Investigation of per- and polyfluorinated alkyl substances (PFAS), especially Tetrafluroacetate (TFA) in Italian bottled mineral water – Greenpeace Italy

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1. Introduction

Drinking water, surface water and groundwater are increasingly contaminated with chemicals from the group of poly- and perfluorinated alkyl substances (PFAS). Greenpeace Italy recently demonstrated that 76% of 260 samples of drinking water from publicly accessible taps are contaminated with PFAS.[1] The report and other studies on PFAS contamination show that TFA (trifluoroacetate) is usually found as the dominant substance in drinking water and mineral water samples.

TFA is the substance with the shortest molecular structure in the PFAS group of substances with two carbon atoms. TFA is very mobile in the environment, very persistent (vMvP) and not biodegradable. TFA does not occur naturally. The main sources of TFA are its release as a metabolite from PFAS-containing pesticides (e.g. flufenacet), refrigerants from refrigerators and heat pumps (F-gases such as tetrafluoroethane) and the chemical industry itself.[2]

For a long time, TFA was considered largely harmless from a toxicological point of view. In 2021, a study showed severe malformations in rabbit fetuses, and since then TFA has been suspected of also posing a risk to human reproduction. In May 2025, German authorities, including the Federal Institute for Risk Assessment (BfR), the Federal Environment Agency (UBA) and the Federal Institute for Occupational Safety and Health (BAuA), confirmed the classification of TFA as toxic to reproduction (category 1B), very persistent and very mobile (vPvM)[3].

Studies show that TFA is increasingly accumulating in plants and thus also in agricultural products such as cereals.[4] It is worrying that an accumulation effect has also been detected

[1] Greenpeace Italia, 22.01.2025: Acque senza Veleni
https://www.greenpeace.org/static/planet4-italy-stateless/2025/01/4bbb41f2-report_def_a_s_v_2025-1.pdf

[2] CHEM Trust provides a good summary on what PFAS are and where they come from, including TFA sources
https://chemtrust.org/wp-content/uploads/FAQ-Green-Transition-2024_January_2025.pdf

[3] German Federal Institute for Risk Assessment, press release, 26.05.2025: Trifluoroacetic acid (TFA): Assessment for classification in new hazard classes submitted – German authorities classify TFA as reprotoxic, very persistent and very mobile
https://www.bfr.bund.de/en/press-release/trifluoroacetic-acid-tfa-assessment-for-classification-in-new-hazard-classes-submitted/

[4] Global 2000, June 2025: The Forever Chemical in our Daily Bread – The worrying rise of TFA in cereal products
https://www.pan-europe.info/sites/pan-

in human blood.[5] According to the European Food Safety Authority (EFSA), significant portions of the European population are already exposed to PFAS above tolerable levels. The high background contamination is compounded by TFA contamination. In a test conducted by BUND (the German branch of Friends of the Earth), TFA was detected in eight out of ten tap water samples and in three out of five mineral waters.[6]

BOX - Per and polyfluoroalkyl substances (PFAS)

PFAS, also known as 'forever chemicals', are a group of man-made chemicals that have been used in many industrial and consumer products since the 1940s due to their unique properties such as heat resistance and oil and water repellency. PFAS are found, for example, in consumer goods such as ski wax, water-repellent outdoor clothing, grease-repellent coatings and packaging such as pizza boxes and baking paper, as well as in stain-resistant carpets and car seats. PFAS are also widely used in technical applications due to their high chemical and temperature resistance. However, these chemicals also have harmful properties that pose a risk to human health and the environment. PFAS are mobile and persistent, meaning they are not biodegradable in the environment. In addition, some PFAS are toxic and bioaccumulative, meaning they can accumulate in animal organisms and the human body. PFAS can enter the body through drinking water or food such as fish, seafood and vegetables, posing a long-term health risk.

Some of the more than 10,000 PFAS chemicals are broken down into TFA in the environment. TFA then remains in the environment for centuries and has already been detected extensively in surface waters and the sea.[7,8] The classification of TFA as toxic to reproduction is currently being reviewed by the European Chemicals Agency (ECHA) at the request of German

europe.info/files/public/resources/reports/Report_03062025_TFA%20in%20Cereal%20Products%20The%20Forever%20Chemical%20in%20our%20Daily%20Bread.pdf

[5] Yishuang Duan, Hongwen Sun, Yiming Yao, Yue Meng, Yongcheng L, 2020, Distribution of novel and legacy per-/polyfluoroalkyl substances in serum and its associations with two glycemic biomarkers among Chinese adult men and women with normal blood glucose levels, Environment International, Volume 134, 2020, https://doi.org/10.1016/j.envint.2019.105295. https://www.sciencedirect.com/science/article/pii/S0160412019320896?pes=vor&utm_source=acs&getft_integrator=acs

