

# Addressing PFAS challenges in water: Veolia return of experience in North America and Australia

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# Summary

## Addressing PFAS challenges in water: Veolia return of experience in North America and Australia

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*Disclaimer: The information contained in this statement is based on the Veolia group's understanding and know-how of the scientific and technical fields discussed herein as of the time of publication. Statements that may be interpreted as predictive of future outcomes or performance should not be considered guarantees of such, but rather reasoned assessments of the possible evolution of the technologies described.*

*As this document is based on the state of the Veolia group's scientific, technical, and regulatory knowledge at the time of its publication, the completeness and accuracy of the information contained herein cannot be guaranteed.*

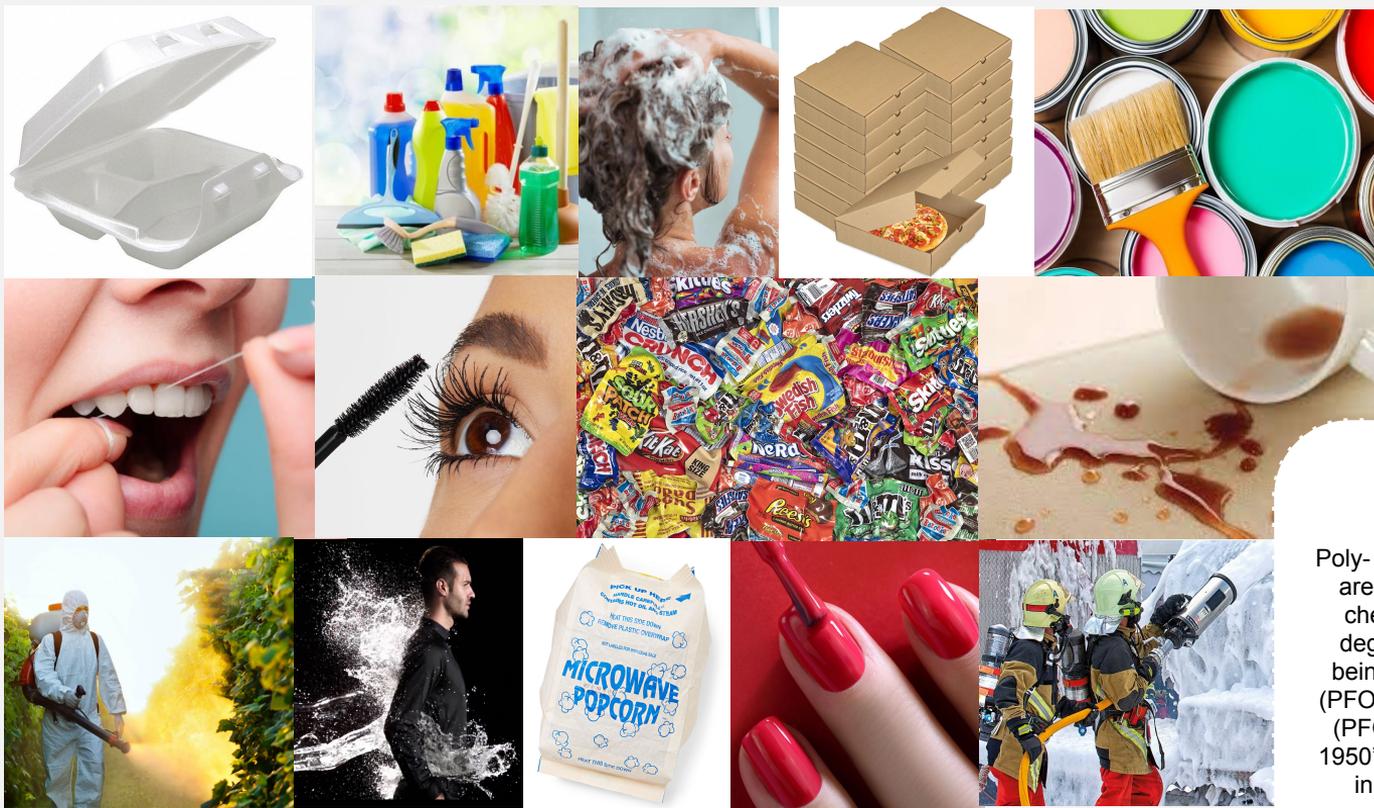
*Descriptions contained herein apply exclusively to those examples and/or to the general situations specifically referenced, and in no event should be considered to apply to specific scenarios without prior review and validation.*



# Scope

## Scope

# Where do we find PFAS ? Everywhere



## PFAS

Poly- and perfluoroalkyl substances are a large family of man-made chemicals strongly resistant to degradation, the most common being Perfluoro-octane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA). Manufactured since the 1950's they have been widely used in fire fighting foam and as a coating.

