Iodine compounds
054	Xenon compounds
055	Caesium compounds
056	Barium compounds
057	Lanthanum
058	Cerium compounds
059	Praseodymium compounds
060	Neodymium compounds
061	Promethium compounds
062	Samarium compounds
063	Europium compounds
064	Gandolinium compounds
065	Terbium compounds
066	Dysprosium compounds
067	Holmium compounds
068	Erbium compounds
069	Thulium compounds
070	Ytterbium compounds
071	Lutetium compounds
072	Hafnium compounds
073	Tantalum compounds
074	Tungsten compounds
075	Rhenium compounds
076	Osmium compounds
077	Iridium compounds
078	Platinum compounds
079	Gold compounds

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Family No.	Families Sub-Families
080	Mercury compounds Organometallic mercury derivatives
081	Thallium compounds
082	Lead compounds Organometallic lead derivatives
083	Bismuth compounds
084	Polonium compounds
085	Astate compounds
086	Radon compounds
087	Francium compounds
088	Radium compounds
089	Actinium compounds
090	Thorium compounds
091	Protactinium compounds
092	Uranium compounds
093	Neptunium compounds
094	Plutonium compounds
095	Americium compounds
096	Curium compounds
097	Berkelium compounds
098	Californium compounds
099	Einsteinium compounds
100	Fermium compounds
101	Mendelevium compounds
102	Nobelium compounds
103	Lawrencium compounds

4.3.2.2 Organic Substances

Family No.	Families Sub-Families
601	Hydrocarbons Aliphatic hydrocarbons Aromatic hydrocarbons Alicyclic hydrocarbons Polycyclic aromatic hydrocarbons (PAH)
602	Halogenated hydrocarbons* Halogenated aliphatic hydrocarbons* Halogenated aromatic hydrocarbons* Halogenated alicyclic hydrocarbons* * Specify according to family corresponding to halogen.

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Family No.	Families Sub-Families
603	Alcohols and derivates Aliphatic alcohols Aromatic alcohols Alicyclic alcohols Alcanolamines Epoxy derivatives Ethers Glycolethers Glycols and polyols
604	Phenols and derivatives Halogenated phenol derivatives* * Specify according to the family corresponding to halogen.
605	Aldehydes and derivates Aliphatic aldehydes Aromatic aldehydes Alicyclic aldehydes Aliphatic acetals Aromatic acetals Alicyclic acetals
606	Ketones and derivatives Aliphatic Ketones Aromatic Ketones* Alicyclic Ketones * Quinones included.
607	Organic acids and derivatives Aliphatic acids Halogenated aliphatic acids* Aromatic acids Halogenated aromatic acids* Alicyclic acids Halogenated alicyclic acids* Aliphatic acid anhydrides Halogenated aliphatic acid anhydrides* Aromatic acid anhydrides Halogenated aromatic acid anhydrides* Alicyclic acid anhydrides Halogenated alicyclic acid anhydrides* Salts of aliphatic acid Salts of halogenated aliphatic acid* Salts of aromatic acid Salts of halogenated aromatic acid* Salts of alicyclic acid Salts of halogenated alicyclic acid* Esters of aliphatic acid Esters of halogenated alicyclic acid*

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Family No.	Families Sub-Families
	Esters of aromatic acid Esters of halogenated aromatic acid* Esters of alicyclic acid Esters of halogenated alicyclic acid* Esters of glycol ether Acrylates Methacrylates Lactones Acyl halogenides * Specify according to the family corresponding to halogen.
608	Nitriles and derivatives
609	Nitrated derivatives
610	Chloronitrated derivatives
611	Azoxy and azoic derivatives
612	Aminated derivatives Aliphatic amines and derivatives Alicyclic amines and derivatives Aromatic amines and derivatives Aniline and derivatives Benzidine and derivatives
613	Heterocyclic basis and derivatives Benzimidazole and derivatives Imidazol and derivatives Pyrethrinoids Quinoline and derivatives Triazine and derivatives Triazole and derivatives
614	Glucosides and alkaloids Alkaloid and derivatives Glucosids and derivatives
615	Cyantes and isocyanates Cyanates Isocyanates
616	Amides and derivatives Acetamide and derivatives Anilides
617	Organic peroxides

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APPENDIX

APPENDIX 2.1

Translation Table from R-phrase to H-code

Classification under Directive 67/ 548/EEC	Classification under the Regulations	
	Hazard Classification	**H-Code: Hazard statement**
Xn; R20	Acute toxicity category 4	H332: Harmful if inhaled
Xn; R21	Acute toxicity category 4	H312: Harmful if in contact with skin
Xn; R22	Acute toxicity category 4	H302: Harmful if swallowed
T; R23 (gas)	Acute toxicity category 3	H331: Toxic if inhaled
T; R23 (vapour)	Acute toxicity category 2	H330: Fatal if inhaled
T; R23 (dust/mist)	Acute toxicity category 3	H331: Toxic if inhaled
T; R24	Acute toxicity category 3	H311: Toxic if in contact with skin
T; R25	Acute toxicity category 3	H301: Toxic if swallowed
T+; R26 (gas)	Acute toxicity category 2	H330: Fatal if inhaled
T+; R26 (vapour)	Acute toxicity category 1	H330: Fatal if inhaled
T+; R26 (dust/mist)	Acute toxicity category 2	H330: Fatal if inhaled
T+; R27	Acute toxicity category 1	H310: Fatal if in contact with skin
T+; R28	Acute toxicity category 2	H300: Fatal if swallowed
R33	Specific target organ toxicity – repeated exposure category 2	H373: May cause damage to organs through prolonged or repeated exposure
C; R34	Skin corrosion or irritation category 1B	H314: Causes severe skin burns and eye damage
C; R35	Skin corrosion or irritation category 1A	H314: Causes severe skin burns and eye damage
Xi; R36	Serious eye damage or eye irritation category 2	H319: Causes serious eye irritation
Xi; R37	Specific target organ toxicity – single exposure category 3	H335: May cause respiratory irritation
Xi; R38	Skin corrosion or irritation category 2	H315: Causes skin irritation
T; R39/23	Specific target organ toxicity – single exposure category 1	H370: Causes damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
T; R39/24	Specific target organ toxicity – single exposure category 1	H370: Causes damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*

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Classification under Directive 67/ 548/EEC	**Classification under the Regulations**	
	Hazard Classification	**H-Code: Hazard statement**
T; R39/25	Specific target organ toxicity – single exposure category 1	H370: Causes damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
T+; R39/26	Specific target organ toxicity – single category 1	H370: Causes damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
T+; R39/27	Specific target organ toxicity – single exposure category 1	H370: Causes damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
T+; R39/28	Specific target organ toxicity – single exposure category 1	H370: Causes damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Xi; R41	Serious eye damage or eye irritation category 1	H318: Causes serious eye damage
R42	Respiratory sensitization category 1	H334: May cause allergic or asthma symptoms or breathing difficulties if inhaled
R43	Skin sensitization category 1	H317: May cause allergic skin reaction
Xn; R48/20	Specific target organ toxicity – repeated exposure category 2	H373: May cause damage to organs through prolonged or repeated exposure
Xn; R48/21	Specific target organ toxicity – repeated exposure category 2	H373: May cause damage to organs through prolonged or repeated exposure
Xn; R48/22	Specific target organ toxicity – repeated exposure category 2	H373: May cause damage to organs through prolonged or repeated exposure
T; R48/23	Specific target organ toxicity – repeated exposure category 1	H372: Causes damage to organs through prolonged or repeated exposure
T; R48/24	Specific target organ toxicity – repeated exposure category 1	H372: Causes damage to organs through prolonged or repeated exposure
T; R48/25	Specific target organ toxicity – repeated exposure category 1	H372: Causes damage to organs through prolonged or repeated exposure
R64	Effect on or via lactation	H362: May cause harm to breast-fed children
Xn; R65	Aspiration hazard category 1	H304: May be fatal if swallowed and enters airways

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Classification under Directive 67/548/EEC	Classification under the Regulations	
	Hazard Classification	**H-Code: Hazard statement**
R67	Specific target organ toxicity- single exposure category 3	H336: May cause drowsiness or dizziness
Xn; R68/20	Specific target organ toxicity – single exposure category 2	H371: May cause damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Xn; R68/21	Specific target organ toxicity – single exposure category 2	H371: May cause damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Xn; R68/22	Specific target organ toxicity – single exposure category 2	H371: May cause damage to organs *(or state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Carc. cat. 1; R45	Carcinogenicity category 1A	H350: May cause cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Carc. cat. 2; R45	Carcinogenicity category 1B	H350: May cause cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Carc. cat. 1; R49	Carcinogenicity category 1A	H350i: May cause cancer by inhalation
Carc. cat. 2; R49	Carcinogenicity category 1B	H350i: May cause cancer by inhalation
Carc. cat. 3; R40	Carcinogenicity category 2	H351: Suspected of causing cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Muta. cat. 2; R46	Germ cell mutagenicity category 1B	H340: May cause genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Muta. cat. 3; R68	Germ cell mutagenicity category 2	H341: Suspected of causing genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Repr. cat. 1; R60	Reproductive toxicity category 1A	H360F: May damage fertility
Repr. cat. 2; R60	Reproductive toxicity category 1B	H360F: May damage fertility
Repr. cat. 1; R61	Reproductive toxicity category 1A	H360D: May damage the unborn child
Repr. cat. 2; R61	Reproductive toxicity category 1B	H360D: May damage the unborn child

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Classification under Directive 67/548/EEC	Classification under the Regulations	
	Hazard Classification	H-Code: Hazard statement
Repr. cat. 3; R62	Reproductive toxicity category 2	H361f: Suspected of damaging fertility
Repr. cat. 3; R63	Reproductive toxicity category 2	H361d: Suspected of damaging the unborn child
Repr. cat. 1; R60-61	Reproductive toxicity category 1A	H360FD: May damage fertility. May damage the unborn child.
Repr. cat. 1; R60 Repr. cat. 2; R61	Reproductive toxicity category 1A	H360FD: May damage fertility. May damage the unborn child.
Repr. cat. 2; R60 Repr. cat. 1; R61	Reproductive toxicity category 1A	H360FD: May damage fertility. May damage the unborn child.
Repr. cat. 2; R60-61	Reproductive toxicity category 1B	H360FD: May damage fertility. May damage the unborn child.
Repr. cat. 3; R62-63	Reproductive toxicity category 2	H361fd: Suspected of damaging fertility. Suspected of damaging the unborn child.
Repr. cat. 1; R60 Repr. cat. 3; R63	Reproductive toxicity category 1A	H360Fd: May damage fertility. Suspected of damaging the unborn child
Repr. cat. 2; R60 Repr. cat. 3; R63	Reproductive toxicity category 1B	H360Fd: May damage fertility. Suspected of damaging the unborn child
Repr. cat. 1; R61 Repr. cat. 3; R62	Reproductive toxicity category 1A	H360Df: May damage the unborn child. Suspected of damaging fertility.
Repr. cat. 2; R61 Repr. cat. 3; R62	Reproductive toxicity category 1B	H360Df: May damage the unborn child. Suspected of damaging fertility.
N; R50	Hazardous to the aquatic environment—acute hazard category 1	H400: Very toxic to aquatic life
N; R50-53	Hazardous to the aquatic environment—acute hazard category 1 Hazardous to the aquatic environment—chronic hazard category 1	H400: Very toxic to aquatic life H410: Very toxic to aquatic life with long lasting effects
N; R51-53	Hazardous to the aquatic environment—chronic hazard category 2	H411: Toxic to aquatic life with long lasting effects
R52-53	Hazardous to the aquatic environment—chronic hazard category 3	H412: Harmful to aquatic life with long lasting effects
R53	Hazardous to the aquatic environment—chronic hazard category 4	H413: May cause long lasting harmful effects to aquatic life

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Classification under Directive 67/548/EEC	Classification under the Regulations	
	Hazard Classification	H-Code: Hazard statement
N; R59	Hazardous to the ozone layer	H420: Harms public health and the environment by destroying ozone in the upper atmosphere

NOTE

T+	: Very toxic
T	: Toxic
Xn	: Harmful
C	: Corrosive
Xi	: Irritant
R42 and/or R43	: Sensitizing
Carc.cat.	: Carcinogenic
Muta.cat.	: Mutagenic
Repr.cat.	: Toxic for reproduction
D	: Damaging the unborn child (known)
F	: Damaging the fertility (known)
d	: Damaging the unborn child (suspected)
f	: Damaging the fertility (suspected)
i	: Exposure through inhalation

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APPENDIX 2.2

Montreal Protocol

Annex A: Controlled substances **Group Substance Ozone-Depleting Potential***	
Group I $CFCl_3$ (CFC-11) 1.0 CF_2Cl_2 (CFC-12) 1.0 $C_2F_3Cl_3$ (CFC-113) 0.8 $C_2F_4Cl_2$ (CFC-114) 1.0 C_2F_5Cl (CFC-115) 0.6	*Group II* CF_2BrCl (halon-1211) 3.0 CF_3Br (halon-1301) 10.0 $C_2F_4Br_2$ (halon-2402) 6.0
* These ozone depleting potentials are estimates based on existing knowledge and will be reviewed and revised periodically.	

