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Proposed Risk Management Strategy for Perfluorooctane Sulfonate (PFOS), Its Salts and Its Precursors

The final ecological and human health screening assessment reports for PFOS, its salts and its precursors were published in Part I of the *Canada Gazette* on July 1, 2006. The final ecological screening assessment report concluded that PFOS, its salts and its precursors are considered to meet the criteria set out in section 64(a) of the *Canadian Environmental Protection Act, 1999* (CEPA 1999). It is also concluded that PFOS and its salts meet the criteria for persistence according to the CEPA 1999 *Persistence and Bioaccumulation Regulations*. The final human health screening assessment report concludes that PFOS, its salts and its precursors do not meet the criteria set out in section 64(c) of CEPA 1999. As a result, it is proposed that PFOS, its salts and its precursors be added to the list of Toxic Substances under Schedule I of CEPA 1999.

The Ministers of the Environment and Health must propose CEPA 1999 control instruments respecting preventative or control action to manage these substances no later than July 1, 2008. Furthermore, the proposed instruments must be implemented within 18 months thereafter. I am pleased to inform you that the proposed Risk Management Strategy respecting PFOS, its salts and its precursors is now available for online consultations. A copy of the proposed Risk Management Strategy has also been mailed directly to stakeholders.

The proposed Risk Management Strategy for PFOS, its salts and its precursors is intended to provide the framework for the development of the CEPA 1999 control instruments that are required to manage the environmental effects of these substances. The risk management objective is to achieve the lowest level of releases to the environment that is technically and economically feasible from all emissions sources of PFOS, its salts and its precursors.

The proposed **Risk Management Strategy** contains a brief description of the issue, background, current uses, known exposure sources, control measures in other jurisdictions and the proposed risk management approach for PFOS, its salts and its precursors.

The purpose of these consultations is to invite all interested and affected parties to provide their comments on the proposed Risk Management Strategy which will contribute to the development of control instruments under CEPA 1999. Based on the demand, a multi-stakeholder session may also be scheduled at a later date.

Environment Canada will review all written responses and any input received during consultation sessions that may be held and will take them into full account prior to developing control instruments under CEPA 1999.

Please send your written comments on the Risk Management Strategy by August 30, 2006 to either of the following addresses:

Regular mail:
Director
Chemicals Sector Division
Environment Canada
351 St. Joseph Blvd., 12th Floor
Gatineau QC K1A 0H3

Email: PFOS@ec.gc.ca

Please type "Consultation on PFOS Risk Management Strategy" in the subject line of your Email message.

If you have any questions on the Risk Management Strategy, please contact:

Greg Carreau
Chemicals Sector Division
Pollution Prevention Directorate
351 St. Joseph Boulevard, 13th Floor
Gatineau, QC K1A 0H3
Tel.: 819-934-8080
E-mail: PFOS@ec.gc.ca

John Buccini
Chemicals Sector Division
Environment Canada

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PERFLUOROCTANE SULFONATE (PFOS), ITS SALTS AND ITS PRECURSORS RISK MANAGEMENT STRATEGY

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1.0 ISSUE

Ecological and human health screening assessments were undertaken on perfluorooctane sulfonate (PFOS), its salts and its precursors under the categorization and screening assessment provisions of the *Canadian Environmental Protection Act, 1999* (CEPA 1999). The screening assessments were undertaken on the basis that some of these compounds were included in the Domestic Substances List (DSL) pilot list for screening based on their meeting the CEPA 1999 criteria for persistence and/or bioaccumulation and inherent toxicity, and in response to a request from a citizen to the Minister of the Environment to add these compounds to the Priority Substances List (PSL).

On July 1, 2006, the final ecological and human health screening assessment reports were published in Part I of the *Canada Gazette*. Based on the available data, the ecological screening assessment report concludes that PFOS, its salts and its precursors are entering into the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity. It is also concluded that PFOS and its salts meet the criteria for persistence according to the CEPA 1999 *Persistence and Bioaccumulation Regulations*. The weight of scientific evidence is sufficient to conclude that PFOS and its salts are bioaccumulative but the relevant data for these substances do not meet the numeric criteria for bioaccumulation as defined in the CEPA 1999 *Persistence and Bioaccumulation Regulations*. Therefore, PFOS and its salts do not meet the conditions set out under subsection 77(3) for mandatory addition to the Virtual Elimination list.

The final ecological screening assessment report concludes that PFOS, its salts and its precursors are considered to meet the criteria set out in section 64(a) of CEPA 1999. The final human health screening assessment report concludes that PFOS, its salts and its precursors do not meet the criteria set out in section 64(c) of CEPA 1999.

The Ministers of the Environment and Health must now propose a CEPA 1999 control instrument respecting preventative or control action to manage these substances no later than July 1, 2008. Furthermore, the proposed instrument must be implemented within 18 months thereafter.



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2.0 BACKGROUND

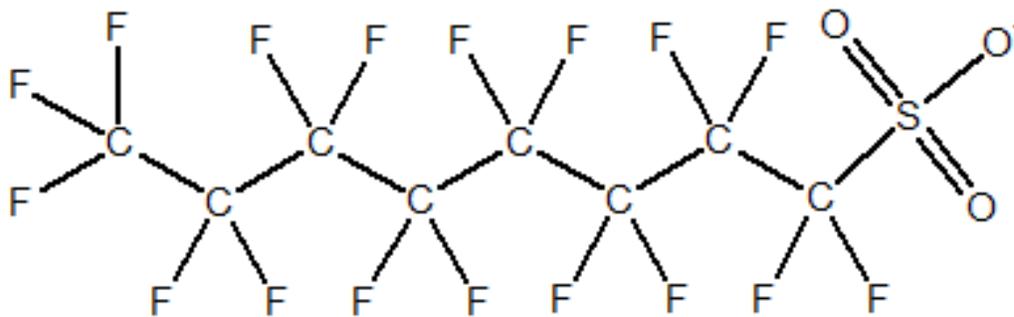
- [2.1 Substances](#)
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2.1 Substances

PFOS, its salts and its precursors all belong to the larger class of fluorochemicals referred to as perfluorinated alkyl (PFA) compounds which contain carbons that are completely saturated by fluorine. It is the strength of the carbon-fluorine bonds that contributes to the extreme stability and unique properties of these perfluorochemicals.

