

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

19 June 2024

Sixty-fourth session

Geneva, 24 June-3 July 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 UN *Model Regulations* currently subsume fluoroanilines under UN 2941, Division 6.1 in liquid form with packing group III.
2. Fluoroanilines form a heterogenous 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 physico-chemical characteristics. Some of them are solid, but more than half of them are liquid.
3. The German competent authority received an inquiry from a company concerning the classification of monofluoroanilines for a safe transport.
4. The German competent authority confirmed that there are indications to support the classification in Class 6.1 of 2-fluoroaniline but only as a secondary hazard. There was no data found for 3-fluoroaniline that would justify a dangerous goods classification. In the case of 4-fluoroaniline, the classification in Class 8 is justified.

II. Discussion

5. 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 19 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-trofluoroaniline, 2,3,4,5-tetrafluoroaniline, 2,3,5,6-tetrafluoroaniline and pentafluoroaniline) can surely not be classified as dangerous goods.
6. 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.
7. 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).
8. Overall, the classification of fluoroanilines in Division 6.1 PG III under UN 2941 does not seem to be adequate: Of the 19 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.

9. In addition to the data from the ECHA (<https://echa.europa.eu/de/home>) and PubChem (<https://pubchem.ncbi.nlm.nih.gov>) databases shown in Annex, this finding is further supported by the data available in the GESTIS database (The hazardous information system of the German Statutory Accident Insurance under: www.gguv.de/ifa/stoffdatenbank), 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 Toxic Category 4).

10. 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.

11. 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.

12. Addressing the very different chemical and physical properties of fluoroanilines in the Model Regulation in a simple yet promising way would be to delete UN 2941 FLUOROANILINES 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 under the relevant n.o.s. entries.

13. However, Germany would like to request feedback from the Sub-Committee to continue working on this issue.

14. In addition, this proposal supports Sustainable Development Goal 3: Good Health and Well-Being as part of the 2030 Agenda for Sustainable Development by promoting the safe transport of fluoroanilines.

III. Proposal

15. Amend the Dangerous Goods List in Chapter 3.2 as follows (deleted text is ~~stricken though~~):

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)
2941	FLUOROANILINES	6.1		III		5L	E1	P001 IBC03 LP01		T4	TP1

Annex

Data for classification of fluoroanilines (Search datum 2023 September)

Cons: Consortium, Not: Notification, DG: Dangerous Goods, ?: questionable
 ECHA: European Chemicals Agency, REACH: European Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals (1907/2006/EG)

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,	97,14 % Acute Tox 3, LD50 oral 820 mg/kg rats, LD50 dermal 672 mg/kg rats, LC50 inhalation 6210 mg/ m ³ /4h rats	Acute Tox 3 or not DG?	Division 6.1, PG III or not DG?

			no detailed data for inhalation toxicity > Acute Tox 3			
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?)
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 ³ 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 Tox 4, 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 (??)	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 EU level by Member States (CLP Regulation 1271/2008/EC).