Chemical Persistence

Why biodegradability is taking centre-stage in the global policy landscape

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SUPPORTING THE
CHEMICAL INDUSTRY CREATE A
SAFE AND SUSTAINABLE WORLD

Show of hands

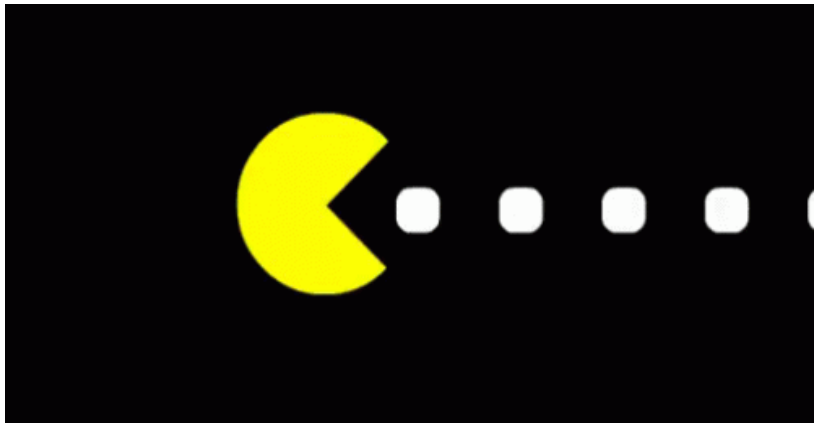
How much does persistence and biodegradability currently feature in your product stewardship strategy?

AGENDA

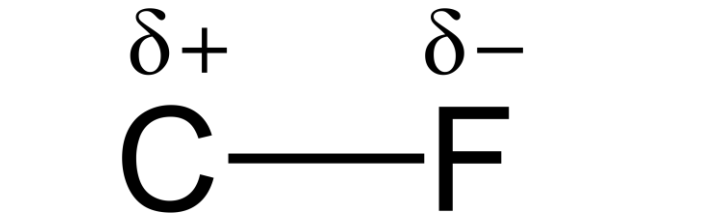
- What is persistence?
- Persistence issues
- How is persistence assessed?
- Challenges with persistence assessment
- New developments
- What can you do?

What is persistence?

- A measure of how long it takes for a substance to be degraded and removed from the environment
- An intrinsic property? Difficult to measure!
- An indicator of increased/poorly reversible exposure
- A key principle of green chemistry and sustainability



Persistence issues



How is persistence assessed?

STOCKHOLM CONVENTION

ECHA
EUROPEAN CHEMICALS AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

OSPAR COMMISSION

efsa
European Food Safety Authority

Environment Canada

RICARDO

How is persistence assessed?

Persistent (P)

(a) The degradation half-life in marine water is higher than 60 days;
(b) The degradation half-life in fresh or estuarine water is higher than 40 days;
(c) The degradation half-life in marine sediment is higher than 180 days;
(d) The degradation half-life in fresh or estuarine water sediment is higher than 120 days;
(e) The degradation half-life in soil is higher than 120 days.

Very Persistent (vP)

(a) The degradation half-life in marine, fresh or estuarine water is higher than 60 days;
(b) The degradation half-life in marine, fresh or estuarine water sediment is higher than 180 days;
(c) The degradation half-life in soil is higher than 180 days.

EU REACH (Regulation (EC) No 1907/2006), Annex XIII criteria

How is persistence assessed?

Biodegradation screening tests

Quantitative structure activity relationship (QSAR) models

Monitoring data

Field studies

Other relevant information

- **Should follow a weight of evidence (WoE) approach**

Different types of biodegradation test

Screening tests (e.g. ready biodegradability)

Biodegradability (pass/fail)

Artificial inoculum (e.g. STP sludge)

Not compartment-specific

High test concentration

Low cost, simple

Conclusion: not P / potentially P

Simulation tests (OECD 307, 308, 309)

Biodegradation rate (half-life)

Natural inoculum (environmental sample)

Compartment-specific (water, sediment, soil)

Low test concentration

High cost, technically challenging

Conclusion: not P, P, vP (definitive)