For the purpose of this document, the expression "PFOS and its salts" refers to the group of compounds consisting of the PFOS anion, the PFOS acid (PFOSH) and the PFOS salts (PFOS potassium salt, PFOS ammonium salt, PFOS lithium salt and PFOS diethanol-amine salt). While PFOS can exist in anionic, acid and salt forms, the PFOS anion is the most common form in the environment. The PFOS anion has the molecular formula $C_8F_{17}SO_3^-$ and has the structural formula $CF_3(CF_2)_7SO_3^-$ as shown in [Figure 1](#).

Figure 1: PFOS anion structure



The expression "PFOS precursors" refers to compounds that contain the $C_8F_{17}SO_2$, $C_8F_{17}SO_3$ or $C_8F_{17}SO_2N$ group. These compounds were included in the ecological and human health screening assessments and in this Risk Management Strategy since these substances have similar use applications, have the potential to transform or degrade to PFOS in the environment and the final degradation product of these substances is PFOS.

Appendix 1 lists the compounds considered to be PFOS, its salts and PFOS precursors in the final ecological screening assessment report. This list is not considered to be exhaustive and does not preclude PFOS precursors not appearing on this list.

2.2 Production, Import and Use of PFOS, its Salts and its Precursors

PFOS, its salts and its precursors are not manufactured in nor exported from Canada but rather are imported as raw chemicals, products and formulations and in manufactured articles.

Approximately 600 tonnes of perfluorinated alkyl compounds were imported into Canada during 1997-2000, with PFOS and its precursors accounting for 43% of imported perfluorinated alkyl compounds. The primary uses of these substances were applications involving water, oil, soil and grease repellents for fabric, leather, packaging and rugs and carpets; as well as additives in firefighting foams, aviation hydraulic fluids, photographic photofinishing, paints and coatings. The primary supplier of PFOS, its salts and its precursors voluntarily phased out the production of these substances in 2002.

Background information collected in support of this Risk Management Strategy indicates that, since 2002, imports of PFOS, its salts and its precursors into Canada have essentially ceased. This was confirmed by a use pattern survey published on January 15, 2005 under the authority of CEPA 1999. The survey targeted manufacturers, exporters and importers of PFOS in amounts exceeding 100 kg in concentrations of greater than 10 grams per kilogram for the 2004 calendar year. The results indicate that approximately 3 tonnes of PFOS were imported in 2004 for use as a surfactant in the electroplating sector. The survey also reaffirmed that there are no manufacturers or exporters of PFOS in Canada. With the exception of an estimated 300 tonne stockpile (representing approximately 3 tonnes of PFOS) of Aqueous Film Forming Foam (AFFF) used for firefighting that was purchased prior to 2002, it is believed that most supplies of PFOS in all other sectors have been depleted.

Despite the voluntary phase-out of PFOS production and the current low level of PFOS imports, the potential does exist for PFOS and PFOS containing products and articles to be imported into Canada in greater quantities in the future as some PFOS production has been identified in other countries.



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3.0 WHY WE NEED ACTION

The final ecological screening assessment report concluded that PFOS, its salts and its precursors are entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity. PFOS is anthropogenic and has been detected in vertebrate and invertebrate biota worldwide. In Canada, PFOS has been detected in higher trophic level biota such as fish, fish-eating birds, and Arctic marine mammals far from known sources or manufacturing facilities. A potential risk may occur through bioaccumulation and biomagnification of PFOS in wildlife.

The ecological screening assessment concluded that PFOS and its salts meet the criteria for persistence under the *Persistence and Bioaccumulation Regulations*. While there is scientific evidence that PFOS is a persistent organic pollutant that accumulates in animals and magnifies in food chains, PFOS does not meet the numeric criteria for bioaccumulation defined in the *Persistence and Bioaccumulation Regulations* and therefore PFOS, its salts and its precursors do not meet the conditions set out under subsection 77(3) for mandatory addition to the Virtual Elimination List.

Given the conclusions of the ecological screening assessment, PFOS, its salts and its precursors will be managed as a group under the provisions of CEPA 1999 with the objective of achieving the lowest level of releases to the environment that is technically and economically feasible from all emission sources. **Section 8** of this report outlines the proposed risk management approach and objectives in more detail.

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4.0 CURRENT USES

A use pattern survey with respect to PFOS, its salts and its precursors, under the authority of paragraph 71(1)(b) of CEPA 1999, was conducted in January 2005. Companies were required to report if they were involved in activities pertaining to the manufacture, import or export of more than 100 kilograms of a substance belonging to the class substances identified in Schedule 1 to the Notice, whether the substance is "alone, in a mixture or in a product, and in a concentration greater than 10 grams per kilogram in a mixture or in a product".

The survey results confirmed that PFOS, its salts and its precursors are not being manufactured in Canada or being exported from Canada. Only one substance was imported into Canada representing a quantity of approximately 3 tonnes of PFOS. The imported substance was sold as a product that is used as a surfactant in the electroplating sector.

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5.0 EXPOSURE SOURCES

There are no known natural sources of PFOS, its salts or its precursors in the environment. Release of PFOS to the environment varies with the process or product and disposal practices of the end user.

PFOS, its salts and its precursors may enter into the environment through treated or untreated municipal/industrial wastewater discharges to surface water and through leachates from landfills when products and materials containing these substances are sent for final disposal. PFOS may also be released directly to air, land and surface water when products containing PFOS are used. These exposure sources are discussed in this section.

Aqueous Film Forming Foams (AFFF)

AFFF manufactured and imported into Canada prior to the voluntary phase-out in production in 2002 contained PFOS. AFFF is used primarily to fight fuel related fires. Sectors using AFFF include the military and other Government of Canada operations, civil aviation, municipal fire departments, petroleum, petrochemical and emergency responders. Equipment used to dispense AFFF may be either fixed or portable. Fixed systems are mounted in buildings or other permanent structures and portable systems may include moveable fire extinguishers or systems mounted on emergency response vehicles used to access the location of the fire.

Releases of PFOS may occur when foam is discharged during testing and training exercises, when fighting fuel fires, during accidental releases or when out of date product must be retired and sent for disposal. These activities may result in direct discharge of AFFF to surface water, groundwater and land. Depending on the nature of the activity, it is not always possible to collect and pre-treat or contain the AFFF residual for proper disposal. AFFF that is collected is treated as hazardous waste and is sent to either a hazardous waste landfill or to an approved thermal destruction facility for high temperature incineration. Current industry estimates suggest that an average of 10% of the existing AFFF stock is expended each year.