[6] BUND (Friends of the Earth Germany), April 2024: Ewigkeitschemikalien sind überall – BUND findet sie in Mineral- und Leitungswasser https://www.bund.net/fileadmin/user_upload_bund/publikationen/chemie/pfas-trinkwasser-mineralwasser-leitungswasser-wasser-test-deutschland-toxfox-bund.pdf

[7] Umweltbundesamt UBA (German Environment Agency), September 2023: PMT/vPvM assessment of REACH registered Substances Detected in Wastewater Treatment Plant Effluent, Freshwater Resources and Drinking Water https://www.umweltbundesamt.de/publikationen/pmtvpvm-assessment-of-reach-registered-substances

[8] Umweltbundesamt UBA (German Environment Agency), March 2024: Untersuchung von aktuellen Meerwasserproben auf Trifluoressigsäure https://www.umweltbundesamt.de/publikationen/untersuchung-von-aktuellen-meerwasserproben-auf

authorities.[9] The Dutch National Institute for Public Health and the Environment (RIVM) fears effects on the liver and immune system and has therefore set a guideline value of 2.2 µg/L for tap water in the Netherlands.[10] Some PFAS are associated with thyroid dysfunction, immune deficiency, kidney and testicular cancer, diabetes and, according to recent studies, developmental and behavioral disorders. A widespread source of TFA is pesticides from agriculture and so-called F-gases from refrigerators and heat pumps.[11] TFA is discharged into water via sewage and sewage treatment plants. There are hints that industrial plants could cause very high local pollution levels, although there is little data available on this.

Residues of TFA in water are not yet regulated. Potentially 26 PFAS active ingredients approved in Germany for use in pesticides can release TFA.[12,13] Laboratory studies have already proven that the fungicide flufenacet forms TFA. The regulation of flufenacet is therefore a lever for managing TFA emissions into the environment.

TFA cannot be removed using conventional water treatment methods. It therefore poses a challenge for water protection and the protection of drinking water resources. Further entries into water bodies must be urgently avoided. If the pollutants continue to enter the environment, concentrations will rise continuously. This will make drinking water treatment increasingly complex and expensive in the future and pose an ever greater health risk to the population.

2. Sampling and Analysis

The mineral water samples analyzed were purchased in March 2025 from two supermarkets in Rome.

Two bottles of each brand were purchased. The contents of one bottle were tested for PFAS in an Italian laboratory and the contents of the second bottle has been tested in a German laboratory.

The following samples were examined:

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[9] European Chemical Agency ECHA, Registry of CLH intentions until outcome, Sodium Trifluoracetate, June 2025
https://echa.europa.eu/de/registry-of-clh-intentions-until-outcome?p_p_id=disslists_WAR_disslistsportlet&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&_disslists_WAR_disslistsportlet_javax.portlet.action=searchDissLists

[10] Rijksinstituut voor Volksgezondheit en Milieu RIVM (Natiional Insitute for Public Health and the Environment), November 2023: https://www.rivm.nl/sites/default/files/2023-03/DMG-2023-0011%20Bijlage%20Advies%2014434A02_Drinkwaterrichtwaarde%20TFA_07122022.pdf

[11] Umweltbundesamt UBA (German Environment Agency): Trifluoracetat (TFA) - Grundlagen für eine effektive Minimierung schaffen - Räumliche Analyse der Eintragspfade in den Wasserkreislauf
https://www.umweltbundesamt.de/publikationen/trifluoracetat-tfa-grundlagen-fuer-eine-effektive

[12] Global 2000, Factsheet 2024: Pestizide, die TFA freisetzen können, https://www.global2000.at/sites/global/files/Factsheet_PFAS-Pestizide.pdf

[13] Arp HP, Gredelj A, Glüge J, Scheringer M, Cousins Ian T.: The Global Threat from the Irreversible Accumulation of Trifluoroacetic Acid (TFA), Environmental Science & Technology 2024 *58* (45), 19925-19935, DOI: 10.1021/acs.est.4c06189
https://pubs.acs.org/doi/10.1021/acs.est.4c06189