Challenges with persistence assessment

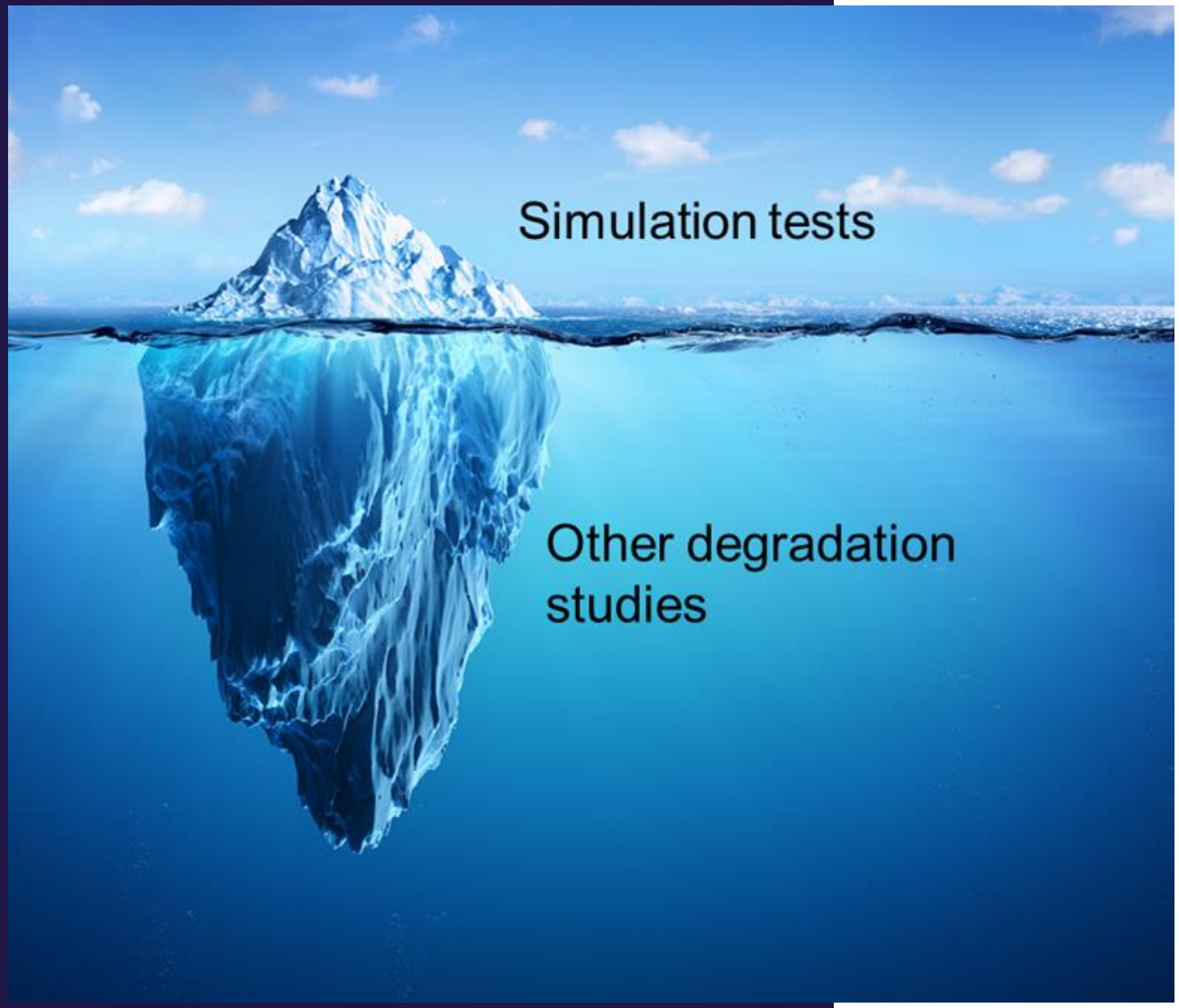
Variability

Degradation of chemicals depends on both their intrinsic properties and the environmental conditions.

Biodegradation testing is therefore inherently highly variable!

Sources of variability include:

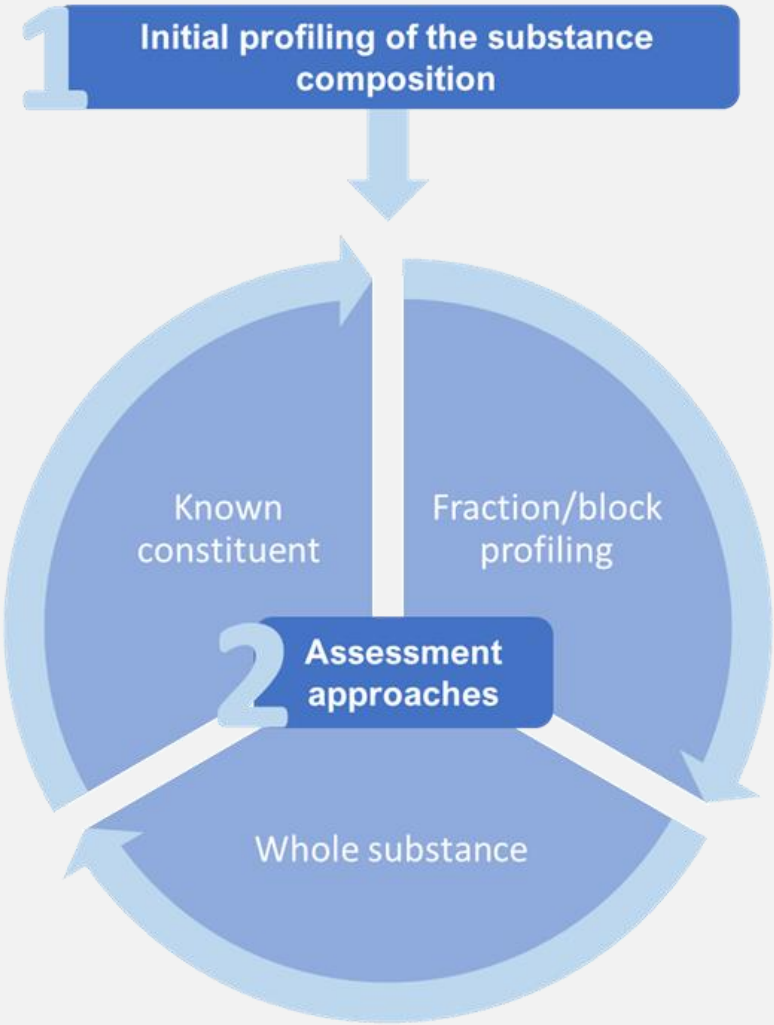
- Microbial inoculum
- Matrix characteristics
- Redox conditions
- Temperature
- Light
- Experimental setup