Background information collected in this industry sector shows that PFOS-based AFFF has

not been imported into Canada since 2002. However, given that the average lifespan of AFFF can be in the order of 25 years or longer and that the estimated existing stock of PFOS AFFF stock at airports, military installations and industrial facilities in Canada is approximately 300 tonnes (representing approximately 3 tonnes of PFOS), AFFF remains a potential PFOS emission source.

Surfactant Use in the Electroplating Sector

PFOS based surfactants are used to reduce the surface tension of plating solutions in the electroplating sector. This is the only sector importing PFOS (approximately 3 tonnes in 2004) into Canada at the present time. PFOS may enter the environment via the rinse water from the facility that is discharged directly to the municipal sewer systems if the effluent quality meets the sewer bylaw requirements. PFOS is not removed in these municipal systems and flows through into the downstream aquatic environment. PFOS may also be contained in the sewage sludge that is generated by the municipal treatment system that may be either applied as a bio-solid on land or sent to a residential landfill. PFOS is also a constituent of the metal sludge that is consolidated at the electroplating facility and then removed as a hazardous waste. This waste may be sent for recycling, used as an input to the steel industry where the residual PFOS is destroyed through high temperature incineration or placed in an approved hazardous waste landfill for final disposal.

Industrial/Manufacturing Processes

The use of PFOS, its salts and its precursors in industrial and manufacturing processes includes a wide range of operations in which these substances are used as product aids to produce industrial, commercial and consumer materials.

PFOS, its salts and its precursors have been used as product aids in tanneries, textile mills, carpet manufacturers and packaging producers to treat surfaces for water, oil, and soil and grease repellency. The releases of PFOS, its salts and its precursors from these sources occur primarily through the discharge to process wastewaters from industrial or manufacturing processes. However, with the voluntary phase-out in production in 2002, it is believed that PFOS is no longer used in these manufacturing processes.

Material Disposal

Materials refer to articles to which PFOS containing products have been applied. This may include rugs and carpets, furniture, fabrics, leather articles, paper, packaging and photographic material. However, since 2002, PFOS-based products have not been used in Canada for the treatment of these materials and the import of materials containing PFOS is believed to be limited.

The release of PFOS, its salts and its precursors from these sources may occur when legacy materials purchased prior to 2002 or when material imported from jurisdictions without PFOS restrictions are disposed of in landfill sites at the end of their operational life or in the case of some paper products, sent to recycling facilities for processing.

Landfilling may result in releases of PFOS, its salts and its precursors to soil, surface water and then potentially to groundwater. Releases from landfills are dependent on the concentration of these substances remaining in the material at their end of life, landfilling practices and the existence of leachate collection systems.

It should be noted that leachates that may contain PFOS that is collected from landfills is normally taken to municipal treatment facilities. Since PFOS is not removed from the influent at these facilities, the PFOS is either passed directly through and into the downstream aquatic environment or is contained in bio-solid sludge that is either applied on the land or returned to the landfill that originally generated the leachates.

The majority of the paper and packaging that was coated with PFOS is sent to landfills but there is a percentage that would have been sent to recycling facilities for re-processing into other products. Based on the phase-out in production in December 2002 and the limited retention time for this material in the manufacturing and recycling systems, it is believed that most of this material has already been processed.

Municipal incineration of solid waste is a potential source of PFOS emissions. However, incineration represents less than 5% of solid waste disposal in Canada.

Long-Range Atmospheric Transport

PFOS has been detected in remote sites around the world, including the Canadian Arctic where it is present at elevated levels, for example, in the livers of polar bears and ringed seals, which suggests that the precursors to PFOS undergo long-range transport. This possible long-range atmospheric transport of PFOS precursors through the atmosphere or through the ocean currents is a potential source of PFOS loadings to the Canadian environment. Manufacturing processes of PFOS, its salts and its precursors, as well as uses and disposal of formulations, products and materials outside of Canada may also contribute to the presence of PFOS in Canada. Although polar bear and ringed seal sample data from 2005 has shown the first decline in levels since the reduction in worldwide production that began in 2000, more sample data must be collected in future years before it can be confirmed if the reductions are indeed the start of a long term downward trend in PFOS levels.

Material Use

The day-to-day use of certain materials that have been treated with PFOS based water, oil, soil and grease repellents have the potential to release PFOS, its salts and its precursors to the environment. Potential emissions to wastewater effluents have been identified from the washing of fabrics and by vacuuming or steam cleaning rugs and carpets. The output from these activities is usually in the form of liquid effluent which makes its way to the municipal treatment facility or is in the form of solid waste which is sent to a residential landfill. The final fate of the PFOS in these waste streams is described in the **Material Disposal** section 5 of this report. However, since 2002, PFOS-based products have not been used in Canada for the treatment of these materials and the current imports of materials containing PFOS are believed to be limited.

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6.0 CONSIDERATIONS

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6.1 Existing Controls on PFOS, its salts and its precursors

Canada

There are no existing controls on PFOS, its salts and its precursors in Canada.

United States

The United States Environmental Protection Agency (EPA) has adopted two federal *Significant New Use Rules* (SNUR) for 88 perfluorooctyl sulfonate substances that apply to new producers and for new uses of these substances. A third SNUR for 183 perfluoroalkyl sulfonate substances has been posted for stakeholder review by August 8, 2006. The 271 substances listed in the three SNURs include perfluorooctane sulfonic acid (PFOSH) and certain of its salts, perfluorooctane sulfonyl fluoride (POSF), certain higher and lower homologues of PFOSH and POSF, polymers that are derived from PFOSH and its homologues, as well as other substances that have the potential to degrade to PFOSH.

The SNURs require manufacturers and importers to notify the EPA at least 90 days before new manufacture or import of these substances. This provides the EPA with the necessary time to evaluate the intended new use and prohibit or limit the new activity if necessary. While the SNURs do not require current manufacturers to stop producing or selling the substances, the only manufacturer in the United States voluntarily discontinued production in 2002. Therefore, once existing stocks are exhausted, the three SNURs will essentially restrict all

manufacture and importation.

