







What are **PFAS?** Types, applications, restrictions, etc.









"PFAS"¹ (per- and polyfluoroalkyl substances) are a group of chemical substances with a specific chemical structure that contain fluorine atoms.

The production and use of some PFAS, such as "PFOS" and "PFOA," are now prohibited due to concerns about their impact on the environment and human health.

These are listed as Persistent Organic Pollutants (POPs), together with PFHxS, under the Stockholm Convention.

Other PFAS that are not restricted are used in many different applications in everyday life and industry.

They contribute greatly to sustainable development, and technological and scientific advances.

This page features a variety of information about PFAS, including basic facts about PFAS, their types and applications, and regulations in Japan.

O1 Basic facts about PFAS

What are **PFAS**?

"PFAS" (per- and polyfluoroalkyl substances) are a group of chemical substances with a specific chemical structure that contain fluorine atoms. PFAS have many specific characteristics which in combination cannot be effectively replicated by other materials. These characteristics include heat resistance, fire resistance and electrical insulation, which makes them critical in the various aspects of daily life to improve society and support a sustainable, carbon neutral world.

Types of PFAS

There is an extremely large variety of types of PFAS, each with their own different properties². According to the United States Environmental Protection Agency (EPA), there are approximately 12,000 types of PFAS³. PFOS and PFOA have already been banned from production and use in Japan, with PFHxS also expected to be banned in the near future⁴. These three types of PFAS were listed for restriction under the "Stockholm Convention on Persistent Organic Pollutants" (POPs Convention), because PFOS, PFOA, and PFHxS have been found to be persistent in nature or bioaccumulative, and may have potential adverse health effects. The term "PFAS contamination" is found in some media reports in Japan, but more precisely, this refers to contamination by these three restricted types of PFAS.



02 Applications of PFAS

PFAS, excluding these three restricted types of PFAS, are used in various applications in daily life and industry. PFAS have various combinations of properties, such as being highly resistant to heat, chemicals, and ultraviolet rays, highly repellant to fluids, such as water and oil, less adhesive, less conductive to electricity, and less refractive to light. Due to these properties, PFAS are used in a variety of existing and future technologies that contribute greatly to sustainable development, a net-zero carbon society, and technological and scientific advances. These include energy, renewables, semiconductors, and telecommunications. For example, PFAS are used as indispensable substances in photoresists applied to semiconductors to print circuits onto the base material, and as a separator material (separating positive and negative electrodes) in lithium-ion batteries.

Fluorine products used in daily life

Fluorine products have multiple advanced functions that are critical to various aspects of daily life.



02 Applications of PFAS

Going forward, there are further expectations for the use of PFAS, such as a material used in the electrodes of fuel cells, which will be needed to realize a hydrogen society, and as a material used in electrolytes to extract hydrogen from water. PFAS are also expected to be used in electronic substrates and cables in equipment for high-speed communication, such as 5G and 6G.



PFAS are indispensable materials for the future realization of a carbon-free society and digital society.

D3 PFAS FAQ

Q1. Do PFAS have any impact on the environment and human health?

Not all PFAS have been determined to have negative impacts on the environment or human health. Fluoropolymers, for example, meet the criteria of Polymers of Low Concern as defined by the Organisation for Economic Cooperation and Development (OECD), which means that fluoropolymers are deemed to have insignificant environmental and human health impacts, and the World Health Organization (WHO) concluded that organic polymeric materials (including fluoropolymers) are not classifiable as carcinogenic to humans. On the other hand, PFOS and PFOA have already been banned from production and use in Japan, with PFHxS expected to come under the same ban in the near future⁵. The three restricted PFAS, namely PFOS, PFOA, and PFHxS, have certain characteristics, such as persistence in the environment, bioaccumulativeness when they enter the body via tap water or other means, and high solubility in water, which may have possible negative health impacts.

⁰³ **PFAS FAQ**

Q2. Are there any restrictions or rules concerning PFAS?