Annex B: Controlled substances **Group Substance Ozone-Depleting Potential**		
Group I CF_3Cl (CFC-13) 1.0 C_2FCl_5 (CFC-111) 1.0 C_2F2Cl_4 (CFC-112) 1.0 C_3FCl_7 (CFC-211) 1.0 $C_3F_2Cl_6$ (CFC-212) 1.0 $C_3F_3Cl_5$ (CFC-213) 1.0 $C_3F_4Cl_4$ (CFC-214) 1.0 $C_3F_5Cl_3$ (CFC-215) 1.0 $C_3F_6Cl_2$ (CFC-216) 1.0 C_3F_7Cl (CFC-217) 1.0	*Group II* CCl_4 carbon tetrachloride 1.1	*Group III* $C_2H_3Cl_3$* 1,1,1-trichloroethane* (methyl chloroform) 0.1
* This formula does not refer to 1,1,2-trichloroethane.		

Annex C: Controlled substances **Group Substance** **Number of isomers Ozone-Depleting Potential**		
Group I $CHFCl_2$ (HCFC-21)** 1 0.04 CHF_2Cl (HCFC-22)** 1 0.055 CH_2FCl (HCFC-31) 1 0.02 C_2HFCl_4 (HCFC-121) 2 0.01–0.04 $C_2HF_2Cl_3$ (HCFC-122) 3 0.02–0.08 $C_2HF_3Cl_2$ (HCFC-123) 3 0.02–0.06 $CHCl_2CF_3$ (HCFC-123)** – 0.02 C_2HF_4Cl (HCFC-124) 2 0.02–0.04 $CHFClCF_3$ (HCFC-124)** – 0.022 $C_2H_2FCl_3$ (HCFC-131) 3 0.007–0.05 $C_2H_2F_2Cl_2$ (HCFC-132) 4 0.008–0.05 $C_2H_2F_3Cl$ (HCFC-133) 3 0.02–0.06 $C_2H_3FCl_2$ (HCFC-141) 3 0.005–0.07	*Group II* $CHFBr_2$ 1 1.00 CHF_2Br (HBFC-22B1) 1 0.74 CH_2FBr 1 0.73 C_2HFBr_4 2 0.3–0.8 $C_2HF_2Br_3$ 3 0.5–1.8 $C_2HF_3Br_2$ 3 0.4–1.6 C_2HF_4Br 2 0.7–1.2 $C_2H_2FBr_3$ 3 0.1–1.1 $C_2H_2F_2Br_2$ 4 0.2–1.5 $C_2H_2F_3Br$ 3 0.7–1.6 $C_2H_3FBr_2$ 3 0.1–1.7 $C_2H_3F_2Br$ 3 0.2–1.1	*Group III* CH_2BrCl bromochloromethane 1 0.12

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Annex C: Controlled substances **Group Substance** **Number of isomers Ozone-Depleting Potential**		
CH_3CFCl_2 (HCFC-141b)** – 0.11 $C_2H_3F_2Cl$ (HCFC-142) 3 0.008–0.07 CH_3CF_2Cl (HCFC-142b)** – 0.065 C_2H_4FCl (HCFC-151) 2 0.003–0.005 C_3HFCl_6 (HCFC-221) 5 0.015–0.07 $C_3HF_2Cl_5$ (HCFC-222) 9 0.01–0.09 $C_3HF_3Cl_4$ (HCFC-223) 12 0.01–0.08 $C_3HF_4Cl_3$ (HCFC-224) 12 0.01–0.09 $C_3HF_5Cl_2$ (HCFC-225) 9 0.02–0.07 $CF_3CF_2CHCl_2$ (HCFC-225ca)** – 0.025 CF_2ClCF_2CHClF (HCFC-225cb)** – 0.033 C_3HF_6Cl (HCFC-226) 5 0.02–0.10 $C_3H_2FCl_5$ (HCFC-231) 9 0.05–0.09 $C_3H_2F_2Cl_4$ (HCFC-232) 16 0.008–0.10 $C_3H_2F_3Cl_3$ (HCFC-233) 18 0.007–0.23 $C_3H_2F_4Cl_2$ (HCFC-234) 16 0.01–0.28 $C_3H_2F_5Cl$ (HCFC-235) 9 0.03–0.52 $C_3H_3FCl_4$ (HCFC-241) 12 0.004–0.09 $C_3H_3F_2Cl_3$ (HCFC-242) 18 0.005–0.13 $C_3H_3F_3Cl_2$ (HCFC-243) 18 0.007–0.12 $C_3H_3F_4Cl$ (HCFC-244) 12 0.009–0.14 $C_3H_4FCl_3$ (HCFC-251) 12 0.001–0.01 $C_3H_4F_2Cl_2$ (HCFC-252) 16 0.005–0.04 $C_3H_4F_3Cl$ (HCFC-253) 12 0.003–0.03 $C_3H_5FCl_2$ (HCFC-261) 9 0.002–0.02 $C_3H_5F_2Cl$ (HCFC-262) 9 0.002–0.02 C_3H_6FCl (HCFC-271) 5 0.001–0.03	C_2H_4FBr 2 0.07–0.1 C_3HFBr_6 5 0.3–1.5 $C_3HF_2Br_5$ 9 0.2–1.9 $C_3HF_3Br_4$ 12 0.3–1.8 $C_3HF_4Br_3$ 12 0.5–2.2 $C_3HF_5Br_2$ 9 0.9–2.0 C_3HF_6Br 5 0.7–3.3 $C_3H_2FBr_5$ 9 0.1–1.9 $C_3H_2F_2Br_4$ 16 0.2–2.1 $C_3H_2F_3Br_3$ 18 0.2–5.6 $C_3H_2F_4Br_2$ 16 0.3–7.5 $C_3H_2F_5Br$ 8 0.9–14.0 $C_3H_3FBr_4$ 12 0.08–1.9 $C_3H_3F_2Br_3$ 18 0.1–3.1 $C_3H_3F_3Br_2$ 18 0.1–2.5 $C_3H_3F_4Br$ 12 0.3–4.4 $C_3H_4FBr_3$ 12 0.03–0.3 $C_3H_4F_2Br_2$ 16 0.1–1.0 $C_3H_4F_3Br$ 12 0.07–0.8 $C_3H_5FBr_2$ 9 0.04–0.4 $C_3H_5F_2Br$ 9 0.07–0.8 C_3H_6FBr 5 0.02–0.7	
* Where a range of ODPs is indicated, the highest value in that range shall be used for the purposes of the Protocol. The ODPs listed as a single value have been determined from calculations based on laboratory measurements. Those listed as a range are based on estimates and are less certain. The range pertains to an isomeric group. The upper value is the estimate of the ODP of the isomer with the highest ODP, and the lower value is the estimate of the ODP of the isomer with the lowest ODP. ** Identifies the most commercially viable substances with ODP values listed against them to be used for the purposes of the Protocol. ***NOTE*** ODP – Ozone depleting potential		

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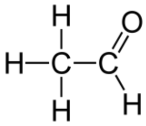
APPENDIX 2.3

Classification Record

Example 1: Substance in classified list

A.1 Identification of the chemicals

(a) Name of chemicals	**Acetaldehyde**
(b) CAS number	**Ethyl aldehyde** **Ethanal** **Acetic aldehyde**
(c) Synonyms	**C_2H_4O**
(d) Molecular formula (if any)	
(e) Structural formula (if any)	
(f) Purity[1]	**100%**
(g) Significant impurities or additives[2]	**Not applicable**
(h) Known uses	

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[1] *(w/w) for solids, liquids, dusts, mists and vapours, and (v/v) for gases*
[2] *Only those contributing to the hazard classification*

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A.2 Classification Result

	Classification	Justification[3]	Data Source[4]
Physical	Flammable liquid category 1	Classified List	Industry Code of Practice on Chemicals Classification and Hazard Communication
Health	Carcinogenicity category 2		
	Serious eye damage or eye irritation category 2		
	Specific target organ toxicity – single exposure category 3		
Environment	Not classified		
Remark	Date of classification:28/12/2010 Name of classifier & Position: FADHIL Approved by: Ir. ANUAR BIN MOHD MOKHTAR		

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[3] *Observation or test data for the classification decision*
[4] *Primary source of data (refer to 2.3.5)*

Example 2: Mixture

Classification Record

A.1 Identification of the chemicals

(a)	**Name of chemicals**	**Active Chem**
(b)	**CAS number**	**Not applicable**
(c)	**Synonyms**	**Methyltoxy solution**
(d)	**Molecular formula (if any)**	**Not applicable**
(e)	**Structural formula (if any)**	**Not applicable**
(f)	**Purity**[1]	**80%**
(g)	**Significant impurities or additives**[2]	**None**
(h)	**Known uses**	**Organic synthesis**

[1] *(w/w) for solids, liquids, dusts, mists and vapours, and (v/v) for gases*
[2] *Only those contributing to the hazard classification*

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A.2 Classification result

	Classification	**Justification**[3]	**Data Source**[4]
Physical	Flammable liquids category 2	Flash point: 2^0C Boiling Point: 77^0C	Test data
Health	Acute toxicity category 2 (inhalation)	LC_{50} (rat, 4 hrs) = 200 ppm	IUCLID (2008)
	Acute toxicity category 3 (oral)	LD_{50} (rat) = 100 mg/kg	
	Acute toxicity category 3 (dermal)	LD_{50} (rabbit) = 225 - 300 mg/kg	
	Skin corrosion or irritation category 1	May cause reddening, blistering or burn with permanent damage.	ACGIH (2001)
	Serious eye damage or eye irritation category 1	Based on product test data.	ACGIH (2001)
	Skin sensitization category 1	Positive result in patch test.	EHC - INCHEM
	Germ cell mutagenicity category 2	Positive data on somatic cell mutagenicity test in vivo.	CERI-NITE Assessment No. 61 (2004)
	Carcinogenicity category 1B	Evidence of carcinogenicity in experimental animals.	IARC
	Reproductive toxicity category 2	Suspected of damaging fertility or unborn child.	Patty 5th Ed. Handbook (2001)
	Specific target organ toxicity – repeated exposure category 2	Causes damage to respiratory (nervous system) to prolong repeated exposure.	ACGIH 7th Ed. (2001)
Environment	Not classified		
Remark	Date of classification: 28/12/2010 Name of classifier & Position: FADHIL Approved by: Ir. ANUAR BIN MOHD MOKHTAR		

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[3] *Observation or test data for the classification decision*

