

PFCAs and Precursors

Simplified Terminology/Sources/Fate

Consultation Meeting on
PFCA Action Plan
February 2006

Purpose

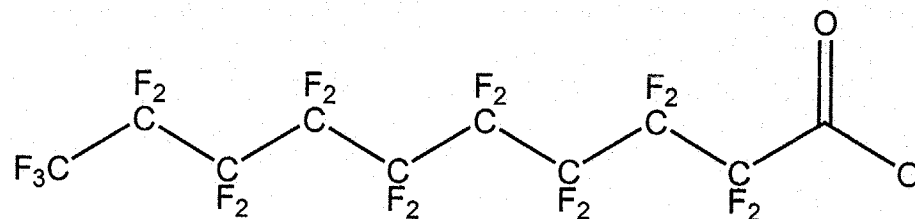
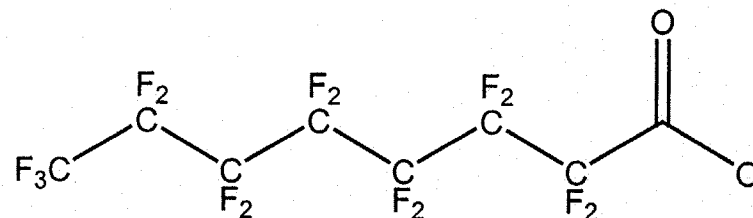
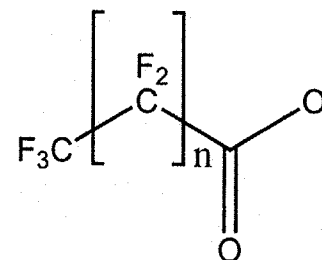
- Intended to provide terminology and simplified background on PFCA sources and environmental fate.
- Useful in discussing the proposed Action Plan.

Presentation Outline

- Perfluorinated Carboxylic Acids
- Fluorotelomer Intermediates
- Fluorotelomer Based Substances
- “Residuals”
- Pathways to PFCAs
 - Via Residuals
 - Via degradation of Fluorotelomer Based Substances

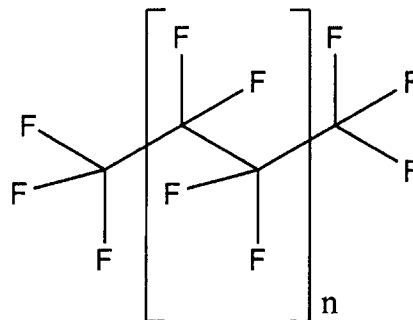
Perfluorinated Carboxylic Acids (PFCAs)

- General structure:
- Can be referred to by the number of carbons in the molecule; e.g..
Perfluorooctanoic acid called "C8"
- Perfluorodecanoic acid called "C10"



PFCAs (continued)

- Some PFCAs, notably C8 and C9 are manufactured for industrial use
- Estimated total industrial annual production of;
 - C8 (1999) of ~260,000 kg, and
 - C9 (2004) of 15,000 to 75,000 kg (Prevedouros *et al.* 2005)
 - Total ~300,000 kg/year globally
- Used mainly as a processing aid in the manufacture of fluoropolymers. This action plan does NOT address fluoropolymers e.g. PTFE

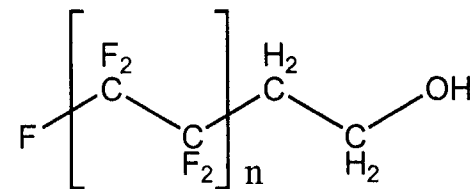


- C8 is subject to a separate assessment under CEPA (1999) and is not the focus of this proposed action plan

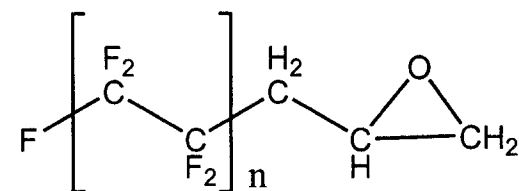
Fluorotelomer Intermediates

Used as building blocks in more complex molecules

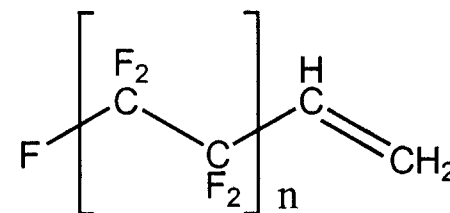
- Fluorotelomer alcohols (FTOHs)