Four uses are identified as not significant new uses as defined by the SNURs, and as such are exempt from the restrictions on manufacture and importations. These four uses are:

1. As an anti-erosion additive in fire-resistant phosphate ester aviation hydraulic fluids;
2. As a component of a photoresist substance, including a photo acid generator or surfactant, or as a component of an anti-reflective coating used in a photomicro lithography process to produce semiconductors or similar components of electronic or other miniaturized devices;
3. In coatings for surface tension, static discharge, and adhesion control for analog or digital imaging films, papers and printing plates, or as a surfactant in mixtures to process imaging films; and,
4. As an intermediate only to produce other chemical substances to be used solely for the uses listed in 1, 2, or 3.

Internationally

The Organization for Economic Co-operation and Development (OECD) hazard assessment report has concluded that PFOS's persistence, its presence in the environment and in a number of wildlife species, and bioaccumulation potential are a cause for concern. In 2002, a number of OECD countries agreed to contact the PFOS manufacturers in their countries to determine whether these companies had plans to phase out PFOS production. As well, member countries agreed to report every two years on new PFOS-related information concerning production, use and exposure, along with new information on routes of exposure. A survey on the production and use of PFOS, PFAS, perfluorooctanoic acid (PFOA), related substances, products and mixtures containing these substances was circulated to OECD countries in 2004 to support these actions. Ten member countries submitted responses. The results indicated that substances containing solely PFOS and PFOS products and mixtures are still being imported and manufactured by member countries. The majority of the reported PFOS use is in the firefighting (existing AFFF stock), metal plating, photographic, semiconductor and aviation (hydraulic fluids) sectors. Essential uses were reported for existing stocks of AFFF, aircraft hydraulic fluids, surfactants for metal plating and in the photographic and semiconductor sectors. No new uses for PFOS were reported. This survey is being repeated in 2006.

Australia has produced two Alerts concerning PFOS through its National Industrial Chemicals Notification and Assessment Scheme (NICNAS). The first Alert indicated that all 3M water, oil, soil and grease repellent products containing PFOS were to be phased out in Australia by September 2002 and PFOS use for leather products was to be phased out by March 2003. All other PFOS-containing products, including firefighting foams and industrial additives, were to be phased out in Australia by December 2003. The Alert states that the NICNAS will consider regulatory actions regarding PFOS once the OECD concludes its assessment of PFOS. The second Alert, dated April 30th 2003, makes recommendations regarding PFOS, PFAS and PFOA. These recommendations include:

- That PFOS (and PFAS-based chemicals) be used only for essential uses for which there is no suitable alternative, such as certain class B firefighting foams;
- That Class B firefighting foams not be used in fire training exercises; and,
- That caution be used in selecting PFOA as an alternative for PFOS since PFOA may show the same environmental and health concerns as PFOS.

In April 2005, Norway proposed major reductions in emissions of PFOS by 2010.

Sweden proposed the listing of PFOS and its precursors in Annex A of the Stockholm Convention on Persistent Organic Pollutants (POPs) in June 2005. At the November 2005 meeting of the Persistent Organic Pollutants Review Committee, it was decided that the screening criteria of the Convention had been fulfilled for PFOS and that an ad hoc working group under the Convention would be established to review the proposal further and to prepare a draft risk profile.

In October 2005, the UK published a proposed national action plan that would restrict the use and marketing of PFOS and substances that degrade to it.

In December 2005, the Parties to the United Nations Economic Commission for Europe (UNECE) Long-Range Transboundary Air Pollution (LRTAP) Convention's Protocol on POPs agreed that PFOS should be considered as a persistent organic pollutant. The convention will explore management strategies in 2006.

The European Union published a proposed directive relating to restrictions on the marketing and use of PFOS on December 5, 2005. The restrictions relating to PFOS substances include:

- May not be placed on the market or used as a substance or constituent of preparations in a concentration equal or higher than 0.1% by mass;
- May not be placed on the market in products or parts thereof in a concentration equal or higher than 0.1% by mass; and,
- Exemptions to the restrictions include coatings for photolithography processes, photographic coatings applied to films, papers, or printing plates, mist suppressants for chromium plating, hydraulic fluids for aviation, firefighting foams and closed systems releasing less than 1 µg per kg and where the release corresponds to less than 0.1% by mass of the PFOS used in the system.

6.2 Proposed Controls on the Metal Plating Industry in Canada

The *Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulations* under CEPA 1999 have been proposed to limit emissions of hexavalent chromium from chromium electroplating, chromium anodizing and reverse etching facilities in Canada and are expected to come into force in 2006. One of the three permissible control options under these proposed regulations is a requirement to maintain the surface tension of plating solutions below specified limits through the addition of surfactants combined with daily measurements of surface tension. The majority of the surfactants currently in use in the electroplating sector contain PFOS. Environment Canada recognizes the need for consistency between the requirements of the proposed *Chromium Electroplating, Chromium Anodizing and Reverse Etching Regulation* and the proposed risk management approach for PFOS. The proposed consultation approach, as outlined in **section 9** of this report, will provide the opportunity for continued discussions between Environment Canada and affected stakeholders on these two initiatives.

6.3 Alternatives

Alternatives to PFOS, its salts and its precursors are available for the vast majority of industrial and manufacturing applications. The voluntary phase-out of PFOS production in 2002 accelerated the switch to alternative products.

Research is ongoing to identify alternative substances to deal with the remaining applications for photolithography, surfactants for electroplating, photographic coatings and aviation hydraulic fluids where PFOS is still used.

Alternatives that have been chosen in the past include perfluorobutane sulphonate substances, fluorotelomers as well as hydrocarbon-based and silicone-based surfactants. It should be noted that similar environmental concerns have been noted internationally for some fluorotelomer chemistries. In this regard, *Regulations Amending the Prohibition of Certain Toxic Substances Regulations 2005* to include four new fluorotelomer-based substances were published on June 17, 2006.

6.4 Destruction

PFOS, its salts and its precursors are expected to be effectively destroyed by high temperature incineration. The carbon-sulphur bond in PFOS, its salts and its precursors is relatively weak and is expected to break down first at elevated temperatures ranging from 760 to 982°C. Other technologies that have been reported to safely destroy PFOS, its salts and its precursors include plasma gasification, microwave plasma and removal of PFOS via carbon adsorption followed by incineration at 1200°C.