[4] *Primary source of data (refer to 2.3.5)*

APPENDIX 3.1

List of Hazard Statements

Physical Hazards

Code	Hazard statement
H200	Unstable explosive
H201	Explosive; mass explosion hazard
H202	Explosive; severe projection hazard
H203	Explosive; fire, blast, or projection hazard
H204	Fire or projection hazard
H205	May mass explode in fire
H220	Extremely flammable gas
H221	Flammable gas
H222	Extremely flammable aerosol
H223	Flammable aerosol
H224	Extremely flammable liquid and vapour
H225	Highly flammable liquid and vapour
H226	Flammable liquid and vapour
H228	Flammable solid
H240	Heating may cause explosion
H241	Heating may cause fire or explosion
H242	Heating may cause fire
H250	Catches fire spontaneously if exposed to air
H251	Self-heating; may catch fire
H252	Self-heating in large quantities; may catch fire
H260	If in contact with water, releases flammable gases which may ignite spontaneously
H261	If in contact with water, releases flammable gases
H270	May cause or intensify fire; oxidizer
H271	May cause fire or explosion; strong oxidizer
H272	May intensify fire; oxidizer
H280	Contains gas under pressure; may explode if heated
H281	Contains refrigerated gas; may cause cryogenic burns or injury
H290	May be corrosive to metals

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Health Hazards

Code	Hazard statement
H300	Fatal if swallowed
H301	Toxic if swallowed
H302	Harmful if swallowed
H304	May be fatal if swallowed and enters airways
H310	Fatal if in contact with skin
H311	Toxic if in contact with skin
H312	Harmful if in contact with skin
H314	Causes severe skin burns and eye damage
H315	Causes skin irritation
H317	May cause allergic skin reaction
H318	Causes serious eye damage
H319	Causes serious eye irritation
H330	Fatal if inhaled
H331	Toxic if inhaled
H332	Harmful if inhaled
H334	May cause allergic or asthma symptoms or breathing difficulties if inhaled
H335	May cause respiratory irritation
H336	May cause drowsiness or dizziness
H340	May cause genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H341	Suspected of causing genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H350	May cause cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H350i	May cause cancer by inhalation
H351	Suspected of causing cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H360	May damage fertility or the unborn child *(state specific effect, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H360D	May damage the unborn child

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Code	Hazard statement
H360F	May damage fertility
H360FD	May damage fertility. May damage the unborn child.
H360Fd	May damage fertility. Suspected of damaging the unborn child.
H360Df	May damage the unborn child. Suspected of damaging fertility.
H361	Suspected of damaging fertility or the unborn child *(state specific effect, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H361f	Suspected of damaging fertility
H361d	Suspected of damaging the unborn child
H361fd	Suspected of damaging fertility. Suspected of damaging the unborn child.
H362	May cause harm to breast-fed children
H370	Causes damage to organs *(state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H371	May cause damage to organs *(state all organs effected, if known)(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
H372	Causes damage to organs through prolonged or repeated exposure
H373	May cause damage to organs through prolonged or repeated exposure
H300 + H310	Fatal if swallowed or in contact with skin
H300 + H330	Fatal if swallowed or inhaled
H310 + H330	Fatal if in contact with skin or inhaled
H300 + H310 + H330	Fatal if swallowed, in contact with skin or inhaled
H301 + H311	Toxic if swallowed or in contact with skin
H301 + H331	Toxic if swallowed or inhaled

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Code	Hazard statement
H311 + H331	Toxic if in contact with skin or inhaled
H301 + H311 + H331	Toxic if swallowed, in contact with skin or inhaled
H302 + H312	Harmful if swallowed or in contact with skin
H302 + H332	Harmful if swallowed or inhaled
H312 + H332	Harmful if in contact with skin or inhaled
H302 + H312 + H332	Harmful if swallowed, in contact with skin or inhaled
H315 + H320	Causes skin and eye irritation

Environmental Hazards

Code	Hazard statement
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects
H411	Toxic to aquatic life with long lasting effects
H412	Harmful to aquatic life with long lasting effects
H413	May cause long lasting harmful effects to aquatic life
H420	Harms public health and the environment by destroying ozone in the upper atmosphere

APPENDIX 3.2

List of Precautionary Statements

Precautionary statements – Prevention

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P201	**Obtain special instructions before use.**	Explosives	Unstable explosive	
		Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
		Reproductive toxicity	Effects on or via lactation	
P202	**Do not handle until all safety precautions have been read and understood.**	Explosives	Unstable explosive	
		Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
P210	**Keep away from heat/sparks/open flames/hot surfaces – No smoking.**	Explosives	Divisions 1.1, 1.2, 1.3, 1.4, 1.5	… Manufacturer/supplier to specify applicable ignition source(s).
		Flammable gases	1, 2	
		Flammable aerosols	1, 2	
		Flammable liquids	1, 2, 3	
		Flammable solids	1, 2	
		Self-reactive chemicals	Types A, B, C, D, E, F	
		Pyrophoric liquids	1	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
		Pyrophoric solids	1	
		Organic peroxides	Types A, B, C, D, E, F	
		Oxidizing liquids	1, 2, 3	*Specify to keep away from heat.*
		Oxidizing solids	1, 2, 3	
P211	**Do not spray on an open flame or other ignition source.**	Flammable aerosols	1, 2	
P220	**Keep/store away from clothing/…/combustible materials.**	Oxidizing gases	1	… Manufacturer/supplier to specify incompatible materials.
		Self-reactive chemicals	Types A, B, C, D, E, F	
		Oxidizing liquids	1	… Manufacturer/supplier to specify incompatible materials. *– specify to keep away from clothing as well as other incompatible materials.*
			2, 3	… Manufacturer/supplier to specify incompatible materials.
		Oxidizing solids	1	… Manufacturer/supplier to specify incompatible materials. *– specify to keep away from clothing as well as other incompatible materials.*

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
			2, 3	… Manufacturer/supplier to specify incompatible materials.
		Oxidizing solids	Types A, B, C, D, E, F	
P221	**Take any precaution to avoid mixing with combustibles/…**	Oxidizing liquids	1, 2, 3	… Manufacturer/supplier to specify incompatible materials.
		Oxidizing solids	1, 2, 3	
P222	**Do not allow contact with air.**	Pyrophoric liquids	1	
		Pyrophoric solids	1	
P223	**Keep away from any possible contact with water, because of violent reaction and possible flash fire.**	Chemicals which, if in contact with water, emit flammable gases	1, 2	
P230	**Keep wetted with …**	Explosives	Divisions 1.1, 1.2, 1.3, 1.5	… Manufacturer/supplier to specify appropriate material. *– if drying out increases explosion hazard, except as needed for manufacturing or operating processes (e.g. nitrocellulose).*
P231	**Handle under inert gas.**	Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P232	**Protect from moisture.**	Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
P233	**Keep container tightly closed.**	Flammable liquids	1, 2, 3	
		Acute toxicity (inhalation)	1, 2, 3	*– if product is volatile so as to generate hazardous atmosphere.*
		Specific target organ toxicity – single exposure *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure *(narcosis)*	3	
P234	**Keep only in original container.**	Self-reactive chemicals	Types A, B, C, D, E, F	
		Organic peroxides	Types A, B, C, D, E, F	
		Corrosive to metals	1	
P235	**Keep cool.**	Flammable liquids	1, 2, 3	
		Self-reactive chemicals	Types A, B, C, D, E, F	
		Self-heating chemicals	1, 2	
		Organic peroxides	Types A, B, C, D, E, F	
P240	**Ground/bond container and receiving equipment.**	Explosives	Divisions 1.1, 1.2, 1.3, 1.4, 1.5	*– if the explosive is electrostatically sensitive.*
		Flammable liquids	1, 2, 3	*– if electrostatically sensitive material is for reloading.* *– if product is volatile so as to generate hazardous atmosphere.*

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
		Flammable solids	1, 2	*– if electrostatically sensitive material is for reloading.*
P241	**Use explosion-proof electrical/ ventilating/lighting/…/ equipment.**	Flammable liquids	1, 2, 3	… Manufacturer/supplier to specify other equipment.
		Flammable solids	1, 2	… Manufacturer/supplier to specify other equipment. *– if dust clouds can occur.*
P242	**Use only non-sparking tools.**	Flammable liquids	1, 2, 3	
P243	**Take precautionary measures against static discharge.**	Flammable liquids	1, 2, 3	
P244	**Keep reduction valves free from grease and oil.**	Oxidizing gases	1	
P250	**Do not subject to grinding/shock/… /friction.**	Explosives	Divisions 1.1, 1.2, 1.3, 1.4, 1.5	… Manufacturer/supplier to specify applicable rough handling.
P251	**Pressurized container: Do not pierce or burn, even after use.**	Flammable aerosols	1, 2	

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P260	**Do not breathe dust/fume/gas/mist/ vapours/spray.**	Acute toxicity (inhalation)	1, 2	Manufacturer/supplier to specify applicable conditions.
		Specific target organ toxicity – single exposure	1, 2	
		Specific target organ toxicity – repeated exposure	1, 2	
		Skin corrosion	1A, 1B, 1C	*– Specify do not breathe dusts or mists.* *– if inhalable particles of dusts or mists may occur during use.*
		Reproductive toxicity	Effects on or via lactation	
P261	**Avoid breathing dust/fume/ gas/mist/vapours/spray.**	Acute toxicity (inhalation)	3, 4	Manufacturer/supplier to specify applicable conditions.
		Respiratory sensitization	1	
		Skin sensitization	1	
		Specific target organ toxicity – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
P262	**Do not get in eyes, on skin, or on clothing**	Acute toxicity (dermal)	1, 2	
P263	**Avoid contact during pregnancy/ while nursing.**	Reproductive toxicity	Effects on or via lactation	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P264	**Wash … thoroughly after handling.**	Acute toxicity (oral)	1, 2, 3, 4	Manufacturer/supplier to specify parts of the body to be washed after handling.
		Acute toxicity (dermal)	1, 2	
		Skin corrosion	1A, 1B, 1C	
		Skin irritation	2	
		Eye irritation	2	
		Reproductive toxicity	Effects on or via lactation	
		Specific target organ toxicity – single exposure	1, 2	
		Specific target organ toxicity – repeated exposure	1	
P270	**Do not eat, drink, or smoke when using this product.**	Acute toxicity (oral)	1, 2, 3, 4	
		Acute toxicity (dermal)	1, 2	
		Reproductive toxicity	Effects on or via lactation	
		Specific target organ toxicity – single exposure	1, 2	
		Specific target organ toxicity – repeated exposure	1	
P271	**Use only outdoors or in a well-ventilated area.**	Acute toxicity (inhalation)	1, 2, 3, 4	
		Specific target organ toxicity – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
P272	**Contaminated work clothing shall not be allowed out of the workplace.**	Skin sensitization	1	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P273	**Avoid release to the environment.**	Hazardous to the aquatic environment – acute aquatic hazard	1	– if this is not the intended use.
		Hazardous to the aquatic environment – chronic aquatic hazard	1, 2, 3, 4	
		Hazardous to the ozone layer	1	
P280	**Wear protective gloves/protective clothing/eye protection/face protection.**	Explosives	Divisions 1.1, 1.2, 1.3, 1.4, 1.5	Manufacturer/supplier to specify type of equipment. – Specify face protection.
		Flammable liquids	1, 2, 3	Manufacturer/supplier to specify type of equipment. – Specify protective gloves and eye/face protection.
		Flammable solids	1, 2	
		Self-reactive chemicals	Types A, B, C, D, E, F	
		Pyrophoric liquids	1	
		Pyrophoric solids	1	
		Self-heating chemicals	1, 2	
		Chemicals which, in contact with water, emit flammable gases	1, 2, 3	
		Oxidizing liquids	1, 2, 3	
		Oxidizing solids	1, 2, 3	
		Organic peroxides	Types A, B, C, D, E, F	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
		Acute toxicity (dermal)	1, 2, 3, 4	Manufacturer/supplier to specify type of equipment. – Specify protective gloves/clothing.
		Skin corrosion or irritation	1A, 1B, 1C	Manufacturer/supplier to specify type of equipment. – Specify protective gloves/clothing and eye/face protection.
		Skin corrosion or irritation	2	Manufacturer/supplier to specify type of equipment. – Specify protective gloves.
		Skin sensitization	1	
		Serious eye damage or eye irritation	1, 2	Manufacturer/supplier to specify type of equipment. – Specify eye/face protection.
P281	**Use personal protective equipment as required.**	Explosives	Unstable explosive	
		Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
P282	**Wear cold insulating gloves/face shield/eye protection.**	Gases under pressure	Refrigerated liquefied gas	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P283	**Wear fire/flame resistant/retardant clothing.**	Oxidizing liquids	1	
		Oxidizing solids	1	
P284	**Wear respiratory protection.**	Acute toxicity (inhalation)	1, 2	Manufacturer/supplier to specify equipment.
P285	**In case of inadequate ventilation wear respiratory protection.**	Respiratory sensitization	1	Manufacturer/supplier to specify equipment.