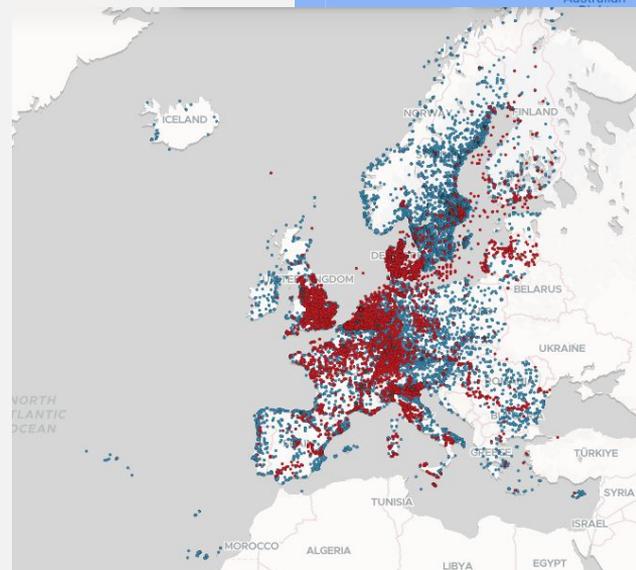
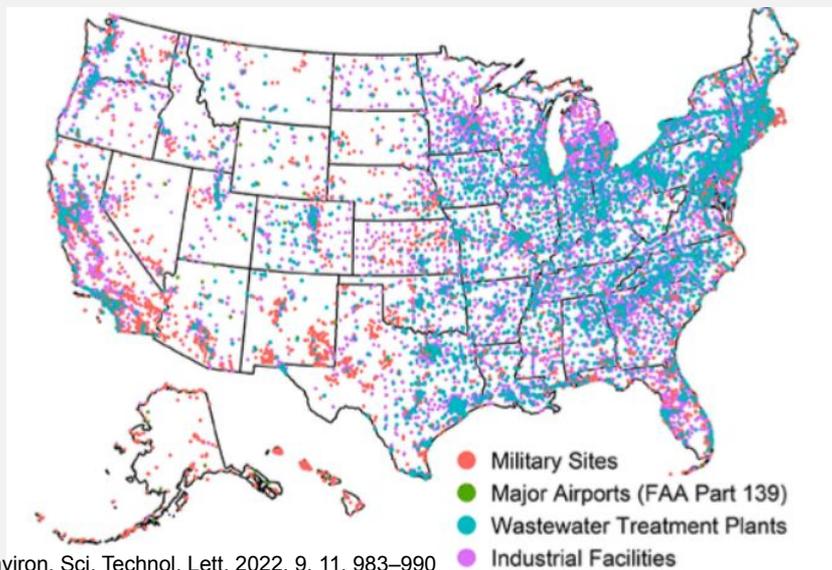
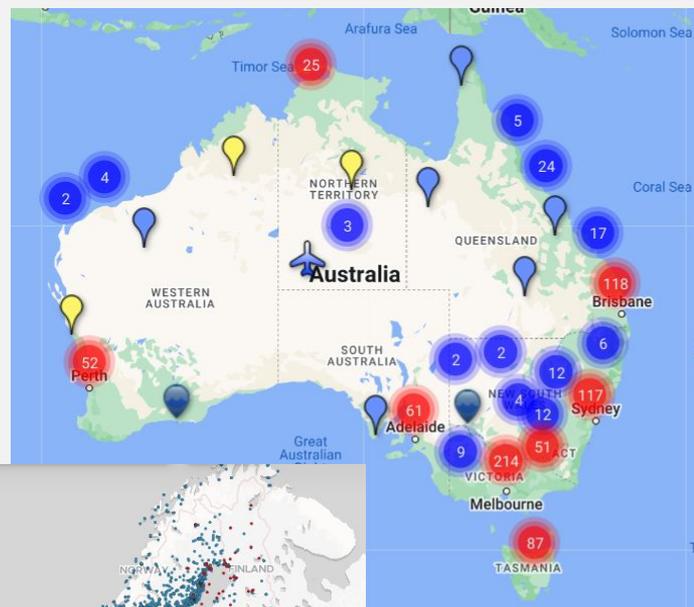
## Scope