Company	Product-Label	Batch (Lot-No. on bottle)	Lab	Packaging (indicated on bottle)	BBD
Acqua Minerale San Benedetto S.p.A.	San Benedetto naturale	13LB4330(I) San Benedetto 2 14LB5041(I) San Benedetto 1	TIL Italia TZW Germany	Plastics 0,5L Plastics 0,5L	27/05/2026 12/08/2026
FERRARELLE S.p.A.	Ferrarelle	L2025021858 Ferrarelle 2 L2024080858 Ferrarelle 1	TIL Italia TZW Germany	Plastics (Plastica riciclata) Plastics (Plastica riciclata)	18/02/2026 08/08/2025
Co.Ge.Di. International S.p.A.	Uliveto naturale	L05957G Uliveto 2 L05657K Uliveto 1	TIL Italia TZW Germany	Plastics 0,5L Plastics 0,5L	Feb 2026 Feb 2026
	Rocchetta naturale	L03154G Rocchetta 1 L05955R Roccetta 2	TZW Germany TIL Italia	plastics 0,5L plastics 0,5L	Jul 2026 Aug 2026
Acqua Sant'Anna S.p.A.	Sant'Anna naturale	L5044/061 Sant Anna 2 L5049T025 Sant Anna 1	TIL Italia TZW Germany	Plastics 0,5L Plastics 0,5L	Feb 2027 Feb 2027
Nestlé Italiana S.p.A.	San Pellegrino frizzante	L5014087012 San Pellegrino 2 L4279087010 San Pellegrino 1	TIL Italia TZW Germany	Plastics (50% plastica riciclata 1L) plastics (50% plastica riciclata 1L)	Jan 2026 Oct 2025
	Panna	L5038087705 Panna 2 L5042087705 Panna 1	TIL Italia TZW Germany	Plastics (con plastica riciclata) Plastics (con plastica riciclata)	Feb 2026 Feb 2026
	Levissima naturale	L5050087110 Levissima 2 L5023087110 Levissima 1	TIL Italia TZW Germany	Plastics (Plastica riciclata) plastics (Plastica riciclata)	Feb 2026 Jan 2026

Table 1: List of purchased and investigated mineral water products

Lot-No.: Batch-Number on the bottle
BBD: Best Before Date according to producer, indicated on the bottle
packaging: Information on the proportion of recycled plastic according to manufacturer

The analyses were carried out in two different laboratories in order to verify any positive findings, i.e. to be able to check them. Both laboratories are independent. The German lab has accreditation for the analysis method used[14]. The Italian laboratory has quality assurance

[14] https://tzw.de/fileadmin/user_upload/pdf/02_Loesungen/Anlage_zur_Akkreditierungsurkunde2021.pdf

measures in place. The samples were tested for the substances listed in Table 1. The table shows the limits of quantification (LOQ) as specified by the respective laboratory. The Italian laboratory also provided the CAS numbers of the substances tested.

Parameter	**CAS**	**Lab**	**LOQ (ng/l)**
Pentafluoropropionate (PFPrA)	n.a.	DE	20
Acido Perfluoropropanoico (PFPrA)	423-64-0	IT	1
Perfluoro-n-butanoate (PFBA)**	n.a.	DE/TwV	1
Acido Perfluorobutanoico (PFBA)**	375-22-4	IT	1
Perfluoro-n-pentanoate (PFPeA)**	n.a.	DE/TwV	1
Acido Perfluoropentanoico (PFPeA)**	2706-90-3	IT	1
Perfluorohexanoate (PFHxA)**	n.a.	DE/TwV	1
Acido Perfluoro n-esanoico (PFHxA)**	307-24-4	IT	1
Perfluoroheptonate (PFHpA)**		DE/TwV	1
Acido Perfluoro n-eptanoico Acido (PFHpA)**	375-85-9	IT	1
Acido 7H-Perfluoroeptanoico (HPFHpA)	1546-95-8	IT	1
Perfluorooctanoate (PFOA)*	**n.a.**	**DE/TwV**	**1**
Acido Perfluoro-ottanoico (PFOA)*	**335-67-1**	**IT**	**1**
Perfluorononanoate (PFNA)*	**n.a.**	**DE/TwV**	**1**
Acido Perfluoro-nonanoico (PFNA)*	**375-95-1**	**IT**	**1**
Perfluorodecanoate (PFDA)**	n.a.	DE/TwV	1
Acido Perfluorodecanoico (PFDA)**	335-76-2	IT	1
Perfluoroundecanoate (PFUnA)**	n.a.	DE/TwV	1
Acido Perfluoroundecanoico (PFUnA)**	2058-94-8	IT	1
Perfluorododecanoate (PFDoA)**	n.a.	DE/TwV	1
Acido Perfluorododecanoico (PFDoA)**	307-55-1	IT	1
Perfluorotridecanoate (PFTrA)**	n.a.	DE/TwV	1
Acido Perfluorotridecanoico (PFTrA)**	72629-94-8	IT	1
Acido Perfluorotetradecanoico (PFTA)	376-06-7	IT	1
Acido perfluoroesadecanoico (PFHxDA)	67905-19-5	IT	1
Acido perfluoroottadecanoico (PFODA)	16517-11-6	IT	1
Perfluoroethanesulfonate (PFES)	n.a.	DE	50
Acido perfluoroetansulfonico (PFES)	354-88-1	IT	1
Perfluoropropanesulfonate (PFPrS)	n.a.	DE	1
Acido Perfluoropropansulfonico (PFPrS)	423-41-5	IT	1
Perfluorobutanesulfonate (PFBS)**	n.a.	DE/TwV	1
Acido Perfluorbutansolfonico (PFBS)**	375-73-5	IT	1
Perfluoropentanesulfonate (PFPeS)**	n.a.	DE/TwV	1
Acido Perfluoropentasolfonico (PFPeS)**	2706-91-4	IT	1
Perfluorohexanesulfonate (PFHxS)*	**n.a.**	**DE/TwV**	**1**
Acido Perfluoroesansolfonico (PFHxS)*	**355-46-4**	**IT**	**1**
Perfluoroheptanesulfonate (PFHpS)**	n.a.	DE/TwV	1
Acido Perfluoro 1-eptansulfonico (PFHpS)**	375-92-8	IT	1
Perfluoroctanesulfonate (PFOS)*	**n.a.**	**DE/TwV**	**1**
Acido Perfluoroottansolfonico (PFOS)*	**1763-23-1**	**IT**	**1**