Combined precautionary statements – Prevention

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P231 + P232	**Handle under inert gas. Protect from moisture.**	Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
P235 + P410	**Keep cool. Protect from sunlight.**	Self-heating chemicals	1, 2	

Precautionary statements - Response

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P301	**IF SWALLOWED:**	Acute toxicity (oral)	1, 2, 3, 4	
		Skin corrosion or irritation	1A, 1B, 1C	
		Aspiration hazard	1	
P302	**IF ON SKIN:**	Pyrophoric liquids	1	
		Acute toxicity (dermal)	1, 2, 3, 4	
		Skin corrosion or irritation	2	
		Skin sensitization	1	
P303	**IF ON SKIN (or hair):**	Flammable liquids	1, 2, 3	
		Skin corrosion or irritation	1A, 1B, 1C	
P304	**IF INHALED:**	Acute toxicity (inhalation)	1, 2, 3, 4	
		Skin corrosion or irritation	1A, 1B, 1C	
		Respiratory sensitization	1	
		Specific target organ toxicity – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P305	**IF IN EYES:**	Skin corrosion or irritation	1A, 1B, 1C	
		Serious eye damage or eye irritation	1, 2	
P306	**IF ON CLOTHING:**	Oxidizing liquids	1	
		Oxidizing solids	1	
P307	**IF exposed:**	Specific target organ toxicity – single exposure	1	
P308	**IF exposed or concerned:**	Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
		Reproductive toxicity	Effects on or via lactation	
P309	**IF exposed or if you feel unwell:**	Specific target organ toxicity – single exposure	2	
P310	**Immediately call a POISON CENTER or doctor/physician.**	Acute toxicity (oral)	1, 2, 3	
		Acute toxicity (dermal)	1, 2	
		Acute toxicity (inhalation)	1, 2	
		Skin corrosion or irritation	1A, 1B, 1C	
		Serious eye damage or eye irritation	1	
		Aspiration hazard	1	

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P311	**Call a POISON CENTER or doctor/physician.**	Acute toxicity (inhalation)	3	
		Respiratory sensitization	1	
		Specific target organ toxicity – single exposure	1, 2	
P312	**Call a POISON CENTER or doctor/physician if you feel unwell.**	Acute toxicity (oral)	4	
		Acute toxicity (dermal)	3, 4	
		Acute toxicity (inhalation)	4	
		Specific target organ toxicity – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
P313	**Get medical advice/attention.**	Skin corrosion or irritation	2	
		Serious eye damage or eye irritation	2	
		Skin sensitization	1	
		Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
		Reproductive toxicity	Effects on or via lactation	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P314	**Get medical advice/attention if you feel unwell.**	Specific target organ toxicity – repeated exposure	1, 2	
P315	**Get immediate medical advice/attention.**	Gases under pressure	Refrigerated liquefied gas	
P320	**Specific treatment is urgent (see … on this label).**	Acute toxicity (inhalation)	1, 2	… Reference to supplemental first aid instruction. *– if immediate administration of antidote is required.*
P321	**Specific treatment (see … on this label).**	Acute toxicity (oral)	1, 2, 3	… Reference to supplemental first aid instruction. *– if immediate administration of antidote is required.*
		Acute toxicity (inhalation)	3	… Reference to supplemental first aid instruction. *– if immediate specific measures are required.*
		Specific target organ toxicity – single exposure	1	… Reference to supplemental first aid instruction. *–if immediate measures are required*.
		Skin sensitization	1	… Reference to supplemental first aid instruction. *– manufacturer/supplier may specify a cleansing agent if appropriate.*
		Skin corrosion or irritation	1A, 1B, 1C, 2	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P322	**Specific measures (see … on this label).**	Acute toxicity (dermal)	1, 2, 3, 4	… Reference to supplemental first aid instruction. – *if immediate measures such as specific cleansing agent is advised.*
P330	**Rinse mouth.**	Acute toxicity (oral)	1, 2, 3, 4	
		Skin corrosion or irritation	1A, 1B, 1C	
P331	**Do NOT induce vomiting.**	Skin corrosion or irritation	1A, 1B, 1C	
		Aspiration hazard	1	
P332	**If skin irritation occurs:**	Skin corrosion or irritation	2	
P333	**If skin irritation or rash occurs:**	Skin sensitization	1	
P334	**Immerse in cool water/wrap in wet bandages.**	Pyrophoric liquids	1	
		Pyrophoric solids	1	
		Chemicals which, if in contact with water, emit flammable gases	1, 2	
P335	**Brush off loose particles from skin.**	Pyrophoric solids	1	
		Chemicals which, if in contact with water, emit flammable gases	1, 2	
P336	**Thaw frosted parts with lukewarm water. Do not rub affected area.**	Gases under pressure	Refrigerated liquefied gas	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P337	**If eye irritation persists:**	Serious eye damage or eye irritation	2	
P338	**Remove contact lenses, if present and easy to do. Continue rinsing.**	Skin corrosion or irritation	1A, 1B, 1C	
		Serious eye damage or eye irritation	1, 2	
P340	**Remove victim to fresh air and keep at rest in a position comfortable for breathing.**	Acute toxicity (inhalation)	1, 2, 3, 4	
		Skin corrosion or irritation	1A, 1B, 1C	
		Specific target organ toxicity – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
P341	**If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.**	Respiratory sensitization	1	
P342	**If experiencing respiratory symptoms:**	Respiratory sensitization	1	
P350	**Gently wash with plenty of soap and water.**	Acute toxicity (dermal)	1, 2	
P351	**Rinse cautiously with water for several minutes.**	Skin corrosion or irritation	1A, 1B, 1C	
		Serious eye damage or eye irritation	1, 2	

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P352	**Wash with plenty of soap and water.**	Acute toxicity (dermal)	3, 4	
		Skin corrosion or irritation	2	
		Skin sensitization	1	
P353	**Rinse skin with water/shower.**	Flammable liquids	1, 2, 3	
		Skin corrosion or irritation	1A, 1B, 1C	
P360	**Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.**	Oxidizing liquids	1	
		Oxidizing solids	1	
P361	**Remove/Take off immediately all contaminated clothing.**	Flammable liquids	1, 2, 3	
		Acute toxicity (dermal)	1, 2, 3	
		Skin corrosion or irritation	1A, 1B, 1C	
P362	**Take off contaminated clothing and wash before reuse.**	Skin corrosion or irritation	2	
P363	**Wash contaminated clothing before reuse.**	Acute toxicity (dermal)	1, 2, 3, 4	
		Skin corrosion or irritation	1A, 1B, 1C	
		Skin sensitization	1	
P370	**In case of fire:**	Explosives	Divisions 1.1, 1.2, 1.3, 1.4,1.5	
		Oxidizing gases	1	
		Flammable liquids	1, 2, 3	
		Flammable solids	1, 2	
		Self-reactive chemicals	Types A, B, C, D, E, F	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
		Pyrophoric liquids	1	
		Pyrophoric solids	1	
		Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
		Oxidizing liquids	1, 2, 3	
		Oxidizing solids	1, 2, 3	
P371	**In case of major fire and large quantities:**	Oxidizing liquids	1	
		Oxidizing solids	1	
P372	**Explosion risk in case of fire.**	Explosives	Unstable explosives and Divisions 1.1, 1.2, 1.3, 1.4, 1.5	– except if explosives are 1.4S AMMUNITION AND COMPONENTS THEREOF
P373	**DO NOT fight fire when fire reaches explosives.**	Explosives	Unstable explosives and Divisions 1.1, 1.2, 1.3, 1.4, 1.5	
P374	**Fight fire with normal precautions from a reasonable distance.**	Explosives	Division 1.4	*– if explosives are 1.4S AMMUNITION AND COMPONENTS THEREOF*
P375	**Fight fire remotely due to the risk of explosion.**	Self-reactive chemicals	Types A, B	
		Oxidizing liquids	1	
		Oxidizing solids	1	
P376	**Stop leak if safe to do so.**	Oxidizing gases	1	
P377	**Leaking gas fire: Do not extinguish, unless leak can be stopped safely.**	Flammable gases	1, 2	
P378	**Use … for extinction.**	Flammable liquids	1, 2, 3	… Manufacturer/supplier to specify appropriate media
		Flammable solids	1, 2	
		Self-reactive chemicals	Types A, B, C, D, E, F	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
		Pyrophoric liquids	1	*– if water increases risk.*
		Pyrophoric solids	1	
		Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
		Oxidizing liquids	1, 2, 3	
		Oxidizing solids	1, 2, 3	
P380	**Evacuate area.**	Explosives	Unstable explosives	
		Explosives	Divisions 1.1, 1.2, 1.3, 1.4, 1.5	
		Self-reactive chemicals	Types A, B	
		Oxidizing liquids	1	
		Oxidizing solids	1	
P381	**Eliminate all ignition sources if safe to do so.**	Flammable gases	1, 2	
P390	**Absorb spillage to prevent material damage.**	Corrosive to metals	1	
P391	**Collect spillage.**	Hazardous to the aquatic environment – acute hazard	1	
		Hazardous to the aquatic environment – chronic hazard	1, 2	

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Combined precautionary statements - Response

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P301 + P310	**IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.**	Acute toxicity (oral)	1, 2, 3	
		Aspiration hazard	1	
P301 + P312	**IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.**	Acute toxicity (oral)	4	
P301 + P330 + P331	**IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.**	Skin corrosion or irritation	1A, 1B, 1C	
P302 + P334	**IF ON SKIN: Immerse in cool water/wrap in wet bandages.**	Pyrophoric liquids	1	
P302 + P350	**IF ON SKIN: Gently wash with plenty of soap and water.**	Acute toxicity (dermal)	1, 2	
P302 + P352	**IF ON SKIN: Wash with plenty of soap and water.**	Acute toxicity (dermal)	3, 4	
		Skin corrosion or irritation	2	
		Skin sensitization	1	
P303 + P361 + P353	**IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.**	Flammable liquids	1, 2, 3	
		Skin corrosion or irritation	1A, 1B, 1C	

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P304 + P340	**IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.**	Acute toxicity (inhalation)	1, 2, 3, 4	
		Skin corrosion or irritation	1A, 1B, 1C	
		Specific target organ toxicity – single exposure; *(respiratory tractirritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
P304 + P341	**IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.**	Respiratory sensitization	1	
P305 + P351 + P338	**IF IN EYES: Rinse cautiously with water for several minutes.** **Remove contact lenses, if present and easy to do. Continue rinsing.**	Skin corrosion or irritation	1A, 1B, 1C	
		Serious eye damage or eye irritation	1, 2	
P306 + P360	**IF ON CLOTHING: Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.**	Oxidizing liquids	1	
		Oxidizing solids	1	
P307 + P311	**IF exposed: Call a POISON CENTER or doctor/physician**.	Specific target organ toxicity – single exposure	1	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P308 + P313	**IF exposed or concerned: Get medical advice/attention.**	Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
		Reproductive toxicity	Effects on or via lactation	
P309 + P311	**IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.**	Specific target organ toxicity – single exposure	2	
P332 + P313	**If skin irritation occurs: Get medical advice/attention.**	Skin corrosion or irritation	2	
P333 + P313	**If skin irritation or rash occurs: Get medical advice/attention.**	Skin sensitization	1	
P335 + P334	**Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages.**	Pyrophoric solids	1	
		Chemicals which, if in contact with water, emit flammable gases	1, 2	
P337 + P313	**If eye irritation persists: Get medical advice/attention.**	Serious eye damage or eye irritation	2	
P342 + P311	**If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.**	Respiratory sensitization	1	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P370 + P376	**In case of fire: Stop leak if safe to do so.**	Oxidizing gases	1	
P370 + P378	**In case of fire: Use … for extinction.**	Flammable liquids	1, 2, 3	... Manufacturer/supplier to specify appropriate media. *–if water increases risk.*
		Flammable solids	1, 2	
		Self-reactive chemicals	Types A, B, C, D, E, F	
		Pyrophoric liquids	1	
		Pyrophoric solids	1	
		Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
		Oxidizing liquids	1, 2, 3	
		Oxidizing solids	1, 2, 3	
P370 + P380	**In case of fire: Evacuate area.**	Explosives	Divisions 1.1, 1.2, 1.3, 1.4, 1.5	
P370 + P380 + P375	**In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.**	Self-reactive chemicals	Types A, B	
P371 + P380 + P375	**In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.**	Oxidizing liquids	1	
		Oxidizing solids	1	

