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# PFCS: OUTCOME OF THE 2009 SURVEY
# SURVEY ON THE PRODUCTION, USE AND RELEASE OF PFOS, PFAS, PFOA PFCA, THEIR RELATED SUBSTANCES AND PRODUCTS/MIXTURES CONTAINING THESE SUBSTANCES

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# PFCs: Outcome of the 2009 survey
## Survey on the production, use and release of PFOS, PFAS, PFOA PFCA, their related substances and products/mixtures containing these substances


**Environment Directorate**

**ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT**

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## FOREWORD

The OECD monitors the manufacture and use of perfluoroalkyl sulfonates (PFAS) and related chemicals including perfluorooctane sulfonate (PFOS) and perfluorocarboxylic acids (PFCA) and related chemicals including perfluorooctanoic acid (PFOA) through surveys conducted every 2-3 years. The related substances also include precursors, which are chemicals that can break down to form PFCA or PFAS. These chemicals are being monitored as they are known to be persistent in the environment and some of them produce adverse health and environmental effects (OECD, 2007).

Two surveys were conducted by the OECD, one in 2004 followed by another in 2006. These surveys:

- collected information on importation and manufacture of individual perfluorinated chemicals and their products/mixtures.
- included PFOS, PFAS, PFOA and PFCAs and their higher and lower homologues including polymers that contain PFCA or PFAS as a portion of the entire polymer.
- invited OECD member countries and all Designated National Authorities (DNA) for the implementation of the Rotterdam Convention and Focal Points for the Stockholm Convention to participate in the survey

Both OECD member and non-member governments responded to the survey. However, in some of the responses to these surveys, names and CAS numbers of some chemicals were not provided for confidentiality reasons, and most countries provided information on manufactured and imported volumes as ranges for the same reasons. Moreover, in several responses, importation could not be easily distinguished from manufacture. As a result, in these cases, data could only be compiled on the total trade of chemicals or products. This resulted in an over-estimation of volumes of some substances. Australia analysed the responses to both surveys and prepared the reports.

Results of the 2004 OECD Survey titled "Production and Use Information on Perfluorooctane Sulfonate (PFOS), Perfluoroalkyl Sulfonate (PFAS), Perfluorooctanoic Acid (PFOA), related Substances and Products/Mixtures containing these Substances" were published in 2005 as ENV/JM/MONO(2005)1 and are available at:

http://www.olis.oecd.org/olis/2005doc.nsf/LinkTo/env-jm-mono(2005)1.

The second survey on "Production and Use of PFOS, PFAS, PFOA, PFCA and their Related Substances and Products/Mixtures Containing these Substances" was undertaken in 2006. The outcome of the survey was published in December 2006 as ENV/JM/MONO(2006)36 and can be found at: http://appli1.oecd.org/olis/2006doc.nsf/linkto/env-jm-mono(2006)36.

In addition to these surveys, an OECD sponsored PFCA Workshop was held in Stockholm, Sweden in November 2006. An OECD Steering Group on Perfluorinated Chemicals, consisting of interested OECD member countries, such as Australia, USA, Canada and the European Union and representatives from industry was tasked with organising and conducting the workshop. The report of the workshop "Report of

an OECD Workshop on Perfluorocarboxylic Acids (PFCAs) and Precursors" (OECD, 2007) can be found at: http://www.olis.oecd.org/olis/2007doc.nsf/LinkTo/NT00002AB6/$FILE/JT03229256.PDF.

One of the recommendations of the workshop was that BIAC assist the OECD in the development of the next survey with the goal of collecting more useful data associated with the manufacture, use and release of these substances.

Over the past year, a BIAC team worked closely with the OECD Steering Group on Perfluorinated Chemicals to design a survey questionnaire (Annex 1) and prepare the list of chemicals to be surveyed (Annex 2). BIAC also identified the known global manufacturers of these perfluorinated chemicals.

The 2009 Survey was conducted with the aim of gathering information that would assist OECD and non-OECD countries in assessing potential contributions of PFOS, PFAS, PFOA and longer chain length perfluorocarboxylic acids (PFCA) to the environmental loadings of these chemicals. Australia took the lead in conducting the survey for the OECD.

The 2009 survey was significantly different from the two previous surveys, in that it:

- sought information on the production and use of perfluorinated chemicals and their release to the environment (air, water and land) during the manufacturing process and during formulation of products.

- focused on PFAS with chain lengths of C6 and higher (including PFOS) and PFCAs with chain lengths C8 and higher (including PFOA) and potential precursors of carboxylic acids in fluorotelomer based products.

- invited manufacturers of these chemicals and/or products containing these chemicals from OECD and non-OECD member countries to participate in the survey

- excluded information on import of perfluorinated chemicals

A comparison of the 2009 survey results with those of 2006 or 2004 surveys is difficult, due primarily to lower response rate in this survey as compared to the previous surveys and also because of the differences in the type of information collected and on the number of perfluorinated chemicals surveyed. For instance, this survey focused on a defined list of perfluorinated chemicals, rather than all perfluorinated chemicals including the complex fluoropolymers. In addition, only information on the perfluorinated chemicals manufactured and used in the formulation of products was requested in this survey, as opposed to manufacture and import volumes of these chemicals and their precursors requested in the previous surveys.

A first draft of the survey was presented to the 45th Joint Meeting on 9-11 February 2010 [ENV/JM(2010)11] and a revised version of the document was submitted to Heads of Delegation of the Joint Meeting for declassification by 22 of November 2010. This document is published under the responsibility of the Joint Meeting of the Chemicals Committee and Working Party on Chemicals, Pesticides and Biotechnology.

The OECD secretariat would like to thank the members of the PFC Steering Group and in particular Australia, who lead the work, and the companies who provided the data and were represented by BIAC, for their significant efforts in completing this work.

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## INTRODUCTION TO THE 2009 SURVEY

Perfluorinated substances are characterised by a fully fluorinated carbon chain with all hydrogens in the chain being replaced by fluorine atoms. The bond between carbon and fluorine is very strong making these substances persistent. The perfluorinated chemicals are of interest as some of these substances have been shown to have adverse effects on human health and/or the environment (OECD, 2007).

Definitions of the chemicals are as in the previous two surveys. Perfluoroalkyl sulfonate (PFAS) is the generic term used to describe any fully fluorinated carbon chain length sulfonate, and includes higher and lower homologues. PFOS belongs to this group of chemicals. It is a fully fluorinated eight carbon chain length organic compound. PFOS and PFAS related substances can be simple salts of PFAS, e.g. potassium, lithium, ammonium or diethanolamine salts, or more complex polymer compounds that contain PFAS as a portion of an entire polymer. Many of the PFOS-related substances are high molecular weight polymers in which PFOS represents variable proportion of the total polymer weight (OECD, 2006).

Perfluorooctanoic acid (PFOA) is a fully fluorinated eight-carbon carboxylic acid. The acid is largely produced as an intermediate step in the manufacture of its salt (isolated or generated in situ). PFOA-related substances may be salts of PFOA or substances that can degrade to form PFOA. Salts of PFOA (especially ammonium salt) are used as processing aids in the production of fluoropolymers and fluoroelastomers and in other surfactant uses.

Perfluorocarboxylic acids (PFCA) are fully fluorinated carboxylic acids of a range of chain lengths, including perfluorooctanoic acid (PFOA). PFCA-related substances may be salts of PFCA or substances that can degrade to form PFCA.

### Data collection and methodology of analysis

Seventy three chemicals were included in the list of perfluorinated chemicals to be surveyed. Twenty seven companies were identified globally as manufacturing these chemicals and/or products containing these chemicals. The OECD assisted in obtaining contact details of some of the manufacturers.

The questionnaire and the list of survey substances were sent in July 2009 to all companies, and responses were requested by 30 September 2009. Companies in OECD countries that had not responded to the survey by the due date were followed up by BIAC to encourage submission of completed surveys, whereas those in the non-OECD countries were not followed up. The information requested included chemical name, CAS numbers, concentration in products, mass quantity in the products, use of the product, and the amount of substance released to the environment (air, water and land) or transferred offsite, including for reuse, recycling or destruction by incineration, during production for the year 2008.

In the report, releases to air, water, land (landfills), and water treatment including publicly owned treatment works (POTW) were considered under one group as “releases to the environment”. Treatments through incineration or recycling were grouped under “reuse, recycling or incineration”.

Some respondents expressed production or release volumes as ‘less than’ values (for example, <1 kg). In such cases the higher value (1 kg in this example) was used for calculating total release of the substance.

The survey included a list of chemicals of interest. For consistency with the 2004 and 2006 surveys, the chemicals are grouped as PFOS and related chemicals, PFAS and related chemicals, PFOA and related chemicals, and PFCA and related chemicals. For purposes of this report, PFAS includes perfluoroalkyl sulfonates with chain length of C6 or greater (apart from PFOS) and PFCA includes perfluorocarboxylic acid of C9 or greater. The PFOA and PFCA-related chemicals includes salts, direct precursors such as perfluoroalkyl iodides, and indirect precursors (IDPs) such as the Cn:2 fluorotelomer based compounds. The IDPs degradation amounts and rates are dependent on many variables including product structure, impurity levels and the environment conditions themselves.

C8:2 fluorotelomer-based chemicals (C8-2 Alcohol, C8-2 Iodide, C8-2 Methacrylate and C8-2 Acrylate) and intermediates containing eight carbon fluorinated chains as part of a range of chain lengths are considered in the 'PFOA and related substances' group as the product mixture resulting from environmental degradation can contain PFOA. Fatty acids C7-13, perfluoro, ammonium salt is also considered in this group as the range includes C8.

The 'PFOA and related substances' group has been named as 'PFOA, C8:2 fluorotelomers and other PFOA-related substances' to reflect the distinction between C8:2 fluorotelomer compounds and the other related substances. Similarly, the 'PFCA and Related Substances' group has been named as PFCA, Longer chain Cn:2 fluorotelomers and other PFCA-related Substances. Reporting on releases of the C8:2 and Cn:2 telomer based chemicals has been separated from reporting of the acids and other related substances to reflect the fact that the environmental degradation to the perfluorocarboxylic acids may not be quantitative.

