

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.

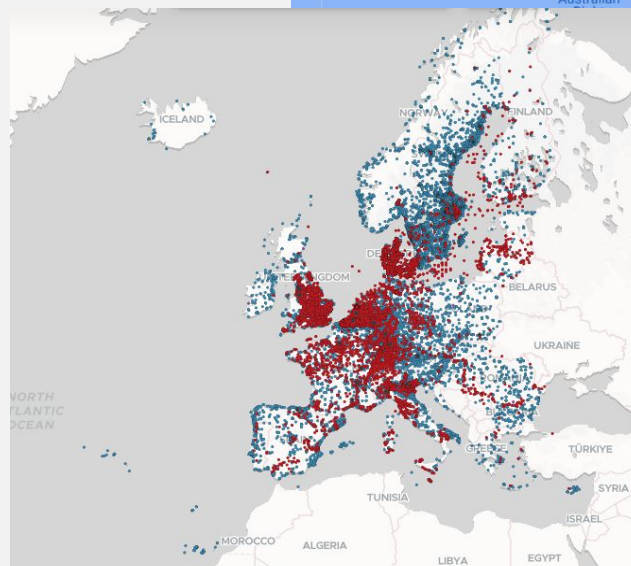
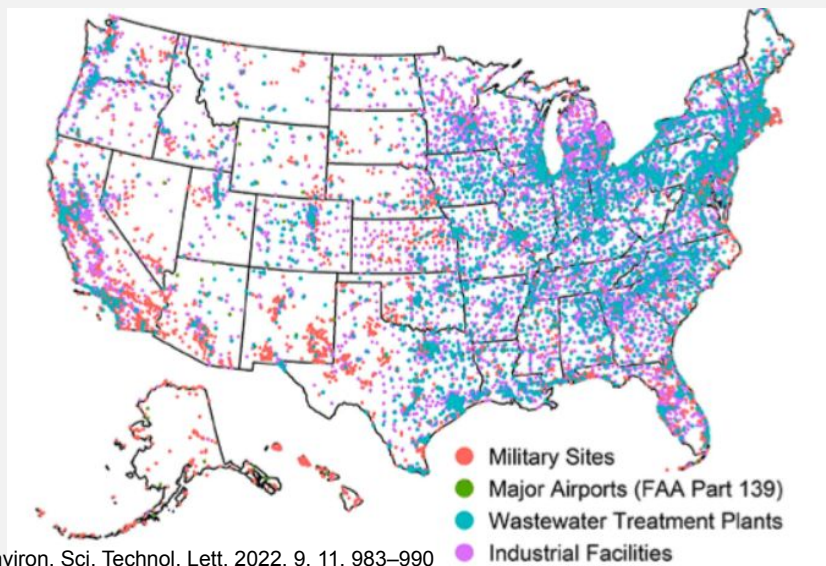
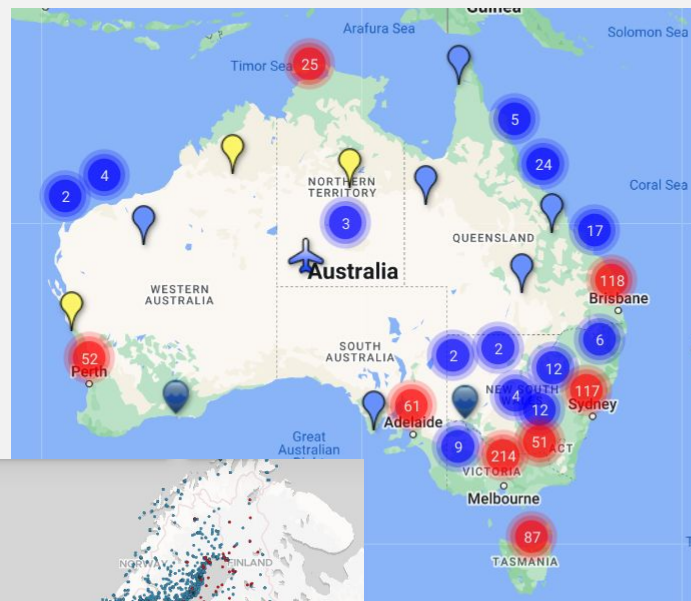
Scope

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>)



