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

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

#### Sixty-fifth session

Geneva, 25 November-3 December 2024

Item 3 of the provisional agenda

#### Listing, classification and packing

### Deletion of the entry UN 2941 Fluoroanilines

#### Transmitted by the expert from Germany\*

## I. Introduction

1. The *Model Regulations* currently subsume fluoroanilines in liquid form under UN 2941, Division 6.1 and packing group III.
2. The expert from Germany submitted informal document INF.36 on the deletion of UN 2941 for fluoroanilines at the sixty-fifth session. General support was noted and it was agreed to continue the discussion at the next session.

## II. Discussion

3. Fluoroanilines form a group of substances that are derived from both aniline and fluorobenzene. The structure consists of a benzene ring with an added amino group ( $-NH_2$ ) and fluorine/s ( $-F$ ) as substituents. Their different arrangements (ortho, meta or para) results in different constitutional isomers and in different physicochemical characteristics. Some of them are solid, but more than half of them are liquid.
4. The analysis of fluoroanilines shows the wide spectrum of characteristics leading to different classifications. This can easily be demonstrated by taking a closer look at the nineteen fluoroanilines with only fluorine substituent(s). According to the available data seven of these fluoroanilines (2,3,4-trifluoroaniline, 2,3,6-trifluoroaniline, 2,4,5-trifluoroaniline, 3,4,5-trifluoroaniline, 2,3,4,5-tetrafluoroaniline, 2,3,5,6-tetrafluoroaniline and pentafluoroaniline) can surely not be classified as dangerous goods.
5. The classifications of another seven fluoroanilines with only fluorine substitute(s) are questionable: one may be acute toxic 3 (2,4-difluoroaniline) and the other six fluoroanilines (3-fluoroaniline, 2,3-difluoroaniline, 2,5-difluoroaniline, 3,4-difluoroaniline, 3,5-difluoroaniline and 2,3,5-trifluoroaniline) may also not be classified as dangerous goods.

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\* A/78/6 (Sect. 20), table 20.5.



6. Of the remaining five fluoroanilines with only fluorine substitute(s) two substances are flammable liquids (2,6-difluoroaniline and 2,3,4,6-tetrafluoroaniline), one of which may also be acute toxic (2,6-difluoroaniline). One substance is a flammable solid (2,4,6-trifluoroaniline), one is skin corrosive (4-fluoroaniline) and one substance is flammable and acute toxic (2-fluoroaniline) (for further details see annex).

7. Overall, the classification of fluoroanilines in Division 6.1, packing group III under UN 2941 does not seem to be adequate: Of the nineteen fluoroanilines mentioned above only three fluoroaniline have either confirmed toxic (2-fluoroaniline) or possible toxic properties (2,4-difluoroaniline and 2,6-difluoroaniline). For a comprehensive overview of the data for the classification of fluoroanilines with only fluorine substitute(s) (see annex).

8. In addition to the data from the European Chemicals Agency (ECHA)<sup>1</sup> and the National Center for Biotechnology Information of the United States of America (PubChem)<sup>2</sup> databases shown in the annex, this finding is further supported by the data available in the the hazardous information system database of the German Statutory Accident Insurance (GESTIS)<sup>3</sup>, which provides classification for the following monofluoroanilines: 2-fluoroaniline (Flammable Liquid Category 3), 3-fluoroaniline (not toxic, not flammable) and 4-fluoroaniline (skin corrosive category 1C based on rabbit data and human experiences and acute toxicity category 4).

9. In conclusion, the analysis shows that the vast majority of fluoroanilines with only fluorine substitute(s) do not meet the classification criteria for division 6.1. In addition, some of these fluoroanilines have divergent or additional hazards, which are not addressed by UN 2941.

10. Given the variety of fluoroanilines with only fluorine substitute(s) and fluoroanilines in general, this document tries to illustrate how different the chemical and physical properties of fluoroaniline can be and how one class or division under a single UN entry cannot cover all or most (or at least several) of them.

11. Addressing the very different chemical and physical properties of fluoroanilines in the *Model Regulations* in a simple yet promising way would be to delete UN 2941 from the dangerous goods list in chapter 3.2 as proposed below. This would allow those fluoroanilines, which are classified as dangerous goods, to be transported according to their physical and chemical properties under the relevant “not otherwise specified” (n.o.s.) entries that adequately reflect their hazards in transport.

12. The deletion of UN 2941 does not mean automatically that fluoroanilines can be freely transported and they are not subject of the *Model Regulations*. Fluoroanilines should be transported according to their physical and chemical properties and the hazards they pose under the relevant n.o.s. entries. The alphabetical index in the *Model Regulations* should continue to list the most commonly transported fluoroanilines with the appropriate UN entries (see para. 16).