Perfluorononanesulfonate (PFNS)** Acido Perfluononansolfonico (PFNS)	n.a. 35192-74-6	DE/TwV IT	1 1
Perfluorodecanesulfonate (PFDS)** Acido Perfluorodecansolfonico (PFDS)	n.a. 355-77-3	DE/TwV IT	1 1
Perfluoroottan-sulfonamide (PFOSA)	n.a. 754-91-6	IT	1
Perfluoroundecanesulfonate (PFUnS)** Acido perfluoroundecansulfonico (PFUnS)**	n.a. 749786-16-1	DE/TwV IT	1 1
Perfluordodecanesulfonate (PFDoS)** Acido perfluorododecansolfonico (PFDoS)**	n.a. 79780-39-5	DE/TwV IT	1 1
Perfluorotridecanesulfonate (PFTrS)** Acido perfluorotridecansulfonato (PFTrS)**	n.a. 791563-89-8	DE/TwV IT	1 1
Trifluoroacetate (TFA) Acido Trifluroacetico (TFA)°	n.a. 76-05-1	DE IT	50 50
Trifluoromethanesulfonate Acido perfluorometansulfonico (PFMS)	n.a. 1493-13-6	DE IT	50 1
Acido Perfluoro-3,7-dimetilottanoico (H2PFDA)	172155-07-6	IT	1
1H,1H,2H,2H-Perfluorodecan-solfonato (8:2 FTS)	39108-34-4	IT	1
1H,1H,2H,2H-perfluoro-1-esanesolfonato (4:2 FTS)	757124-72-4	IT	1
1H,1H,2H,2H-perfluoro-1-octanesulfonate (6:2 FTS)	27619-97-2	IT	1
1H,1H,2H,2H-perfluoro-1-dodecanesolfonato (10:2 FTS)	108026-35-3	IT	1
Acido 2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-eptafluoropropossi) propanoico (HFPO-DA / GenX)°	62037-80-3	IT	1
Acido 2H,2H,3H,3H-Perfluoroundecanoico (HPFUnA)°	34598-33-9	IT	1
Acido perfluiro-5-oxaesanoico (PF5OHxA)°	863090-89-5	IT	1
Acido perfluoro-3,6-dioxaeptanoico (3,6-OPFHpA)°	151772-58-6	IT	1
Acido perfluoro-4-oxapentanoico (PF4OPeA)°	377-73-1	IT	1
Potassio 9-cloroeicosanfluoro-3-oxaundecan-1- sulfonato (9Cl-PF3OUdS)°	83329-89-9	IT	1
Potassio 9-cloroesadecafluoro-3-oxanonan-1- sulfonato (9Cl-PF3ONS)°	73606-19-6	IT	1
Potassio perfluoro (2-etossietan)sulfonato (PFEESA)°	113507-82-7	IT	1
Sodio 1H,1H,2H,2H-perfluorodecil fosfato (8:2 PAP)°	57678-03-2	IT	1
Sodio 1H,1H,2H,2H-perfluoroottil fosfato (6:2 PAP)°	57678-01-0	IT	1
Sodio 8-cloroperfluoro-1-ottansulfonato (8Cl- PFOS)°	2481740-05-8	IT	1
Sodio dodecafluoro-3H-4,8-dioxanonato (NaDONA)°	958445-44-8	IT	1
F-DIOX Acid - C6O4°	1190931-41.9	IT	10
2-Cloro-perfluoroeterecarbossilato cogenere 0,1 - ADV-N2°	948590-83-8	IT	10
2-Cloro-perfluoroeterecarbossilato cogenere 0,2 - ADV-N3°	n.a.	IT	10
2-Cloro-perfluoroeterecarbossilato cogenere 0,3 - ADV-N4°	n.a.	IT	10
2-Cloro-perfluoroeterecarbossilato cogenere 0,4 - ADV-N5°	n.a.	IT	10
2-Cloro-perfluoroeterecarbossilato cogenere 1,1 - ADV-M3°	n.a.	IT	10
2-Cloro-perfluoroeterecarbossilato cogenere 1,2 - ADV-M4°	n.a.	IT	10
Acido Perfluoro(2,5,8,11,14-pentametil-3,6,9,12,15-pentaoxaottadecanoico - HFPO-HxA°	n.a.	IT	10
Acido Perfluoro(2,5,8,11-tetrametil-3,6,9,12-tetraoxapentadecanoico - HFPO-Pea°	65150-95-0	IT	10
Acido Perfluoro-(2,5,8-trimetil-3,6,9- trioxadodecanoico) - HFPO-TeA°	65294-16-8	IT	10
Acido Perfluoro-2,5-dimetil-3,6-dioxanonanoico - HFPO-TA°	13252-14-7	IT	10