Weight of evidence

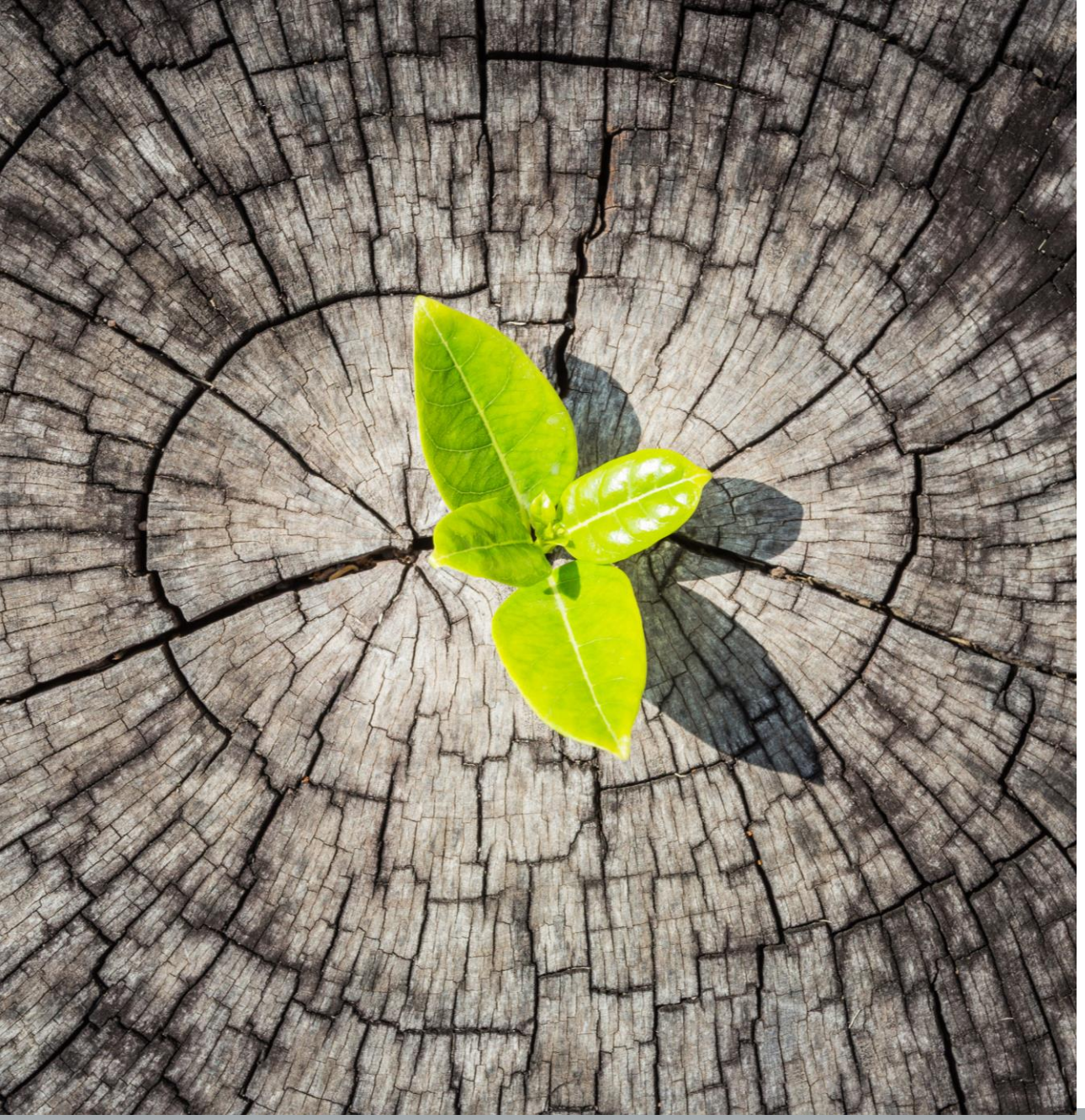
Difficult substance properties

- Properties of substances can interfere with testing and assessment of persistence.
- Need to account for these in testing.
- Need to consider the type of test.