13. With the deletion of UN 2941, some of the most commonly transported fluoroanilines (e.g. 2,4-Difluoroaniline as toxic liquid, 2-Fluoroaniline as flammable liquid, 4-Fluoroaniline as corrosive liquid) would be transported under the n.o.s. entries UN 2810, 1992 or 1760 (see para. 16) which prescribe T7 portable tank instruction in contrast to T4 in UN 2941. It has to be noted that T7 portable tank instruction differs only in minimum test pressure from T4 (T7 with 4 bar, T4 with 2,65 bar), and that the minimum shell thickness, the pressure-relief requirements and the bottom opening requirements are the same (see 4.2.5.2.6 of the *Model Regulations*). In addition, it is noteworthy that TP28 portable tank special provision is also assigned to these n.o.s. entries, which allows portable tanks having a minimum of 2,65 bar test pressure to be used when it is acceptable. Taking these considerations into account, there is no need to introduce a transitional measure in the *Model Regulations*.

14. The following proposal supports Sustainable Development Goal 3: *Good health and well-being* as part of the 2030 Agenda for Sustainable Development by promoting the safe

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<sup>1</sup> <https://echa.europa.eu/home>

<sup>2</sup> <https://pubchem.ncbi.nlm.nih.gov>

<sup>3</sup> <https://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp>

transport of fluoroanilines and Sustainable Development Goal 16: *Peace, justice and strong institutions* by promoting consistent regulations for the safe transport of dangerous goods.

### III. Proposal

15. Amend the dangerous goods list in chapter 3.2 as follows (deleted text is ~~strikethrough~~):

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
<del>2941</del>	<del>FLUOROANILINES</del>	<del>6.1</del>		<del>III</del>		<del>5L</del>	<del>E1</del>	<del>P001 IBC03 LP01</del>		<del>T4</del>	<del>TP1</del>

### IV. Required supplementary provisions

16. Amend the alphabetical index in the *Model Regulations* as follows (new text is underlined, deleted text is ~~strikethrough~~):

Name and description	Class	UN No.
<del>FLUOROANILINES</del>	<del>6.1</del>	<del>2941</del>
2- Fluoroaniline, see	<u>6.13</u>	<u>29411992</u>
4-Fluoroaniline, see	<u>6.18</u>	<u>29411760</u>
o-Fluoroaniline, see	<u>6.13</u>	<u>29411992</u>
p-Fluoroaniline, see	<u>6.18</u>	<u>29411760</u>

## Annex

[English only]

## Data for classification of fluoroanilines (accessed in September 2023)

Cons: Consortium; Not: Notification; DG: Dangerous Goods; PG: Packing Group; ?: questionable; C&L: Classification and Labelling

ECHA: European Chemicals Agency; REACH: European Union Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (1907/2006/EC).

Chemical name CAS-Nr.	Solid/liquid Flashpoint	C&L Inventory in ECHA (Self- classification)	Registered according to REACH Regulation	PubChem	Classification according to GHS criteria	Classification according to the UN Model Regulations
2-fluoroaniline 348-54-9	liquid 60 °C	3 Cons, 66 Not > Acute Tox 3; 8 Cons, 54 Not > Flam Liq 3; 1 Cons, 1 Not > Flam Liq 3 and Acute Tox 3; 2 Cons, 2 Not > not DG	Phys. hazards: data lacking Health hazards: Acute Tox 3, no detailed data	29,89 % Flam Liq 3, 69,57 % Acute Tox 3, 30,43 % Acute Tox 4	Flam Liq 3 Subs. hazard: Acute Tox 3	Class 3 (6.1) PG III
3-fluoroaniline 372-19-0	liquid 77 °C	5 Cons, 42 Not > no DG; 3 Cons, 6 Not > Acute Tox 3; 1 Cons, 1 Not > Skin Corr 1B	no	12,24 % Acute Tox 3, 87,76 % Acute Tox 4	Not DG?	Not DG?
4-fluoroaniline 371-40-4	liquid 73,9 °C	10 Cons, 137 Not > Skin Corr 1 (of it 3 Cons, 42 Not > Skin Corr 1B, 6 Cons, 94 Not > Skin Corr 1C); 2 Cons, 2 Not > Acute Tox 3; 3 Cons, 37 Not > not DG	Phys. hazards: data not sufficient for classification Health hazards: LD50 oral 417-460 mg/kg bw rats > Acute Tox 4, 2 mg caused severe irritation to rabbit skin during 24 hr exposure > Skin Corr 1C	98,36 % Acute Tox 4, 76,5 % Skin Corr 1C, LD50 oral 417 mg/kg rats	Skin Corr 1 (C?)	Class 8 (PG III?)
2,3-difluoroaniline 4519-40-8	liquid 71 °C	4 Cons, 41 Not > not DG; 3 Cons, 6 Not > Acute Tox 3	no	12,77 % Acute Tox 3, 95,74 % Acute Tox 4	Not DG?	Not DG?
2,4-difluoroaniline 367-25-9	liquid 62,8 °C	7 Cons, 51 Not > Acute Tox 3 2 Cons, 2 Not > not DG	Intermediate use only! Phys. hazards: data lacking Health hazards: LD50 oral 951 mg/kg bw rats > Acute Tox 4, LD50 dermal 1014 mg/kg bw rats > Acute Tox 4, no detailed data for inhalation toxicity > Acute Tox 3	97,14 % Acute Tox 3, LD50 oral 820 mg/kg rats, LD50 dermal 672 mg/kg rats, LC50 inhalation 6210 mg/ m <sup>3</sup> /4h rats	Acute Tox 3 or not DG?	Division 6.1, PG III or not DG?
2,5-difluoroaniline 367-30-6	liquid 66-69 °C	2 Cons, 5 Not > Acute Tox 3; 3 Cons, 41 Not > not DG	no	95,65 % Acute Tox 4, 10,87 % Acute Tox 3	Not DG?	Not DG?
2,6-difluoroaniline 5509-65-9	liquid 43-51 °C	4 Cons, 111 Not > Flam Liq 3; 2 Cons, 5 Not > Flam Liq 3 and Acute Tox 3	no	100 % Flam Liq 3, 97,41 % Acute Tox 4	Flam Liq 3 (Subs. hazard: Acute Tox 3?)	Class 3 PG III (Subs. hazard Division 6.1?)