In some cases, the same chemical was reported under both 'Manufacture of products containing PFOA or PFOA-related substances**'** and **'**Manufacture of products containing PFCA or PFCA-related substances**'** by the same respondent. In these cases the chemicals were counted only once, especially when the reported concentrations in the products and the 'mass quantity of the substance' were also consistent. Some respondents reported a chemical under 'Manufacture of products containing PFOA or PFOA-related substances**'**, while other respondents reported the same chemical under **'**Manufacture of products containing PFCA or PFCA-related substances**'**. Such chemicals were however placed in the correct groups during analysis. There were also cases where respondents only provided the names of chemicals produced but did not give other details (volume, use or release) about those chemicals.

The products discussed in the report are those which contain the perfluorinated chemicals, whether as part of a formulation or as residuals. The majority of the reported products contain very low proportions of the perfluorinated chemicals as residuals. The survey included a question about the uses of the products, and reporting of uses relates to the products which contain the chemicals, rather than the uses of the chemicals themselves. Due to the limitations of the data obtained in the survey, it is not possible to determine the major uses of the products. However this report includes discussion of the uses which were reported by a large proportion of respondents. This does not necessarily imply that they are the largest volume uses.

**Survey Results**

Responses were received from nine of the 27 companies surveyed with a response rate of 33%. The responses indicated that the surveyed chemicals are manufactured (or their products formulated) globally at 18 sites in a total of 7 countries. Companies manufacturing chemicals or their products at several different sites provided separate data for each of these production sites. A list of all the chemicals manufactured or formulated into products as reported in this survey is provided at annex 3.

One company indicated that it had ceased producing the perfluorinated chemicals surveyed.

In this report, information on product content, use and release of all the perfluorinated chemicals, taken as a single class of chemicals, will be discussed briefly first, followed by a detailed analysis of the four groups of the perfluorinated chemicals individually (PFOS, PFAS, PFOA and PFCA).

- The survey results indicated that a total of 42 of the 73 perfluorinated chemicals surveyed were manufactured and/or formulated into products in 2008.

The responses included three chemicals not in the list of surveyed chemicals. These chemicals are:

- perfluorohexane sulfonic acid CAS No. 355-46-4 (PFAS related)
- PFOA methyl ester CAS No. 376-27-2 (PFOA related)
- C7-13 perfluoroalkyl carboxylic acid ammonium salt CAS No. 72968-38-8 (PFOA related).

**Product content and use of perfluorinated chemicals**

The survey results showed that products containing perfluorinated chemicals continue to have a wide range of uses. The different uses reported by the respondents fell into 13 broad categories. Table 1 shows the various uses of products containing perfluorinated chemicals. The uses for products were not clearly defined and only a broad description, such as 'processing agents' or 'manufacturing intermediates' was mentioned in many responses.

The concentrations of residual perfluorinated chemicals in the products generally ranged between 0.1 ppm and 80000 ppm. The total amount of these chemicals present as residues in products was nearly 45 tonnes. Some respondents reported the concentration of chemicals in the products as 100%. The quantities provided for such chemicals were considered to be the volume of traded commodity and therefore not included in calculating the total mass quantity of the substance. Several perfluorinated chemicals were reported to be present only as impurities with no specific use in products being reported.

Table 1 presents the commercial uses of products containing four groups of perfluorinated chemicals.

Table 1. Uses of products containing different groups of perfluorinated chemicals

| ***Reported uses*** |
|---|
| AFFF agents / surfactants / surface protectants |
| Anti reflective coatings (ARCs) for photolithography processes |
| Coatings / additives |
| Etchants for Aluminium Surface active agents for etching process of high frequency compound semiconductors |
| Gaskets / seals / membranes |
| Tubing / pipe liners / cable insulation |
| Impregnation of glass or plastic |
| Ion Exchange |
| Manufacture of fluoropolymers |
| Raw material for surface treatment agent |
| Lubricants |

| *Reported uses* |
|---|
| Treatment of Industrial stream |
| Water / oil repellent |

The majority of the reported uses were for products containing PFOA and PFCA related chemicals. The uses of products containing chemicals in the PFOS group were limited to ARCs, etchants and mist suppressants, while products containing the chemicals in the PFAS group were only reported to be used as ARCs.

**Release**

The survey questionnaire also requested information about the release of the perfluorinated chemicals at the production site and their off-site transfers.

Seven companies from four countries provided information on the release of perfluorinated chemicals to the environment and their off-site transfer as waste during production and formulation. Information included volumes released to different media; air, water and land.

The results indicated that 38 perfluorinated chemicals were released or transferred offsite during the year 2008. The majority (<225 tonnes) was disposed of by incineration, or reused or recycled. This was particularly the case for perfluorooctanoic acid (PFOA) and related compounds.

Of the total amount of all perfluorinated chemicals released to the environment (Table 2), less than 9 tonnes were released to air and less than 7 tonnes to water. The major proportion of environmental release was to landfills. Of the nearly 9 tonnes of chemicals released to air on-site, less than 2.2 tonnes were fugitive release, and approximately 5 tonnes ended up as stack release (not included in the table). No details were specified for the remaining volume of chemicals released to air. The accuracy of these estimations ranged between 10% and 50%. The number of days per year that air release occurred was estimated to be 10-333 for fugitive release and 100-365 days for stack release. Generally a company reported either fugitive air release or stack air release; and it was rare that companies reported both fugitive and stack release.

The release of chemicals to water was generally to local waterways and occurred on 250 to 365 days per year. The accuracy of the estimates was reported to be between 20% and 90% with an average of about 70%. The largest environmental release route was to land, mostly to landfill. The number of days the chemicals were transferred to landfills was not provided.

Table 2. Release and offsite transfer of surveyed perfluorinated chemicals (tonnes)

| *Release media* | *Quantity* | *Days released* | *Accuracy* |
|---|---|---|---|
| **Releases to the environment** | | | |
| Air | <9.0 | 10- 365 | 10-50% |
| Water, Waste water treatment, POTW | <7.0 | 250 – 365 | 20–90% |
| On-site and off-site Landfills, and Underground injection | CBI | Not provided | 50-70 % |
| | | | |
| **Reuse, recycling or incineration** | | | |
| Incineration/ recycle/recover | <225 | Not provided | 2-50% |
| | | | |

In a few instances, respondents reported the release of chemicals which they had not listed as being produced in 2008. Reasons for this discrepancy are not clear. It is possible that the chemical was produced in previous years and used for formulating products in 2008, or the chemical may have been obtained from other sources. Nonetheless, the release data for these chemicals were included in calculating the total release of that chemical group. Table 3 provides the releases and offsite transfer of the chemicals.

Table 3. Release and offsite transfer of perfluorinated chemicals to all media during manufacture (tonnes)

| *Chemical Group* | *Releases to the environment* | *Reuse, recycling or incineration* |
|---|---|---|
| PFOS and related substances | <1.50 | <0.75 |
| PFAS and related substances | <0.08 | <0.055 |
| PFOA and related substances | CBI | <201.0 |
| PFCA and related substances | CBI | <23.0 |
| **Total** | Cannot be reported | **<225.0** |

'PFOA & related substances' refers to PFOA, C8:2 fluorotelomers and other related substances

'PFCA & related substances' refers to PFCA, higher chain Cn:2 fluorotelomers and other related substances

## PERFLUOROOCTANE SULFONATE (PFOS) AND RELATED SUBSTANCES

Four PFOS and PFOS-related substances were reported to be manufactured in 2008. These chemicals were PFOS and its ammonium and potassium salts and a fluoride derivative (Table 4). No perfluoro sulfonamides or sulfonamidoacrylates (included in the 'List of Substances') were reported as being manufactured or formulated into products.

Table 4. PFOS and PFOS-related substances manufactured in 2008

| ***CAS No.*** | ***Substance*** | ***Common name*** |
|---|---|---|
| 1763-23-1 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro- | perfluorooctane sulfonate |
| 2795-39-3 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt | potassium perfluorooctane sulfonate |
| 29081-56-9 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt | ammonium perfluorooctane sulfonate |
| 307-35-7 | 1-Octanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro- | perfluorooctane sulfonyl fluoride |

### Products/mixtures containing PFOS and related substances

Of the four PFOS and related substances reported as manufactured, only two were reported as being contained in products, whether as part of a formulation or as residuals. The concentration of PFOS and related substances in the products ranged between 10% and 30%. The mass quantity of these substances in products for the year 2008 was less than 3.5 tonnes (Table 5). The reported uses are for the products containing the chemicals.

Tabel 5. PFOS and related substances in products for the year 2008

| ***CAS No.*** | ***Substance (common name)*** | ***Reported uses of products containing the substance*** | ***Mass Qty of substance as a residual or impurity in products*** |
|---|---|---|---|
| 1763-23-1 | perfluorooctane sulfonate | Antireflective coatings for photolithography processes, raw material of photo-acid generators, precursor of PFOS-ammonium salt | <3.5tonnes |
| 29081-56-9 | ammonium perfluorooctane sulfonate | Etchants for aluminium, surface active agents for etching process of high frequency compound semiconductors | |

**Product use information**

Results showed that products containing PFOS are used mainly in the photolithography process as antireflective coatings (ARCs), as intermediates in industrial applications (e.g. as raw material of photo-acid generators, PAG) and as precursor for ammonium PFOS production (Table 5). The potassium salt of PFOS (CAS No. 2795-39-3) had a variety of uses including those as mist suppressant for chromium (VI) plating, processing aid in the manufacture of fluoropolymers and in medical devices.

**Release**

Less than 2.5 tonnes of PFOS or PFOS-related substances were released or transferred offsite during 2008 (Table 6). Nearly half of this was released on-site to waterways, while a third was transferred off-site for incineration. The highest amount of a PFOS-related substance reportedly transferred off-site was perfluoro-1-octanesulfonyl fluoride (POSF), and the only use reported for this chemical was as a raw material. PFOS constituted only a small fraction (3%) of the total release of the PFOS and related substances, all of which was released to local waterways.