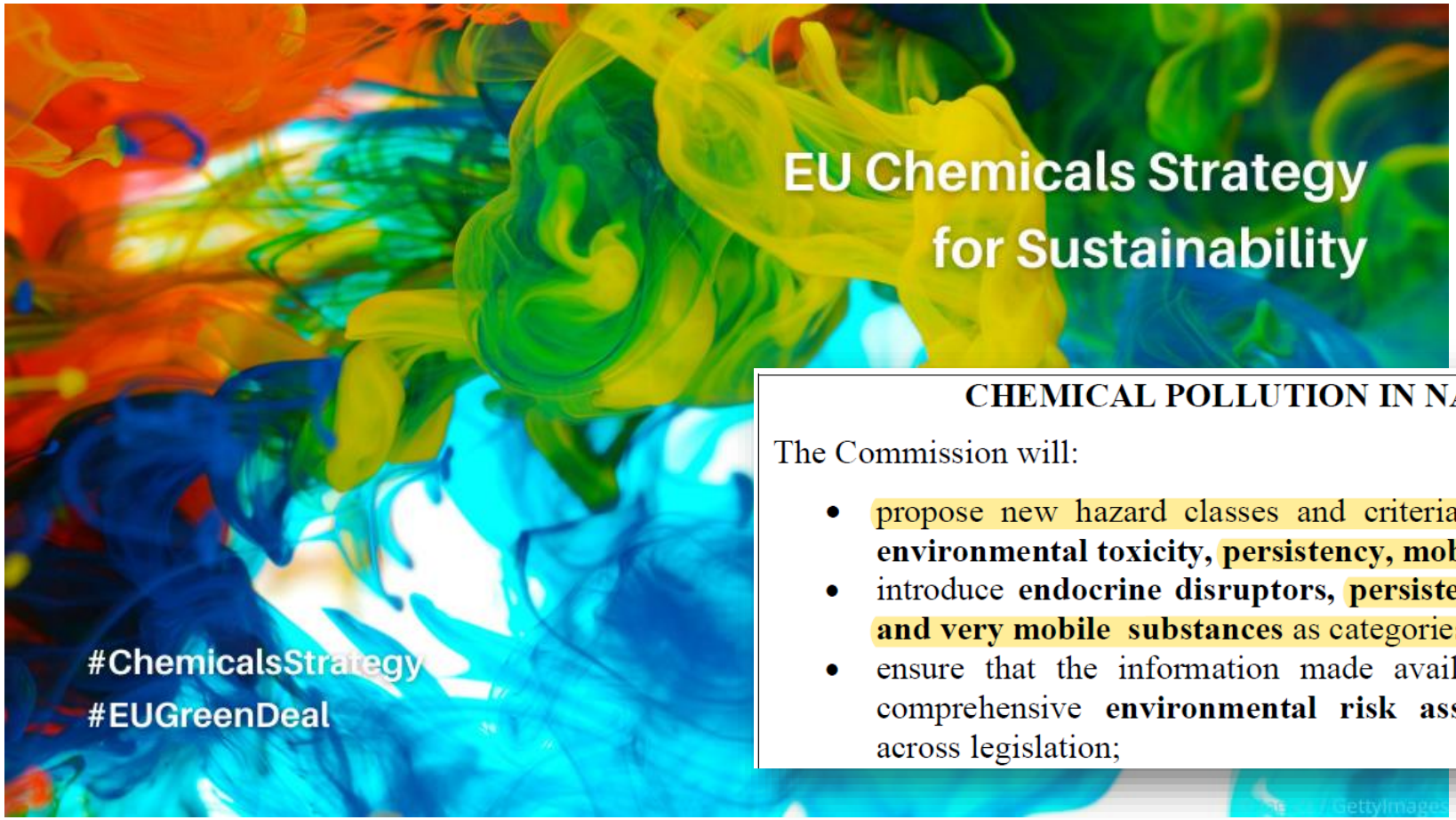
Complex (UVCB) substances

- Complex substances present significant challenges to persistence assessments.
- Each constituent has its own fate properties.
- Assessments must cover whole composition.
- Bespoke approaches needed per substance.



New developments

EU Chemicals Strategy for Sustainability



CHEMICAL POLLUTION IN NATURAL ENVIRONMENT

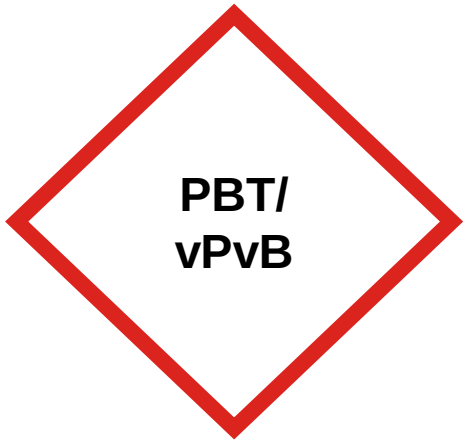
The Commission will:

- propose new hazard classes and criteria in the CLP Regulation to fully address **environmental toxicity, persistency, mobility and bioaccumulation;**
- introduce **endocrine disruptors, persistent, mobile and toxic** and **very persistent and very mobile substances** as categories of substances of very high concern;
- ensure that the information made available to authorities on substances allows comprehensive **environmental risk assessments** by strengthening requirements across legislation;

Persistent, Mobile, Toxic (PMT)

- Goal: protection of drinking water.

- New hazard classes under CLP:



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Jin et al., 2020. The Need to Adopt an International PMT Strategy to Protect Drinking Water Resources. *Environ. Sci. Technol.*
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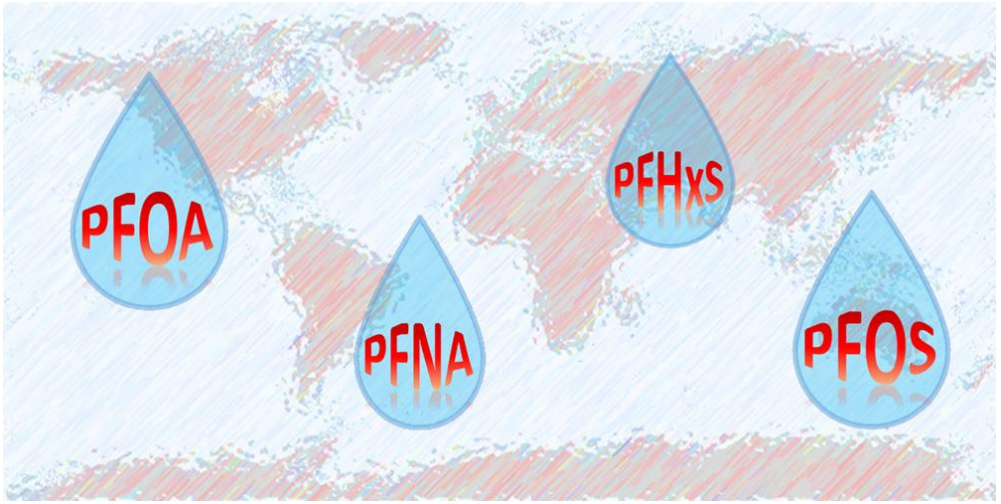
Per- and poly-fluoroalkyl substances (PFAS)