Table 2: List of analysed PFAS in Italian and German lab

DE: German Lab
IT: Italian Lab

DE/TwV: Substance is regulated in German Drinking Water Regulation Trinkwasserverordnung (TrinkwV 2023)

*Sum of PFAS-20 in EU Drinking Water Directive and German Drinking Water Regulation - TrinkwV (2023) <100 ng/l:
fort he substances PFPeA, PFPeS, PFHpS, PFDA, PFUnDS, PFDoDS and PFTrDS no single toxicological value can be specified. Concentration for PFPeA, PFPeS, PFHpS, PFDA, PFUnDS, PFDoDS and PFTrDS as individual value and in total with the other substances in PFAS-20 may not exceed a maximum of 100 ng/l.

**Sum PFAS-4 in German Drinking Water Regulation - TrinkwV (2023) <20 ng/l:
For the substances PFOA, PFNA, PFHxS and PFOS, the total concentration of these substances must not exceed 20 ng/l.

***From a toxicological point of view, the substance concentration for PFNS should be a maximum of 20 ng/l as a single value and in total with the substances PFOA, PFNA, PFHxS and PFOS.

°The laboratory is not accredited to analyse these substances.

In both laboratories, the samples were prepared and processed in accordance with DIN 38407-42:2011-03.

Extraction was performed using solid-phase extraction (SPE), and analysis was carried out using liquid chromatography and tandem mass spectrometry (LC-MS/MS).

In the German laboratory, each sample was analysed for 25 PFAS (Table 2), including all substances in the PFAS-20 group, which is regulated by the German Drinking Water Ordinance (TrinkwV, 2023) [15]. The laboratory is accredited for all of the substances examined.

The Italian laboratory analysed each sample for 58 PFAS (Table 2). These include 24 PFAS that were also examined by the German laboratory. Among these are the PFAS-20, which are regulated by the German Drinking Water Ordinance. The laboratory examined 10 additional substances that may be found in consumer goods. These include fluorotelomer sulfonic acids (FTS).

In addition, the Italian laboratory examined 23 substances that are used as substitutes for particularly hazardous substances such as PFOA and PFOS. These substitutes include, for example, NaDONA and GenX. A number of chlorine perfluoroethers used in the manufacture of polymers were also examined. There is no accreditation for the examination of these substances.

[15]German Drinking Water Regulation - Verordnung über die Qualität von Wasser für den menschlichen Gebrauch (Trinkwasserverordnung – TrinkwV, 2023)
https://www.gesetze-im-internet.de/trinkwv_2023/TrinkwV.pdf

3. Results

Table 3 summarises the results of the PFAS analyses in eight mineral waters. The concentrations are expressed in nanograms per litre of water (ng/L).

No PFAS were detected in two water samples, meaning that the PFAS concentrations in these samples were below the detection limit of 50 ng/L. These were the samples from San Benedetto and Ferrarelle.

None of the eight samples tested contained substances from the group of 20 PFAS regulated by the EU Drinking Water Directive[16].

None of the eight samples tested contained substances from the PFAS-4 group (PFOA, PFOS, PFHxS and PFNA), which are classified as particularly hazardous.

Trifluoroacetate (TFA) was detected in six samples. No other PFAS were identified in any of the samples tested. For the assessment of TFA concentrations, a concentration of 100 ng/l was used as a guideline and due to the debate on the classification of TFA as toxic to reproduction, see next chapter.

In summary, it can be stated that a concentration of 100 ng TFA per litre of water was measured in two different laboratories in samples of the brands Panna, Levissima, Sant'Anna and San Pellegrino.

It has to be noted that the concentrations found by the Italian laboratory are significantly lower than those determined by the German laboratory, see the comparison in Figure 1. Although samples from different production batches were examined in each case, the fact that all measured values are between 2.8 and 6 times lower indicates a systematic difference, the cause of which must be investigated further.