Table 6. Release and offsite transfer of PFOS and PFOS-related substances (tonnes)

| ***CAS No. (Substance)*** | ***Release to the environment (including off-site landfill, underground injection and water treatment*** | ***Reuse, recycling or incineration*** |
|---|---|---|
| 1763-23-1 (PFOS);<br>2795-39-3 (potassium perfluorooctane sulfonate);<br>29081-56-9 (ammonium perfluorooctane sulfonate);<br>307-35-7 (perfluorooctane sulfonyl fluoride) | <1.50 | <0.8 |

## PERFLUOROALKYL SULFONATE (PFAS) AND RELATED SUBSTANCES

Three other PFAS-related substances were reportedly produced in 2008. All were six carbon compounds. They were used mainly as raw materials or precursors for production of PFAS based products. The PFAS-related substances are given in Table 7.

Table 7. PFAS and PFAS-related substances manufactured in 2008

| ***CAS No.*** | ***Substance*** | ***Common name*** |
|---|---|---|
| 355-46-4 | 1-hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, | perfluorohexane sulfonate |
| 3871-99-6 | 1-hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, potassium salt | potassium perfluorohexane sulfonate |
| 423-50-7 | 1-hexanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, | perfluorohexane sulfonyl fluoride |

### Products/mixtures containing PFAS and related substances

Only one product containing a PFAS-related substance was reported. The concentration of the substance in the product was <10% and its total residual quantity in the product was reported as approximately 0.5 tonnes.

### Product use information

According to the respondents the product containing the PFAS is used for antireflective coatings in photolithography.

### Release

Less than 80 kg of PFAS and PFAS-related substances were released during 2008. All substances released were six carbon length chains. More than 80% of the releases of PFAS chemicals were to local waterways and very little to air. Perfluorohexane sulfonate (PFHS) contributed the most to PFAS release. Lesser amounts of the chemicals were transferred off-site (approximately 55 kg), mostly for incineration (Table 8).

Table 8. Release and offsite transfer of PFAS and PFAS-related substances (tonnes)

| ***CAS No. (Substance)*** | ***Release to the environment (including off-site landfill, underground injection and water treatment*** | ***Reuse, recycling or incineration*** |
|---|---|---|
| 355-46-4 (perfluorohexane sulfonate)<br>423-50-7(perfluorohexane sulfonyl fluoride)<br>3871-99-6 (potassium perfluorohexane sulfonate) | <0.1 | <0.06 |

## PERFLUOROOCTANOIC ACID (PFOA), C8:2 FLUOROTELOMERS AND OTHER PFOA RELATED SUBSTANCES

Seven companies surveyed reported the manufacture of PFOA and/or PFOA-related substances in four countries globally. The PFOA was either in the linear form as pentadecafluorooctanoic acid (CAS Number 335-67-1) or as a branched form (branched pentadecafluorooctanoic acid, CAS Number 90480-55-0) (Table 9).

Among the chemicals in the overall group (PFOA, C8:2 fluorotelomers and other PFOA related substances), PFOA and the ammonium salt were the most commonly reported in products, whether as part of the formulation or a residue. Concentrations of PFOA and its ammonium salt in products were generally low, although the ammonium salt of PFOA was reported in one product at 3500 ppm. The sodium salt of PFOA (sodium pentadecafluorooctanoate), identified in an earlier survey, was not reported in this survey.

Table 9. PFOA and other PFOA-related substances manufactured in 2008

| ***CAS No.*** | ***Substance*** | ***Common name*** |
|---|---|---|
| ***PFOA and salts/ esters*** | | |
| 335-67-1 | octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro- | PFOA |
| 90480-55-0 | octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-branched | PFOA branched |
| 376-27-2 | octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, methyl ester | methyl perfluorooctanoate |
| 2395-00-8 | octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, potassium salt | PFOA potassium salt |
| 3825-26-1 | octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, ammonium salt | PFOA ammonium salt |
| 72968-38-8 | fatty acids, C7-13, perfluoro, ammonium salts | fatty acids, C7-13, perfluoro, ammonium salts |
| ***PFOA related substances (excluding C8:2 fluorotelomers)*** | | |
| 507-63-1 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-8-iodooctane | Perfluorooctyl iodide |

The five C8-2 telomer based substances listed in Table 10 are included for analysis with PFOA and PFOA-related substances, as recent literature has indicated that these substances have the potential to degrade to PFOA under various biotic and abiotic conditions (Lau et al, 2007). A total number of five such substances were manufactured by three companies in two countries. Not all companies that produce PFOA-related substances and C8:2 fluorotelomers produce PFOA.

Table 10. C8:2 fluorotelomers and related substances manufactured in 2008

| *CAS No.* | *Substance* | *Common name* |
|---|---|---|
| 678-39-7 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecan-1-ol | C8-2 alcohol |
| 2043-53-0 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-10-iododecane | C8-2 iodide |
| 1996-88-9 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl methacrylate | C8-2 methacrylate |
| 27905-45-9 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl acrylate | C8-2 acrylate |
| 21652-58-4 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-pentadecafluorodec-1-ene | C8-2 olefin |

**Products/mixtures containing PFOA, C8:2 fluorotelomers and other PFOA related substances**

Eight manufacturers in four countries reported production of mixtures/products containing PFOA, C8:2 fluorotelomers and other PFOA-related substances. Tables 11 and 12 provide lists of PFOA-related substances and C8:2 fluorotelomers contained in mixtures/products. Three of the PFOA-related substances included in Table 9 (CAS Nos. 376-27-2, 2395-00-8, and 90480-55-0) were not reported in mixtures or products. Consistent with this observation, the use of these chemicals were reported by respondents as 'chemical intermediates'.

The reported concentration of PFOA in products varied between <1 ppm and 160 ppm. Concentrations of other PFOA-related substances in the products ranged between 1 and 4200 ppm and concentrations of C8:2 fluorotelomers ranged between 5 and 35000 ppm. The reported total mass quantity of PFOA in products was <2 tonnes and that of related substances, including C8:2 fluorotelomers, was less than 24 tonnes.

**Product use information**

Respondents reported a wide range of industrial uses for products containing PFOA, C8:2 fluorotelomers and other related substances, whether as part of the formulation or a residue. Uses of products containing PFOA, C8:2 fluorotelomers and other PFOA-related substances are similar to those reported in the previous two surveys. Ammonium perfluorocarboxylate (C7-13) was reported to be contained in products. See Table 1 for general use information.

Table 11. Uses of products containing PFOA and related substances

| *CAS No.* | *Substance (common name)* | *Reported uses of the substance* | *Mass Qty of substance as a residual or impurity in products* |
|---|---|---|---|
| **PFOA, related substances and other related compounds (excluding C8:2 fluorotelomers)** | | | |
| 335-67-1 | PFOA | Fluoropolymer polymerisation aid | <5.5 tonnes |
| 3825-26-1 | PFOA ammonium salt | Fluoropolymer polymerisation aid | |
| 72968-38-8 | fatty acids, C7-13, perfluoro, ammonium salts | Fluoropolymer polymerisation aid | |
| 507-63-1 | Perfluorooctyl iodide | Manufacturing intermediates | |

Table 12. Uses of products containing C8:2 Fluorotelomers and related Substances

| ***CAS No.*** | ***Substance (common name)*** | ***Reported uses of products containing the substance*** | ***Mass Qty of substance as a residual or impurity in products*** |
|---|---|---|---|
| 678-39-7 | C8-2 alcohol | Manufacturing intermediate/raw material | <20 tonnes |
| 2043-53-0 | C8-2 iodide | Manufacturing intermediate/raw material | |
| 1996-88-9 | C8-2 methacrylate | Manufacturing intermediate/raw material | |
| 27905-45-9 | C8-2 acrylate | Manufacturing intermediate/raw material | |
| 21652-58-4 | C8-2 olefin | Manufacturing intermediate/raw material | |

**Release**

Seven out of eight respondents that reported manufacture of PFOA and PFOA-related substances (including the C8:2 telomers) in 2008 also reported release of these substances during the same period. A total of eight chemicals were reportedly released to the environment. The major proportion of environmental release of substances was to landfills. Relatively smaller amounts were released to local waterways and air. The PFOA, C8:2 fluorotelomers and other related substances that were transferred off-site were largely disposed of by incineration (Table 13).

PFOA ranked among the highest to be transferred off-site (136 tonnes); for incineration or recycling. The C7-13 perfluorocarboxylic acids ammonium salt (CAS No.72968-38-8) has not been included in Table 13 as no quantitative information on its release was provided.

The environmental release volumes of the C8:2 fluorotelomer based substances were larger than those of PFOA and related substances. In the following table, release volumes of the C8:2 fluorotelomer based substances are shown separately to those of PFOA and related substances.

Table 13. Release and offsite transfer of PFOA, C8:2 fluorotelomers and other PFOA related substances (tonnes)

| *CAS No. (Substance)* | ***Release to the environment (including off-site landfill, underground injection and water treatment*** | ***Reuse, recycling or incineration*** |
|---|---|---|
| **PFOA** | | |
| 335-67-1 (PFOA) | <5.5 | <136 |
| **PFOA salts and related substances (excluding C8:2 fluorotelomers** | | |
| 3825-26-1(PFOA ammonium salt)<br>507-63-1 (Perfluorooctyl iodide ) | <6.0 | <7.0 |
| **C8:2 fluorotelomers** | | |
| 678-39-7 (C8-2 alcohol)<br>2043-53-0 (C8-2 iodide)<br>1996-88-9 (C8-2 methacrylate)<br>27905-45-9 (C8-2 acrylate)<br>21652-58-4 (8-2 olefins) | CBI* | <58 |

*The basic principle ("Principle") in processing and aggregating data from the survey is that CBI must always be protected. The "Rule of Three" is a tool for implementing that Principle, described as follows: For any particular chemical or substance reported within the survey, aggregation of data for transmission to or use by the public shall represent input from at least three companies. If less than three companies report data on a chemical or substance then those data will not be reported publicly, either individually or in aggregate.