### Focus on PFAS: why it is a concern

PFAS are widely used chemicals that are both mobile and resistant to degradation ⇒ **widespread environmental contamination.**

In addition some are bioaccumulative and suspected of harmful impact on human and animal health (EPA 2022)

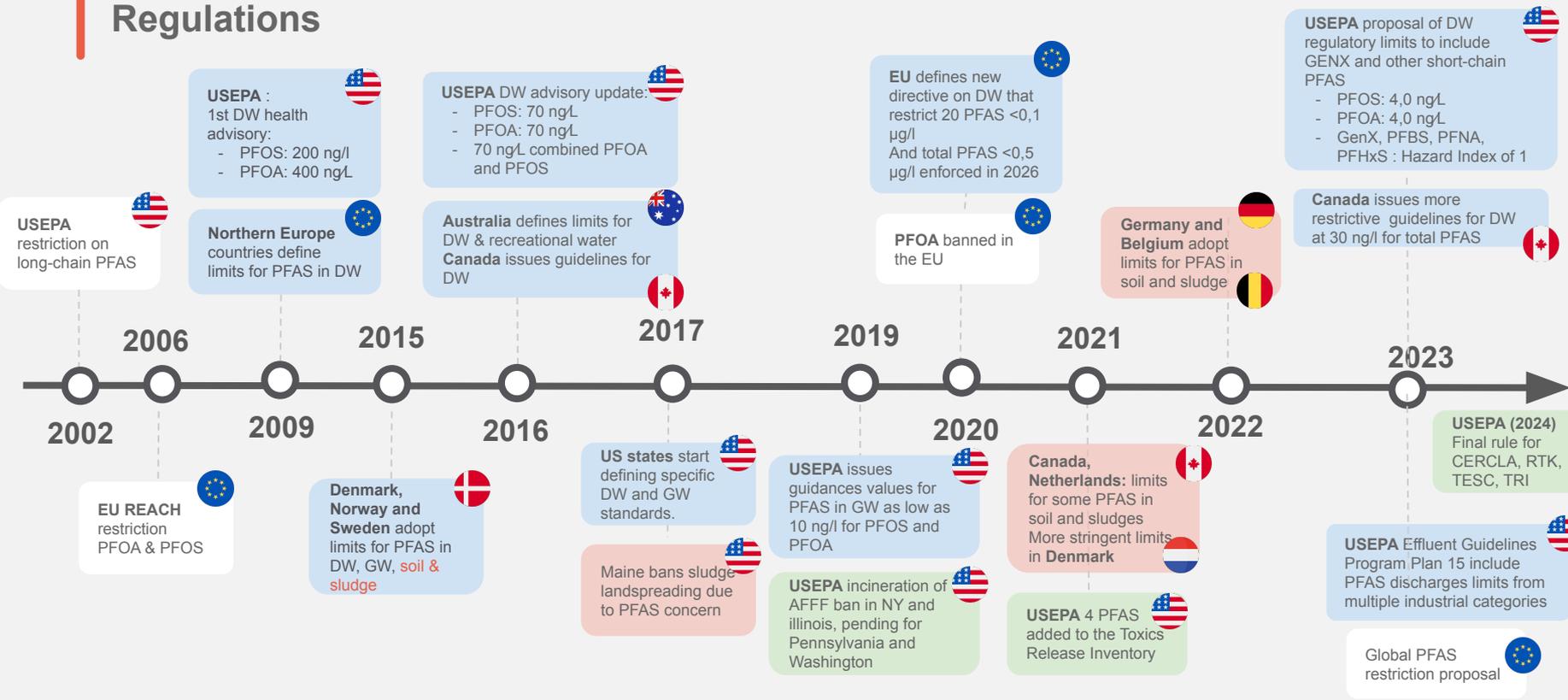
Potential locations of PFAS contamination in Australia  
(Source: <https://pfas.australianmap.net>)