The highest measured value of 700ng/l TFA was found by the German laboratory in the sample from the Panna brand. A second sample was sent to an Italian laboratory, where 114.3ng/l was measured in the Panna water. This is 16% of the concentration measured in the German laboratory.

The second highest TFA measurement was found in the Levissima brand sample, at 570ng/l. In the second sample of Levissima the Italian lab found 206ng/l of TFA. This is the highest concentration measured in the Italian lab in this study, but it is only 36% of the concentration measured in the German lab.

The third highest concentration of TFA was measured by the German lab in the Sant'Anna water sample at 440ng/l. A second sample of Sant'Anna water was sent to an Italian lab that reported 157ng/l of TFA, which is 36% of the concentration measured by the German laboratory.

[16]European Commission, Drinking Water Directive, December 2020: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020L2184

In the sample of San Pellegrino water sent to a German lab, the TFA concentration was determined to be 350ng/l. The Italian lab found 102ng/l in a second sample of San Pellegrino water.

In the samples from the Uliveto and Roccheta brands, the German laboratory determined the TFA concentration to be 240ng/l (Uliveto) and 360 ng/l (Roccheta), while the Italian laboratory found concentrations below 100ng/l for TFA (71.1 ng/l and 83.5 ng/l, respectively) in the water samples sent there.

Company	**Product-Label**	**Lot-No. – bottle**	**Lab**	**Result TFA (Trifluoroa-cetic Acid)**	**Sum PFAS-4 (PFOA, PFNA, PFOS, PFHxS)**	**Sum PFAS-20 EU DWD Directive 2020/2**
Acqua Minerale San Benedetto S.p.A.	San Benedetto naturale	13LB4330(I) San Benedetto 2 14LB5041(I) San Benedetto 1	TIL Italia TZW Germany	<50ng/l <50ng/l	<20ng/l <20ng/l	<100ng/l <100ng/l
FERRARELLE S.p.A.	Ferrarelle	L2025021858 Ferrarelle 2 L2024080858 Ferrarelle 1	TIL Italia TZW Germany	<50ng/l <50ng/l	<20ng/l <20ng/l	<100ng/l <100ng/l
Co.Ge.Di. International S.p.A.	Uliveto naturale	L05957G Uliveto 2 L05657K Uliveto 1	TIL Italia TZW Germany	**71,1 ng/l** (30% of DE) **240 ng/l**	<20ng/l <20ng/l	<100ng/l <100ng/l
	Rocchetta naturale	L03154G Rocchetta 1 L05955R Roccetta 2	TIL Italia TZW Germany	**83,5 ng/l** (23% of DE) **360 ng/l**	<20ng/l <20ng/l	<100ng/l <100ng/l
Acqua Sant'Anna S.p.A.	Sant'Anna naturale	L5044/061 Sant Anna 2 L5049T025 Sant Anna 1	TIL Italia TZW Germany	**157 ng/l** (36% of DE) **440 ng/l**	<20ng/l <20ng/l	<100ng/l <100ng/l
Nestlé Italiana S.p.A.	San Pellegrino frizzante	L5014087012 San Pellegrino 2 L4279087010 San Pellegrino 1	TIL Italia TZW Germany	**102 ng/l** (29% of DE) **350 ng/l**	<20ng/l <20ng/l	<100ng/l <100ng/l
	Panna	L5038087705 Panna 2 L5042087705 Panna 1	TIL Italia TZW Germany	**114 ng/l** (16% of DE) **700 ng/l**	<20ng/l <20ng/l	<100ng/l <100ng/l
	Levissima naturale	L5050087110 Levissima 2 L5023087110 Levissima 1	TIL Italia TZW Germany	**206 ng/l** (36% of DE) **570 ng/l**	<20ng/l <20ng/l	<100ng/l <100ng/l

Table 3: Results of investigations in two labs, showing concentration of TFA, PFAS-4 und PFAS-20 in samples of Italian mineral waters purchased in March 2025

No tests have been carried out on the material used to make the sample bottles. It is therefore not possible to say whether the material may release PFAS chemicals. However, PFAS contamination from plastic material is not to be expected in mineral water.[17]