The Rule must be applied individually to each data element and, in general, from the "bottom up." That is, from the highest level of detail (lowest degree of aggregation) up through the lowest level of reporting detail (highest degree of aggregation) to test for protection of a given data element according to the Rule. It is not sufficient that there be more than three companies submitting data from a particular country or region; what matters is whether the Rule of Three will protect a particular item of data (data element) for which a company has made a CBI claim. Nor will the Rule of Three work to implement the Principle, if there is more than one and less than three submitters for that data element that are claiming CBI.

## PERFLUOROCARBOXYLIC ACIDS (PFCA), LONGER CHAIN CN:2 FLUOROTELOMERS AND OTHER PFCA RELATED SUBSTANCES

Four companies in two countries reported manufacture of PFCA, longer chain fluorotelomers (more than 8 carbon chain) and related substances. Nine PFCA and related substances and fourteen longer chain fluorotelomers were reportedly contained in products, whether as part of the formulation or as residue. Some of these substances were not manufactured by the companies formulating the products but apparently obtained from other sources (Tables 14 and 15). Substances ranged between 9 to 18 perfluorinated carbon chain lengths and contained mostly alcohol, iodide, acrylate and methacrylate functional groups.

Table 14. PFCA, salts and other related substances produced in 2008

| ***CAS No.*** | ***Substance*** | ***Common name*** |
|---|---|---|
| **PFCA substances** | | |
| 307-55-1 | dodecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-tricosafluoro- | perfluorododecanoic acid (PFDoA) |
| 375-95-1 | 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9-heptadecafluorononan-1-oic acid | perfluorononanoic acid (PFNA) |
| 4149-60-4 | nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-, ammonium salt | ammonium perfluorononanoate (APFN) |
| 335-76-2 | decanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-nonadecafluoro- | perfluorodecanoic acid (PFDA) |
| 2058-94-8 | undecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,11-heneicosafluoro- | perfluoroundecanoic acid (PFUnA) |
| **PFCA related substances excluding longer chain Cn:2 fluorotelomers** | | |
| 423-62-1 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-heneicosafluoro-10-iododecane | C10-iodide |
| 307-60-8 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12-pentacosafluoro-12-iododododecane | C12-iodide |
| 307-63-1 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14-nonacosafluoro-14-iodotetradecane | C14-iodide |
| 355-50-0 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16-tritriacontafluoro-16-iodohexadecane | C16-iodide |

Table 15. Longer chain-length Cn:2 fluorotelomers and related substances produced in 2008

| *CAS No.* | *Substance* | *Common name* |
|---|---|---|
| 865-86-1 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-henicosafluorododecanol | C10-2 alcohol |
| 39239-77-5 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafluorotetradecanol | C12-2 alcohol |
| 60699-51-6 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafluorohexadecanol | C14-2 alcohol |
| 2043-54-1 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-heneicosafluoro-12-iododododecane | C10-2 iodide |
| 30046-31-2 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12-pentacosafluoro-14-iodotetradecane | C12-2 iodide |
| 65510-55-6 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14-nonacosafluoro-16-iodohexadecane | C14-2 iodide |
| 65150-94-9 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16-tritriacontafluoro-18-iodooctadecane | C16-2 Iodide |
| 65104-63-4 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18,18-heptatriacontafluoro-20-iodoicosane | C18-2 iodide |
| 2144-54-9 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-henicosafluorododecyl methacrylate | C10-2 methacrylate |
| 6014-75-1 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafluorotetradecyl methacrylate | C12-2 methacrylate |
| 4980-53-4 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafluorohexadecyl methacrylate | C14-2 methacrylate |
| 17741-60-5 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-henicosafluorododecyl acrylate | C10-2 acrylate |
| 34395-24-9 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafluorotetradecyl acrylate | C12-2 acrylate |
| 34362-49-7 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafluorohexadecyl acrylate | C14-2 acrylate |

**Products/mixtures containing PFCA and related substances**

Of the four companies that reported the manufacture of PFCA, longer chain fluorotelomers and related substances, three reported products containing the chemicals, whether as part of the formulation or a residue. Products with 23 different PFCAs and related substances including longer chain Cn:2 fluorotelomers were reported. Generally, the concentrations of residual PFCAs in their respective products were very low (as low as 0.1 ppm in one product). However, for fluorotelomer alcohols, the residual concentrations in the products ranged between 5 and 35000 ppm. The total volume of residual PFCAs, longer chain fluorotelomers and related substances in products was nearly 16 tonnes. Tables 16 and 17 lists the PFCAs, longer chain fluorotelomers and related substances used for the manufacture of products and their uses.

**Product use information**

Respondents reported a wide range of industrial uses for products containing PFCAs, Cn:2 fluorotelomers and other related substances, whether as part of the formulation or a residue. The majority of the substances were reported to have uses as fluoropolymer polymerisation aids, manufacturing intermediates or raw materials. General uses are reported in Table 1.

Table 16. PFCA, salts and related substances in products/mixtures (tonnes)

| ***CAS No.*** | ***Substance (Common name)*** | ***Reported uses of the substance*** | ***Mass Qty of the substance as a residual or impurity in products*** |
|---|---|---|---|
| **PFCA substances** | | | |
| 307-55-1 | PFDoA | Not provided | <0.003 |
| 375-95-1 | perfluorononanoic acid | Fluoropolymerisation aid (FPA) and/or impurity | <1.2 |
| 4149-60-4 | Ammonium perfluorononanoate | Fluoropolymerisation aid (FPA) | <0.001 |
| 335-76-2 | perfluorodecanoic acid | impurity | <0.01 |
| 2058-94-8 | PFUnA | Not provided and/or impurity | |
| | | | |
| **PFCA related substances excluding longer chain Cn:2 fluorotelomers** | | | |
| 423-62-1 | C10 iodide | Manufacturing intermediate/Raw material | <0.1 |
| 307-60-8 | C12 iodide | | |
| 307-63-1 | C14 iodide | | |
| 355-50-0 | C16 iodide | | |

Table 17. Longer chain-length Cn:2 fluorotelomers in products/mixtures (tonnes)

| *CAS No.* | *Substance (Common name)* | *Reported uses of products containing the substance* | *Mass Qty of the substance as a residual or impurity in products* |
|---|---|---|---|
| 865-86-1 | C10-2 alcohol | Manufacturing intermediates | <15.0 |
| 39239-77-5 | C12-2 alcohol | | |
| 60699-51-6 | C14-2 alcohol | | |
| 2043-54-1 | C10-2 iodide | | |
| 30046-31-2 | C12-2 iodide | Manufacturing intermediates | |
| 65510-55-6 | C14-2 iodide | | |
| 65150-94-9 | C16-2 iodide | | |
| 65104-63-4 | C18-2 iodide | | |
| 2144-54-9 | C10-2 methacrylate | | |
| 6014-75-1 | C12-2 methacrylate | | |
| 4980-53-4 | C14-2 methacrylate | | |
| 17741-60-5 | C10-2 acrylate | Manufacturing intermediates | |
| 34395-24-9 | C12-2 acrylate | | |
| 34362-49-7 | C14-2 acrylate | | |

**Release**

Four companies that reported production of PFCAs, longer chain fluorotelomers and related substances or formulation of their products also reported their release. A total of twenty three substances were released to the environment or incinerated, reused or recycled in 2008.

Of the releases to the environment, the majority went to landfills and publicly owned treatment works; only minor amounts were released to air and local waterways.

In the following table, release volumes of the longer chain Cn:2 fluorotelomer based substances are shown separately to those of PFCA and other related substances. The environmental releases were predominantly of the longer chain Cn:2 fluorotelomers to landfills. However, the release volumes of these substances cannot be quantitatively related to the amounts of PFCA formed in the environment. PFNA was the only other substance in this group for which there was significant environmental release.

Table 18. Release and offsite transfer of PFCA, longer chain fluorotelomers and related substances (tonnes)

| *CAS No. (Substance)* | *Release to the environment (including off-site landfill, underground injection and water treatment* | *Reuse, recycling or incineration* |
|---|---|---|
| **PFCAs, their salts and related substances excluding longer chain Cn:2 fluorotelomers** | | |
| 375-95-1 (PFNA)<br>4149-60-4 (APFN)<br>307-55-1 (PFDoA)<br>335-76-2 (PFDA)<br>2058-94-8 (PFUnA)<br>423-62-1 (C10 iodide)<br>307-60-8 (C12 iodide)<br>307-63-1 (C14 iodide)<br>355-50-0 (C16 iodide) | <8.0 | <20.0 |
| **Longer chain Cn:2 fluorotelomers** | | |
| 865-86-1 (C10-2 alcohol)<br>39239-77-5 (C12-2 alcohol)<br>60699-51-6 (C14-2 alcohol) | CBI* | <3.0 |
| 2043-54-1(C10-2 iodide)<br>30046-31-2 (C12-2 iodide)<br>65510-55-6 (C14-2 iodide)<br>65150-94-9 (C16-2 iodide)<br>65104-63-4 (C18-2 iodide) | | |
| 2144-54-9 (C10-2 methacrylate)<br>6014-75-1 (C12-2 methacrylate)<br>4980-53-4 (C14-2 methacrylate) | | |
| 17741-60-5 (C10-2 acrylate)<br>34395-24-9 (C12-2 acrylate)<br>34362-49-7 (C14-2 acrylate) | | |
| **Total** | Cannot be reported | **<23.0** |

* The basic principle ("Principle") in processing and aggregating data from the survey is that CBI must always be protected. The "Rule of Three" is a tool for implementing that Principle, described as follows: For any particular chemical or substance reported within the survey, aggregation of data for transmission to or use by the public shall represent input from at least three companies. If less than three companies report data on a chemical or substance then those data will not be reported publicly, either individually or in aggregate.