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Precautionary statements - Storage

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P401	**Store …**	Explosives	Unstable explosives and Divisions 1.1,1.2, 1.3, 1.4,1.5	… in accordance with local/regional/national/ international regulations (to be specified).
P402	**Store in a dry place.**	Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
P403	**Store in a well-ventilated place.**	Flammable gases	1, 2	*–if product is volatile so as to generate hazardous atmosphere.*
		Oxidizing gases	1	
		Gases under pressure	Compressed gas	
			Liquefied gas	
			Refrigerated liquefied gas	
			Dissolved gas	
		Flammable liquids	1, 2, 3	
		Self-reactive chemicals	Types A, B, C,D, E, F	
		Acute toxicity (inhalation)	1, 2, 3	
		Specific target organ toxicity – single exposure; *(respiratory tractirritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P404	**Store in a closed container.**	Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
P405	**Store locked up.**	Acute toxicity (oral)	1, 2, 3	
		Acute toxicity (dermal)	1, 2, 3	
		Acute toxicity (inhalation)	1, 2, 3	
		Skin corrosion or irritation	1A, 1B, 1C	
		Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
		Specific target organ toxicity – single exposure	1, 2	
		Specific target organ toxicity – single exposure; *(respiratory tractirritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
		Aspiration hazard	1	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P406	**Store in corrosive resistant/ … container with a resistant inner liner.**	Corrosive to metals	1	… Manufacturer/supplier to specify other compatible materials.
P407	**Maintain air gap between stacks/pallets.**	Self-heating chemicals	1, 2	
P410	**Protect from sunlight.**	Flammable aerosols	1, 2	
		Gases under pressure	Compressed gas	
			Liquefied gas	
			Dissolved gas	
		Self-heating chemicals	1, 2	
		Organic peroxides	Types A, B, C, D, E, F	
P411	**Store at temperatures not exceeding …°C/…°F.**	Self-reactive chemicals	Types A, B, C, D, E, F	… Manufacturer/supplier to specify temperature.
		Organic peroxides	Types A, B, C, D, E, F	
P412	**Do not expose to temperatures exceeding 50°C/122°F.**	Flammable aerosols	1, 2	
P413	**Store bulk masses greater than … kg/…lbs at temperatures not exceeding …°C/…°F.**	Self-heating chemicals	1, 2	… Manufacturer/supplier to specify mass and temperature.
P420	**Store away from other materials.**	Self-reactive chemicals	Types A, B, C, D, E, F	
		Self-heating chemicals	1, 2	
		Organic peroxides	Types A, B, C, D, E, F	
P422	**Store contents under …**	Pyrophoric liquids	1	… Manufacturer/supplier to specify appropriate liquid or inert gas.
		Pyrophoric solids	1	

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Combined precautionary statements – Storage

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P402 + P404	**Store in a dry place. Store in a closed container.**	Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
P403 + P233	**Store in a well-ventilated place. Keep container tightly closed.**	Acute toxicity (inhalation)	1, 2, 3	*– if product is volatile so as to generate hazardous.*
		Specific target organ toxicity atmosphere – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
P403 + P235	**Store in a well-ventilated place. Keep cool.**	Flammable liquids	1, 2, 3	
		Self-reactive chemicals	Types A, B, C, D, E, F	
P410 + P403	**Protect from sunlight. Store in a well-ventilated place.**	Gases under pressure	Compressed gas	
			Liquefied gas	
			Dissolved gas	
P410 + P412	**Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F.**	Flammable aerosols	1, 2	
P411 + P235	**Store at temperatures not exceeding …°C/…°F. Keep cool.**	Organic peroxides	Types A, B, C, D, E, F	… Manufacturer/supplier to specify temperature.

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Precautionary statements - Disposal

Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
P501	**Dispose of contents/container to …**	Explosives	Unstable explosives and Divisions 1.1, 1.2, 1.3, 1.4,1.5	… in accordance with local/regional/national/internationa l regulation(to be specified).
		Flammable liquids	1, 2, 3	
		Self-reactive chemicals	Types A, B, C, D, E, F	
		Chemicals which, if in contact with water, emit flammable gases	1, 2, 3	
		Oxidizing liquids	1, 2, 3	
		Oxidizing solids	1, 2, 3	
		Organic peroxides	Types A, B, C, D, E, F	
		Acute toxicity (oral)	1, 2, 3, 4	
		Acute toxicity (dermal)	1, 2, 3, 4	
		Acute toxicity (inhalation)	1, 2	
		Skin corrosion or irritation	1A, 1B, 1C	
		Respiratory sensitization	1	
		Skin sensitization	1	
		Germ cell mutagenicity	1A, 1B, 2	
		Carcinogenicity	1A, 1B, 2	
		Reproductive toxicity	1A, 1B, 2	
		Specific target organ toxicity – single exposure	1, 2	

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Code	General precautionary statements	Hazard class	Hazard category	Conditions for use
		Specific target organ toxicity – single exposure; *(respiratory tract irritation)*	3	
		Specific target organ toxicity – single exposure; *(narcosis)*	3	
		Specific target organ toxicity – repeated exposure	1, 2	
		Aspiration hazard	1	
		Hazardous to the aquatic environment – acute hazard	1	
		Hazardous to the aquatic environment – chronic hazard	1, 2, 3, 4	
P502	**Refer to manufacturer/supplier for information on recovery/recycling.**	Hazardous to the ozone layer	1	

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APPENDIX 3.3
Label Elements for Each Hazard Classes

Physical Hazards

1. Hazard Class: Explosives

Classification	Unstable Explosive	Division 1.1	Division 1.2	Division 1.3	Division 1.4	Division 1.5	Division 1.6
Hazard pictogram						No hazard pictogram	No hazard pictogram
Signal word	Danger	Danger	Danger	Danger	Warning	Danger	No signal word
Hazard statement	H200: Unstable Explosive	H201: Explosive; mass explosion hazard	H202: Explosive; severe projection hazard	H203: Explosive; fire, blast or projection hazard	H204: Fire or projection hazard	H205: May mass explode in fire	No hazard statement
Precautionary statement prevention	P201 P202 P281	P210 P230 P240 P250 P280	P210 P230 P240 P250 P280	P210 P230 P240 P250 P280	P210 P240 P250 P280	P210 P230 P240 P250 P280	No precautionary statement
Precautionary statement response	P372 P373 P380	P370+P380 P372 P373	P370+P380 P372 P373	P370+P380 P372 P373	P370+P380 P372 P373	P370+P380 P372 P373	No precautionary statement
Precautionary statement storage	P401	P401	P401	P401	P401	P401	No precautionary statement
Precautionary statement disposal	P501	P501	P501	P501	P501	P501	No precautionary statement

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2. Hazard Class: Flammable gases

Classification	Category 1	Category 2
Hazard pictogram		No hazard pictogram
Signal word	Danger	Warning
Hazard statement	H220: Extremely flammable gas	H221: Flammable gas
Precautionary statement prevention	P210	P210
Precautionary statement response	P377 P381	P377 P381
Precautionary statement storage	P403	P403
Precautionary statement disposal	No precautionary statement	No precautionary statement

3. Hazard Class: Flammable aerosols

Classification	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H222: Extremely flammable aerosol	H223: Flammable aerosol
Precautionary statement prevention	P210 P211 P251	P210 P211 P251
Precautionary statement response	No precautionary statement	No precautionary statement
Precautionary statement storage	P410 + P412	P410 + P412
Precautionary statement disposal	No precautionary statement	No precautionary statement

4. Hazard Class: Flammable liquids

Classification	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
Hazard statement	H224: Extremely flammable liquid and vapour	H225: Highly flammable liquid and vapour	H226: Flammable liquid and vapour
Precautionary statement prevention	P210 P233 P240 P241 P242 P243 P280	P210 P233 P240 P241 P242 P243 P280	P210 P233 P240 P241 P242 P243 P280
Precautionary statement response	P303 + P361 + P353 P370 + P378	P303 + P361 + P353 P370 + P378	P303 + P361 + P353 P370 + P378
Precautionary statement storage	P403 + P235	P403 + P235	P403 + P235
Precautionary statement disposal	P501	P501	P501

5. Hazard Class: Flammable solids

Classification	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H228: Flammable solid	H228: Flammable solid
Precautionary statement prevention	P210 P240 P241 P280	P210 P240 P241 P280
Precautionary statement response	P370 + P378	P370 + P378
Precautionary statement storage	No precautionary statement	No precautionary statement
Precautionary statement disposal	No precautionary statement	No precautionary statement

6. Hazard Class: Oxidizing gases

Classification	Category 1
Hazard pictogram	
Signal word	Danger
Hazard statement	H270: May cause or intensify fire; oxidizer
Precautionary statement prevention	P220 P244
Precautionary statement response	P370 + P376
Precautionary statement storage	P403
Precautionary statement disposal	No precautionary statement

7. Hazard Class: Oxidizing liquids

Classification	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
Hazard statement	H271: May cause fire or explosion; strong oxidizer	H272: May intensify fire; oxidizer	H272: May intensify fire; oxidizer
Precautionary statement prevention	P210 P220 P221 P280 P283	P210 P220 P221 P280	P210 P220 P221 P280
Precautionary statement response	P306 + P360 P371 + P380 + P375 P370 + P378	P370 + P378	P370 + P378
Precautionary statement storage	No precautionary statement	No precautionary statement	No precautionary statement
Precautionary statement disposal	P501	P501	P501

8. Oxidizing solids

Classification	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
Hazard statement	H271: May cause fire or explosion; strong oxidizer	H272: May intensify fire; oxidizer	H272: May intensify fire; oxidizer
Precautionary statement prevention	P210 P220 P221 P280 P283	P210 P220 P221 P280	P210 P220 P221 P280
Precautionary statement response	P306 + P360 P371 + P380 + P375 P370 + P378	P370 + P378	P370 + P378
Precautionary statement storage	No precautionary statement	No precautionary statement	No precautionary statement
Precautionary statement disposal	P501	P501	P501

9. Hazard Class: Gases under pressure

Classification	Compressed gas	Liquefied gas	Refrigerated liquefied gas	Dissolved gas
Hazard pictogram				
Signal word	Warning	Warning	Warning	Warning
Hazard statement	H280: Contains gas under pressure; may explode if heated	H280: Contains gas under pressure; may explode if heated	H281: Contains refrigerated gas; may cause cryogenic burns or injury	H280: Contains gas under pressure; may explode if heated
Precautionary statement prevention	No precautionary statement	No precautionary statement	P282	No precautionary statement
Precautionary statement response	No precautionary statement	No precautionary statement	P336 P315	No precautionary statement
Precautionary statement storage	P410 + P403	P410 + P403	P403	P410 + P403
Precautionary statement disposal	No precautionary statement	No precautionary statement	No precautionary statement	No precautionary statement

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10. Hazard Class: Self-reactive chemicals

Classification	Type A	Type B	Type C & D	Type E & F	Type G
Hazard pictogram		 			There are no label elements allocated to this hazard category
Signal word	Danger	Danger	Danger	Warning	
Hazard statement	H240: Heating may cause explosion	H241: Heating may cause fire or explosion	H242: Heating may cause fire	H242: Heating may cause fire	
Precautionary statement prevention	P210 P220 P234 P280	P210 P220 P234 P280	P210 P220 P234 P280	P210 P220 P234 P280	
Precautionary statement response	P370 + P378 P370 + P380 + P375	P370 + P378 P370 + P380 + 375	P370 + P378	P370 P378	No precautionary statement
Precautionary statement storage	P403 + P235 P411 P420	P403 + P235 P411 P420	P403 + P235 P411 P420	P403 + P235 P411 P420	No precautionary statement
Precautionary statement disposal	P501	P501	P501	P501	No precautionary statement