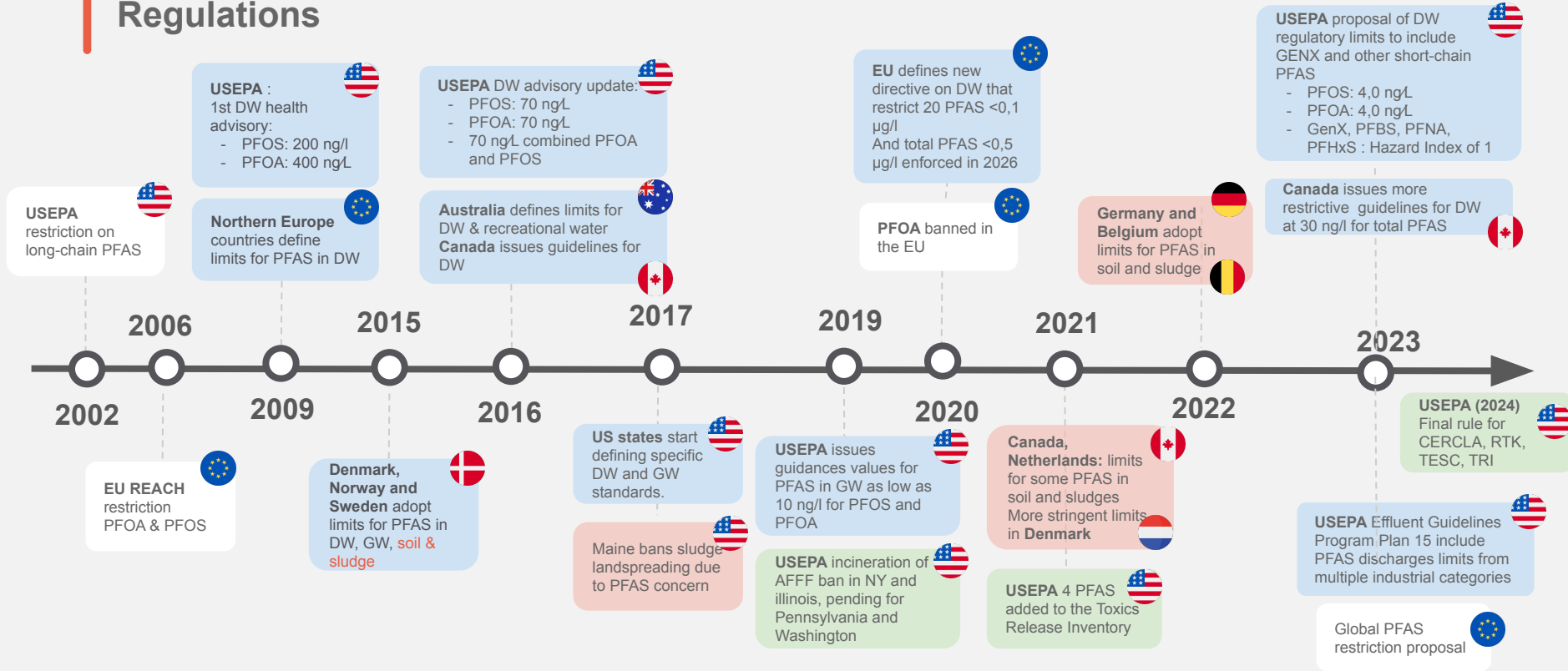
Map of PFAS contamination in Europe
(Source: Forever Pollution Project, February 2023)