Currently, PFOS and PFOA are subject to restrictions in Japan. In 2009, PFOS was included in the listed substances regulated under the "Stockholm Convention on Persistent Organic Pollutants" (POPs Convention). In 2010, Japan banned PFOS from production and use in products in Japan. Japan is a party to the POPs Convention, under the "Act on the Regulation of Manufacture and Evaluation of Chemical Substances," which is the Chemical Substances Control Law in Japan. In 2019, PFOA was "banned in principle" under the POPs Convention, and in 2021, production and use of PFOA in products was banned in Japan.

A decision was made to include PFHxS as a target substance for restriction by the Conference of the Parties of the POPs Convention in June 2022. Accordingly, certain measures are expected to be implemented regarding PFHxS in Japan under the Act on the Regulation of Manufacture and Evaluation of Chemical Substances. To date, there have been no reported cases of PFHxS production in Japan⁶.



United Nations laws and regulations POPs Convention PFOS restricted in 2009PFOA restricted in 2019

PFHxS restricted in 2021



Japan laws and regulations Act on the Regulation of Manufacture and Evaluation of Chemical Substances PFOS restricted in 2010PFOA restricted in 2021

Details of PEHxS restrictions under deliberation

Q3. What is AGC's response to the restricted PFAS to date?

Among the three restricted PFAS, AGC has never engaged in the production of PFOS and PFHxS, and we had already ceased the production and sale of PFOA in 2015, prior to its restriction under the POPs Convention and the Japanese legislation. To fulfill our corporate responsibility to society, AGC is committed to proactive efforts to minimize the environmental footprint of its business activities and to reduce the environmental impact of its products, based on scientific evidence⁷. AGC will continue to provide fluorine products that are indispensable for customers and society in a responsible manner, in our efforts to support the daily lives of people around the world.



¹ There are several different ways to pronounce PFAS and other related abbreviations. The most common pronunciations are as follows.

⁴ For the restriction status of PFOA, PFOS, etc. on this page, please refer to the Ministry of

Economy, Trade and Industry's "List of Targeted Substances under the Act on the Regulation of Manufacture and Evaluation of Chemical Substances" (Japanese only) and the Ministry of Environment's Reference Material 3: "Developments in Japan" (Japanese only) for the 1st Study Group on Evaluation of Organic Fluorine Compounds held on December 27, 2019.

⁵ For the restriction status of PFOA, PFOS, etc. on this page, please refer to the Ministry of Economy, Trade and Industry's "List of Targeted Substances under the Act on the Regulation of Manufacture and Evaluation of Chemical Substances" (Japanese only) and the Ministry of Environment's Reference Material 3: "Developments in Japan" (Japanese only) for the 1st Study Group on Evaluation of Organic Fluorine Compounds held on December 27, 2019.

⁶ Ministry of Environment, Reference Material 3-3: "Production status, etc., of PFAS other than PFOS and PFOA in Japan" (Japanese only), 2nd Comprehensive Strategy Review Expert Meeting for PFAS, March 28, 2023

Please refer to ⁷ Environmental Initiatives of the AGC Group (Japanese only)

PFAS → Peefass PFOS → Peefoss PFOA → Peefoa PFHxS → P-F-hex-S

² The PFAS that are being studied most include PFOA, PFNA, PFHpA, PFBA, PFPA, PFHxA, PFDA, PFUAA, PFDAA, PFTrDA, PFTcDA, PFToDA, PFOS, PFBS, PFDS, PFNS, PDHpS, PFPeS, 6:2FTOH, and 8:2FTOH. (See: Ministry of Environment, Reference Material 1: "Overview of PFAS" (Japanese only), 1st Comprehensive Strategy Review Expert Meeting for PFAS, January 30, 2023; United States Interstate Technology & Regulatory Council (ITRC), "PFAS — Per- and Polyfluoroalkyl Substances")

³ See "PFAS Master List of PFAS Substances," United States Environmental Protection Agency. This is a comprehensive list of PFAS in which researchers and regulatory authorities around the world are interested. It currently lists 12,034 substances (last update: August 10, 2021)