



Perfluorinated Chemicals: Outcome of the 2009 OECD Survey

**Survey on the production, use and release of PFOS, PFAS, PFOA
PFCA, related substances and products/mixtures of these substances**

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2009 Survey

The 2009 survey focused on

- chain lengths of C6 and higher perfluoro alkyl sulfonates (PFAS chemicals including PFOS)
- chain lengths of C8 and higher perfluorocarboxylates (PFCAs including PFOA)
- Potential precursors of these chemicals



Survey Methodology

- Seventy three PFCs were identified for inclusion in the survey by the OECD Perfluorinated Chemicals Steering Group
- Questionnaires and the list of chemicals sent to 27 companies identified as manufacturers in OECD and non-OECD countries
- Information requested only from manufacturers of perfluorinated chemicals and/or products
- No importation data sought



Information Collected

Information collected for 2008

- chemical name & CAS number
- concentration in products
- mass quantity in the products (residual)
- use of the chemical/product
- amount of substance released to air, water, land
- amount transferred offsite – reason for transfer ie reuse, recycling or destruction by incineration



Results

- 9/27 companies surveyed responded (low response rate on a global basis – 33%)
- Majority of the companies in the OECD countries responded to the survey
- The surveyed chemicals were manufactured or products formulated globally at 18 sites in 7 countries
- 42/73 PFCs surveyed were manufactured and/or formulated into products
- Responses included 3 chemicals not in the survey list



Reported uses of PFCs and PFC products

Wide range of uses

- AFFF agents / surfactants / surface protectants
- Manufacture of fluoropolymers
- Raw material for surface treatment agent
- Anti reflective coatings (ARCs) for photolithography processes
- Coatings / additives
- Etchants for Aluminium Surface active agents
- Gaskets / seals / membranes / cable insulations
- Tubing / pipe liners / cable insulation
- Impregnation of glass or plastic
- Ion Exchange
- Lubricants
- Water/oil repellent
- Treatment of industrial stream



Release of PFCs to Environment

- Seven companies (7/9) provided release information, not sufficient to provide a global view
- 38/42 perfluorinated chemicals reported were released to the environment or transferred offsite
- Majority (<225 tonnes) were disposed of by incineration, or reused or recycled, particularly for PFOA and related chemicals
- Of the total amount of all PFCs released to the environment
 - <9 tonnes were released to air with <2.2 t as fugitive release and approximately 5 tonnes as stack release
 - <7 tonnes to water, generally to local waterways
 - major proportion of environmental release was to landfills



Summary of release and offsite transfer of PFCs (tonnes)

<i>Chemical Group</i>	<i>Releases to the environment</i>	<i>Reuse, recycling or incineration</i>
PFOS and related substances	<1.50	<0.75
PFAS and related substances	<0.08	<0.055
PFOA and related substances	Cannot be reported	<201
PFCA and related substances	Cannot be reported	<23.0
Total	Cannot be reported	<225.0



PFOS, PFAS PFOA, 8:2 Fluorotelomers and related substances

	Uses	Releases
<i>PFOS & related compounds</i>	mist suppressant for chromium plating, processing aid in the manufacture of fluoropolymers and in medical devices	<2.5 tonnes released or transferred offsite with <1.5 tonnes released to environment and rest incinerated
<i>PFAS and related compounds</i>	anti-reflective coatings	<0.08 tonnes released with 80% to local waterways, very little to air, approx 55 kg incinerated
<i>PFOA, 8:2 Fluorotelomers and other PFOA related substances</i>	Variety of uses - surfactants and surface protectants Largest use as an intermediate in the manufacture of fluoropolymers	Release of these substances constituted approximately 55% of the total environmental releases of the four groups of PFCs. Releases mainly to landfills



PFCAs, Cn:2 fluorotelomers and other related substances

Manufacture

- Numerically the largest group of perfluorinated chemicals (23 chemicals) produced and/or present in products.

Uses

- Most commonly reported uses were as raw material for surface treatment agents, water/oil and soil repellent.

Releases

- Slightly lower volumes of these substances released to the environment as compared to PFOA and related substances.
- 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.



PFOS, PFAS PFOA, 8:2 Fluorotelomers and related substances

	Manufacture
<i>PFOS & related compounds</i>	PFOS, ammonium, potassium salts and a fluoride derivative
<i>PFAS and related compounds</i>	perfluorohexane sulfonate, potassium salt and perfluorohexane sulfonyl fluoride
<i>PFOA, C8:2 fluorotelomers and other related substances</i>	<p>PFOA and 5 related substances produced in 2008.</p> <p>Five C8:2 fluorotelomers (PFOA-related substances) manufactured and formulated into products</p> <p>Total amount of PFOA present in products as unreacted residual was less than 1.5 tonnes</p> <p>Other related substances in the products including the C8:2 fluorotelomers were approximately 22 tonnes</p>