Chemical name CAS-Nr.	Solid/liquid Flashpoint	C&L Inventory in ECHA (Self- classification)	Registered according to REACH Regulation	PubChem	Classification according to GHS criteria	Classification according to the UN Model Regulations
3,4-difluoroaniline 3863-11-4	solid (melting point 22 °C) 85 °C	4 Cons, 42 Not > not DG; 3 Cons, 6 Not > Acute Tox 3	no	97,92 % Acute Tox 4, 12,5 % Acute Tox 3, LD50 oral 340 mg/kg rats, LD50 oral 260 mg/kg mice, LC50 inhalation 10720 mg/ m <sup>3</sup> rats	Not DG?	Not DG?
3,5-difluoroaniline 372-39-4	solid (melting point 37-41 °C) 75 °C	5 Cons, 42 Not > not DG; 2 Cons, 5 Not > Acute Tox 3	no	97,87 % Acute Tox4, 10,64 % Acute Tox 3	Not DG?	Not DG?
2,3,4- trifluoroaniline 3862-73-5	liquid 83 °C	2 Cons, 32 Not > not DG	LD 50 oral 728 mg/kg bw species not given; LD50 dermal 1590 mg/kg bw species not given	100 % Acute Tox 4, LD50 oral 699 mg/kg rats	Not DG *	Not DG
2,3,5- trifluoroaniline 363-80-4	liquid 69 °C	3 Cons, 6 Not > not DG 1 Cons, 1 Not > Acute Tox 3	no	85,71 % Acute Tox 4	Not DG?	Not DG?
2,3,6- trifluoroaniline 67815-56-9	liquid 61 °C	3 Cons, 43 Not > not DG	no	100 % Acute Tox 4	Not DG	Not DG
2,4,5- trifluoroaniline 367-34-0	solid (melting point 59-63 °C) 107 °C	3 Cons, 44 Not > not DG	no	100 % Acute Tox 4	Not DG	Not DG
2,4,6- trifluoroaniline 363-81-5	solid (melting point 33-37 °C) 58 °C	7 Cons, 47 Not > Flam Sol 1/2 1 Cons, 1 Not > not DG	no	97,92 % Flam Sol 2, 93,75 % Acute Tox 4	Flam Sol (2?)	Class 4.1 (PG II?)
3,4,5- trifluoroaniline 163733-96-8	solid (melting point 61-64 °C) 82 °C	8 Cons, 48 Not > not DG	no	Not DG	Not DG	Not DG
2,3,4,5- tetrafluoroaniline 5580-80-3	solid (melting point 27-29 °C) 79 °C	3 Cons, 40 Not > not DG	no	Not DG	Not DG	Not DG
2,3,4,6- tetrafluoroaniline 363-73-5	liquid 57,8 °C	1 Cons, 38 Not > Flam Liq 3	no	100 % Flam Liq 3, 100 % Acute Tox 4	Flam Liq 3	Class 3 PG III
2,3,5,6- tetrafluoroaniline 700-17-4	solid (melting point 31 °C) 62 °C	6 Cons, 46 Not > not DG	no	Not DG	Not DG	Not DG
Pentafluoroaniline 771-60-8	solid (melting point 33-35 °C) 73 °C	9 Cons, 49 Not > not DG	no	Not DG	Not DG	Not DG

\* Substance for which an agreed set of classification and labelling data has been agreed at European level by Member States (Regulation (EC) No 1272/2008, on the classification, labelling and packaging of substances and mixtures (CLP Regulation)).