Map of PFAS contamination in Europe  
(Source: Forever Pollution Project, February 2023)

# Scope Regulations

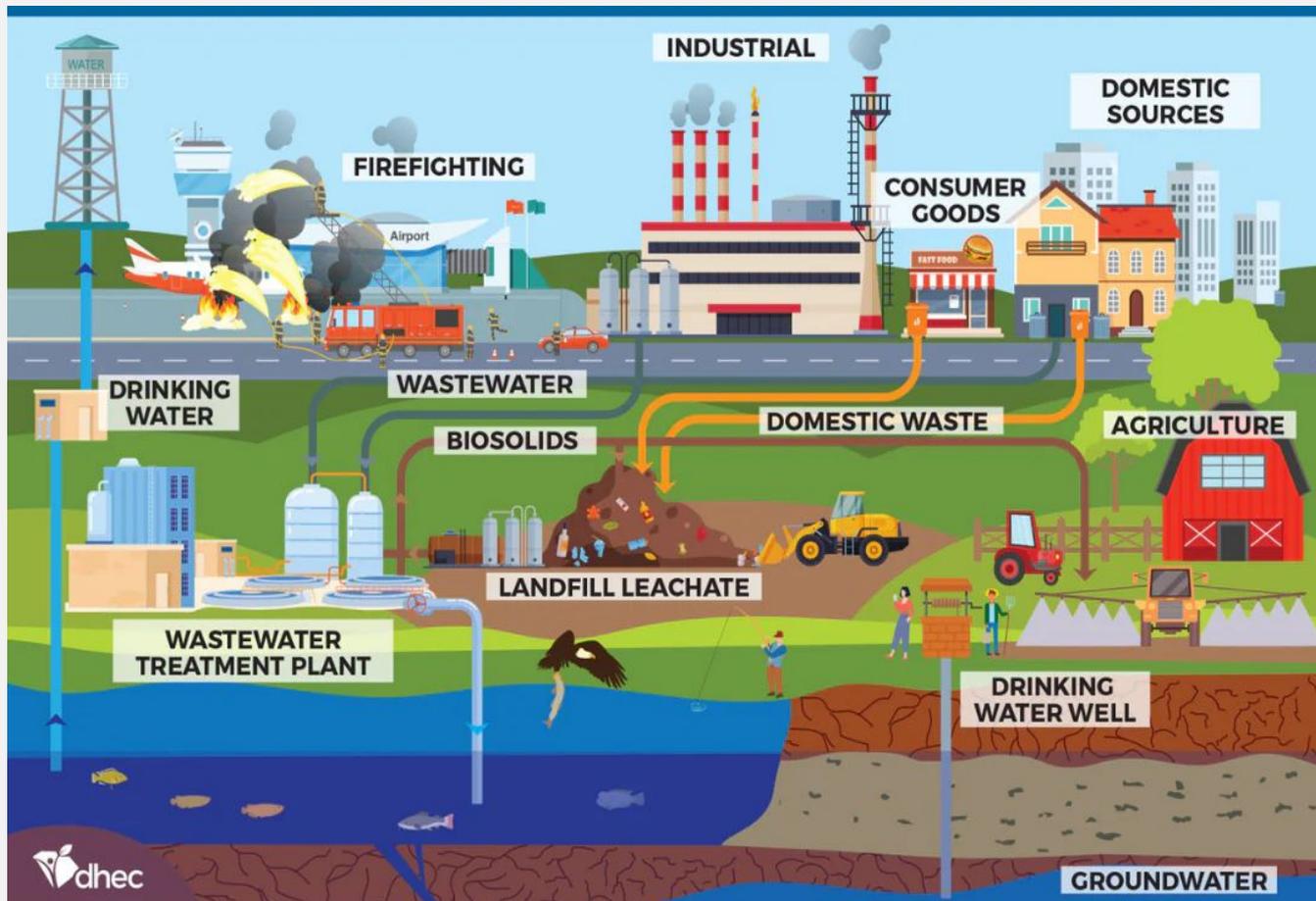
Water    Soil & Biosolids    Waste



**More stringent regulations. Scope moving to waste, biosolids and soil. US and Australia first to limit PFAS in water.**