PFOS, PFAS PFOA, 8:2 Fluorotelomers and related substances

	Residual quantity in products
<i>PFOA and salts and esters PFOA related substances (excluding C8:2 fluorotelomers)</i>	<5.5 tonnes
<i>C8:2 fluorotelomers</i>	<20 tonnes
<i>PFCA substances</i>	<0.001 to <1.2
<i>PFCA related substances excluding Cn:2 fluorotelomers</i>	<0.1
<i>Longer chain Cn:2 fluorotelomers</i>	< 15 tonnes



General Observations Conclusions



General observations

- 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 noted except as antireflective coatings in photolithography where PFOS, PFAS or PFOA products were reported to be used
- Products containing PFOS and related substances were not reported to be used in fire fighting products.
- Release of perfluorinated compounds to air or water systems is very small compared to landfill or off-site transfer for incineration.



Conclusions

- The 2009 survey results are important as a starting point for future surveys
- Participation in future surveys by companies from both OECD and non-OECD countries will generate valuable data for monitoring the production and release of perfluorinated chemicals and provide an accurate picture of the global environmental loading of these chemicals
- The 2009 OECD survey report is available at <http://www.oecd.org/officialdocuments/displaydocumentpdf/?cote=env/jm/mono%282011%291&doclanguage=en>
- The next survey is proposed to be conducted in 2012



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Past OECD Survey Activities



OECD activities related to PFAS and PFCA chemicals

Two OECD surveys conducted in 2004 and 2006

Governments in OECD member countries

Designated National Authorities (DNA) of the Rotterdam Convention

Focal Points for the Stockholm Convention.

Information collected on importation and manufacture volumes, uses of PFOS, PFAS, PFOA and PFCAs and their higher and lower homologues and polymers that contain PFCA or PFAS as a portion of the entire polymer.

An OECD sponsored workshop on PFCAs and Precursors held in 2006

Workshop recommended that the OECD with BIAC identify a way to collect more reliable data from companies on production and use of perfluorinated chemicals (PFCs)



Reasons for unreliable data from previous 2 surveys

- Production and importation volumes reported by countries in ranges because of CBI issues
- Alternatives could not be named because of CBI
- Importers, in many cases, were not aware of the perfluorinated compounds in the imported products because the names were not included in the labels
- Insufficient details on uses of the chemicals
- Import volumes reported in the survey responses could not be distinguished from the production volumes resulting in double counting during analysis of responses



PFOA, C8:2 Fluorotelomers and other PFOA-related Substances



PFOA and PFOA-related substances manufactured in 2008

CAS No.	Substance	Residual Qty in products
<i>PFOA and salts / esters</i>		
335-67-1	PFOA	<5.5 tonnes
90480-55-0	PFOA branched	
376-27-2	Methyl perfluorooctanoate	
2395-00-8	PFOA potassium salt	
3825-26-1	PFOA ammonium salt	
72968-38-8	Fatty acids C7-13, perfluoro, ammonium salts	
<i>PFOA related substances (excluding C8:2 fluorotelomers)</i>		
507-63-1	Perfluorooctyl iodide	



C8:2 fluorotelomers and related substances manufactured in 2008

<i>CAS No.</i>	<i>Substance</i>	<i>Residual Qty in products</i>
678-39-7	C8-2 alcohol	<20 tonnes
2043-53-0	C8-2 iodide	
1996-88-9	C8-2 methacrylate	
27905-45-9	C8-2 acrylate	
21652-58-4	C8-2 olefin	



PFCAs, longer chain Cn:2 fluorotelomers and other PFCA-related substances



PFCA, salts and related substances

CAS No.	Substance	<i>Residual Qty in products</i>
<i>PFCA substances</i>		
307-55-1	Perfluorododecanoic acid (PFDoA)	<0.003
375-95-1	Perfluorononanoic acid (PFNA)	<1.2
4149-60-4	Amm. perfluorononanoate (APFN)	<0.001
335-76-2	Perfluorodecanoic acid (PFDA)	<0.01
2058-94-8	Perfluoroundecanoic acid (PFUnA)	
<i>PFCA related substances excluding Cn:2 fluorotelomers</i>		
423-62-1	C10-iodide	<0.1
307-60-8	C12-iodide	
307-63-1	C14-iodide	
355-50-0	C16-iodide	



Longer chain Cn:2 fluorotelomers

<i>CAS No.</i>	<i>Substance</i>	<i>Residual Qty in products (tonnes)</i>
865-86-1	C10-2 alcohol	<15.0 tonnes
39239-77-5	C12-2 alcohol	
60699-51-6	C14-2 alcohol	
2043-54-1	C10-2 iodide	
30046-31-2	C12-2 iodide	
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	
34395-24-9	C12-2 acrylate	
34362-49-7	C14-2 acrylate	