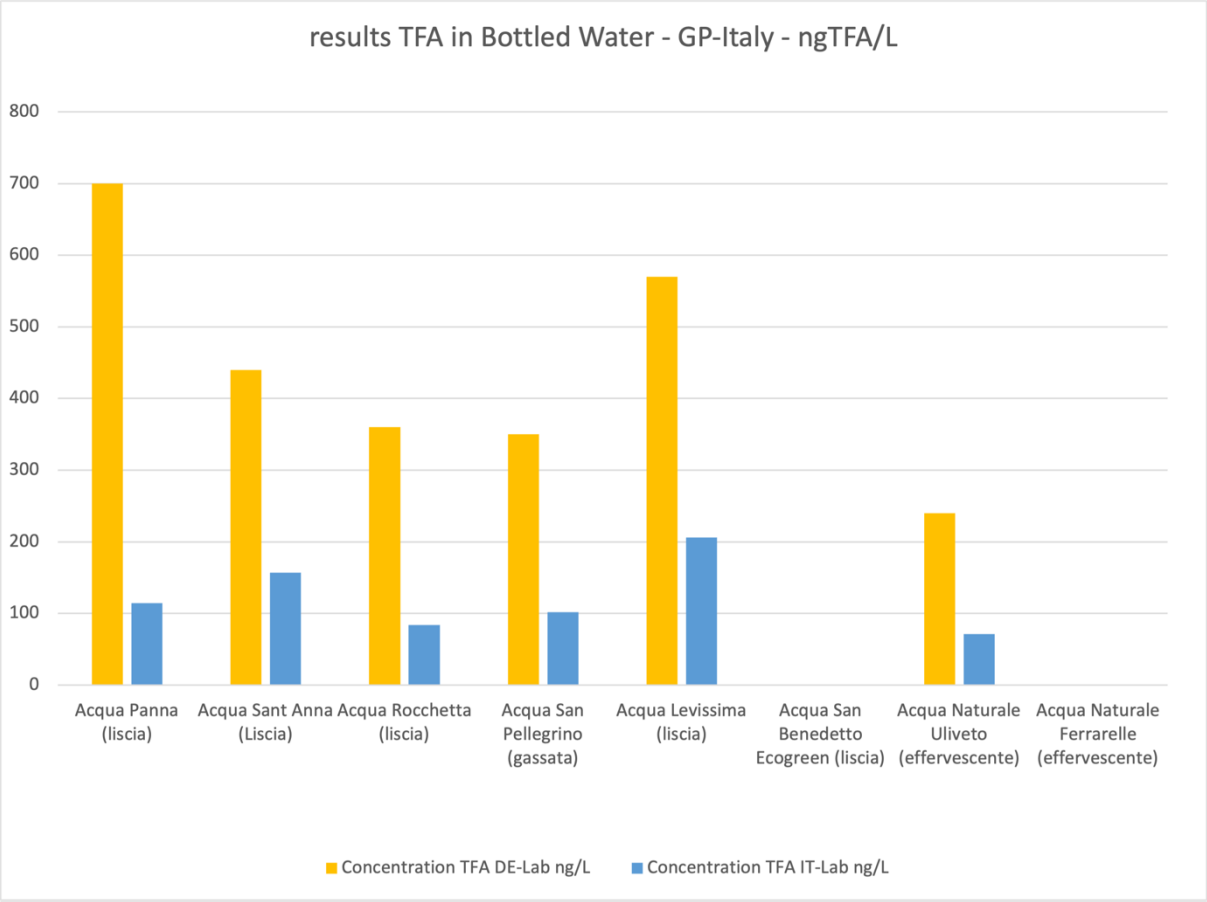

Figure 1: Comparison of results for TFA in bottled mineral water samples, German lab vs. Italian lab

4. Assessment criteria and evaluation of measurement results

There are currently no environmental quality standards for PFAS in mineral water.

Trifluoroacetic acid (TFA) is a synthetic chemical compound from the group of perfluorocarboxylic acids. Due to its good solubility properties, TFA is used as a solvent in

[17] Chow S J, Ojeda N, Jacangelo JG, Schwab KJ, Detection of ultrashort-chain and other per- and polyfluoroalkyl substances (PFAS) in U.S. bottled water, Science Direct (2021), Water Research Volume 201, 2021
https://doi.org/10.1016/j.watres.2021.117292

chemical research and industry. With increasing attention being paid to the group of perfluorinated and polyfluorinated alkyl substances (PFAS), which also includes TFA in the current definition of the OECD (Organisation for Economic Co-operation and Development), TFA is now increasingly becoming the focus of public attention and regulation.

As a result of the latest study findings, Germany has applied to the ECHA (European Chemicals Agency) for the classification of TFA as toxic to reproduction in spring 2024. If the ECHA approves the application, TFA could be classified as a 'relevant metabolite' of active substances in plant protection products. This would mean that a limit value of 100ng/l may not be exceeded in drinking water in accordance with the German Drinking Water Ordinance (TrinkwV) [18]. Due to the ubiquitous occurrence of TFA in raw water resources and the lack of technically and economically efficient treatment technologies for the removal of TFA, the introduction of this limit value could represent a major challenge for water supply companies in Germany.

For guidance purposes, the newly formulated limit values for PFAS in the amendment to the German Drinking Water Ordinance are therefore used to evaluate the measurement results. From 12 January 2026, 100 nanograms per litre (ng/L) will apply as the total limit value for a group of 20 PFAS relevant to drinking water. For substances from the PFAS-4 group (PFHxS, PFOS, PFOA, PFNA), the Drinking Water Ordinance additionally stipulates a limit value of 20 ng/L for the sum of these compounds from 2028 onwards.