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7.0 PROPOSED OBJECTIVES

- [7.1 Environmental Objective](#)
- [7.2 Risk Management Objective](#)

7.1 Environmental Objective

The ecological screening assessment concluded that PFOS, its salts and its precursors are entering into the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity. Furthermore, the ecological screening assessment concluded that PFOS and its salts are persistent in all media and a potential risk may occur through bioaccumulation and biomagnification of PFOS in wildlife. Based on these conclusions, the ultimate environmental objective is to reduce the concentrations of PFOS in the Canadian environment to the lowest level possible.

7.2 Risk Management Objective

The proposed risk management objective is to achieve the lowest level of release to the environment that is technically and economically feasible from all emission sources of PFOS, its salts and its precursors.

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8.0 PROPOSED RISK MANAGEMENT APPROACH

Given the conclusions of the final ecological screening assessment, as outlined in [section 3](#) of this report, action is required to prevent the reintroduction of PFOS, its salts and its precursors into the Canadian market and to address the remaining uses.

It is, therefore, proposed that PFOS, its salts and compounds that contain the C₈F₁₇SO₂, C₈F₁₇SO₃ or C₈F₁₇SO₂N group be added to the *Prohibition of Certain Toxic Substances Regulations, 2005*. This will result in a prohibition on manufacture, use, sale, offer for sale and import of PFOS its salts and its precursors and products or formulations containing PFOS, its salts and its precursors.

Standard exemptions for the use of PFOS, its salts and its precursors in a laboratory for scientific research and as a laboratory analytical standard are provided for in the *Prohibition of Certain Toxic Substances Regulations, 2005*. Additional exemptions may be considered for applications where it has been clearly demonstrated that viable alternatives are not yet available in the marketplace or when it is has been clearly demonstrated that the proposed alternatives may also represent an environmental or health risk. Exemptions that are already being considered include: the use of existing stock of PFOS AFFF, other than for testing or training purposes, for a period of up to five years following the date on which the proposed regulations come into force, and the import of manufactured articles that may contain PFOS.

The average PFOS content of AFFF is approximately 1% and the 3 tonnes of PFOS in the existing stockpile of AFFF is distributed across a large number of facilities in Canada. The proposed use restriction on PFOS AFFF effective 5 years after the coming into force of the Regulations is proposed to allow an orderly transition to non-PFOS AFFF while minimizing releases of PFOS to the environment from the long-term use of existing stocks. In addition to the proposed use restriction, a complementary instrument under CEPA 1999 is being considered to ensure best management practices are being employed during the storage, use and disposal of PFOS AFFF. Further consultation with affected stakeholders is required prior to concluding on the need for a complementary instrument targeting PFOS AFFF.

Environment Canada has considered proposing restrictions on the import of manufactured articles containing PFOS. Canada's major trading partners have already or will soon be implementing restrictions on the use of PFOS and there are expectations that global production of PFOS will eventually be eliminated or significantly reduced. As a result, the total number of imported articles that may contain PFOS will be declining without any direct Canadian intervention. Use pattern data on current imports of manufactured items containing PFOS into Canada is limited. In some instances, the originating country and the Canadian importers may not even be aware that PFOS is contained in the article. Furthermore, analytical methodologies to detect and quantify PFOS concentrations in a wide range of imported articles that could contain these substances would need to be developed.

Therefore, due to the apparent decline in global PFOS production, the concerted actions in other countries and in international forums to address PFOS as well as practical difficulties in enforcing such a measure, restrictions on the import of articles are not being proposed at this time. However, complementary instruments under CEPA 1999 may be considered in the future to address imported articles. A complementary approach for imported articles is being considered since, despite the declining global production and the actions in other jurisdictions and at international forums, it is possible that emerging markets may begin to export more articles containing PFOS to Canada in the future. Consultations with affected stakeholders will be required prior to determining the need for complementary instruments. The proposed consultation approach outlined in **section 9** of this strategy will provide an opportunity to initiate these discussions.

Furthermore, Environment Canada will continue to engage international partners related to the long term reduction and eventual elimination of the worldwide manufacturing and use of PFOS. Environment Canada will also continue domestic research and monitoring activities related to the presence of PFOS in the Canadian environment to contribute to the international body of knowledge on perfluorinated substances and to evaluate if the environmental objective and risk management objective are being achieved.

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9.0 PROPOSED CONSULTATION APPROACH

- 9.1 [General Approach](#)
- 9.2 [Stakeholders](#)

9.1 General Approach

A mail-out and on-line consultation approach is planned to present this risk management strategy to stakeholders. Based on the demand, a multi-stakeholder consultation session may be scheduled. The consultations will address:

- The proposed risk management approach;
- The proposed exemptions; and,
- Any additional exemptions that may be identified.

9.2 Stakeholders

- Canadian importers of PFOS, its salts and its precursors;
- Canadian importers of articles containing PFOS, its salts and its precursors;
- Canadian users of PFOS based surfactants in the electroplating sector;
- Canadian users of PFOS AFFF use for firefighting. This would include, but not be limited to, Airport Authorities, Department of National Defence, Transport Canada, Department of Fisheries and Oceans, municipalities, petrochemical manufacturers and refineries;
- Industry associations representing the various industrial sectors referenced above;
- Environmental non-government organizations (ENGOS);
- Provincial and Territorial governments; and
- Federal government departments and agencies.



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10. NEXT STEPS/TIMELINES

Action	Target Completion Date
Stakeholder Consultations on Risk Management Strategy	July 2006
Publish proposed Regulations in Part I of the <i>Canada Gazette</i>	December 2006
Publish final Regulations in Part II of the <i>Canada Gazette</i>	September 2007

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Appendix 1 List of PFOS, its Salts and its Precursors

(This list is not considered to be exhaustive and does not preclude PFOS precursors not appearing on this list)