Scope Regulations

Water

Soil & Biosolids

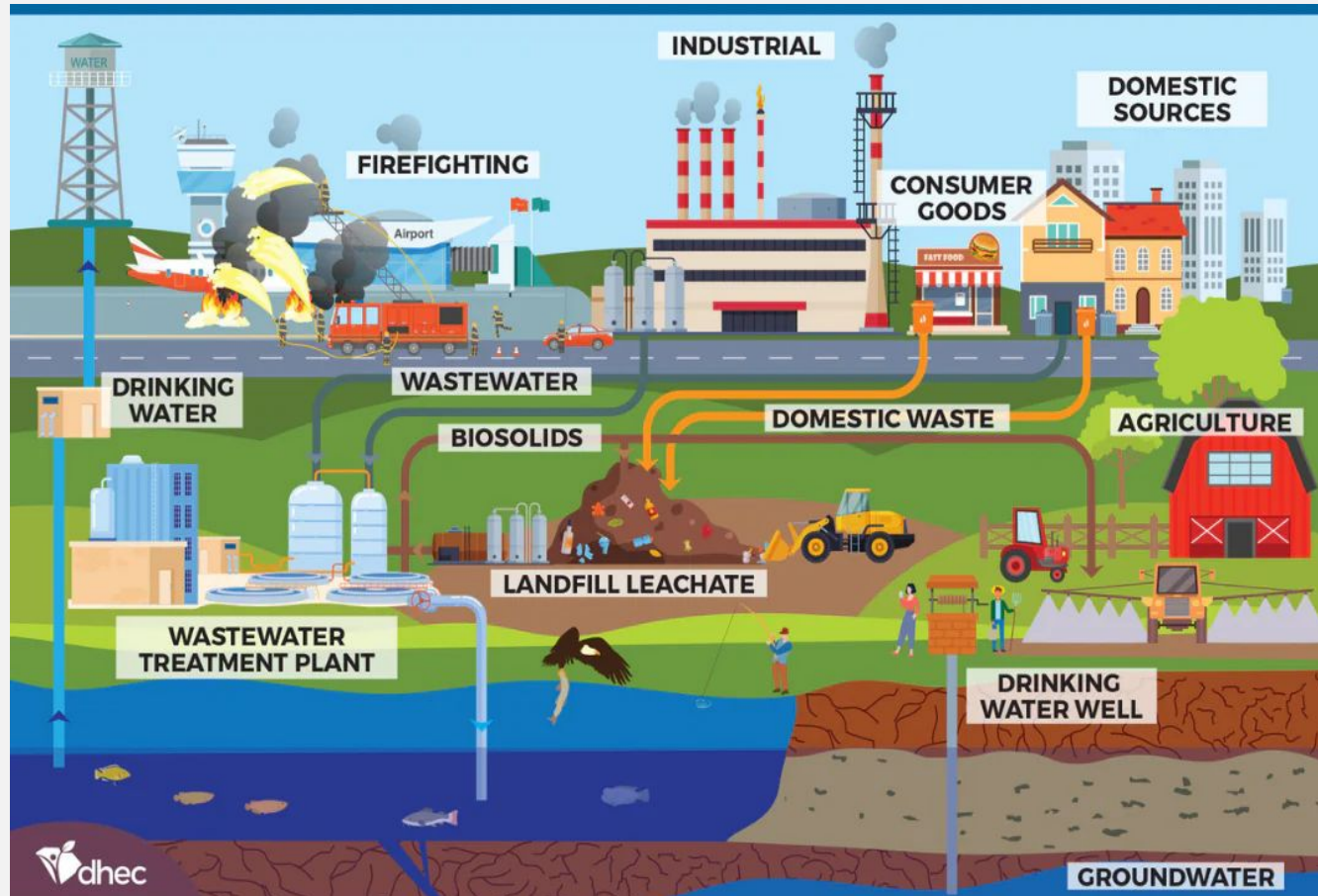
Waste



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





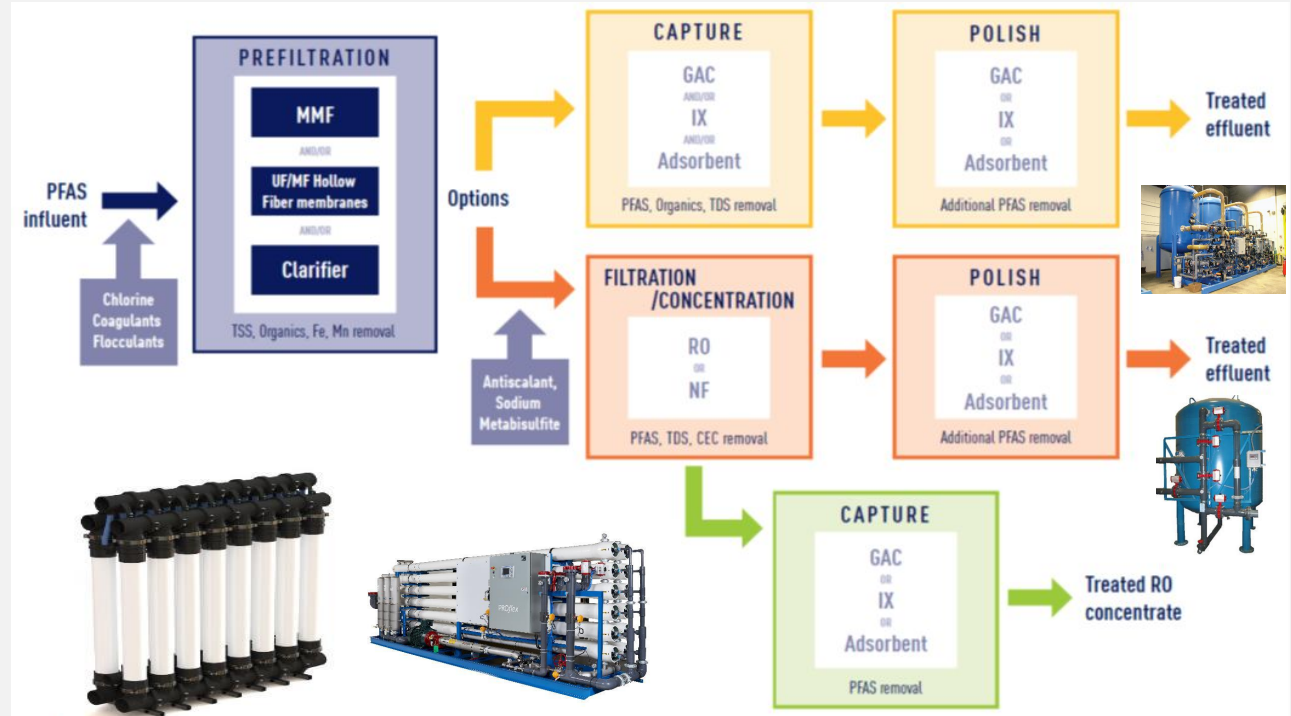
Solutions & experience

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)



GAC treatment in Rahway, NJ- USA



HMAS Cerberus, Australia
PFAS mobile water treatment plant

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

Municipal water: Drinking water

Rahway, New Jersey

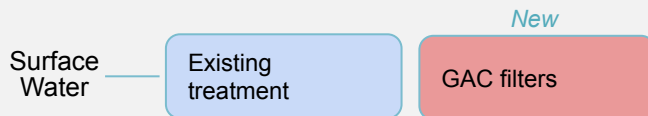


Challenges: NJ state enforced in 2020 Maximum Contaminant Level for PFOS and PFOA in drinking water.