Limits for the other substances of the PFAS group:
The EU sets a limit of 0.1 µg/L for the "Sum of PFAS" (a list of 20 specific PFAS compounds) and 0.5 µg/L for "PFAS Total" (all PFAS), see EU Drinking Water Directive (EU Directive 2020/2184)[19]. While TFA (Trifluoroacetic acid) is a PFAS, it's currently under discussion whether it will be explicitly included in the "PFAS Total" limit.

PFAS Total as a problematic parameter[20]:
The EU Directive 2020/2184 does not contain a definition of the term PFAS. According to the OECD definition from 2021, any substance that contains at least one -CF_2 or one -CF_3 group counts as a PFAS, with a few exceptions. That means that the ultra-short-chain PFAAs trifluoroacetic acid (TFA, one -CF_3 group) and perfluoropropionic acid (PFPrA, one -CF_3 and

[18] German Drinking Water Regulation - Verordnung über die Qualität von Wasser für den menschlichen Gebrauch (Trinkwasserverordnung - TrinkwV)
https://www.gesetze-im-internet.de/englisch_trinkwv/index.html
[19] DIRECTIVE (EU) 2020/2184 of the European Parliament and of the Council, 16 December 2020 on the quality of water intended for human consumption - recast
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020L2184
TZW / DVGW Technologiezentrum Wasser: PFAS in drinking water: Legal regulations are only partially realisable for water analysis
https://tzw.de/en/information/news/news-details/detail/pfas-in-drinking-water-legal-regulations-are-only-partially-realisable-for-water-analysis
[20] https://tzw.de/en/information/news/news-details/detail/pfas-in-drinking-water-legal-regulations-are-only-partially-realisable-for-water-analysis

one -CF_2) will be included in the group of in total around 6.5 million compounds that belong to this group of substances. TFA dominates the PFAS content in drinking water. The EU Commission proposes in Directive C/2024/4910[21] for *PFAS Total* that the TFA concentration should be determined separately and not be included in the *PFAS Total*. This could lead to inaccuracies and to inconclusive results.

In the German Water Regulations TFA has not been regulated separately so far and because the parameter *PFAS Total* has not been included in the Drinking Water Ordinance. Currently there is an ongoing debate on how to consider TFA in regulations. German agencies classified TFA as a toxic to reproduction substance that is very persistent and very mobile and therefore submitted a dossier to the European Chemicals Agency (ECHA) in accordance with the CLP Regulation to harmonise the hazard classification of TFA. If this is confirmed the limit of 0,1µg/l is likely to be adopted. We suggest to use such a precautionary limit for comparison. So far there is a comparatively high limit for TFA of 10 µg/L as a non-relevant pesticide metabolite (nrM) and a drinking water guideline value of 60 µg/L.

5. Conclusion

The results of the study presented here on PFAS in Italian mineral waters show that Italian mineral waters can be significantly contaminated with trifluoroacetate (TFA). In six out of eight samples, at least one of the two laboratories commissioned found a concentration that exceeds the above mentioned precautionary limit value of 100 ng TFA per litre of drinking water. In four of the eight samples, both laboratories found concentrations of more than 100ng/l.

To date, there have been few comparative studies of TFA in mineral water. However, the concentrations found are in the range of comparable studies from Austria and Germany.

The evaluation of the measurement results involves uncertainties, as the two laboratories commissioned found different measurement values in waters of the same brand. One reason for this may be the fact that the samples tested from one brand came from different batches. However, the results show that the Italian laboratory consistently measured lower concentrations than the German laboratory, which indicates a systematic difference. As these are random samples, further investigations are necessary to determine the reason for these differences.

However, the measured TFA concentration in three samples is significantly above the reference value of 100 ng/l.

The results of these investigations of TFA in mineral water and the previous studies by Greenpeace Italy on PFAS contamination in drinking water are alarming. Trifluoroacetate

[21] Commission Notice - Technical guidelines regarding methods of analysis for monitoring of per- and polyfluoroalkyl substances (PFAS) in water intended for human consumption (2024) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C_202404910

(TFA) can now be found almost everywhere, in drinking water, mineral water, cereals and other foods. TFA is persistent and highly mobile, and can only be removed from the environment at great expense. Studies show that TFA now contaminates air, water and soil on a very widespread basis.

The proven harmful properties of many substances in the PFAS group and the classification of TFA as toxic to reproduction should prompt further investigations to determine the potential health risks to the population from the consumption of mineral water.

Further studies should take into account both the influence of the region where the mineral water is sourced and the influence of processing, transport and plastic packaging.