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The Interstate Technology and Regulatory Council (ITRC) is a state-led coalition working to reduce barriers to the use of innovative air, water, waste, and remediation environmental technologies and processes. ITRC produces documents and training that broaden and deepen technical knowledge and expedite quality regulatory decision making while protecting human health and the environment. With public and private sector members from all 50 states and the District of Columbia, ITRC truly provides a national perspective.

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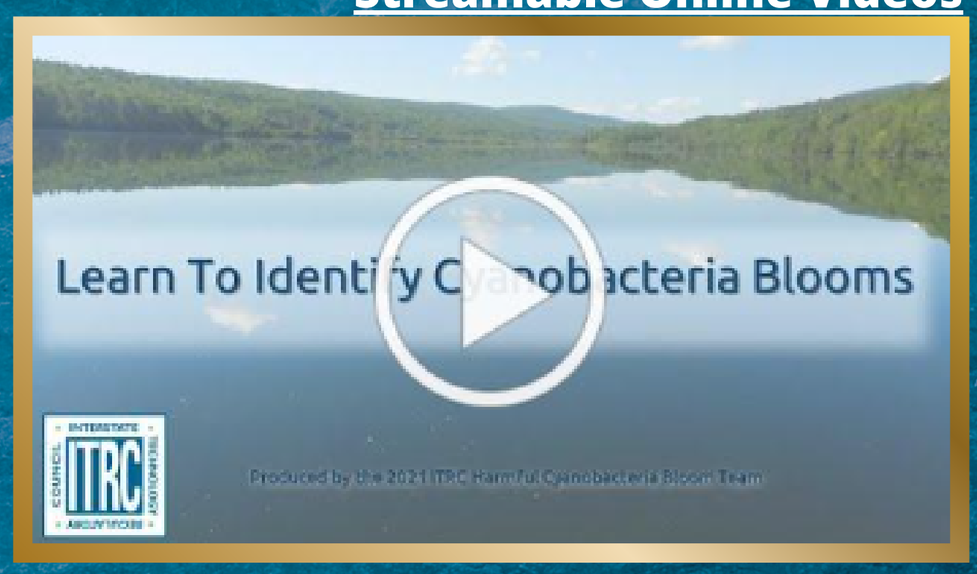
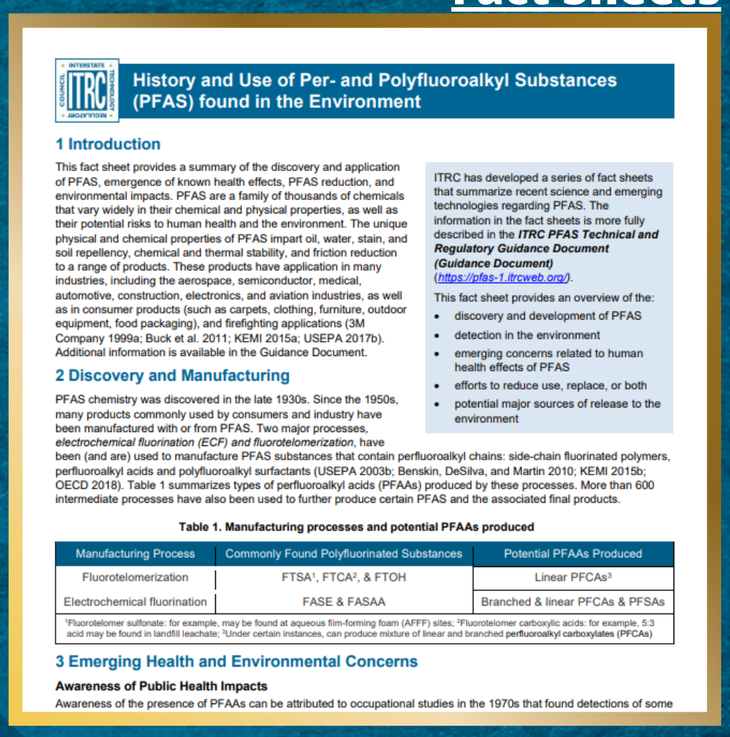


Fact Sheets


History and Use of Per- and Polyfluoroalkyl Substances (PFAS) found in the Environment

1 Introduction

This fact sheet provides a summary of the discovery and application of PFAS, emergence of known health effects, PFAS reduction, and environmental impacts. PFAS are a family of thousands of chemicals that vary widely in their chemical and physical properties, as well as their potential risks to human health and the environment. The unique physical and chemical properties of PFAS impart oil, water, stain, and soil repellency, chemical and thermal stability, and friction reduction to a range of products. These products have application in many industries, including the aerospace, semiconductor, medical, automotive, construction, electronics, and aviation industries, as well as in consumer products (such as carpets, clothing, furniture, outdoor equipment, food packaging), and firefighting applications (3M Company 1999a; Buck et al. 2011; KEMI 2015a; USEPA 2017b). Additional information is available in the Guidance Document.

ITRC has developed a series of fact sheets that summarize recent science and emerging technologies regarding PFAS. The information in the fact sheets is more fully described in the ***ITRC PFAS Technical and Regulatory Guidance Document (Guidance Document)*** (https://pfas-1.itrcweb.org/).

This fact sheet provides an overview of the:

- discovery and development of PFAS
- detection in the environment
- emerging concerns related to human health effects of PFAS
- efforts to reduce use, replace, or both
- potential major sources of release to the environment

2 Discovery and Manufacturing

PFAS chemistry was discovered in the late 1930s. Since the 1950s, many products commonly used by consumers and industry have been manufactured with or from PFAS. Two major processes, *electrochemical fluorination (ECF) and fluorotelomerization*, have been (and are) used to manufacture PFAS substances that contain perfluoroalkyl chains: side-chain fluorinated polymers, perfluoroalkyl acids and polyfluoroalkyl surfactants (USEPA 2003b; Benskin, DeSilva, and Martin 2010; KEMI 2015b; OECD 2018). Table 1 summarizes types of perfluoroalkyl acids (PFAAs) produced by these processes. More than 600 intermediate processes have also been used to further produce certain PFAS and the associated final products.

Table 1. Manufacturing processes and potential PFAAs produced

Manufacturing Process	Commonly Found Polyfluorinated Substances	Potential PFAAs Produced
Fluorotelomerization	FTSA[1], FTCA[2], & FTOH	Linear PFCAs[3]
Electrochemical fluorination	FASE & FASAA	Branched & linear PFCAs & PFSAs

[1]Fluorotelomer sulfonate: for example, may be found at aqueous film-forming foam (AFFF) sites; [2]Fluorotelomer carboxylic acids: for example, 5:3 acid may be found in landfill leachate; [3]Under certain instances, can produce mixture of linear and branched perfluoroalkyl carboxylates (PFCAs)

3 Emerging Health and Environmental Concerns

Awareness of Public Health Impacts

Awareness of the presence of PFAAs can be attributed to occupational studies in the 1970s that found detections of some

2022 ITRC Teams

- Contaminants of Emerging Concern
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- Quickening Environmental Solutions & Training (QUEST)
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- Effective Application of Guidance Documents to Hydrocarbons Sites

ITRC is a program of the Environmental Research Institute of the States (ERIS). ERIS is a 501(c)(3) organization incorporated in the District of Columbia and managed by the Environmental Council of the States (ECOS).