CAS No.	Common name	Chemical name	Molecular formula
N/A	PFOS anion	1-Octanesulfonate, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-	C ₈ F ₁₇ SO ₃ ⁻
1763-23-1	PFOS acid (perfluoro-octane-sulfonic acid) (also called PFOSH)	1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-	C ₈ F ₁₇ SO ₃ H
2795-39-3	PFOS potassium (K ⁺) salt	1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt	C ₈ F ₁₇ SO ₃ K
29081-56-9	PFOS ammonium (NH ₄ ⁺) salt	1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt	C ₈ F ₁₇ SO ₃ NH ₄
29457-72-5	PFOS lithium (Li ⁺) salt	1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, lithium salt	C ₈ F ₁₇ SO ₃ Li
70225-14-8	PFOS diethanol-amine (DEA) salt	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)	C ₈ F ₁₇ SO ₃ NH(CH ₂ CH ₂ OH) ₂
307-35-7	POSF	1-Octanesulfonyl fluoride, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-	C ₈ F ₁₈ O ₂ S
1691-99-2	N-EtFOSE alcohol	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)-	C ₁₂ H ₁₀ F ₁₇ NO ₃ S
4151-50-2	N-EtFOSA	1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-	C ₁₀ H ₆ F ₁₇ NO ₂ S
24448-09-7	N-MeFOSE alcohol	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-	C ₁₁ H ₈ F ₁₇ NO ₃ S
31506-32-8	N-MeFOSA	1-Octanesulfonamide, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-methyl-	C ₉ H ₄ F ₁₇ NO ₂ S
25268-77-3	N-MeFOSEA	2-Propenoic acid, 2-[[heptadecafluorooctyl]sulfonyl]methylamino]ethyl ester	C ₁₄ H ₁₀ F ₁₇ NO ₄ S
423-82-5	N-EtFOSEA	2-Propenoic acid, 2-[ethyl[[heptadecafluorooctyl]sulfonyl]amino]ethyl ester	C ₁₅ H ₁₂ F ₁₇ NO ₄ S
2250-98-8		1-Octanesulfonamide, N,N',N''-[phosphinylidynetris(oxy-2,1-ethanediy)]tris[N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-	C ₃₆ H ₂₇ F ₅₁ N ₃ O ₁₀ PS ₃

2991-51-7	Glycine, N-ethyl-N-[(heptadecafluorooctyl)sulfonyl]-, potassium salt	$C_{12}H_8F_{17}NO_4S\cdot K$
29117-08-6	Poly(oxy-1,2-ethanediyl), α -[2-ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]- ω -hydroxy-	$(C_2H_4O)_n C_{12}H_{10}F_{17}NO_3S$
30381-98-7	1-Octanesulfonamide, N,N-[phosphinicobis(oxy-2,1-ethanediyl)]bis[N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt	$C_{24}H_{19}F_{34}N_2O_8PS_2\cdot H_3N$
38006-74-5	1-Propanaminium, 3-[[[heptadecafluorooctyl)sulfonyl]amino]-N,N,N-trimethyl-, chloride	$C_{14}H_{16}F_{17}N_2O_2S\cdot Cl$
52550-45-5	Poly(oxy-1,2-ethanediyl), α -[2-[[[heptadecafluorooctyl)sulfonyl]propylamino]ethyl]- ω -hydroxy-	$(C_2H_4O)_n C_{13}H_{12}F_{17}NO_3S$
56773-42-3	Ethanaminium, N,N,N-triethyl-, salt with 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-1-octanesulfonic acid (1:1)	$C_8H_{20}N\cdot C_8F_{17}O_3S$
57589-85-2	Benzoic acid, 2,3,4,5-tetrachloro-6-[[[3-[[[heptadecafluorooctyl)sulfonyl]oxy]phenyl]amino]carbonyl]-, monopotassium salt	$C_{22}H_6Cl_4F_{17}NO_6S\cdot K$
67939-88-2	1-Octanesulfonamide, N-[3-(dimethylamino)propyl]-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, monohydrochloride	$C_{13}H_{13}F_{17}N_2O_2S\cdot ClH$
67969-69-1	1-Octanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-N-[2-(phosphonoxy)ethyl]-, diammonium salt	$C_{12}H_{11}F_{17}NO_6PS_2\cdot H_3N$
68298-11-3	1-Propanaminium, 3-[[[heptadecafluorooctyl)sulfonyl](3-sulfo)propyl]amino]-N-(2-hydroxyethyl)-N,N-dimethyl-, hydroxide, inner salt	$C_{18}H_{23}F_{17}N_2O_6S_2$
68298-62-4	2-Propenoic acid, 2-butyl[[heptadecafluorooctyl)sulfonyl]amino]ethyl ester, telomer with 2-butyl[[pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, methyloxirane polymer with oxirane di-2-propenoate, methyloxirane polymer with oxirane mono-2-propenoate and 1-octanethiol	$(C_{17}H_{16}F_{17}NO_4S\cdot C_{16}H_{16}F_{15}NO_4S\cdot W_{99}\cdot W_{99})_x\cdot C_8H_{18}S$
68298-78-2	2-Propenoic acid, 2-methyl-, 2-[[[[[5-[[[2-ethyl[[[heptadecafluorooctyl)sulfonyl]amino]ethoxy]carbonyl]amino]-2-methylphenyl]amino]carbonyl]oxy]propyl ester, telomer with butyl 2-propenoate, 2-[[[[[5-[[[2-ethyl[[[nonafluorobutyl)sulfonyl]amino]ethoxy]carbonyl]amino]-2-methylphenyl]amino]carbonyl]oxy]propyl 2-methyl-2-propenoate, 2-[[[[[5-[[[2-ethyl[[[pentadecafluoroheptyl)sulfonyl]amino]ethoxy]carbonyl]amino]-2-methylphenyl]amino]carbonyl]oxy]propyl 2-methyl-2-propenoate, 2-[[[[[5-[[[2-ethyl[[[tridecafluorohexyl)sulfonyl]amino]ethoxy]carbonyl]amino]-2-methylphenyl]amino]carbonyl]oxy]propyl 2-methyl-2-propenoate, 2-[[[[[5-[[[2-ethyl[[[undecafluoropentyl)sulfonyl]amino]ethoxy]carbonyl]amino]-2-methylphenyl]amino]carbonyl]oxy]propyl 2-methyl-2-propenoate, 2-[[[[[5-[[[2-ethyl[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate, 2-[methyl[[[nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[[pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[[tridecafluorohexyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[[undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate and 1-octanethiol	$(C_{28}H_{28}F_{17}N_3O_8S\cdot C_{27}H_{28}F_{15}N_3O_8S\cdot C_{26}H_{28}F_{13}N_3O_8S\cdot C_{25}H_{28}F_{11}N_3O_8S\cdot C_{24}H_{28}F_9N_3O_8S\cdot C_{14}H_{10}F_{17}NO_4S\cdot C_{13}H_{10}F_{15}NO_4S\cdot C_{12}H_{10}F_{13}NO_4S\cdot C_{11}H_{10}F_{11}NO_4S\cdot C_{10}H_{10}F_9NO_4S\cdot C_7H_{12}O_2)_x\cdot C_8H_{18}S$
68329-56-6	2-Propenoic acid, eicosyl ester, polymer with 2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate, hexadecyl 2-propenoate, 2-[methyl[[[nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[[pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[[tridecafluorohexyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[[undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate and octadecyl 2-propenoate	$(C_{23}H_{44}O_2\cdot C_{21}H_{40}O_2\cdot C_{19}H_{36}O_2\cdot C_{14}H_{10}F_{17}NO_4S\cdot C_{13}H_{10}F_{15}NO_4S\cdot C_{12}H_{10}F_{13}NO_4S\cdot C_{11}H_{10}F_{11}NO_4S\cdot C_{10}H_{10}F_9NO_4S)_x$