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11. Hazard Class: Pyrophoric liquids

Classification	Category 1
Hazard pictogram	
Signal word	Danger
Hazard statement	H250: Catches fire spontaneously if exposed to air
Precautionary statement prevention	P210 P222 P280
Precautionary statement response	P302 + P334 P370 + P378
Precautionary statement storage	P422
Precautionary statement disposal	No precautionary statement

12. Hazard Class: Pyrophoric solids

Classification	Category 1
Hazard pictogram	
Signal word	Danger
Hazard statement	H250: Catches fire spontaneously if exposed to air
Precautionary statement prevention	P210 P222 P280
Precautionary statement response	P335 + P334 P370 +P378
Precautionary statement storage	P422
Precautionary statement disposal	No precautionary statement

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13. Hazard Class: Self-heating chemicals

Classification	Category 1	Category 2
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H251: Self-heating; may catch fire	H252: Self-heating in large quantities; may catch fire
Precautionary statement prevention	P235 + P410 P280	No precautionary statement
Precautionary statement response	No precautionary statement	No precautionary statement
Precautionary statement storage	P407 P413 P420	No precautionary statement
Precautionary statement disposal	No precautionary statement	No precautionary statement

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14. Hazard Class: Chemicals which, if in contact with water, emit flammable gases

Classification	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Danger	Warning
Hazard statement	H260: If in contact with water, releases flammable gases which may ignite spontaneously	H261: If in contact with water, releases flammable gases	H261: If in contact with water, releases flammable gases
Precautionary statement prevention	P233 P231 + P232 P280	P223 P231 + P232 P280	P231 + P232
Precautionary statement response	P335 + P334 P370 + P378	335 + P334 P370 + P378	P370 + P378
Precautionary statement storage	P402 + P404	P402 + P404	P402 + P404
Precautionary statement disposal	P501	P501	P501

15. Hazard Class: Organic peroxides

Classification	Type A	Type B	Type C & D	Type E & F	Type G
Hazard pictogram					There are no label elements allocated to this hazard category
Signal word	Danger	Danger	Danger	Warning	
Hazard statement	H240: Heating may cause explosion	H241: Heating may cause fire or explosion	H242: Heating may cause fire	H242: Heating may cause fire	
Precautionary statement prevention	P210 P220 P234 P280	P210 P220 P234 P280	P210 P220 P234 P280	P210 P220 P234 P280	
Precautionary statement response	No precautionary statement	No precautionary statement	No precautionary statement	No precautionary statement	No precautionary statement
Precautionary statement storage	P411 + P235 P410 P420	P411 + P235 P410 P420	P411 + P235 P410 P420	P411 + P235 P410 P420	No precautionary statement
Precautionary statement disposal	P501	P501	P501	P501	No precautionary statement

16. Hazard Class: Corrosive to metals

Classification	Category 1
Hazard pictogram	
Signal word	Warning
Hazard statement	H290: May be corrosive to metals
Precautionary statement prevention	P234
Precautionary statement response	P390

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Health Hazards

17. Hazard Class: Acute toxicity (oral/dermal/inhalation)

Classification	Category 1	Category 2	Category 3	Category 4
Hazard pictogram				
Signal word	Danger	Danger	Danger	Warning
Hazard statement (oral)	H300: Fatal if swallowed	H300: Fatal if swallowed	H301: Toxic if swallowed	H302: Harmful if swallowed
Hazard statement (dermal)	H310:Fatal if in contact with skin	H310:Fatal if in contact with skin	H311: Toxic if in contact with skin	H312: Harmful if in contact with skin
Hazard statement (Inhalation)	H330:Fatal if inhaled	H330: Fatal if inhaled	H331: Toxic if inhaled	H332: Harmful if inhaled
Precautionary statement prevention (oral)	P264 P270	P264 P270	P264 P270	P264 P270
Precautionary statement response (oral)	P301 + P310 P321 P330	P301 + P310 P321 P330	P301 + P310 P321 P330	P301 + P312 P330
Precautionary statement storage (oral)	P405	P405	P405	No precautionary statement
Precautionary statement disposal (oral)	P501	P501	P501	P501
Precautionary statement prevention (dermal)	P262 P264 P270 P280	P262 P264 P270 P280	P280	P280
Precautionary statement response (dermal)	P302 + P350 P310 P322 P361 P363	P302 + P350 P310 P322 P361 P363	P302 + P352 P312 P322 P361 P363	P302 + P352 P312 P322 P363
Precautionary statement storage (dermal)	P405	P405	P405	No precautionary statement

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Classification	Category 1	Category 2	Category 3	Category 4
Precautionary statement disposal (dermal)	P501	P501	P501	P501
Precautionary statement prevention (inhalation)	P260 P271 P284	P260 P271 P284	P261 P271	P261 P271
Precautionary statement response (inhalation)	P304 + P340 P310 P320	P304 + P340 P310 P320	P304 + P340 P311 P321	P304 + P340 P312
Precautionary statement storage (inhalation)	P403 + P233 P405	P403 + P233 P405	P403 + P233 P405	No precautionary statement
Precautionary statement disposal (inhalation)	P501	P501	P501	No precautionary statement

18. Hazard Class: Skin corrosion or irritation

Classification	Category 1 A/1 B/1 C	Category 2
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H314: Causes severe skin burns and eye damage	H315: Causes skin irritation
Precautionary statement prevention	P260 P264 P280	P264 P280
Precautionary statement response	P301 + P330 + P331 P303 + P361 + P353 P363 PP304 + P340 P310 P321 P305 + P351 + P338	P302 + P352 PP321 PP332 + P313 P362
Precautionary statement storage	P405	No precautionary statement
Precautionary statement disposal	P501	No precautionary statement

19. Hazard Class: Serious eye damage or eye irritation

Classification	**Category 1**	**Category 2**
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H318: Causes serious eye damage	H319: Causes serious eye irritation
Precautionary statement prevention	P280	P264 P280
Precautionary statement response	P305 + P351 + P338 P310	P305 + P351 + P338 P337 + P313
Precautionary statement storage	No precautionary statement	No precautionary statement
Precautionary statement disposal	No precautionary statement	No precautionary statement

20. Hazard Class: Respiratory sensitization

Classification	**Category 1**
Hazard pictogram	
Signal word	Danger
Hazard statement	H334: May cause allergic or asthma symptoms or breathing difficulties if inhaled
Precautionary statement prevention	P261 P285
Precautionary statement response	P304 + P341 P342+ P311
Precautionary statement storage	No precautionary statement
Precautionary statement disposal	P501

21. Hazard Class: Skin sensitization

Classification	**Category 1**
Hazard pictogram	
Signal word	Warning
Hazard statement	H317: May cause an allergic skin reaction
Precautionary statement prevention	P261 P272 P280
Precautionary statement response	P302 + P352 P333 + P313 P321 P363
Precautionary statement storage	No precautionary statement
Precautionary statement disposal	P501

22. Hazard Class: Germ cell mutagenicity

Classification	**Category 1A/1B**	**Category 2**
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H340: May cause genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H341: Suspected of causing genetic defects *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Precautionary statement prevention	P201 P202 P281	P201 P202 P281
Precautionary statement response	P308 + P313	P308 + P313
Precautionary statement storage	P405	P405
Precautionary statement disposal	P501	P501

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23. Hazard Class: Carcinogenicity

Classification	Category 1A/1B	Category 2
Hazard pictogram		
Signal word	Danger	Warning
Hazard statement	H350: May cause cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H351: Suspected of causing cancer *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Precautionary statement Prevention	P201 P202 P281	P201 P202 P281
Precautionary statement response	P308 + P313	P308 + P313
Precautionary statement storage	P405	P405
Precautionary statement disposal	P501	P501

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24. Hazard Class: Reproductive toxicity

Classification	Category 1A/1B	Category 2	Additional labelling for effects on or via lactation
Hazard pictogram			No hazard pictogram
Signal word	Danger	Warning	No signal word
Hazard statement	H360: May damage fertility or the unborn child *(state specific effect, if known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H361: Suspected of damaging fertility or the unborn child *(state specific effect, if known) (state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H362: May cause harm to breast-fed children.
Precautionary statement prevention	P201 P202 P281	P201 P202 P281	P201 P260 P263 P264 P270
Precautionary statement response	P308 + P313	P308 + P313	P308 + P313
Precautionary statement storage	P405	P405	No precautionary statement
Precautionary statement disposal	P501	P501	No precautionary statement

25. Hazard Class: Specific target organ toxicity-single exposure

Classification	Category 1	Category 2	Category 3
Hazard pictogram			
Signal word	Danger	Warning	Warning
Hazard statement	H370 : Causes damage to organs *(or state all organs affected, if known)* *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H371: May cause damage to organs *(or state all organs affected, if known)* *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H335 : May cause respiratory irritation; *(respiratory tract irritation)* or H336: May cause drowsiness and dizziness *(narcotic effects)*
Precautionary statement prevention	P260 P264 P270	P260 P264 P270	P261 P271
Precautionary statement response	P307 + P311 P321	P309 + P311	P304 + P340 P312
Precautionary statement storage	P405	P405	P403 + P233 P405
Precautionary statement disposal	P501	P501	P501

26. Hazard Class: Specific target organ toxicity-repeated exposure

Classification	Category 1	Category 2
Hazard pictogram		
Signal Word	Danger	Warning
Hazard statement	H372: Causes damage to organs *(state all organs affected, if known)*through prolonged or repeated exposure *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*	H373: May cause damage to organs *(state all organs affected, if known)*through prolonged or repeated exposure *(state route of exposure, if it is conclusively proven that no other routes of exposure cause the hazard)*
Precautionary statement prevention	P260 P264 P270	P260
Precautionary statement response	P314	P314
Precautionary statement storage	No precautionary statement	No precautionary statement
Precautionary statement disposal	P501	P501

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27. Hazard Class: Aspiration hazard

Classification	Category 1
Hazard pictogram	
Signal word	Danger
Hazard statement	H304: May be fatal if swallowed and enters airways
Precautionary statement prevention	No precautionary statement
Precautionary statement response	P301+P310 P331
Precautionary statement storage	P405
Precautionary statement disposal	P501

Environmental Hazards

28. Hazard Class: Hazardous to the aquatic environment-acute hazard

Classification	Category 1
Hazard pictogram	
Signal word	Warning
Hazard statement	H400: Very toxic to aquatic life
Precautionary statement prevention	P273
Precautionary statement response	P391
Precautionary statement storage	No precautionary statement
Precautionary statement disposal	P501

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29. Hazard Class: Hazardous to the aquatic environment-chronic hazard

Classification	Category 1	Category 2	Category 3	Category 4
Hazard pictogram			No hazard pictogram	No hazard pictogram
Signal word	Warning	No signal word	No signal word	No signal word
Hazard statement	H410: Very toxic to aquatic life with long lasting effects	H411: Toxic to aquatic life with long lasting effects	H412: Harmful to aquatic life with long lasting effects	H413: May cause long lasting harmful effects to aquatic life
Precautionary statement prevention	P273	P273	P273	P273
Precautionary statement response	P391	P391	No precautionary statement	No precautionary statement
Precautionary statement storage	No precautionary statement	No precautionary statement	No precautionary statement	No precautionary statement
Precautionary statement disposal	P501	P501	P501	P501

30. Hazard Class: Hazardous to the ozone layer

Classification	**Category 1**
Hazard pictogram	
Signal word	Warning
Hazard statement	H420: Harms public health and the environment by destroying ozone in the upper atmosphere.
Precautionary statement prevention	No precautionary statement
Precautionary statement response	No precautionary statement
Precautionary statement storage	No precautionary statement
Precautionary statement disposal	P502

