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O. Reiff-Musgrove, *The ESA REACH Tool – Regulatory risk monitoring for the European Space Sector*, 6th ESA REACH Workshop, ESA ESTEC, Noordwijk, the Netherlands, 17th June 2025

Author affiliation:

Oliver Reiff-Musgrove, Senior Product Manager, REACHLaw

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The ESA REACH Tool – Regulatory risk monitoring for the European Space Sector

Oliver Reiff-Musgrove (Senior Product Manager at REACHLaw)

17 June 2025 | ESA 6th REACH Workshop | ESA ESTEC, Noordwijk, The Netherlands | MPTB-RL-HO-0193





Disclaimer

Only companies from ESA Member & Associate

Member States can use the ESA REACH Tool

Registrants from outside cannot be approved



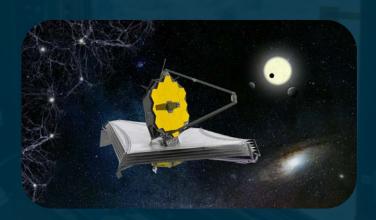
- 1. What aspects of REACH need to be monitored?
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Introduction REACH @ European Space Agency

- ESA does not build anything, but is rather the end user
 - Industry builds spacecraft through a complex supply chain
- Development of ESA projects can take 5-15+ years
 - At odds with REACH regulatory development timelines
- REACH-driven obsolescence can be very costly, so ESA helps industry mitigate these risks through the MPTB
 - Materials and Processes Technology Board of the European Space Components Coordination (ESCC)





Source: https://www.esa.int

Introduction Jurisdictions

ESA Regulatory Jurisdictions

- EU REACH
- UK REACH
- Swiss ChemO/ORRChem



Source: https://www.esa.int/About_Us/Corporate_news/Member_States_Cooperating_States

Introduction EU REACH Substance Lists

Space-relevant EU REACH Substance Lists

Also known as

Compliance Obligations

Obsolescence Risk

Update Frequency

Entries

Candidate List (SVHC)

Reporting duties

Medium

2x/year

247

Restrictions (Annex XVII)

Restriction on certain uses

High* (for ban)

No schedule

77

Authorisation

(Annex XIV)

Ban without authorisation

Very High

No schedule

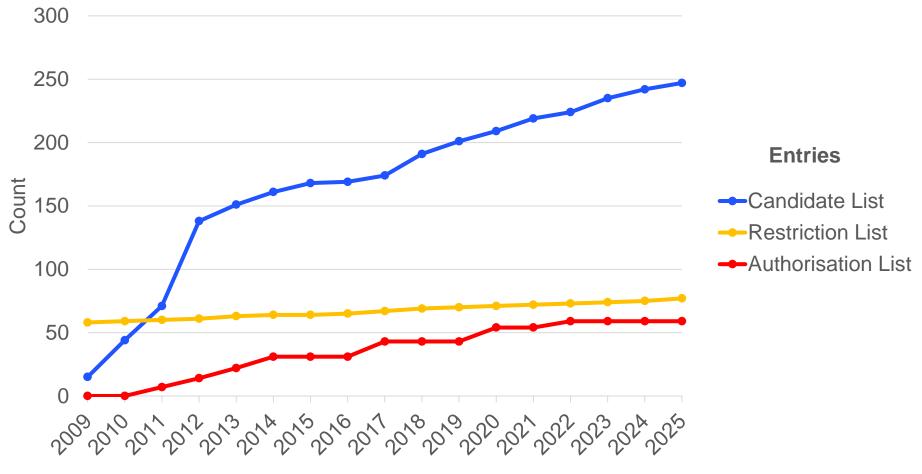
59

*Restriction entry text specific

Multiple regulatory updates each year from EU REACH alone!

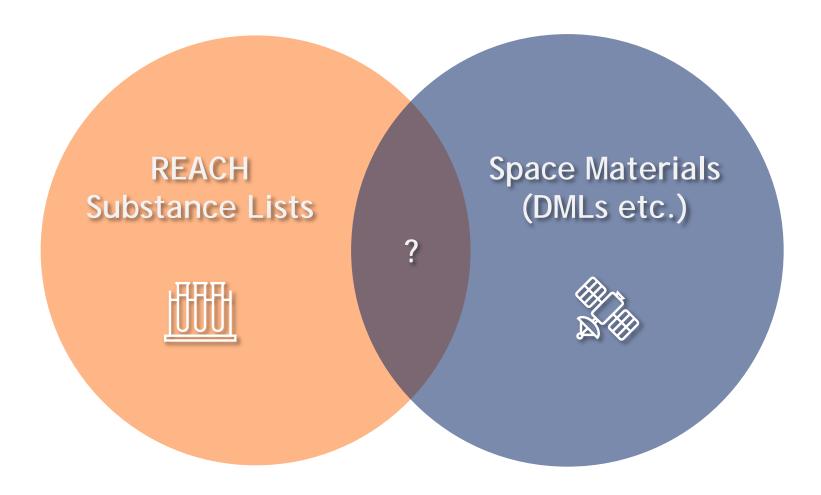
SVHC = Substance of Very High Concern

Introduction EU REACH Entry Number Statistics



Source: ECHA, ESA REACH Tool NOTE: Restriction List data is approximate

Introduction What do we need to find?