## Scope

### PFAS in our business lines





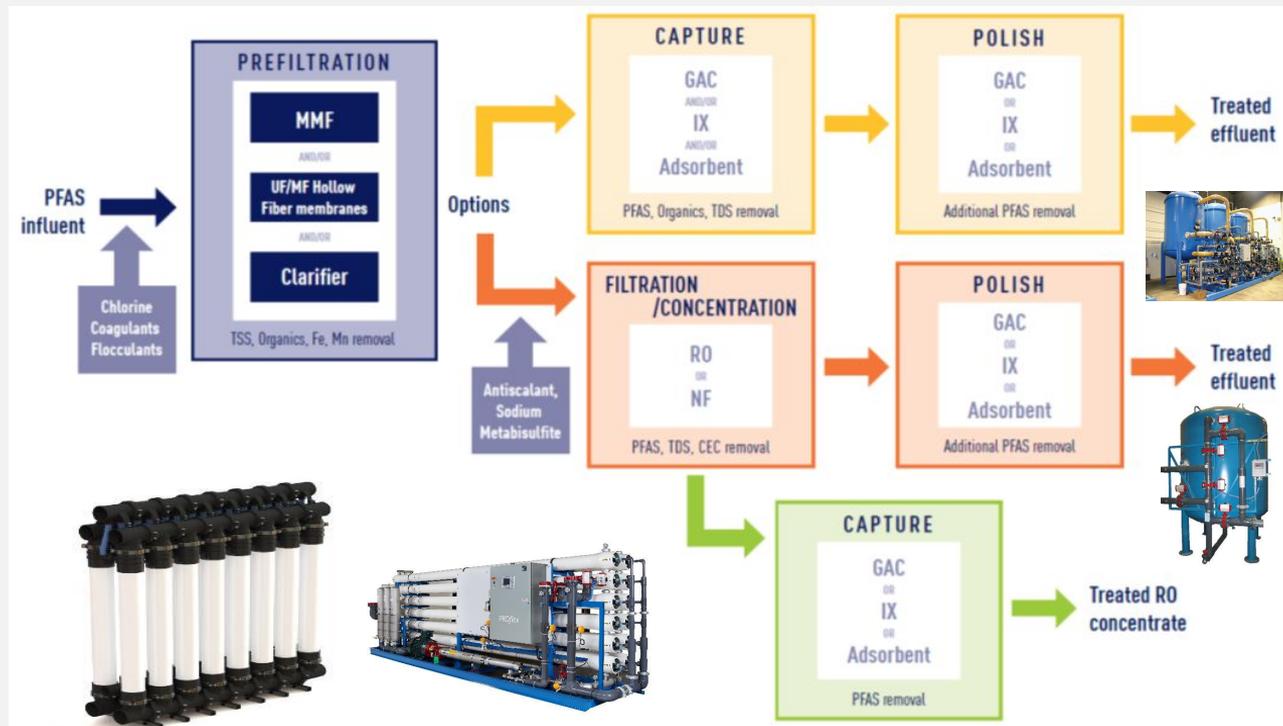
# Solutions & experience

# Solutions & Experience

## Treatment lines design

To enhance PFAS treatment, Veolia can offer

1. a variety of fit-for-purpose **pretreatment options**
2. a **holistic approach**: we consider a broad range of technologies and suppliers: from pretreatment to GAC, IX to Membranes and final concentration including proprietary solutions.
3. the expertise & the knowhow to **select and combine process units** to reach and guarantee technical & economical performance





# Case studies

# Veolia's already have strong references

## PFAS treatment references overview

Over **40 references** on municipal water treatment  
13 references on industrial water treatment

In Europe, Industrial Water treatment references (Belgium, France, Germany) and soil remediation (several references in Belgium and France)