68555-90-8	2-Propenoic acid, butyl ester, polymer with 2-[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate, 2-[methyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(tridecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate and 2-[methyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate	$(C_{14}H_{10}F_{17}NO_4S-C_{13}H_{10}F_{15}NO_4S-C_{12}H_{10}F_{13}NO_4S-C_{11}H_{10}F_{11}NO_4S-C_{10}H_{10}F_9NO_4S-C_7H_{12}O_2)_x$
68555-91-9	2-Propenoic acid, 2-methyl-, 2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester, polymer with 2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(tridecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate and octadecyl 2-methyl-2-propenoate	$(C_{22}H_{42}O_2 \cdot C_{16}H_{14}F_{17}NO_4S-C_{15}H_{14}F_{15}NO_4S-C_{14}H_{14}F_{13}NO_4S-C_{13}H_{14}F_{11}NO_4S-C_{12}H_{14}F_9NO_4S)_x$
68555-92-0	2-Propenoic acid, 2-methyl-, 2-[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl ester, polymer with 2-[methyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[methyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[methyl[(tridecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[methyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate and octadecyl 2-methyl-2-propenoate	$(C_{22}H_{42}O_2 \cdot C_{15}H_{12}F_{17}NO_4S-C_{14}H_{12}F_{15}NO_4S-C_{13}H_{12}F_{13}NO_4S-C_{12}H_{12}F_{11}NO_4S-C_{11}H_{12}F_9NO_4S)_x$
68586-14-1	2-Propenoic acid, 2-[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl ester, telomer with 2-[methyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, α -(2-methyl-1-oxo-2-propenyl)- ω -hydroxypoly(oxy-1,2-ethanediyl), α -(2-methyl-1-oxo-2-propenyl)- ω -[(2-methyl-1-oxo-2-propenyl)oxy]poly(oxy-1,2-ethanediyl), 2-[methyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(tridecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate and 1-octanethiol	$(C_{14}H_{10}F_{17}NO_4S-C_{13}H_{10}F_{15}NO_4S-C_{12}H_{10}F_{13}NO_4S-C_{11}H_{10}F_{11}NO_4S-C_{10}H_{10}F_9NO_4S \cdot (C_2H_4O)_n \cdot C_8H_{10}O_3 \cdot (C_2H_4O)_n \cdot C_4H_6O_2)_x \cdot C_8H_{18}S$
68649-26-3	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)-, reaction products with N-ethyl-1,1,2,2,3,3,4,4,4-nonafluoro-N-(2-hydroxyethyl)-1-butanedisulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-N-(2-hydroxyethyl)-1-heptanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-N-(2-hydroxyethyl)-1-hexanesulfonamide, N-ethyl-1,1,2,2,3,3,4,4,5,5,5-undecafluoro-N-(2-hydroxyethyl)-1-pentanesulfonamide, polymethylenepolyphenylene isocyanate and stearyl alc.	$(C_{18}H_{38}O \cdot C_{12}H_{10}F_{17}NO_3S-C_{11}H_{10}F_{15}NO_3S \cdot C_{10}H_{10}F_{13}NO_3S \cdot C-H_{10}F_{11}NO_3S-C_8H_{10}F_9NO_3S \cdot \text{Unspecified})_x$
68867-62-9	2-Propenoic acid, 2-methyl-, 2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester, telomer with 2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(tridecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 1-octanethiol and α -(1-oxo-2-propenyl)- ω -methoxypoly(oxy-1,2-ethanediyl)	$(C_{16}H_{14}F_{17}NO_4S-C_{15}H_{14}F_{15}NO_4S-C_{14}H_{14}F_{13}NO_4S-C_{13}H_{14}F_{11}NO_4S-C_{12}H_{14}F_9NO_4S \cdot (C_2H_4O)_n \cdot C_4H_6O_2)_x \cdot C_8H_{18}S$
68877-32-7	2-Propenoic acid, 2-methyl-, 2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl ester, polymer with 2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(tridecafluoroheptyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate, 2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl 2-methyl-2-propenoate and 2-methyl-1,3-butadiene	$(C_{16}H_{14}F_{17}NO_4S-C_{15}H_{14}F_{15}NO_4S-C_{14}H_{14}F_{13}NO_4S-C_{13}H_{14}F_{11}NO_4S-C_{12}H_{14}F_9NO_4S-C_5H_8)_x$