- Fluorotelomer epoxides



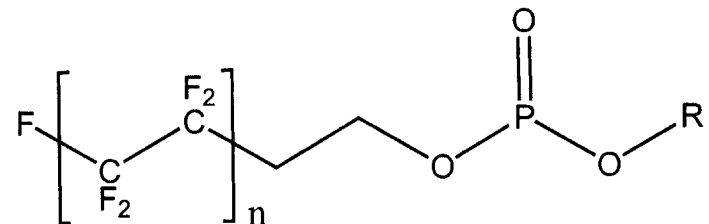
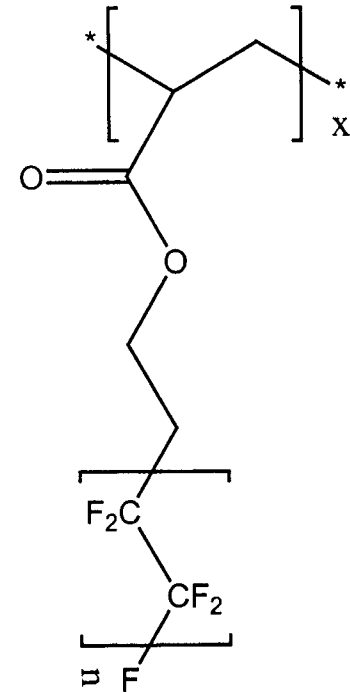
- Fluorotelomer olefins



- Note that manufacture of these substances typically produces a range of carbon chain lengths
- ~12,000,000 kg/year produced globally (DuPont: EPA AR 226-1914)

Fluorotelomer Based Substances

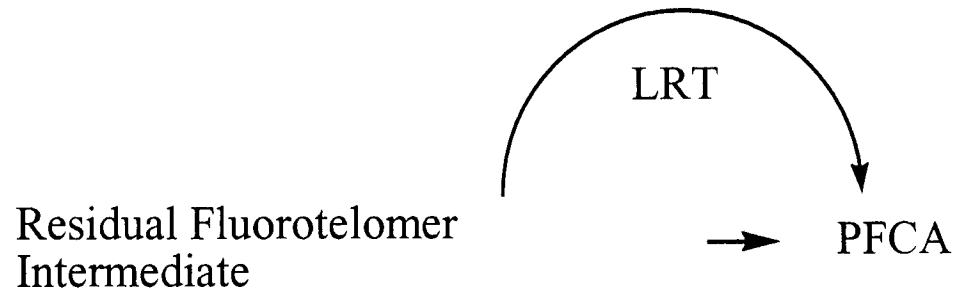
- Applications include oil/water repellents for textiles, paper and leather, levelling agents in paints and coatings
- 80% of fluorotelomer intermediates used to produce polymeric materials (TRP: EPA AR226-1141)
- 20% used to produce chemical substances (TRP: EPA AR226-1141)



“Residuals”

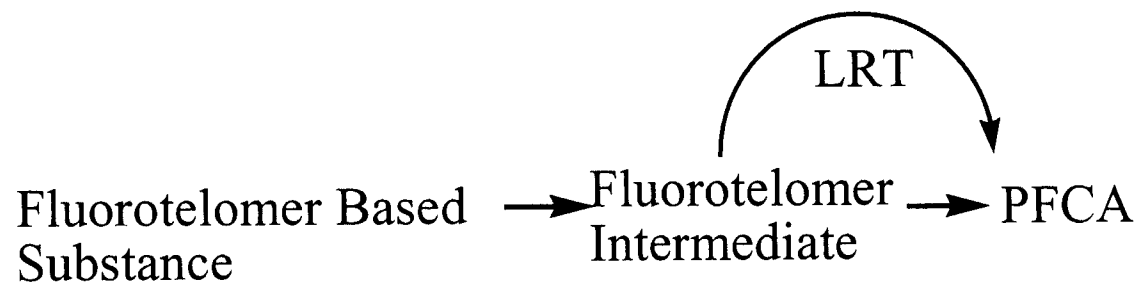
- Fluorotelomer based substances can contain unreacted or “residual” fluorotelomer intermediates
- ~2 wt% in final substances (Prevedouros *et al.* 2005) represents a mass of ~240,000 kg/year globally of fluorotelomer intermediates
- Little uncertainty associated to this source

“Residuals” Conversion to PFCAs



- Volatile residuals can escape from commercial substances and are capable of dispersion through the atmosphere (long range transport or LRT), a portion converted to PFCAs and deposited to the earth via precipitation.
- Dispersion via other pathways, e.g. release to sewage treatment through household wastes, and biodegraded to form PFCAs.
- Substances which chemically convert to PFCAs referred to as “precursors”

PFCAs from Fluorotelomer Based Substances



- 98% of fluorotelomer intermediates reacted into other substances
- a potential latent source of ~11.8 million kg/year globally
- bonds susceptible to degrade, releasing fluorotelomer intermediates available to convert to PFCAs

PFCAs from Fluorotelomer Based Substances: Research

- Uncertainties
 - Conditions under which degradation occurs
 - Rates
 - Relative contribution to environmental levels
- Recent EPA settlement with a company compels \$5 million to study this issue
- US EPA conducting independent research
- Industry studies underway
- Academic interest

Illustration: Volatilization of Residuals and Liberation of Intermediates