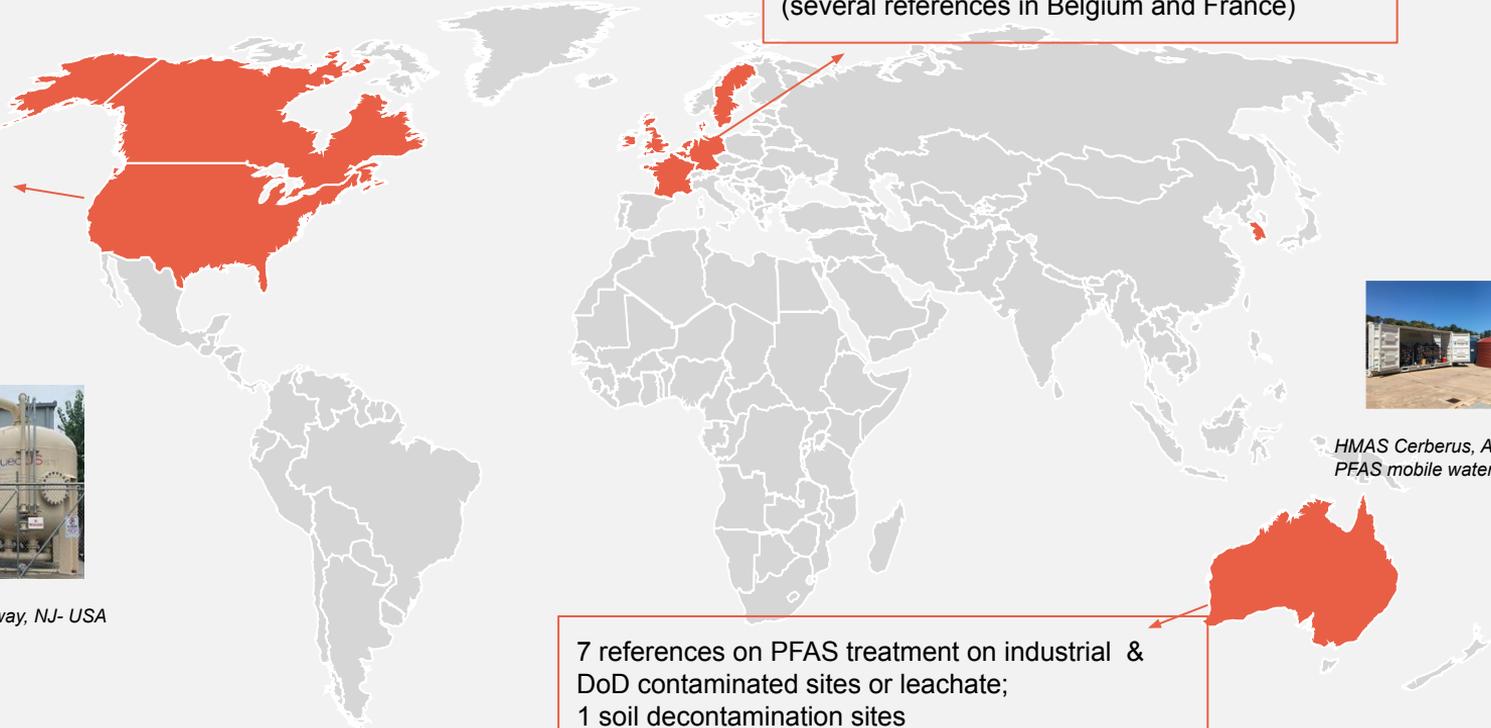
7 references on PFAS treatment on industrial & DoD contaminated sites or leachate;  
1 soil decontamination sites



GAC treatment in Rahway, NJ- USA



HMAS Cerberus, Australia  
PFAS mobile water treatment plant



# Municipal water: Drinking water

## Rahway, New Jersey

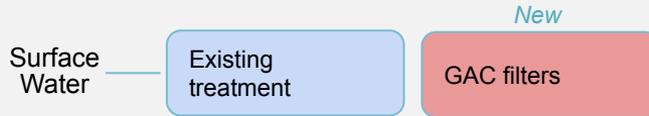


**Challenges:** NJ state enforced in 2020 Maximum Contaminant Level for PFOS and PFOA in drinking water.

How to **reach rapidly these water quality objectives** in Rahway Water Treatment Plant, to fulfill client expectations of a solution within 1-2 years ?