68891-96-3	Chromium, diaquatetrachloro[μ-[N-ethyl-N-[[heptadecafluorooctyl)sulfonyl]glycinato-O':O']μ-hydroxybis(2-methylpropano)]di-	$C_{18}H_{28}Cl_4Cr_2F_{17}NO_9S$
68958-61-2	Poly(oxy-1,2-ethanediyl), α-[2-[ethyl [[heptadecafluorooctyl)sulfonyl]amino]ethyl]-ω-methoxy-	$(C_2H_4O)_n C_{13}H_{12}F_{17}NO_3S$
70776-36-2	2-Propenoic acid, 2-methyl-, octadecyl ester, polymer with 1,1-dichloroethene, 2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate, N-(hydroxymethyl)-2-propenamido, 2-[methyl[[nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl [[pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[tridecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate and 2-[methyl [[undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate	$(C_{22}H_{42}O_2 \cdot C_{14}H_{10}F_{17}NO_4S \cdot C_{13}H_{10}F_{15}NO_4S \cdot C_{12}H_{10}F_{13}NO_4S \cdot C_{11}H_{10}F_{11}NO_4S \cdot C_{10}H_{10}F_9NO_4S \cdot C_4H_7NO_2 \cdot C_2H_2Cl_2)_x$
71487-20-2	2-Propenoic acid, 2-methyl-, methyl ester, polymer with ethenylbenzene, 2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate, 2-[methyl[[nonafluorobutyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl [[pentadecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl[[tridecafluoroheptyl)sulfonyl]amino]ethyl 2-propenoate, 2-[methyl [[undecafluoropentyl)sulfonyl]amino]ethyl 2-propenoate and 2-propenoic acid	$(C_{14}H_{10}F_{17}NO_4S \cdot C_{13}H_{10}F_{15}NO_4S \cdot C_{12}H_{10}F_{13}NO_4S \cdot C_{11}H_{10}F_{11}NO_4S \cdot C_{10}H_{10}F_9NO_4S \cdot C_8H_8 \cdot C_5H_8O_2 \cdot C_3H_4O_2)_x$
92265-81-1	Ethanaminium, N,N,N-trimethyl-2-[(2-methyl-1-oxo-2-propenyl)oxy]-, chloride, polymer with 2-ethoxyethyl 2-propenoate, 2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl 2-propenoate and oxiranyl methyl 2-methyl-2-propenoate	$(C_{14}H_{10}F_{17}NO_4S \cdot C_9H_{18}NO_2 \cdot C_7H_{12}O_3 \cdot C_7H_{10}O_3 \cdot Cl)_x$
94313-84-5	Carbamic acid, [5-[[[2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethoxy]carbonyl]amino]-2-methylphenyl]-, 9-octadecenyl ester, (Z)-	$C_{38}H_{50}F_{17}N_3O_6S$
98999-57-6	Sulfonamides, C ₇₋₈ -alkane, perfluoro, N-methyl-N-[2-[(1-oxo-2-propenyl)oxy]ethyl], polymers with 2-ethoxyethyl acrylate, glycidyl methacrylate and N,N,N-trimethyl-2-[(2-methyl-1-oxo-propenyl)oxy]ethanaminium chloride	$(C_{14}H_{10}F_{17}NO_4S \cdot C_9H_{18}NO_2 \cdot C_7H_{12}O_3 \cdot C_7H_{10}O_3 \cdot Cl)_x$
178094-69-4	1-Octanesulfonamide, N-[3-(dimethyloxidoamino)propyl]-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt	$C_{13}H_{12}F_{17}N_2O_3S \cdot K$
N/A	2-(Perfluoro-N-methyl-C ₄₋₈ -1-alkanesulfonamido)ethyl esters of trimers of C ₁₈ unsaturated fatty acids	N/A
68909-15-9	2-Propenoic acid, eicosyl ester, polymers with branched octyl acrylate, 2-[[[heptadecafluorooctyl)sulfonyl]methylamino]ethyl acrylate, 2-[methyl[[nonafluorobutyl)sulfonyl]amino]ethyl acrylate, 2-[methyl [[pentadecafluoroheptyl)sulfonyl]amino]ethyl acrylate, 2-[methyl[[tridecafluoroheptyl)sulfonyl]amino]ethyl acrylate, 2-[methyl [[undecafluoropentyl)sulfonyl]amino]ethyl acrylate, polyethylene glycol acrylate Me ether and stearyl acrylate	$(C_{23}H_{44}O_2 \cdot C_{21}H_{40}O_2 \cdot C_{14}H_{10}F_{17}NO_4S \cdot C_{13}H_{10}F_{15}NO_4S \cdot C_{12}H_{10}F_{13}NO_4S \cdot C_{11}H_{10}F_{11}NO_4S \cdot C_{10}H_{10}F_9NO_4S \cdot (C_2H_4O)_n C_4H_8O_2 \cdot \text{Unspecified})_x$
148684-79-1	Sulfonamides, C ₄₋₈ -alkane, perfluoro, N-(hydroxyethyl)-N-methyl, reaction products with 1,6-diisocyanatohexane homopolymer and ethylene glycol	N/A
30295-51-3	1-Octanesulfonamide, N-[3-(dimethyloxidoamino)propyl]-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-	N/A
91081-99-1	Sulfonamides, C ₄₋₈ -alkane, perfluoro, N-(hydroxyethyl)-N-methyl, reaction products with epichlorohydrin, adipates (esters)	N/A
N/A	Fatty acids, C ₁₈ -unsatd., dimers, 2-[methyl [[perfluoro-C ₄₋₈ -alkyl)sulfonyl]amino]ethyl esters	N/A

68081-83-4		Carbamic acid, (4-methyl-1,3-phenylene)bis-, bis [2-[ethyl[(perfluoro-C ₄₋₈ -alkyl)sulfonyl]amino]ethyl] ester	
68608-14-0		Sulfonamides, C ₄₋₈ -alkane, perfluoro, N-ethyl-N-(hydroxyethyl), reaction products with 1,1'-methylenebis[4-isocyanatobenzene]	C ₁₅ H ₁₀ N ₂ O ₂ : Unspecified
376-14-7		2-Propenoic acid, 2-methyl-, 2-[ethyl [(heptadecafluorooctyl)sulfonyl]amino]ethyl ester	C ₁₆ H ₁₄ F ₁₇ NO ₄ S
14650-24-9		2-Propenoic acid, 2-methyl-, 2-[[[(heptadecafluorooctyl)sulfonyl]methylamino]ethyl ester	C ₁₅ H ₁₂ F ₁₇ NO ₄ S
94133-90-1		1-Propanesulfonic acid, 3-[[3-(dimethylamino)propyl][(heptadecafluorooctyl)sulfonyl]amino]-2-hydroxy-, monosodium salt	C ₁₆ H ₁₉ F ₁₇ N ₂ O ₆ S ₂ ·Na
127133-66-8		2-Propenoic acid, 2-methyl-, polymers with Bu methacrylate, lauryl methacrylate and 2-[methyl [(perfluoro-C ₄₋₈ -alkyl)sulfonyl]amino]ethyl methacrylate	(C ₁₆ H ₃₀ O ₂ ·C ₈ H ₁₄ O ₂ ·C ₄ H ₆ O ₂) _x
179005-06-2		Sulfonamides, C ₄₋₈ -alkane, perfluoro, N-[3-(dimethyloxidoamino)propyl], potassium salts	N/A
179005-07-3		Sulfonamides, C ₄₋₈ -alkane, perfluoro, N-[3-(dimethyloxidoamino)propyl]	N/A
ROF		Residual Organic Fluorochemicals (impurities)	N/A

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