- ‘Forever chemicals’
- ~15,000 chemicals
- Linked to various health and environmental impacts
- Many regulatory developments globally



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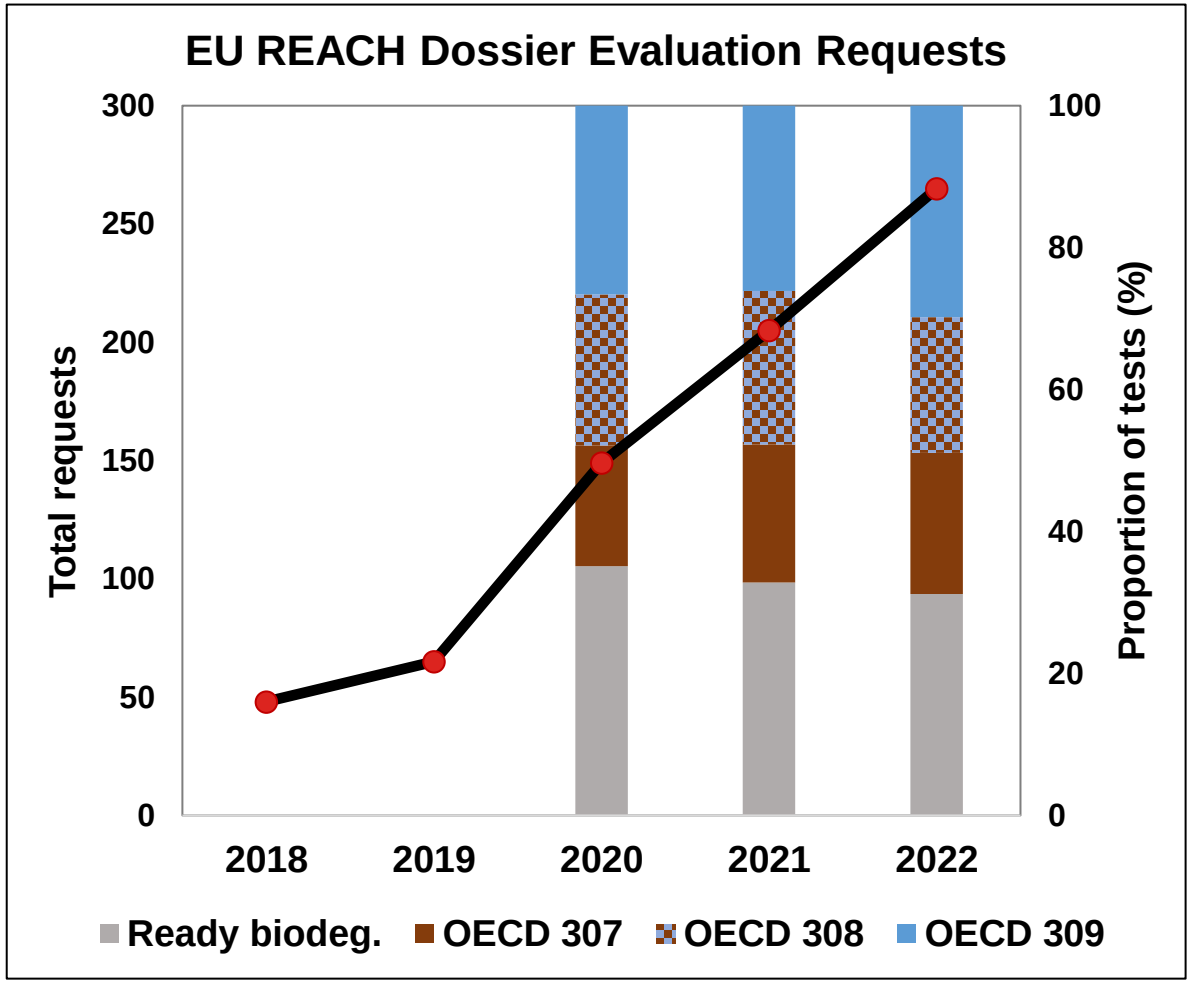
Microplastics

- EU REACH restriction on intentionally added microplastics
- Use-specific phase-in deadlines
- Biodegradability derogation