**Solution:** Veolia and a consulting firm determined the most cost-effective solution was the **optimization of the existing Granular Activated Carbon (GAC)** treatment process by replacing the media with a more effective product.

**Waste disposal:** Saturated activated carbon are managed by the Carbon supplier (Calgon).



### Benefits:

Reactivity : Veolia solution was implemented within a **matter of weeks**

Customer Satisfaction : The City of Rahway **reports to its customers** that they are meeting the MCLs for PFOA and PFOS **ahead of schedule**

4.85  
MGD

Capacity of  
surface water  
treatment plant

12 ng/l  
to  
35 ng/l

Concentration  
of PFOS and  
PFOA in raw  
water (samples  
tested)

Up to  
65%

PFOA and  
PFOS  
reduction

13 ppt  
(PFOS, PFNA)  
14 ppt  
(PFOA)

Warranties :  
MCL for New  
Jersey State

# Municipal water: Drinking water

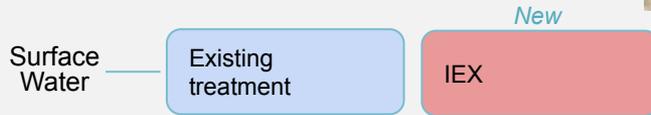
## Northern New Jersey



**Challenges:** NJ state enforced in 2020 Maximum Contaminant (MCL) Levels for PFOS and PFOA in drinking water. Which reliable solution to provide **compliant water in a timely manner** for Northern New Jersey customers, supplied with a **variety of sources**.

**Solution:** Veolia began sampling in 2018 and worked together with a consulting firm to determine the most cost-effective solution: installation of **ion exchange resins** (IEX) due to location space constraints.

**Waste disposal:** Spent resins are incinerated.



### Benefits:

**Reactivity :** While the permanent solution was designed and implemented, Veolia installed **temporary treatment units** at the sites exceeding the MCL.

**Customer satisfaction:** Because all sites are meeting the MCL, Veolia **avoided violations and public notifications** for the sites we own and operate..

> 100  
MGD

Volume of  
drinking water  
supplied

Max  
32 ng/l  
&  
23 ng/l

Concentration  
of PFOS and  
PFOA in  
samples on  
sites that  
requires  
treatment

Not  
detectable

PFOA and  
PFOS  
reduction

14 ng/l  
(PFOA)  
13 ng/l  
(PFOS)

Warranties :  
MCL for New  
Jersey State

# Industrial sites: contaminated water

## 7 Firefighting training sites, Victoria



This fire training authority treats firefighting training waters in order to reuse them and reduce potable water consumption. Water is contaminated due to the historical use of PFAS containing fire fighting foams. Used water is stored in either dams or water tanks.

**Challenge:** How to treat firefighting training water contaminated by PFAS to drinking water quality using a permanent treatment plant located on remote sites and on demand while tackling source variations in untreated water quality?

**Solution:** The treatment train for each water treatment plant consists of a lamella clarifier, a greensand filter, a GAC filter, a selective ion exchange (lead & lag) and finally a mixed ion exchange.

**Waste disposal:** Incineration of saturated GAC and resins.



PFAS  
contaminated  
water →

Lamella clarifier

Greensand filter

GAC filter

IEX resin  
(lead&lag)

IEX resin

**Benefits:** The intensive treatment line with a multi-barrier approach allows to comply with the high quality standard required by the client and the treated water can be reused in drought prone areas across Victoria.

6, 16 &  
25 m<sup>3</sup>/h

Unitary  
capacity of the  
facilities

250 to  
6600  
ng/l

Non-TOPA  
tests in raw  
water for total  
PFAS

96-99%

Reduction  
on  
analyzed  
samples

< 0.07 µg/l

PFOA, PFOS,  
PFOS + PFHxS

Target:  
Australian  
Drinking  
Water  
Guidelines  
(ADWG)

# Industrial water: contaminated water on DoD site New South Wales



**Challenges:** Australia counts numerous remote sites with PFAS contaminated waters. Treating these waters required either transporting it to a treatment plant or building an expensive treatment plant on site.