The Rule must be applied individually to each data element and, in general, from the "bottom up." That is, from the highest level of detail (lowest degree of aggregation) up through the lowest level of reporting detail (highest degree of aggregation) to test for protection of a given data element according to the Rule. It is not sufficient that there be more than three companies submitting data from a particular country or region; what matters is whether the Rule of Three will protect a particular item of data (data element) for which a company has made a CBI claim. Nor will the Rule of Three work to implement the Principle, if there is more than one and less than three submitters for that data element that are claiming CBI.

## CONCLUSIONS AND DISCUSSION

The 2009 survey sought information on the production, use and release of perfluorinated chemicals for the year 2008. The survey focused on PFAS with chain lengths of C6 and higher (including PFOS) and PFCAs with chain lengths C8 and higher (including PFOA) and also on potential precursors of carboxylic acids that may be present in fluorotelomer based products, such as fluorotelomer iodides and fluorotelomer alcohols.

Whereas the previous two surveys requested participating countries to collect information on all perfluorinated chemicals and their products manufactured in or imported into their jurisdictions, the present survey focused on the manufacturers of a defined list of chemicals and/or their products in OECD and non-OECD member countries. Fifty five percent of the companies surveyed were from non-OECD countries. However, no responses were received from companies in these countries, highlighting the need for outreach activities to encourage companies in non-OECD countries to participate in the survey to allow an accurate estimation of the global environmental loading of these chemicals.

An important aspect of this survey is the collection of data on the release of perfluorinated chemicals to the environment during the manufacturing and formulation processes which was not requested in the earlier surveys. The aim was to obtain information on potential contributions of the targeted PFAS and PFCAs to environmental loadings of these chemicals.

The main findings of the survey are that for PFOS, PFAS and related substances

- Four PFOS and related substances and three other PFAS substances are currently being manufactured.

- Significantly higher amounts of PFOS and related substances are reported to be released to the environment as compared to other PFAS substances.

For PFOA, C8:2 fluorotelomers and other related substances

- PFOA and five related substances were reported to be produced during 2008. However only three of these were reportedly present in products. Five C8:2 fluorotelomers (PFOA-related substances) were also manufactured and formulated into products.

- A variety of uses were reported for products containing PFOA and related substances, such as surfactants and surface protectants.

- Of the total environmental releases of the four groups (PFOS, PFAS, PFOA and PFCA and their related substances), release of PFOA, C8:2 fluorotelomers and other PFOA-related substances constituted approximately 55%. Most of the environmental releases of PFOA, C8:2 fluorotelomers and other PFOA-related substances were to landfills.

For PFCAs, Cn:2 fluorotelomers and other related substances

- PFCAs and related substances, including higher carbon chain Cn:2 fluorotelomers formed numerically the largest group of perfluorinated chemicals (23 chemicals) reportedly produced and/or present in products.

- The most commonly reported uses of products containing these substances were as raw material for surface treatment agents, water/oil repellent and soil repellent.

- Slightly lower volumes of these substances were released to the environment as compared to PFOA and related substances. For the PFCA and related substances group, a larger proportion of the total reported releases and offsite transfers were in the form of environmental release, compared with less than half for PFOA and related substances.

For all perfluorinated chemicals

- The total amount of PFOA present in products as unreacted residual was less than 1.5 tonnes. Other related substances, including the C8:2 fluorotelomers, amounted to less than 22 tonnes in the products.

- Based on the reported data, the number of PFCA-related chemicals (23 chemicals) and PFOA-related chemicals (12 chemicals) manufactured and/or present in products was larger than the PFAS (3 chemicals) and PFOS (4 chemicals) groups of chemicals .

- From the survey response, the most commonly reported use of products containing perfluorinated chemicals appears to be in the production of water/oil repellent products. No common uses across all four groups were noted except for antireflective coating products for photolithography that used PFOS, PFAS or PFOA products. Products containing PFOS and related substances were not reported to be used in fire fighting products.

- Very small quantities of perfluorinated chemicals were released to air or water systems compared to landfill or off-site transfer for incineration.

This survey is important as a starting point for future surveys in which increased participation, especially by companies from non-OECD member countries, would generate data that can be used for monitoring the production and release of perfluorinated chemicals. It is now recognized that some shorter chain alternatives are persistent, and as more information on toxicity of these chemicals becomes available they could be included in future OECD surveys.

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# ANNEX 1
# SURVEY OF PRODUCT CONTENT AND ENVIRONMENTAL RELEASE INFORMATION ON PERFLUOROOCTANE SULFONATE (PFOS), PERFLUOROALKYL SULFONATE (PFAS), PERFLUOROOCTANOIC ACID (PFOA), PERFLUOROCARBOXYLIC ACID (PFCA), THEIR RELATED SUBSTANCES AND PRODUCTS/MIXTURES CONTAINING THESE SUBSTANCES

## INTRODUCTION

The Organisation for Economic Cooperation and Development (OECD) monitors the manufacture and use of PFOA and PFOA-related chemicals and other PFAS and PFAS-related chemicals in addition to PFOS and PFOS-related chemicals through surveys conducted every 2-3 years.

The results of the 2004 OECD Survey titled "Production and Use Information on Perfluorooctane Sulfonate (PFOS), Perfluoroalkyl Sulfonate (PFAS), Perfluorooctanoic Acid (PFOA), related Substances and Products/Mixtures containing these Substances" were published in 2005 as ENV/JM/MONO(2005)1 and are available at:

http://www.olis.oecd.org/olis/2005doc.nsf/LinkTo/env-jm-mono(2005)1.

Subsequently lists of these groups of chemicals with CAS numbers were developed to assist in responding to the surveys. These lists were published as ENV/JM/MONO(2006)15 the first time in 2006 and are available at:

http://appli1.oecd.org/olis/2006doc.nsf/linkto/env-jm-mono(2006)15.

The second survey on "Production and Use of PFOS, PFAS, PFOA, PFCA and their Related Substances and Products/Mixtures Containing these Substances" was undertaken in 2006. Among others, the survey identified substances not listed in the "Preliminary Lists". Consequently, the "Lists" were updated in 2007 [ENV/JM/MONO(2006)15]. The outcome of the survey was published in December 2006 as ENV/JM/MONO(2006)36 and can be found at:

http://appli1.oecd.org/olis/2006doc.nsf/linkto/env-jm-mono(2006)36.

One of the recommendations of an OECD sponsored PFCA Workshop held in Stockholm, Sweden in November 2006 was that the Business and Industry Advisory Committee (BIAC) assist the OECD in the development of the next survey with the goal of collecting more useful data associated with the manufacture and use of these substances. Over the past year, a BIAC team worked closely with the OECD PFC Steering Group to design a survey, and develop the forms and instructions needed to conduct it.

This survey differs from the previous surveys in several important ways.

First, it is targeted at the producers of the basic chemistry. The previous surveys, on the other hand, focused further down the value chain, by asking OECD member countries to collect information on products manufactured in or imported into their jurisdictions. This approach significantly complicated data collection. The revised approach was adopted to address this concern, and better ensure achievement of

the underlying goal of the survey, which is to gather information that will assist OECD and countries in assessing potential contributions to environmental loadings of PFOS, PFAS, PFOA and longer chain length Perfluorocarboxylic Acids (PFCA).

- Second, the survey will be administered by a single OECD member country (Australia), which will send out the survey forms to the companies that have been identified as being the producers of the basic chemistry, and summarise the results for use by OECD and other countries. This approach will greatly simplify the handling and processing of Confidential Business Information (CBI). In general, such information will be subject to the protections afforded by the Country administering the survey, and will only be shared with OECD or countries in ways that are consistent with the law of that country governing the protection of CBI.

- Third, the survey focuses on PFAS with chain lengths C6 and higher (including PFOS), PFCAs with chain lengths C8 and higher (including PFOA), and substances that may be potential precursors of these substances that are likely to be produced or present in products, either as residual substances or otherwise. For definitional purposes "precursor" means a substance that has been recognized as having the potential to degrade to a PFAS with a chain length of C6 or higher (including PFOS), or a PFCA with a chain length of C8 and higher (including PFOA). Once entering the environment these precursors may have the potential to degrade to the subject PFAS and PFCA substances. Two kinds of data are sought in the survey concerning the targeted substances: product content data and data on releases to the environment from manufacturing activities. The targeted substance list is attached.

Note that the survey is not intended to capture the content of these substances in consumer products or articles in commerce, to avoid "double counting." In this regard, the focus of the survey is on potential contributions to environmental loadings of the targeted PFAS and PFCAs. This objective is achieved by focusing on manufacturing releases and the presence of targeted substances in products created at the start of the manufacturing process. This objective is achieved by focusing on manufacturing releases and the presence of targeted substances in products created at the start of the manufacturing process. However, it should be kept in mind that the product content information provides a conservative estimate of potential emissions from "products", not an estimate of expected or actual emissions. In fact, downstream processing of "products" of this survey could result in some decrease of the amounts in the product content category.

As a further check to limit "double counting", definitions of "product" and "manufacturer" are included. The definition of "product" is intended to exclude intermediates on the targeted substance list that are sold to other manufacturers and used as reactants. A company that purchases and uses these intermediates will be treated as a "manufacturer" for purposes of the survey and will report, like other "manufacturers", its manufacturing emissions, as well as the content of targeted substances in its products.

A "perfluorochemical product" is a product offered for sale in the marketplace as a solid or as a final finished formulation (solution or dispersion) that consists of or includes one or more chemicals on the targeted substances list. Perfluorochemical products in this definition include certain fluorinated surfactants as well as per- and poly- fluorinated polymeric products and is therefore, by design, over inclusive. Perfluorochemical products are manufactured from fluorochemical intermediates (and other non-fluorinated substances) and then sold to end-use customers and distributors. Perfluorochemical products, for the purposes of this survey, do not include end products and formulated items (*i.e.* cleaning solutions, paints), the articles to which they are applied (paper, textiles, nonwovens, paper, carpet), and articles that are subsequently manufactured from them. Perfluorochemical products also do not include intermediates, when sold and purchased as such. (Note: A company that uses these intermediates will be deemed a manufacturer, so the quantities are accounted for in this survey)

A "manufacturer" is a company that manufactures substances on the targeted substance list, and also any company who uses one or more of the TSL substances to make perfluorochemical-based products.

