

THE OCCURRENCE OF PFAS. WHAT IS REALLY GOING ON, AND WHERE ARE THE RISKS?

A perspective from Europe

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Who are we?



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Outline

- PFAS short introduction
- Screening values
- PFAS uses
- PFAS in products
- Potential PFAS sources
- PFAS in groundwater at source locations
- Atmospheric deposition





PFASs Introduction



PFAS comprises many thousands of compounds –multiple sources – lot's of replacements



Advanced analytical methods are being adopted to measure PFAS



PFAS are impacting drinking water worldwide



None of the PFAS biodegrade, some biotransform to daughter compounds that are extremely persistent



Some PFAS are classed as persistent organic pollutants



Dramatically increasing regulatory concern

Drinking water and ground water guidelines ARCADIS Pesin & Consultance Unit assets

		Netherlands		Health Canada	
Medium		PFOS	PFOA	PFOS	PFOA
Ground water	Screening value not used for drinking	56 µg/l	170 µg/l		
	Screening values in groundwater protection area	0.2 μg/l	0.39 µg/l	0.6 µg/l	0.2 µg/l
Surface water	Yearly average	0.00065 µg/l (0.65 ng/l)	0.048 µg/l		
Drinking water	Drinking water	0.53 μg/l => 0.044 μg/l?	0.0875 µg/l	0.6 µg/l	0.2 µg/l

Dutch SSV and criteria for reuse of soil ARCADIS Design & Consultance of Soil ARCADIS

Environmental risk limits (soil screening values):								
	Netherlands			Health Canada				
	Nature, agriculture	Urban areas	Industrial areas		Agricultural/ residential		Commercial	Industrial
PFOS	3 µg/kg	18 µg/kg	110 µg/kg (0.11 mg/kg)		2.1 mg/kg		3.2 mg/kg	30.5 mg/kg
PFOA	7 µg/kg	89 µg/kg	1100 µg/kg (1.1 mg/kg)		0.7 mg/kg		1.05 mg/kg	9.94 mg/kg
		So	oil reuse crite	ria	:			
PFAS		Nature, agric Based on ba	ulture ckground values	Ur	ban areas	Ind	dustry	
PFOS		<1.4 µg/kg (0.0014 mg/kg) 3		µg/kg	3 µg/kg			
PFOA		<1.9 µg/kg		7	µg/kg	7	µg/kg	
Other PFAS		<1.4 µg/kg 3		µg/kg	3 µg/kg			

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For the second s





JANUARY 30, 2019

Scientists just cut the tolerable intake of PFAS by 99,9%

https://chemsec.org/scientists-just-cut-the-tolerable-intake-of-pfas-by-999/

Animal studies

Epidemiological studies

Canada TDI PFOS = 0.00006 mg/kg bw/day = 60 ng/kg bw/day European proposal TDI PFOS+PFOA+PFNA+PFHxS = 0.63 ng/kg bw/day

PFOS and PFOA background





Figuur 4.2 Ligging meetlocaties en indicatie van de som-PFOA concentratie (toplaag). Concentraties in μ g/kg droge stof. De cirkel met straal van 50km is getrokken om de productielocatie in Dordrecht.





Fire fighting foam – a known problem

Canada

EDMONTON JOURNAL

Residents near Edmonton military base warned of possible water contamination from firefighting foam

Lauren Boothby Feb 08, 2020 · Last Updated 8 months ago · 3 minute read

Channel Island Airport - UK



PFAS class actions over groundwater contaminated by toxic firefighting foam settled by Federal Government

By Stephanie Zillman

Australia

MINEWS

Posted Thu 27 Feb 2020 at 3:41am, updated Thu 27 Feb 2020 at 6:34am

US Pentagon & Congress

The list of military sites with suspected 'forever chemicals' contamination has grown MilitaryTimes

November 20, 2019

Patricia Kime **Netherlands**

SPRINKLERS



BrandVeilig_®com



7 september 2011

De PvdA maakt zich zorgen over een ernstige verontreiniging van het grondwater en de bodem bij Schiphol als gevolg van een incident met een

sprinklerinstallatie.

Multiple and varied PFAS uses

- Fluorosurfactant Firefighting foams for Class B (liquid hydrocarbon) fires e.g. Aqueous Film Forming Foams (AFFF), Film Forming Fluoroprotein Foams (FFFP)
- Electroplating mist suppressants
- Semiconductor manufacture
- Pesticides –Insecticides and Herbicides
- Aviation Hydraulic fluids
- Consumer Products:

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- Oil and water resistant finishes (paper, textiles, carpeting, cookware); Fast-food packaging
- Dyes, Polishes, Adhesives, Lubricants, Inks, Waxes
- Cleaning agents –detergents, carpet cleaners
- Shampoos and Hand creams













PFAS studies

Arcadis:

- PFAS in groundwater
- Potential PFAS source locations
- PFAS in consumer products and waste

Dutch Government

- PFAS sources in surface water
- PFAS in top soil
- PFAS in food contact materials
- PFAS in building materials













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PFAAs in Consumer Products

Fluorinated compounds in cosmetic products

BY EMMA LOCKYER | 6 DECEMBER 2018

f) 💟 🗓 🖾

Moisturisers, shaving foam and foundation investigated as sources of perand polyfluoroalkyl substances



https://www.chemistryworld.com/news/fluorinated-compounds-in-cosmetic-products/3009868.article © Arcadis 2020

Consultants and distributors for leading car wash equipment manufacturers

HF21

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Welcome! Please sign in or Register here.