**Solution:** Veolia mobile water treatment plant solutions can be tailored to answer our client need (inlet concentration, reuse/discharge). In this specific case the treated water was **discharged to the environment** and the diesel generator was replaced by **solar panels**.



**Waste disposal:** Spent GAC and resins are incinerated.



## Benefits:

Veolia mobile plant allowed to **quickly** provide a treatment solution and to be able to discharge the treated water in the environment. Avoiding effluent transportation and relying on solar panels decreased significantly the Carbon footprint of the project.

2000  
m<sup>3</sup>/yr

Treated water  
volume

15 µg/l

Average PFAS  
concentration  
in the effluent  
(sum of 28  
PFAS)

Non  
detecta  
ble

PFOS,  
PFHxS,  
PFOA  
reduction

<0.01  
µg/l

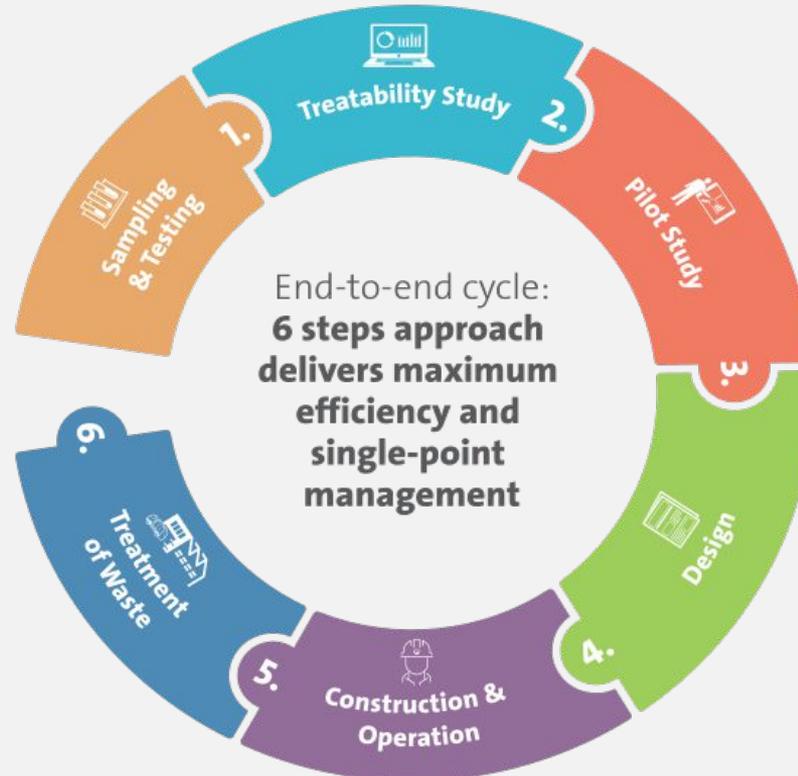
Discharge  
level  
guidelines for  
PFOS,  
PFHxS, PFOA

| **What's next ?**

What's next ?

## An end-to-end offer on PFAS

Veolia North-America offer on PFAS



## What's next

### Investigate emerging technologies

#### Separation technologies

Sorption technologies

Membrane Filtration

Foam fractionation

Thermal desorption

Phytoremediation

Combined solutions

#### Degradation technologies

##### Advanced Oxidation Process (AOP)

Electrochemical oxidation  
Supercritical water oxidation  
Chemical oxidation  
Combined & Other

Plasma

Thermal treatment

Combined solutions

We are conducting a **mapping of other innovative solutions** on the market to be able to offer to our clients the best available solution.

## What's next ?

### Moving forward on the PFAS challenge

#### **Offer solutions to our clients in new geographies as the regulatory framework evolves**

- Offer and solutions developed for the US and Australia to be deployed in Europe
- Tailor the best solution adapted to our customer challenge

#### **Boost our know-how through Research & Innovation**

- Continue investigating degradation technologies to eliminate PFAS compounds
- Develop partnerships and test most promising technologies for PFAS treatment in water and also biosolids