**BACKGROUND**

Perfluorooctane sulfonate (PFOS) refers to fully fluorinated (eight-carbon chain length) sulfonate-containing substances. The acid form of PFOS is 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-1-octanesulfonic acid, (CAS No. 1763-23-1). PFOS-related substances may be salts of PFOS, e.g. potassium, lithium, ammonium or diethanolamine, or polymers that contain the PFOS as a portion of the entire structure.

Uses of PFOS or PFOS-related substances might include (but are not limited to) uses in fire fighting foams, fire resistant hydraulic fluids, mining and oil well surfactants, acid mist suppressants for metal plating and electronic etching baths, protective treatments for carpet and textiles, as an insecticide in bait stations, and as surfactants. It should be pointed out that the US EPA has promulgated a Significant New Use Rule (SNUR) governing the substances used in these applications, and the EU has issued a Marketing and Use Directive (76/769) governing the similar substance uses.

More details about the uses of PFOS or PFOS-related/PFOS based substances identified to date by the OECD can be obtained from the *Hazard Assessment of Perfluorooctane sulfonate (PFOS) and its Salts*. A copy of the assessment report can be found on the OECD web site at:

http://www.oecd.org/dataoecd/23/18/2382880.pdf.

Perfluoroalkyl sulfonate (PFAS) is a generic term used to describe any fully fluorinated carbon chain length sulfonate, including higher and lower homologues as well as PFOS. PFAS-related substances may be salts of PFAS, or polymers that contain the PFAS as only a portion of the entire polymer. For the purposes of this questionnaire, this group includes PFAS and PFAS related substances (with a fully fluorinated six and more carbon chain length) other than PFOS and PFOS related substances mentioned above.

Perfluorooctanoic acid (PFOA), or pentadecafluorooctanoic acid, is a fully fluorinated eight-carbon chain carboxylic acid (CAS Registry Number 335-67-1). PFOA-related substances may be salts of PFOA or substances that can degrade to PFOA. PFOA salts, such as ammonium perfluoroctanoate, are used as processing aids in the production of fluoropolymers and fluoroelastomers and in other surfactant uses.

Perfluorocarboxylic acid (PFCA) is a generic term used to describe any fully fluorinated carbon chain length carboxylic acid. For the purposes of this survey, this group includes PFCA and PFCA related substances (C8 and above).

PFCA-related substances may be salts of PFCA or substances that degrade to form PFCA. For example, some residual chemicals from the telomer manufacturing process such as telomer alcohols and telomer iodides may remain in the final product and break down into PFOA.

**CONFIDENTIAL BUSINESS INFORMATION**

A company may claim information provided for the survey as confidential business information (CBI). Please note that the company must substantiate any CBI claim. Also, be advised that if no CBI claim accompanies your submission, the information provided may be made available to the public. If you make a CBI claim in the submission, the information covered by such claims will only be disclosed to the extent and by means of the procedures set forth under Australian law and specified by NICNAS.

CBI information that is provided for the survey should be sanitized to protect CBI, however, limit the CBI claim to the extent possible and provide as much information as possible.. The submitter should clearly mark an attached cover sheet and each page that contains CBI with the term "Confidential," "Trade Secret," "Proprietary," or other appropriate term indicating the confidential nature of the information

Any part of data or other documentation claimed as CBI should be so marked. Confidential portions of any particular page should be clearly marked by highlighting, bracketing, or some other marking that clearly identifies the precise information that is claimed as CBI. In addition to the marked copy, a second copy of the submission should accompany the submission from which all the marked information and legends are removed, leaving only the non-confidential portions of the submission. Data or other information that are claimed as CBI should not be submitted electronically by e-mail. If the CBI submission is on diskette or CD ROM, mark the outside of the diskette or CD ROM as CBI and then identify electronically within the diskette or CD ROM the specific information that is CBI.

In order to facilitate communication of the data and trends from the data collected in the survey process it is preferable that there be consistency in certain areas where CBI may be claimed. Relative to Tables 2, 4, 6, and 8 where both Concentration and Mass data are collected, if a company selects to claim confidentiality it is recommended that it be limited to Concentration only.

Confidential Business Information provided to Australia (NICNAS) is classified as "Commercial-in-Confidence." In classifying certain information as Commercial-in-Confidence, it is recognised that the information is sensitive commercial information which, if disclosed without authorisation, may possibly cause harm to a person or organisation or give an unfair advantage to an entity. Measures are in place to protect the confidentiality of information.

Information provided in the survey is also subject to the Australian Freedom of Information Act 1982 (the FOI Act). In a situation where the information collected for the OECD survey became the subject of a request under the FOI Act, NICNAS would be required to consult with the person or organisation to which the information relates before it could be disclosed. While there are exemptions under the FOI Act the applicability cannot be determined until a FOI request is lodged and examined.

P**lease complete the questionnaire** by 30 September 2009 **for calendar year 2008 and submit to Dr. Sneha Satya at: Sneha.Satya@nicnas.gov.au**

Confidential information should be submitted through a courier to
**Dr. Sneha Satya**
**NICNAS, Department of Health and Ageing**
**334-336 Illawarra Road**
**Marrickville, NSW 2204**
**Australia**

**SURVEY OF PRODUCT CONTENT AND ENVIRONMENTAL RELEASE INFORMATION ON PERFLUOROOCTANE SULFONATE (PFOS), PERFLUOROALKYL SULFONATE (PFAS), PERFLUOROOCTANOIC ACID (PFOA), PERFLUOROCARBOXYLIC ACID (PFCA), THEIR RELATED SUBSTANCES AND PRODUCTS/MIXTURES CONTAINING THESE SUBSTANCES**

**Company Identification**

Company Name: _____

Site Location: _____

Technical contact: _____

Title: _____

Mailing address: _____

Telephone number: _____

Email address: _____

Date: _____

| Question | Yes | No | Table to be completed |
|---|---|---|---|
| Does your company manufacture PFOS or PFOS-related substances including precursors? *see list of substances | | | Table 1 |
| Does your company manufacture products containing PFOS or PFOS-related substances including precursors? *see list of substances | | | Table 2 |
| Does your company manufacture PFAS or PFAS-related substances including precursors? (PFAS means C6 and above but, not including C8)see list of substances | | | Table 3 |
| Does your company manufacture products containing PFAS or PFAS-related substances including precursors? (PFAS means C6 and above but, not including C8) *see list of substances | | | Table 4 |
| Does your company manufacture PFOA or PFOA-related substances including precursors? *see list of substances | | | Table 5 |
| Does your company manufacture products containing PFOA or PFOA-related substances including precursors? *see list of substances | | | Table 6 |
| Does your company manufacture PFCA or PFCA-related substances including precursors? (PFCA means C9 and above*see list of substances | | | Table 7 |
| Does your company manufacture products containing PFCA or PFCA-related substances including precursors? (PFCA means C9 and above)*see list of substances | | | Table 8 |

**Table 1: Manufacture of PFOS and PFOS-related substances[1]:**

- Do you manufacture PFOS or PFOS-related substances? **YES/NO**
- Please fill in the table below for each substance manufactured.

| **PFOS or PFOS- related Substance Name / CAS No.** | **Known Uses of the Substance** |
|---|---|
| | |
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[1] PFOS and PFOS-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 2: Manufacture of <u>products</u> containing PFOS or PFOS-related substances[2]:**

- Do you manufacture products containing PFOS or PFOS-related substances? **YES/NO**
- Please fill in the table below for each product manufactured (***Where both concentration and mass data are collected, if a company selects to claim confidentiality it is recommended that it be limited to concentration only***).

| **PFOS or PFOS-related Substance**<br><br>**Name / CAS No.** | **Product Name** | **Concentration of the Substance in Product,**<br><br>**ppm, dry weight (CBI)** | **Known Uses of the Product** | **Mass Quantity of the substance (kg/year)**<br><br>**(Non-CBI)** | **Analytical Accuracy (Fill appropriate box)*** | |
|---|---|---|---|---|---|---|
| | | | | | **Measured** | **Estimated** |
| | | | | | | |
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*If measured, please list the appropriate LOQ. If estimated, please include a short description for the basis of the estimate.

[2] PFOS and PFOS-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 3: Manufacture of PFAS and PFAS-related substances[3]:**

- Do you manufacture PFAS or PFAS-related substances? **YES/NO**
- Please fill in the table below for each substance manufactured.

| **PFAS or PFAS-related Substance**<br><br>**Name / CAS No.** | **Known Uses of the Substance** |
|---|---|
| | |
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| | |

[3] PFAS and PFAS-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 4: Manufacture of <u>products</u> containing PFAS or PFAS-related substances[4]:**

- Do you manufacture products containing PFAS or PFAS-related substances? **YES/NO**
- Please fill in the table below for each product manufactured (***Where both concentration and mass data are collected, if a company selects to claim confidentiality it is recommended that it be limited to concentration only***).

| **PFAS or PFAS-related Substance**<br><br>**Name / CAS No.** | **Product Name** | **Concentration of the Substance in Product,**<br><br>**ppm, dry weight (CBI)** | **Known Uses of the Product** | **Mass Quantity of the substance (kg/year)**<br><br>**(Non-CBI)** | **Analytical Accuracy (Fill appropriate box)*** | |
|---|---|---|---|---|---|---|
| | | | | | **Measured** | **Estimated** |
| | | | | | | |
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*If measured, please list the appropriate LOQ. If estimated, please include a short description for the basis of the estimate.