Rex Liquid HF Glic The wax is 100% the same - only the

Hiah Fluor

method is different

SPRAY



Rex Future Fluor is our PEOA-free new generation fluorocarbon technology. More enviromentally-friendly, and better performance too!





PFAS in dust





Figure 13. PFCA and PFSA determined in industry dust samples compared to household dust samples from Stockholm and Skellefteå analysed in 2013. Each letter describes one industrial factory, while numbers refer to different sampling locations within the respective factory (Table 5).

- Max. ~ 6500 µg/kg PFAS in dust
- Industries reported no PFAS use



Figure 14. Phosphorus PFAS and 6:2 FTSA determined in industry dust samples compared to household dust samples from Stockholm and Skellefteå analysed in 2013 (Table 5).

- B: Paint industry
- D: Rubber factory
- F: Plastic industry
- R: Smelter

© Arcadis 2020 Source: Screening of polyfluoroalkyl substances (PFASs), including fluorinated organophosphates in Skellefteå municipality Jana Weiss, Vera Franke, Åsa Gustafsson

Unknown PFAS-source(s)







PFAS – still an unknown unknown

- Consumers don't know which products contain PFAS
- Producers often also don't know they are using PFAS in their production process
- Legislators don't know enough about replacement compounds
- PFAS in waste streams not well understood

So what if we don't know?

PFOS Rastatt and Baden-Baden

- 480 hectares of former arable land contaminated with short-chain PFAAs and precursors.
- Application of compost mixed with sludge from paper production

SWR > SWR Aktuell > SWR Aktuell Baden-Württemberg > Karlsruhe



NACH UMWELTSKANDAL LIEFERN TESTS ERGEBNISSE PFC im Blut nachgewiesen



Recycling – not always a good idea





DE VOLKSKRANT VRIJDAG 19 MEI 2017 27

Van vullis tot...

BRANDBLUSPOEDER → BODEMVERBETERAAR From waste to soil enhancer



Rienko Rutgers met zijn bodemverbeteraar.



▲ De ruim 1300 vaten met giftig blusschuim op het terrein van het faillietverklaarde Rutgers Milieu in Doetinchem. © DG

To put it into perspective...





The Netherlands ... far away

To put it into perspective...



		BRUNSWIC	СК		
	Canada	Netherlands	redericton	Moncton	
Size	9,984,670 km ²	41,865 km ²	Saint John	13	New Glasgowo Antigonish
Inhabitants	37 million	17 million	S. The	NO	VAISCOTIA
Population density	3.92/km ²	521/km ²			
					https

NEW

And tiny ... but densely populated

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Potential PFAS point source locations

Airports

🚌 Fire training areas

Sewage treatment plant

Historical database

Anitfouling (boats)

Fire prevention

Chemical plants

Use of fluor in production

Textiles (impregnation)

Factory with suspected PFAS use

Large fires

Oil terminal

Waste

Defense

Galvanizing

Metal plating

Chrome plating

eather

Carpet

+





Potential source locations





Groundwater - Fire Training Centre



PFAS groundwater concentrations



You might have heard of ...



PULLMAN MARK ANNE ROBBINS BILL VICTOR GARBER R Κ W Δ Δ **"A PERFECT FILM "MARK RUFFALO'S** RIVETING, POWERFUL BEST PERFORMANCE YET AND IMPORTAN SCREENPLAY BY MARIO CORREA AND MATTHEW MICHAEL CARNAHAN DIRECTED BY TODD HAYNES eone 🚰 IN CINEMAS SOON

A TODD HAYNES FILM

FEATURE

The Lawyer Who Became DuPont's Worst Nightmare

Rob Bilott was a corporate defense attorney for eight years. Then he took on an environmental suit that would upend his entire career — and expose a brazen, decades-long history of chemical pollution.

https://www.nytimes.com/2016/01/10/magazine/the-lawyer-who-became-duponts-worst-nightmare.html

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Teflon production facility in Dordrecht GARCADIS Design & Consultance States and States

Trouvy

Bittere boosheid in Dordrecht om uitstoot giftige stoffen

Bitter anger in Dordrecht about emission of toxic substances



GROEN Meindert van der Kaaij – 13:14, 12 december 2017





Production of fluoropolymers since 1967







PFOA in soil – the risks



Don't eat garden veg, toxicologist tells Chemours plant locals

PARCADIS Design & Consultancy for natural and built assets

Health f 😏 in 🔊 July 21, 2017



GenX and C8 are used to make Teflon. Photo: Depositphotos.com

People living near the Chemours chemical factory in Dordrecht have been advised not to eat fruit or vegetables from their own gardens because the ground may be polluted, the Volkskrant said on Friday.



RIVM background values





2002 - PFOA replaced by GenX

- GenX: perfluoroether (2,3,3,3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propanoic acid)
- Replacement product for PFOA in Teflon production
- Very mobile, soluble, low to no adsorption
- No biodegradation
- Emitted in lower amounts than PFOA





PARCADIS Design & Consultancy for natural and built assets

Similar case in Helmond





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Conceptual site model





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Take home message



- There are many potential PFAS point sources
- Users (and even manufacturers) often are not aware they are using PFAS
- Although not volatile, air deposition is a major cause of contamination near PFAS production plants
- Soil Screening Values might decrease in future





Questions?



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