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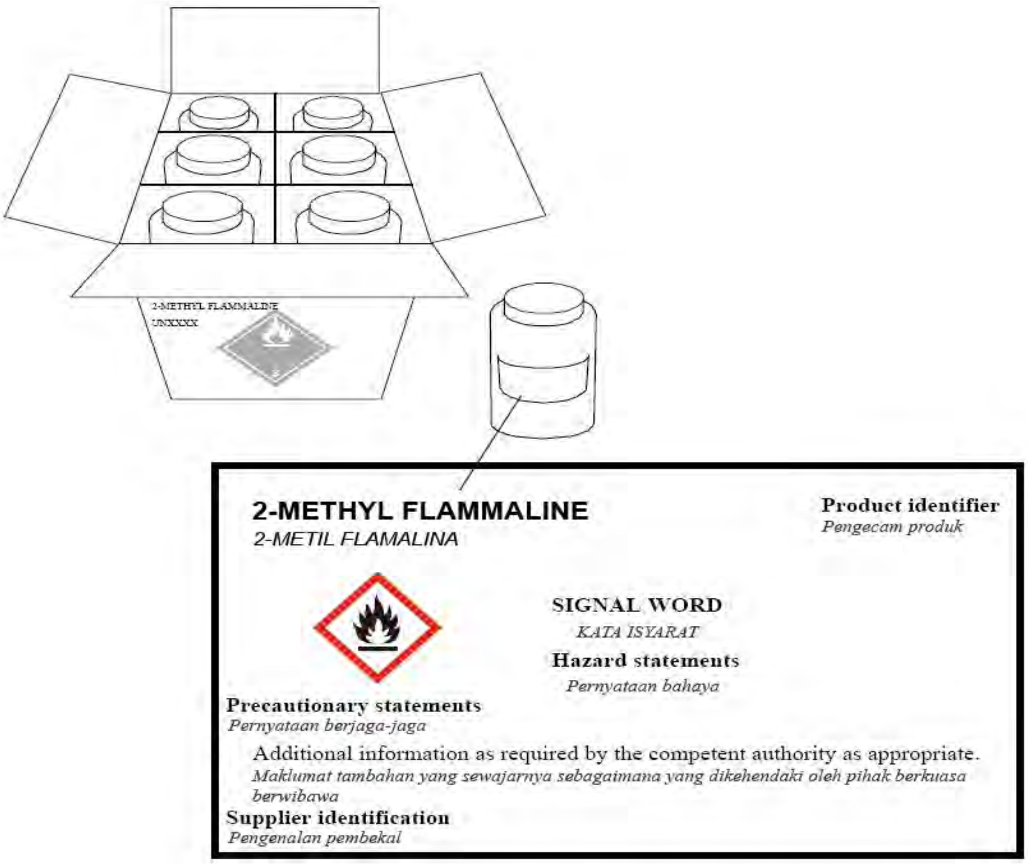
APPENDIX 3.4
Examples of Arrangements of the Label Elements

Example 1: Combination packaging for a flammable liquids category 2

Outer packaging: Box with a flammable liquids transport label*
Inner packaging: Plastic bottle with label according to the Regulations



2-METHYL FLAMMALINE
2-METIL FLAMALINA

Product identifier
Pengecam produk

SIGNAL WORD
KATA ISYARAT

Hazard statements
Pernyataan bahaya

Precautionary statements
Pernyataan berjaga-jaga

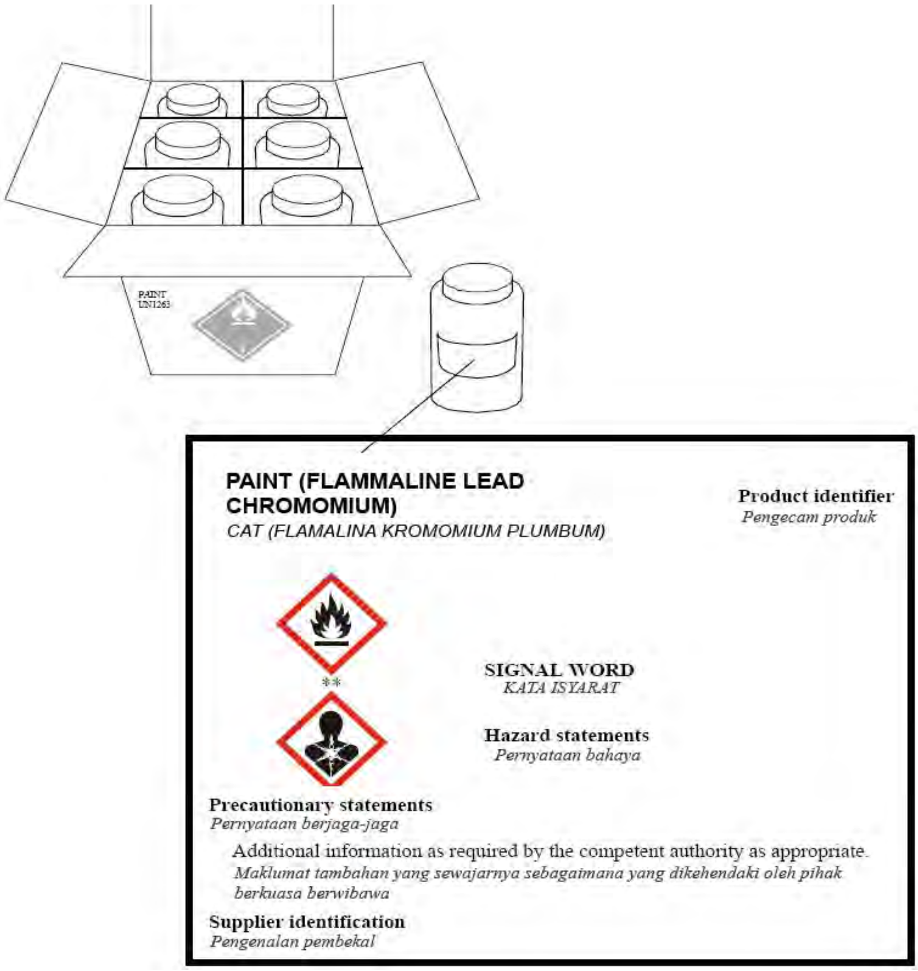
Additional information as required by the competent authority as appropriate.
Maklumat tambahan yang sewajarnya sebagaimana yang dikehendaki oleh pihak berkuasa berwibawa

Supplier identification
Pengenalan pembekal

* *the UN transport markings and labels may be used for outer packaging.*

Example 2: Combination packaging for a specific target organ toxicity category 1and flammable liquids category 2

Outer packaging: Box with a flammable liquids transport label*
Inner packaging: Plastic bottle with label according to the Regulations



PAINT (FLAMMALINE LEAD CHROMOMIUM)
CAT (FLAMALINA KROMOMIUM PLUMBUM)

Product identifier
Pengecam produk

SIGNAL WORD
KATA ISYARAT

Hazard statements
Pernyataan bahaya

Precautionary statements
Pernyataan berjaga-jaga

Additional information as required by the competent authority as appropriate.
Maklumat tambahan yang sewajarnya sebagaimana yang dikehendaki oleh pihak berkuasa berwibawa

Supplier identification
Pengenalan pembekal

* *The UN transport markings and labels may be used for outer packaging.*

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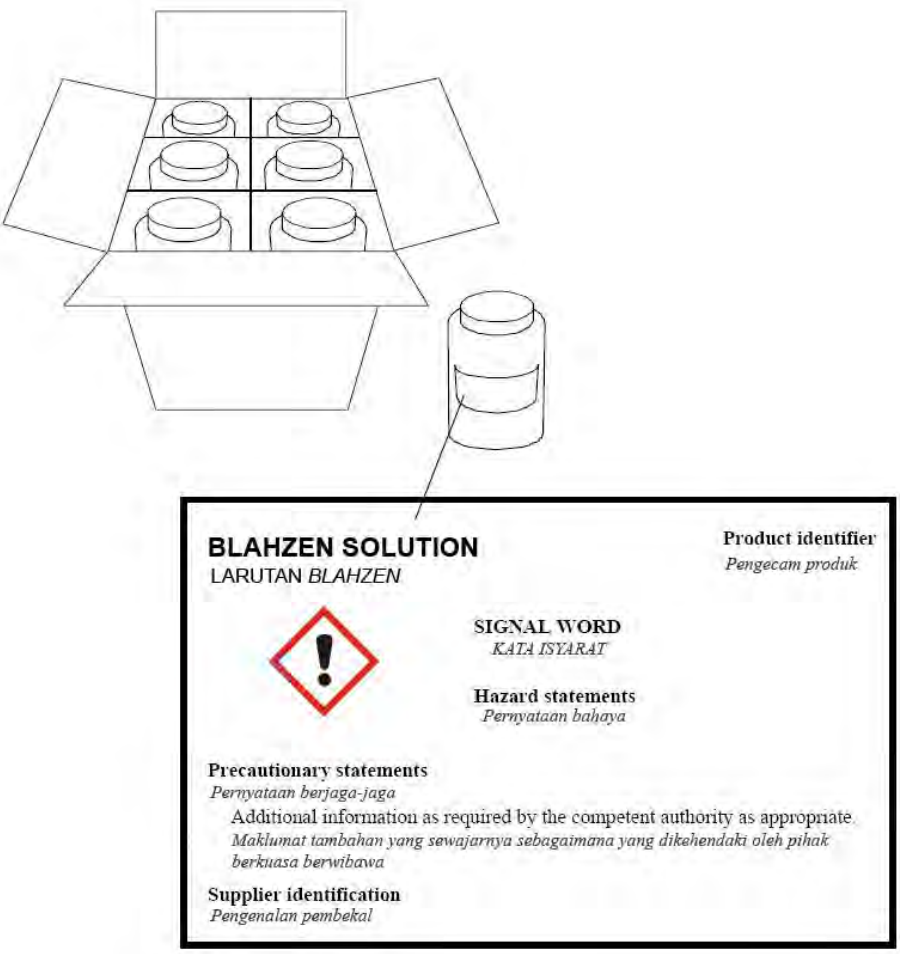
Example 3: Combination packaging for a skin corrosion or irritation category 2 and serious eye damage and eye irritation category 2

Outer packaging: Box with no label required for transport *
Inner packaging: Plastic bottle with label according to the Regulations



BLAHZEN SOLUTION
LARUTAN *BLAHZEN*

Product identifier
Pengecam produk

SIGNAL WORD
KATA ISYARAT

Hazard statements
Pernyataan bahaya

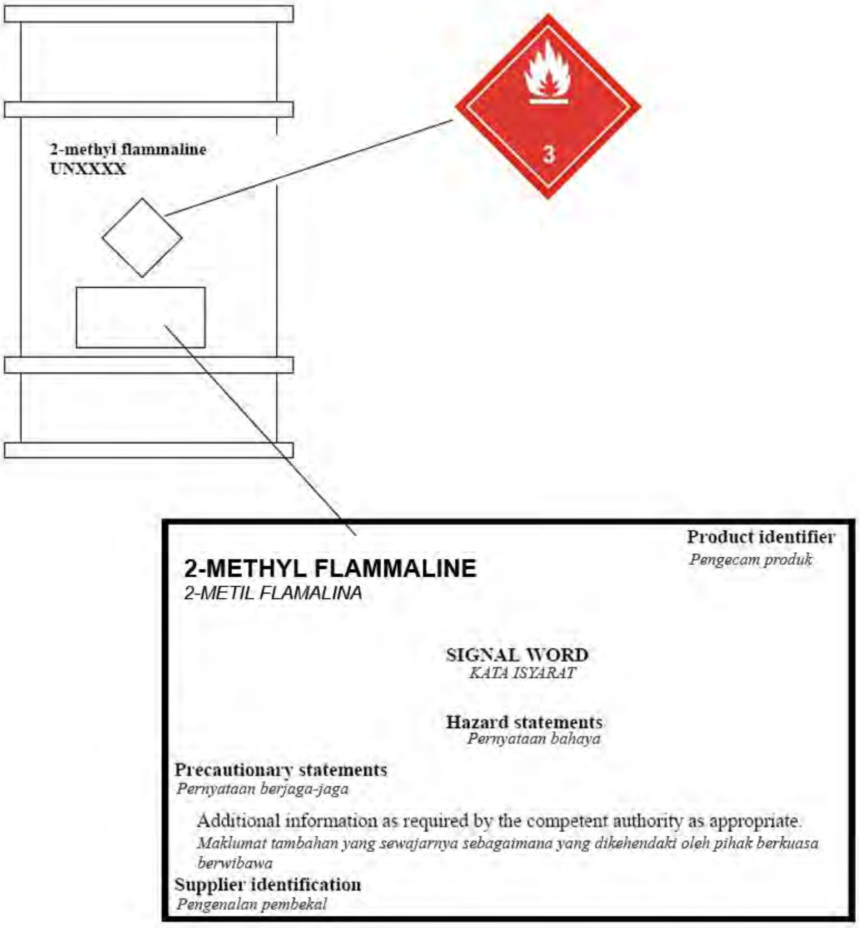
Precautionary statements
Pernyataan berjaga-jaga