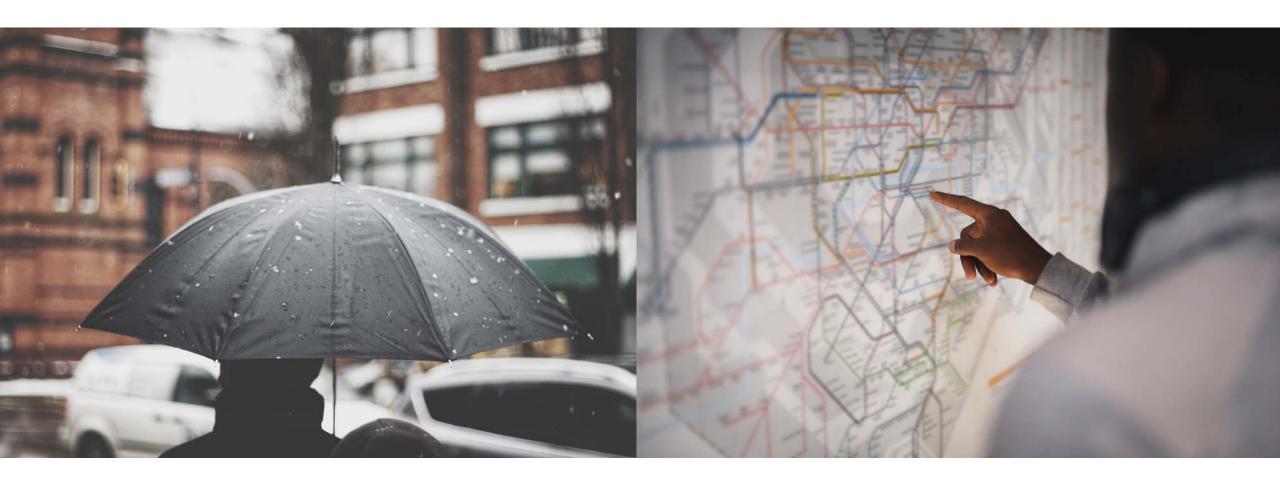


Source: ECHA, ESA REACH Tool

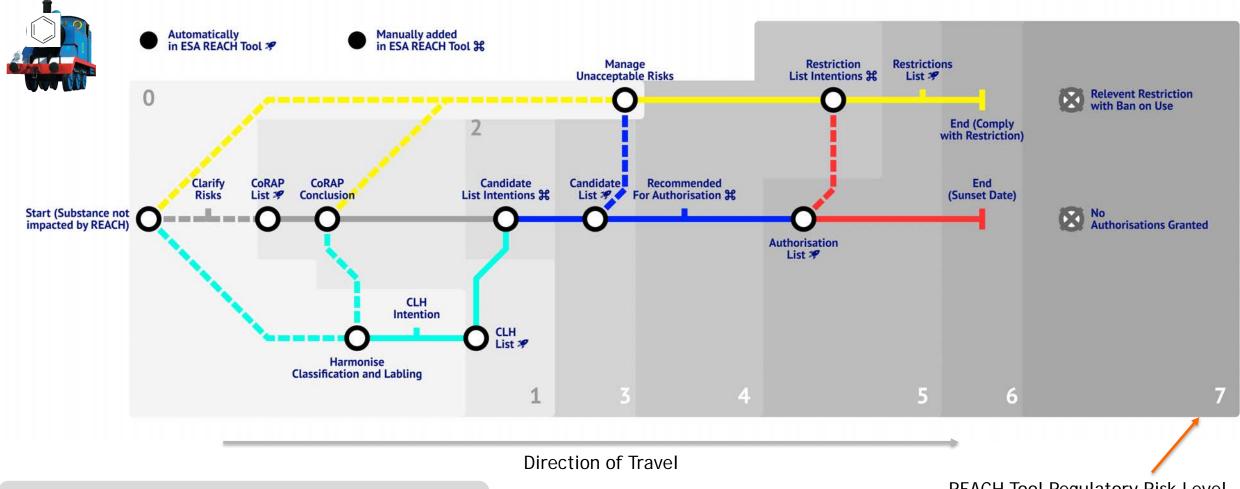
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REACH Monitoring Monitoring ECHA Substance Lists



REACH Monitoring EU REACH High Level Substance Pathway



Please note: This is a simplified representation.

