Environmental Science & Technology Letters

pubs.acs.org/journal/estlcu

Highlight

Scientists' Statement on the Chemical Definition of PFASs

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Cite This: *Environ. Sci. Technol. Lett.* 2025, 12, 1104−1106

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The undersigned are scientists with expertise in per- and polyfluoroalkyl substances (PFASs) and/or the management of chemicals. We assert that the Organization for Economic Co-operation and Development (OECD) definition of PFASs is scientifically grounded, unambiguous, and well suited to identify these chemicals. We are concerned that some individuals and organizations are seeking a redefinition of PFASs endorsed by the International Union of Pure and Applied Chemistry (IUPAC) to exclude certain fluorinated chemical subgroups from the scope of the existing definition. We are concerned that this effort is politically and/or economically, rather than scientifically, motivated. An IUPAC-endorsed and potentially narrower PFAS definition could confer undue legitimacy from the endorsement by a recognized global scientific organization and, thereby, influence regulatory bodies and others to adopt less protective policies.

Organofluorine chemicals are used in consumer products and industrial applications to impart oil-, water-, and stain-resistance, stability, inertness, and/or other useful properties. The term "PFASs" arose from the need to identify a subgroup of organofluorine chemicals with a common feature, the very stable perfluorinated carbon. There are millions of theoretical PFAS structures, but the much lower number of PFASs actually manufactured and used is estimated to be several thousands.

THE OECD PFAS DEFINITION IS UNAMBIGUOUS

In 2021, following a transparent, science-based, and peer-reviewed process that included PFAS experts from academia, regulatory bodies, and the chemical industry, the OECD published a definition of PFASs (Box 1).

Box 1. The Chemical Definition of PFASs according to OECD[1]

PFASs are defined as fluorinated substances that contain at least one fully fluorinated methyl or methylene carbon atom (without any H/Cl/Br/I atom attached to it), i.e., with a few noted exceptions, any chemical with at least a perfluorinated methyl group ($-CF_3$) or a perfluorinated methylene group ($-CF_2-$) is a PFAS.

The OECD definition was developed to address concerns that certain substances containing fully fluorinated moieties were excluded from a previous PFAS definition developed by Buck et al.[2] These substances included, for example, perfluoroalkyldicarboxylic acids with acid groups on each end of the perfluorinated carbon chain and substances with aromatic rings and perfluoroalkyl moieties. The OECD definition closed this gap and is chemically unambiguous and well suited for classifying chemicals as PFASs.

THE OECD DEFINITION OF PFASs IS INCLUSIVE

The OECD definition is solely based on intrinsic molecular features and does not prescribe how PFASs should be regulated. Initiatives for creating alternative PFAS definitions have emerged, including within IUPAC.[3] Such initiatives may exclude fluorinated gases (F-gases), trifluoroacetic acid (TFA), and/or polymers from their definition.

Many F-gases contain at least one fully fluorinated methyl or methylene carbon. They can persist in the environment or be transformed to TFA, an extremely persistent PFAS and the smallest perfluoroalkylcarboxylic acid. The OECD definition of PFASs includes all molecules that contain a CF_3-group, including gases, pesticides, and pharmaceuticals, many of which can degrade to form TFA.

Fluorinated polymers are also PFASs, including fluoropolymers, perfluoropolyethers, and side-chain fluorinated polymers, because they contain perfluorinated moieties. Such PFAS polymers have been exempted in some regulatory PFAS scope[4] due to a lack of evidence on their toxicity during use. However, these fluorinated polymers are PFASs, regardless of evidence of toxicity.

REGULATORY USE OF THE OECD DEFINITION

Governmental and intergovernmental bodies as well as other interested parties should continue to use the unambiguous and

Received: May 12, 2025
Revised: May 28, 2025
Accepted: May 29, 2025
Published: June 10, 2025

effective chemical definition of PFASs provided by the OECD to identify PFASs. It is a separate question as to what is and is not included by jurisdictions for specific regulatory or policy-making purposes, as also recommended by the OECD.[1] For example, while both are based on the OECD definition, the current Canadian group-based PFAS approach[4] excludes fluoropolymers in its current action, while the proposed group-based restriction of PFASs in the EU includes time-limited derogations, e.g., for uses in medical products, and exclusions of the small subgroup of fully mineralizable PFASs.[5] Similarly, pesticides, pharmaceuticals, and F-gases have been regulated or managed separately from other PFASs in many jurisdictions. This does not exempt them from meeting the chemical definition of PFASs.

Claims that certain PFASs are needed to fulfill public health, climate, and infrastructure goals are unrelated to the chemical definition of PFASs. If decision-makers choose to exempt specific PFASs, they are free to do so by defining their own scope based on political and/or regulatory objectives, ideally with clear, transparent justification. The chemical definition for the general identification of PFASs should not change because of such specific needs, and it is misleading to propose otherwise.

IMPLICATIONS OF ALTERNATIVE PFAS DEFINITIONS

Introducing an alternative or competing PFAS definition for general PFAS identification that includes considerations beyond chemical structure is concerning. It may be used by some parties with vested interests to influence regulations and, hence, which PFASs are allowed to be used, emitted, and occur in products and environments. It will also cause substantial ambiguity and confusion in international discussions and could lead to unnecessary jurisdictional inconsistencies and contradictions in PFAS regulations and action. This will counteract the desired harmonization between jurisdictions that would benefit those regulating, producing, and/or using PFASs, as well as exposed humans and the environment. Moreover, since methods for monitoring compliance and enforcement are tailored to regulations, changes in the definition will set back ongoing standardization of methods. The current debate of which PFASs to include as part of the EU Drinking Water Directive[6] is an example of the need for a consistent and comprehensive definition. If a definition excludes many substances (e.g., short-chain PFASs), it will hamper the use of simpler, less costly, and comprehensive "Total PFAS" methods for analysis since these analyses would include substances not part of such a narrower PFAS definition.

We thus maintain that the unambiguous OECD definition should be the general basis for harmonized regulation. Justified exemptions can be made by policy makers for specific purposes without changing the general definition of what constitutes a PFAS. There is no evidence to indicate that the OECD definition is flawed or problematic, and hence, there is no need for a new PFAS definition.

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https://doi.org/10.1021/acs.estlett.5c00478
Environ. Sci. Technol. Lett. 2025, 12, 1104−1106

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https://pubs.acs.org/10.1021/acs.estlett.5c00478

Notes

The authors declare no competing financial interest.
RL, IC, JD, JF and CN served as paid expert witnesses.

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https://doi.org/10.1021/acs.estlett.5c00478
Environ. Sci. Technol. Lett. 2025, 12, 1104−1106