Additional information as required by the competent authority as appropriate.
Maklumat tambahan yang sewajarnya sebagaimana yang dikehendaki oleh pihak berkuasa berwibawa

Supplier identification
Pengenalan pembekal

** May use the label according to the Regulations on the outer packaging in the absence of a transport label. In case where it is not practicable to label or tag the inner packaging due to the size or nature of the packaging, the label shall be affixed on the outer packaging.*

Example 4: Single packaging (200L drum) for a flammable liquids category 2

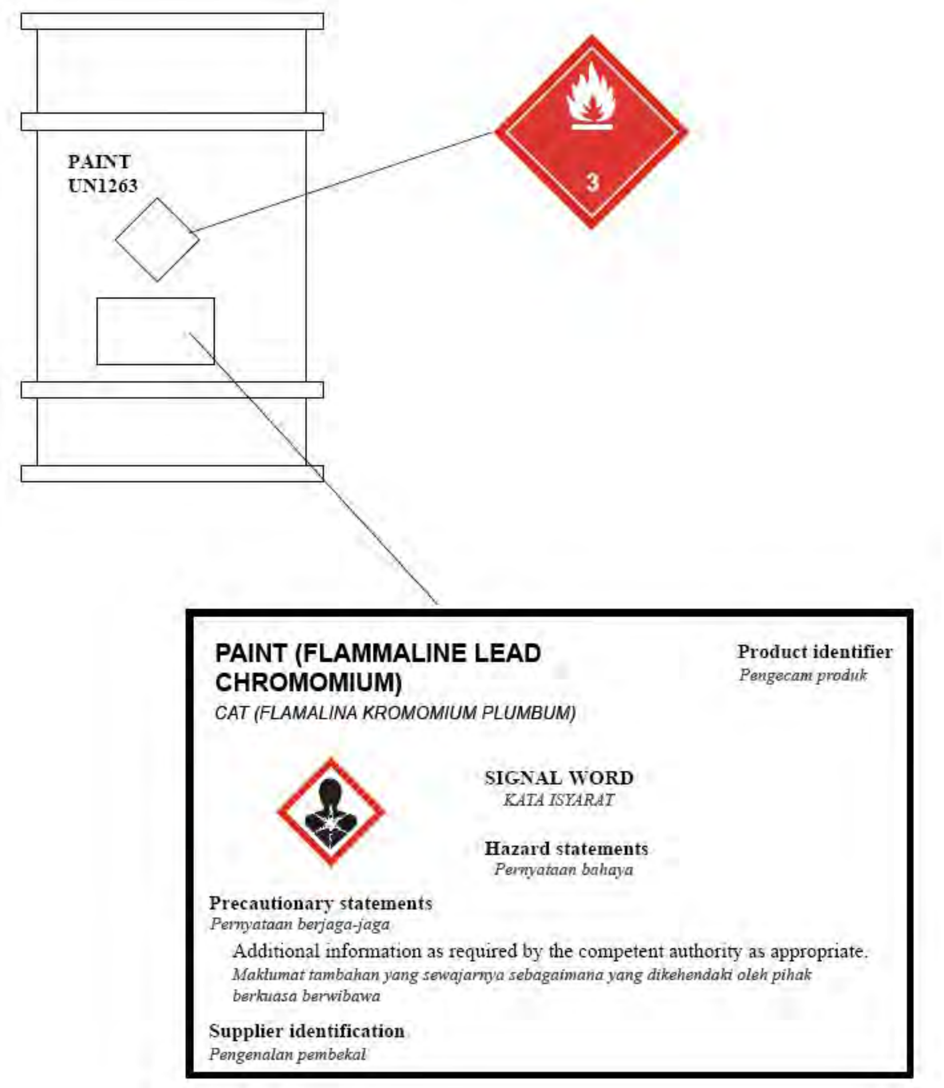


Additional information as required by the competent authority as appropriate.
Maklumat tambahan yang sewajarnya sebagaimana yang dikehendaki oleh pihak berkuasa berwibawa

NOTE

The label according to the Regulations and flammable liquid pictogram and markings required by the "*UNRTDG, Model Regulations*" may be also being presented in a combined format.

Example 5: Single packaging for a specific target organ toxicity category 1 and flammable liquids category 2



PAINT (FLAMMALINE LEAD CHROMOMIUM)
CAT (FLAMALINA KROMOMIUM PLUMBUM)

Product identifier
Pengecam produk

SIGNAL WORD
KATA ISYARAT

Hazard statements
Pernyataan bahaya

Precautionary statements
Pernyataan berjaga-jaga

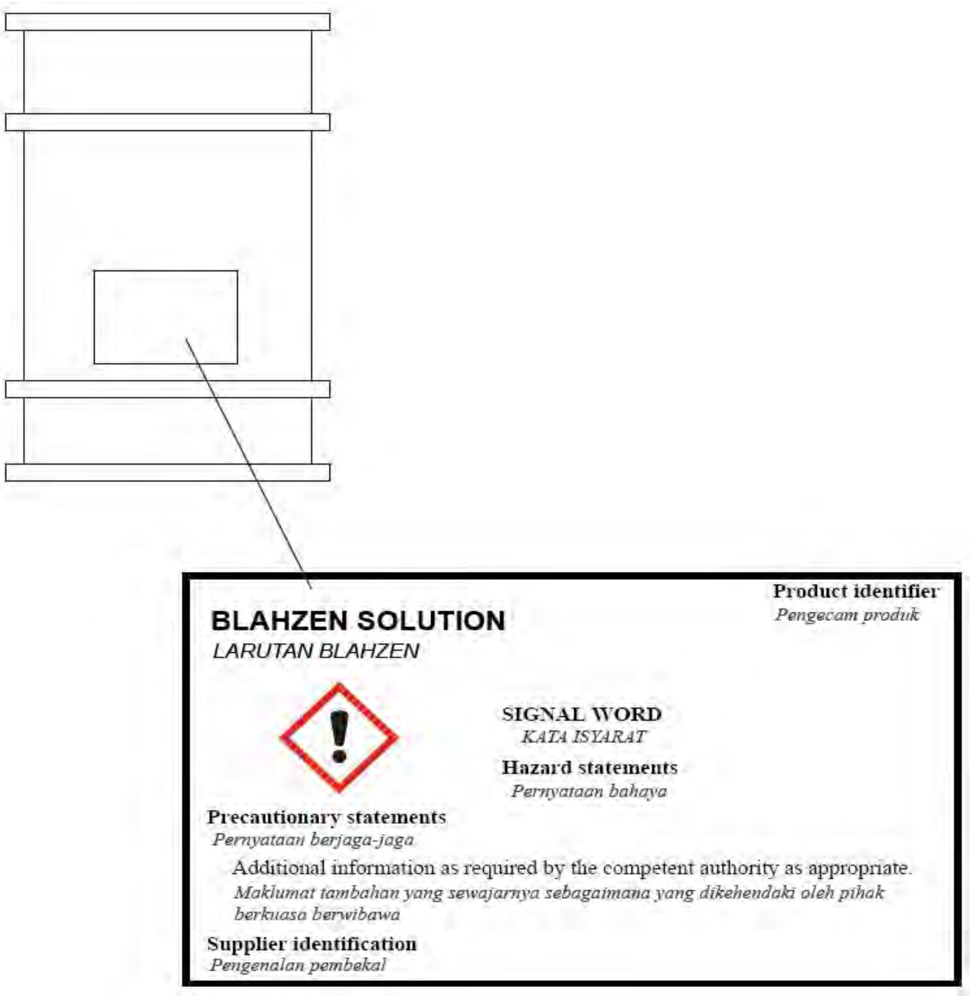
Additional information as required by the competent authority as appropriate.
Maklumat tambahan yang sewajarnya sebagaimana yang dikehendaki oleh pihak berkuasa berwibawa

Supplier identification
Pengenalan pembekal

NOTE

The label according to the Regulations and flammable liquid pictogram and markings required by the "*UNRTDG, Model Regulations"* may be also being presented in a combined format.

Example 6: Single packaging for a skin corrosion or irritant category 2 and serious eye damage and eye irritation category 2



BLAHZEN SOLUTION
LARUTAN BLAHZEN

Product identifier
Pengecam produk

SIGNAL WORD
KATA ISYARAT

Hazard statements
Pernyataan bahaya

Precautionary statements
Pernyataan berjaga-jaga

Additional information as required by the competent authority as appropriate.
Maklumat tambahan yang sewajarnya sebagaimana yang dikehendaki oleh pihak berkuasa berwibawa

Supplier identification
Pengenalan pembekal

Single packaging using 3 adjacent panels to convey multiple hazards

Product classified as: (a) flammable liquids category 2; (b) acute toxicity (inhalation) category 4; (c) specific target organ toxicity –repeated exposure category 2

CODE *KOD*

PRODUCT NAME *NAMA PRODUK*

COMPANY NAME

Street Address
City, State, Postal Code, Country
Phone Number
Emergency Phone Number
Nama Jalan
Bandar, Negeri, Poskod, Negara
Nombor Telefon
Nombor Telefon Kecemasan

DIRECTIONS FOR USE:
XXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXX
ARAHAN BAGI PENGGUNAAN:
XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX

Fill weight:	**XXXX**	**Lot Number:**	**XXXX**
Gross weight:	**XXXX**	**Fill Date:**	**XXXX**
Expiration Date:	**XXXX**		
Berat isi:	*XXXX*	*Nombor Lot:*	*XXXX*
Berat kasar:	*XXXX*	*Tarikh Isi:*	*XXXX*
Tarikah Luput:	*XXXX*		

Danger
Keep out of the reach of children.
Read label before use.
Bahaya
Jauhkan dari kanak-kanak.
Baca label sebelum menggunakan produk.

Highly flammable liquid and vapour.
Harmful if inhaled.
May cause liver and kidney damage through prolonged or repeated exposure.

Keep container tightly closed.
Keep away from heat/sparks/open flame. -No smoking.
Use only outdoors or in a well-ventilated area.
Do not breath fume/gas/mist/vapours/spray.
Wear protective gloves and eye/face protection [as specified….]
Ground/bond container and receiving equipment.

IN CASE OF FIRE use [as specified] for extinction

FIRST AID
IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
Call a POISON CENTER or doctor/physician if you feel unwell.

Store in a cool, well-ventilated place.

Cecair dan wap amat mudah bakar.
Memudaratkan jika tersedut.
Boleh menyebabkan kerosakan hati dan buah pinggang melalui pendedahan berpanjangan atau berulang.

Pastikan bekas ditutup ketat.
Jauhkan dari haba/bunga api/nyalaan terbuka – Jangan merokok.
Guna hanya di luar bangunan atau di tempat yang beralih udara baik.
Jangan sedut wasap/gas/kabut/wap/semburan.
Pakai sarung tangan pelindung dan perlindungan mata/muka [seperti yang dinyatakan …].
Bumikan/ikat bekas dan kelengkapan peralatan terimaan.

JIKA BERLAKU KEBAKARAN, guna [seperti yang dinyatakan] untuk memadamkan api.

BANTUAN KECEMASAN
JIKA TERSEDUT: Alihkan mangsa ke tempat berudara segar dan pastikan dia dalam keadaan rehat dan dalam kedudukan yang selesa untuk bernafas.
Hubungi Pusat Racun Negara atau doktor/pakar perubatan jika anda berasa tidak sihat.

UN Number
Proper shipping name
Nombor UN
Nama penghantaran sah

[Universal Product Code (UPC)]
[Kod Produk Universal (UPC)]

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(Ministry of Human Resource Malaysia)
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