[4] PFAS and PFAS-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 5: Manufacture of PFOA and PFOA-related substances[5]:**

Do you manufacture PFOA or PFOA-related substances? **YES/NO**

- Please fill in the table below for each substance manufactured.

| **PFOA or PFOA-related Substance**<br><br>**Name / CAS No.** | **Known Uses of the Substance** |
|---|---|
| | |
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[5] PFOA and PFOA-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 6: Manufacture of <u>products</u> containing PFOA or PFOA-related substances[6]:**

- Do you manufacture products containing PFOA or PFOA-related substances? **YES/NO**
- Please fill in the table below for each product manufactured (***Where both concentration and mass data are collected, if a company selects to claim confidentiality it is recommended that it be limited to concentration only***).

| **PFOA or PFOA-related Substance Name / CAS No.** | **Product Name** | **Concentration of the Substance in Product, ppm, dry weight (CBI)** | **Known Uses of the Product** | **Mass Quantity of the substance (kg/year) (Non-CBI)** | **Analytical Accuracy (Fill appropriate box)*** | |
|---|---|---|---|---|---|---|
| | | | | | **Measured** | **Estimated** |
| | | | | | | |
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| | | | | | | |

*If measured, please list the appropriate LOQ. If estimated, please include a short description for the basis of the estimate.

6 PFOA and PFOA-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 7: Manufacture of PFCA and PFCA-related substances[7]:**

- Do you manufacture PFCA or PFCA-related substances? **YES/NO**
- Please fill in the table below for each substance manufactured.

| **PFCA or PFCA-related Substance**<br><br>**Name / CAS No.** | **Known Uses of the Substance** |
|---|---|
| | |
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[7] [7]PFCAs and PFCA-related substances are those listed in the attached list of substances to be reported in this survey.

**Table 8: Manufacture of <u>products</u> containing PFCA or PFCA-related substances[8]:**

- Do you manufacture products containing PFCA or PFCA-related substances? **YES/NO**
- Please fill in the table below for each product/mixture manufactured (***Where both concentration and mass data are collected, if a company selects to claim confidentiality it is recommended that it be limited to concentration only***).

| PFCA or PFCA-related Substance<br><br>Name / CAS No. | Product Name | Concentration of the Substance in Product,<br><br>ppm, dry weight (CBI) | Known Uses of the Product | Mass Quantity of the substance (kg/year) (Non-CBI) | Analytical Accuracy (Fill appropriate box)* | |
|---|---|---|---|---|---|---|
| | | | | | Measured | Estimated |
| | | | | | | |
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| | | | | | | |

*If measured, please list the appropriate LOQ. If estimated, please include a short description for the basis of the estimate.

[8] PFCAs and PFCA-related substances are those listed in the attached list of substances to be reported in this survey.

**SUMMARY OF SITE RELEASE AND TRANSFER INFORMATION**

| Chemical Name/CAS No. | Total Annual Site Release (kg) | | | Total off-site transfers (kg) |
|---|---|---|---|---|
| | Air release | Water release | On-site land release | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**DETAILED SITE RELEASE AND TRANSFER INFORMATION [Data to be provided for individual chemicals]**

***AIR RELEASES***

| Fugitive (Non-Point Source) | | | | Stack (Point Source) | | |
|---|---|---|---|---|---|---|
| Chemical Name/CAS No. | Annual Releases (kg) | Estimated Accuracy % | #Days/year/Releases Occurred | Annual Releases (kg) | Estimated Accuracy % | #Days/year/Releases Occurred |
| | | | | | | |
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***WATER RELEASES***

| Chemical Name/CAS No. | Receiving Body of Water | Annual Releases (kg) | Estimated Accuracy % | #Days/year/Releases Occurred |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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| | | | | |

***ON-SITE LAND RELEASES***

| | Annual Releases (kg) and Estimated Accuracy % | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemical Name/CAS No. | Landfill | | Land Treatment | | Surface Impoundment | | Underground Injection | | Other (specify) | |
| | Release | Accuracy | Release | Accuracy | Release | Accuracy | Release | Accuracy | Release | Accuracy |
| | | | | | | | | | | |
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***OFF-SITE TRANSFERS***

| | Annual Releases (kg) and Estimated Accuracy % | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Chemical Name/CAS No. | Publically Owned Treatment Works (POTW)[name of city & receiving body of water]<br>Release | Accuracy | Incineration (Include name of incineration facility)<br>Release | Accuracy | Wastewater Treatment (excluding POTW)<br>Release | Accuracy | Underground Injection<br>Release | Accuracy |
| | | | | | | | | |
| | | | | | | | | |
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***OFF-SITE TRANSFERS***

| Annual releases (kg and Estimated Accuracy % | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Chemical Name/CAS No. | Recycle or Recovery ( not to include internal recycled)<br>Release | Accuracy | Internally Recycled<br>Release | Accuracy | Landfill<br>Release | Accuracy | Unknown or Other (specify)<br>Release | Accuracy |
| | | | | | | | | |
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## ANNEX 2
## LIST OF SUBSTANCES TO BE REPORTED IN THE PFC SURVEY

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| **Perfluorocarboxylic Acids** | | | **$F(CF_2)_n$-COOH** | | |
| | 335-67-1 | | Octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro- | perfluorooctanoic acid | PFOA |
| | 335-95-5 | | Octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, sodium salt | sodium perfluorooctanate | |
| | 3825-26-1 | | Octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, ammonium salt | ammonium perfluorooctanoate | APFO |
| | 2395-00-8 | | Octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro-, potassium salt | potassium perfluorooctanoate | KPFO |
| | 90480-55-0 | | Octanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-pentadecafluoro- branched | | |
| | 375-95-1 | | Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro- | perfluorononanoic acid | PFNA |
| | 21049-38-7 | | Nonanoic acid, heptadecafluoro-, potassium salt | potassium perfluorononanoate | KPFN |
| | 4149-60-4 | | Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-, ammonium salt | ammonium perfluorononanoate | APFN |

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| | 335-76-2 | | Decanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-nonadecafluoro- | perfluorodecanoic acid | PFDA |
| | 2058-94-8 | | Undecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,11-heneicosafluoro- | perfluoroundecanoic acid | PFDoA |
| | 307-55-1 | | Dodecanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-tricosafluoro- | perfluorododecanoic acid | PFUnA |
| | 375-95-1 | 206-801-3 | 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9-heptadecafluorononan-1-oic acid | perfluorononan-1-oic acid | |
| ***See footnote 1*** | 74499-44-8 | | phosphoric acid, γ-ω-perfluoro-C8-16-alkyl esters, compounds with diethanolamine | | |
| ***See footnote 1*** | 86508-42-1 | | and perfluoro compounds, C5-18 | | |
| | | | | | |
| **Perfuoroalkyl Iodides** | | | **$F(CF_2)_n$-I** | | |
| | 000507631 | 2080795 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-8-iodooctane | 8 Iodide | |
| | 000423621 | 2070305 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-heneicosafluoro-10-iododecane | 10 Iodide | |
| | 000307608 | 2062053 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12-pentacosafluoro-12-iodododecane | 12 Iodide | |
| | 000307631 | 2062074 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14-nonacosafluoro-14-iodotetradecane | 14 Iodide | |

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| | 000355500 | 2065892 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16-tritriacontafluoro-16-iodohexadecane | 16 Iodide | |
| | 090622712 | 2924742 | Alkyl iodides, C6-18, perfluoro | mixture | |
| **Fluorotelomer Iodides** | | | **$F(CF_2)_nCH_2CH_2$-I** | | |
| | 002043530 | 2180535 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-10-iododecane | 8-2 Iodide | |
| | 002043541 | 2180540 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10-heneicosafluoro-12-iododododecane | 10-2 Iodide | |
| | 030046312 | 2500148 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12-pentacosafluoro-14-iodotetradecane | 12-2 Iodide | |
| | 065510556 | 2658006 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14-nonacosafluoro-16-iodohexadecane | 14-2 iodide | |
| | 065150949 | 2655251 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16-Tritriacontafluoro-18-iodooctadecane | 16-2 Iodide | |
| | 065104634 | 2654352 | 1,1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,17,17,18,18-Heptatriacontafluoro-20-iodoicosane | 18-2 Iodide | |
| | 068188125 | 2691415 | Alkyl iodides, C4-20, γ-ω-perfluoro | X-2 Iodides | |
| | 085995911 | 2891005 | Alkyl iodides, C8-14, γ-ω-perfluoro | X-2 Iodides | |
| **Fluorotelomer Alcohols** | | | **$F(CF_2)_nCH_2CH_2$-OH** | | |

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| | 000678397 | 2116480 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecan-1-ol | 8-2 Alcohol | |
| | 000865861 | 2127487 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-henicosafluorododecanol | 10-2 Alcohol | |
| | 039239775 | 2543731 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafluorotetradecanol | 12-2 Alcohol | |
| | 060699516 | 2623827 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafluorohexadecanol | 14-2 Alcohol | |
| | 068391082 | 2699278 | Alcohols, C8-14, γ-ω-perfluoro | x-2 Alcohol | |
| **Fluorotelomer Methacrylate Monomers** | | | **$F(CF_2)_nCH_2CH_2$-OC(O)C($CH_3$)=$CH_2$** | | |
| | 001996889 | 2178772 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl methacrylate | 8-2 Methacrylate | |
| | 002144549 | 2184084 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-henicosafluorododecyl methacrylate | 10-2 Methacrylate | |
| | 006014751 | 2278706 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafluorotetradecyl methacrylate | 12-2 Methacrylate | |
| | 004980534 | 2256279 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafluorohexadecyl methacrylate | 14-2 Methacrylate | |
| **Fluorotelomer Acrylate Monomers** | | | **$F(CF_2)_nCH_2CH_2$-OC(O)CH=$CH_2$** | | |
| | 027905459 | 2487227 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl acrylate | 8-2 Acrylate | |