EU REACH evaluation

- Demand for information on biodegradation is increasing

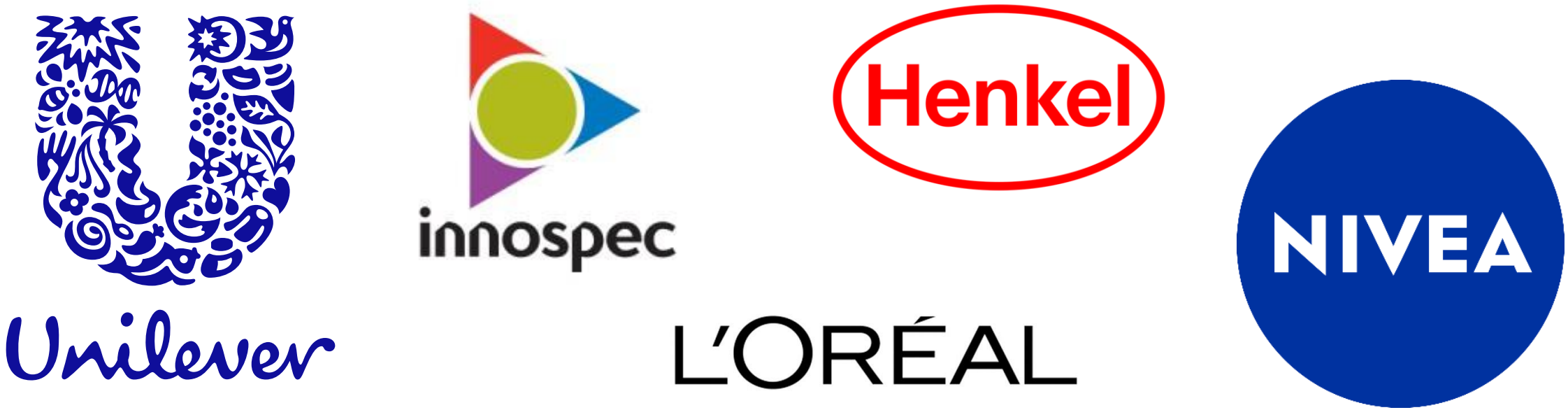
- EU REACH
  - Substance → Dossier evaluation
  - Dossier evaluation information requests
  - Shift towards grouping approaches



Source: https://echa.europa.eu/overall-progress-in-evaluation

Biodegradability is now a key customer demand!

As a result many companies are making biodegradability a central pillar of their **product development and marketing strategies**.



Cefic-LRI ECO52 project

Ricardo has carried out a detailed investigation of persistence assessment frameworks.

Developed guidance documents on:

- Difficult test substances
- Complex substances
- Polymers and microplastics
- Multimedia fate modelling
- Weight of evidence

Persistence Assessment Tool (PAT)

Ricardo has developed the PAT to help users to carry out persistence assessments.

The PAT provides:

- Guidance and structure to evaluate data quality
- Weight of evidence methodology
- Improved consistency, transparency and robustness in persistence assessments.

FREE TO DOWNLOAD
www.ricardo.com/pat

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What can you do?

Next steps

01

Check your data

- Review your available data: Do you have gaps? Could you answer customer questions?

- Can results be improved through repeated testing?
  - Remember: inherent variability and difficult substance properties.
  - Positive results generally supersede negative in screening tests!

- Can you improve the quality of REACH registration dossiers?
  - Avoid costly, poorly timed and legally-binding compliance checks.

Next steps

02 Evaluate the impact of new policies and market trends

- Review products and raw materials vs PMT/vPvM criteria.
- Assess where PFAS and microplastic restrictions affect your products and operations.
- Get ahead of the curve!
  Incorporate persistence and biodegradability into new product development.

Next steps

03 Get the right expertise

- Biodegradation testing and assessment is littered with pitfalls!
- Results are highly variable and sensitive to experimental methods.
  - Difficult substance properties can lead to incorrect conclusions.
- Subsequent interpretation and assessments are complex.
- **The right expertise can make a difference to regulatory outcomes.**

Conclusion

Persistence is becoming an essential part of chemicals management.

Global sustainability agenda, societal demands and regulatory developments now make it impossible to ignore.

Persistence assessments are complex and technically challenging.

Companies need to adjust to this new reality:

- Review and update your biodegradation data.
- Understand and mitigate new regulatory policies.
- Get the right expertise!

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