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

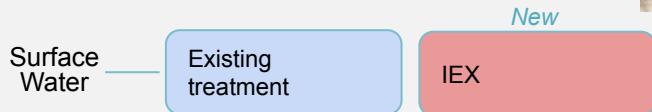
Northern New Jersey



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 m³/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)

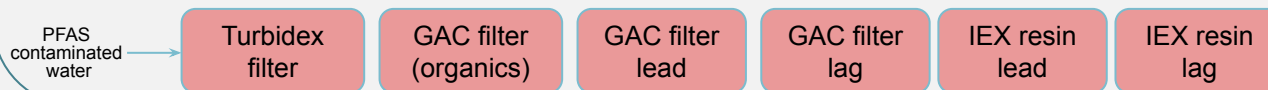
Industrial water: contaminated water on DoD site New South Wales



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
m³/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

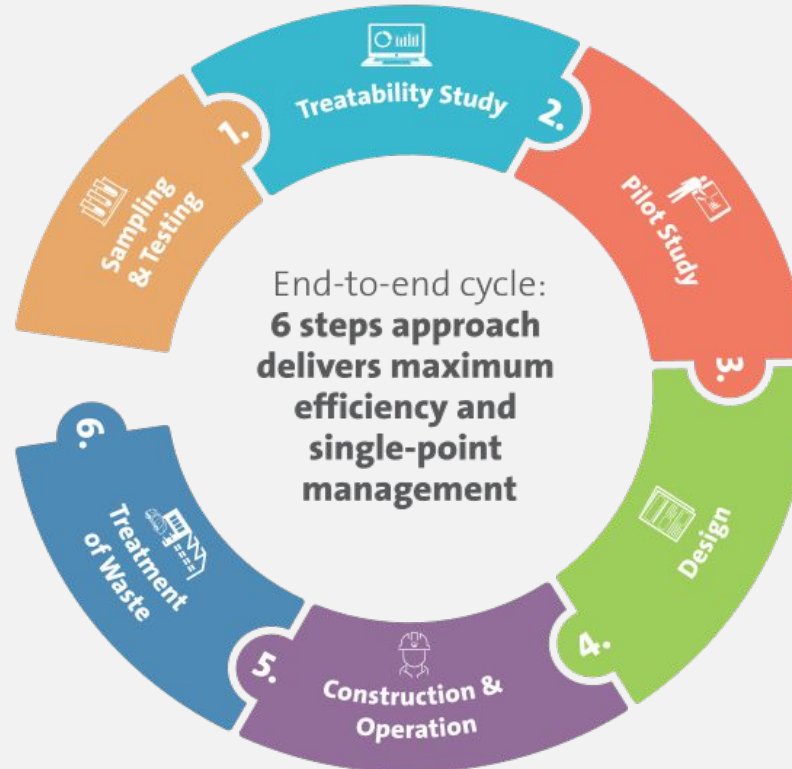
Discharge
level
guidelines for
PFOS,
PFHxS, PFOA

| **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