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| | 017741605 | 2417322 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,12-henicosafluorododecyl acrylate | 10-2 Acrylate | |
| | 034395249 | 2519929 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,14-pentacosafluorotetradecyl acrylate | 12-2 Acrylate | |
| | 034362497 | 2519630 | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,14,14,15,15,16,16,16-nonacosafluorohexadecyl acrylate | 14-2 Acrylate | |
| **Fluorotelomer Olefins** | | | **$F(CF_2)_nCH=CH_2$** | | |
| | 21652584 | | 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-pentadecafluorodec-1-ene | 8-2 Olefin | |
| **Perfluorosulfonyl fluorides** | | | **$C_nF_{2n+1}$-$SO_2F$** | | |
| | 423-50-7 | 207-026-3 | 1-Hexanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro- | perfluorohexane sulfonyl fluoride | PHSF |
| | 307-35-7 | 206-200-6 | 1-Octanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro- | perfluorooctane sulfonyl fluoride | POSF |
| | 307-51-7 | 206-202-7 | 1-Decanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heneicosafluoro- | perfluorodecane sulfonyl fluoride | PDSF |
| **Perfluorosulfonates and Perfluorosulfonate salts** | | | **$C_nF_{2n+1}$-$SO3^-$ and $C_nF_{2n+1}$-$SO3^-$ $M^+$** | | |
| | 108427-53-8 | | 1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, ion (-1) | Perfluorohexane sulfonate | PFHS |
| | 3871-99-6 | 223-393-2 | 1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-, potassium salt | Potassium perfluorohexane sulfonate | PFHS-K+ |

| Group | CAS No. | EINECS-,ELINCS-,NLP-no. | substance name ( IUPAC or CAS Index Name) | common name | Abbreviation |
|---|---|---|---|---|---|
| | 45298-90-6 | | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ion (-1) | Perfluorooctane sulfonate | PFOS |
| | 2795-39-3 | 220-527-1 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt | Potassium perfluorooctane sulfonate | PFOS-K+ |
| | 29081-56-9 | 249-415-0 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt | Ammonium perfluorooctane sulfonate | PFOS-NH4+ |
| | 29457-72-5 | 249-644-6 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, lithium salt | Lithium perfluorooctane sulfonate | PFOS-Li+ |
| | 70225-14-8 | 274-460-8 | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, compd. With 2,2'-iminobis[ethanol] (1:1) | Diethanolamine perfluorooctane sulfonate | PFOS-DEA+ |
| | | | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro- | | |
| | 4021-47-0 | | 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, sodium salt | Sodium perfluorooctane sulfonate | PFOS-Na+ |
| | 67584-42-3 | 266-724-6 | Cyclohexanesulfonic acid, decafluoro(pentafluoroethyl)-, potassium salt | Potassium perfluoroethylcyclohexyl sulfonate | PECHS-K+ |
| | 126105-34-8 | | 1-Decanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heneicosafluoro-, ion (-1) | Perfluorodecane sulfonate | PFDS |
| | 2806-16-8 | 220-544-4 | 1-Decanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heneicosafluoro-, potassium salt | Potassium perfluorodecane sulfonate | PFDS-K+ |
| | 1652-63-7 | | 1-Propanaminium, 3-[[(heptadecafluorooctyl) sulfonyl] amino]-N,N,N-trimethyl-,iodide | | |
| | 52550-45-5 | | Poly(oxy-1,2-ethanediyl), α-[2-[[(heptadecafluorooctyl) sulfonyl] propylamino] ethyl]-ω-hydroxy- | | |

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| | 56773-42-3 | 260-375-3 | Ethanaminium, N,N,N-triethyl salt with 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8-heptadecafluoro-1-octanesulfonic acid (1:1) | Tetraethylammonium PFOS | TEAP |
| **Perfluoro sulfonamides** | | | **$C_nF_{2n+1}$-$SO_2N(R_1)R_2$** | | |
| | 754-91-6 | 212-046-0 | 1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, | Perfluorooctane sulfonamide | PFOSA |
| | 24448-09-7 | 246-262-1 | 1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-(2-hydroxyethyl)-N-methyl | 2-(N-methylperfluoro octanesulfonamide)ethyl alcohol | N-MeFOSE alcohol |
| | 1691-99-2 | 216-887-4 | 1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-(2-hydroxyethyl)- | 2-(N-ethylperfluoro octanesulfonamide)ethyl alcohol | N-EtFOSE alcohol |
| | 31506-32-8 | 250-665-8 | 1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-methyl | 2-N-methylperfluoro octanesulfonamide | N-MeFOSA |
| | 13417-01-1 | | 1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro- | | |
| | 61660-12-6 | | 1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6, 7,7,8,8,8-heptadecafluoro-N-[3-(trimethoxysilyl)propyl]- | | |
| | 4151-50-2 | 223-980-3 | 1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro- | 2-N-ethylperfluoro octanesulfonamide | N-EtFOSA |
| **Perfluoro sulfonamidoacrylates** | | | **$C_nF_{2n+1}$-$SO_2N(R_1)CH2CH2O$-CO-$C(R_2)=CH_2$** | | |
| | 25268-77-3 | 246-779-2 | 2-Propenoic acid, 2-[[(heptadecafluorooctyl)sulfonyl]methylamino]ethyl ester | N-methylperfluorooctane sulfonamidoethyl acrylate | N-MeFOSEA |

| *Group* | *CAS No.* | *EINECS-,ELINCS-,NLP-no.* | *substance name ( IUPAC or CAS Index Name)* | *common name* | *Abbreviation* |
|---|---|---|---|---|---|
| | 14650-24-9 | 238-699-1 | 2-Propenoic acid, 2-methyl-, 2-[[(heptadecafluorooctyl)sulfonyl]methylamino]ethyl ester | N-methylperfluorooctane sulfonamidoethyl methacrylate | N-MeFOSEMA |
| | 423-82-5 | 207-031-0 | 2-Propenoic acid, 2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester | N-ethylperfluorooctane sulfonamidoethyl acrylate | N-EtFOSEA |
| | 376-14-7 | 206-805-5 | 2-Propenoic acid, 2-methyl-, 2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester | N-ethylperfluorooctane sulfonamidoethyl methacrylate | N-EtFOSEMA |
| | 2357-60-0 | 219-097-8 | 2-Propenoic acid, 2-[[(heptadecafluorooctyl)sulfonyl]propylamino]ethyl ester | N-propylperfluorooctane sulfonamidoethyl acrylate | N-PrFOSEA |
| | 13285-40-0 | 236-298-6 | 2-Propenoic acid, 2-methyl-, 2-[[(heptadecafluorooctyl)sulfonyl]propylamino]ethyl ester | N-propylperfluorooctane sulfonamidoethyl methacrylate | N-PrFOSEMA |
| | 383-07-3 | 206-846-9 | 2-Propenoic acid, 2-[butyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester | N-butylperfluorooctane sulfonamidoethyl acrylate | N-BuFOSEA |
| **FOOTNOTE 1** | | | For substances that represent a mixture, subtract the weight of any component with a discrete CAS number that is also being reported separately under that CAS number. | | |

**ANNEX 3**
**LIST OF PERFLUORINATED CHEMICALS MANUFACTURED IN 2008**

| ***Substance (Common name)*** | ***CAS No.*** | ***Mass Qty of the substance as a residual or impurity in products*** |
|---|---|---|
| **PFOS and related substances** | | |
| Perfluorooctane sulfonate | 1763-23-1 | <3.5tonnes |
| Potassium perfluorooctane sulfonate | 2795-39-3 | |
| Ammonium perfluorooctane sulfonate | 29081-56-9 | |
| Perfluorooctane sulfonyl fluoride | 307-35-7 | |
| **PFAS and related substances** | | |
| Perfluorohexane sulfonate | 355-46-4 | <0.5 tonnes |
| Potassium perfluorohexane sulfonate | 3871-99-6 | |
| Perfluorohexane sulfonyl fluoride | 423-50-7 | |
| **PFOA and related substances** | | |
| PFOA | 335-67-1 | <5.5 tonnes |
| PFOA branched | 90480-55-0 | |
| Methyl perfluorooctanoate | 376-27-2 | |
| PFOA potassium salt | 2395-00-8 | |
| PFOA ammonium salt | 3825-26-1 | |
| Fatty acids, C7-13, perfluoro, ammonium salts | 72968-38-8 | |
| Perfluorooctyl iodide | 507-63-1 | |
| **C8:2 fluorotelomers and related substances** | | |
| C8-2 alcohol | 678-39-7 | |

| | | |
|---|---|---|
| C8-2 iodide | 2043-53-0 | |
| C8-2 methacrylate | 1996-88-9 | <20.0 tonnes |
| C8-2 acrylate | 27905-45-9 | |
| C8-2 olefin | 21652-58-4 | |
| **PFCA and related substances** | | |
| Perfluorododecanoic acid (PFDoA) | 307-55-1 | |
| Perfluorononanoic acid (PFNA) | 375-95-1 | |
| Ammonium perfluorononanoate (APFN) | 4149-60-4 | |
| Perfluorodecanoic acid (PFDA) | 335-76-2 | <1.5 tonnes |
| Perfluoroundecanoic acid (PFUnA) | 2058-94-8 | |
| C10-iodide | 423-62-1 | |
| C12-iodide | 307-60-8 | |
| C14-iodide | 307-63-1 | |
| C16-iodide | 355-50-0 | |
| **Longer chain fluorotelomers and related substances** | | |
| C10-2 alcohol | 865-86-1 | |
| C12-2 alcohol | 39239-77-5 | |
| C14-2 alcohol | 60699-51-6 | |
| C10-2 iodide | 2043-54-1 | |
| C12-2 iodide | 30046-31-2 | |
| C14-2 iodide | 65510-55-6 | <15 tonnes |
| C16-2 Iodide | 65150-94-9 | |
| C18-2 iodide | 65104-63-4 | |
| C10-2 methacrylate | 2144-54-9 | |
| C12-2 methacrylate | 6014-75-1 | |

| | | |
|---|---|---|
| C14-2 methacrylate | 4980-53-4 | |
| C10-2 acrylate | 17741-60-5 | |
| C12-2 acrylate | 34395-24-9 | |
| C14-2 acrylate | 34362-49-7 | |