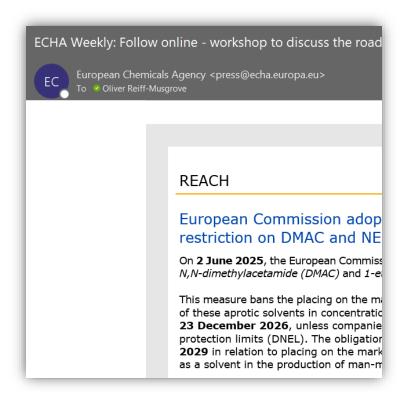
Passing from one stop to the next is never guaranteed!

REACH Tool Regulatory Risk Level

Source: MPTB List of Lists

REACH monitoring Monitoring ECHA Substance Lists







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Tracking Space Materials Finding the Data



- The average spacecraft will have between 2000-4000 materials
- These are typically declared in Declared Materials Lists (DMLs)
- However, DMLs cannot tell you the full chemical composition of the materials
- Other than from Article 33 declarations, the space supply chain is blind to its (non-SVHC) chemical usage

Tracking Space Materials Safety Data Sheets (SDSs)

- Currently Section 3 of SDSs are the main publicly accessible way to find the chemical composition of materials used in space
 - Although only the hazardous ones!
- However legally only the procurer of the substance must receive the SDS
 - ESA is not the manufacturer, thus has not bought the material nor received the SDS
- Therefore, to obtain the data, ESA and REACHLaw search SDS databases to find the SDSs of materials known to be in space use



Safety Data Sheet according to (EC) No 1907/2006 as amended

Page 1 of 25

SDS No.: 204341

LOCTITE EA 9492

SECTION 3: Composition/information on ingredients

3.2. Mixtures

SECTION

1.1. Product identif LOCTITE EA 9

1.2. Relevant identi Intended use: Epoxy Hardener

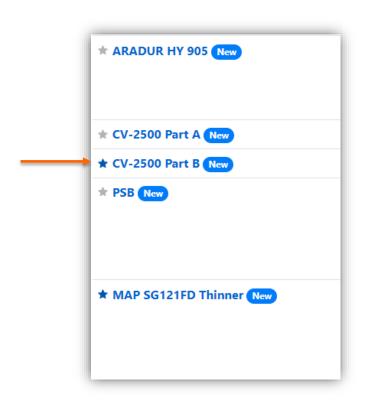
1.3. Details of the st Henkel AG & Co Henkelstr. 67

For Safety Data adhesives.com

1.4. Emergency tele exceptional cases

Hazardous components CAS-No. EC Number REACH-Reg No.	Concentration	Classification	Specific Conc. Limits, M- factors and ATEs	Add. Information	
Diethylenetriamine 111-40-0 203-865-4 01-2119473793-27	25- 50%	Acute Tox. 4, Ornal, H302 Acute Tox. 4, Dermal, H312 Skin Corr. 1B, H314 Skin Sens. 1, H317 Acute Tox. 2, Inhalation, H330 STOT SE 3, H335 Eye Dam. 1, H318	inhalation:ATE = 0,071 mg/l;dust/mist		
m-Phenylenebis(methylamine) 1477-55-0 216-032-5 01-2119480150-50	5-< 10 %	Acute Tox. 4, Oral, H302 Skin Corr. 1B, H314 Skin Sens. 1B, H317 Acute Tox. 4, Inhalation, H332 Acute Tox. 4, Inhalation, H332 Eye Dam. 1, H318			
4.4'-Isopropylidenediphenol 80-05-7 201-245-8 01-2119457856-23	1-< 5%	Eye Dam. 1, H318 Skin Sens. 1, H317 STOT SE 3, H335 Repr. 1B, H360F Aquatic Acute 1, H400 Aquatic Chronic 1, H410	M acute = 1 M chronic = 10 oral ATE = 2.500 mg/kg	SVHC ED EU OEL	
benzyl alcohol 100-51-6 202-859-9 01-2119492630-38	1-< 5%	Acute Tox. 4, Oral, H302 Acute Tox. 4, Inhalation, H332 Eye Irrit. 2, H319	dermal:ATE = 2.500 mg/kg inhalation:ATE = 4,17 mg/l;dust/mist		
N-(3- Frimethoxysilyl)propyl)ethylene diamine 1760-24-3 217-164-6 01-2119970215-39	0,1-< 1%	Skin Sens. 1A, H317 Eye Dam. 1, H318 Acute Tox. 4, Inhalation, H332 STOT RE 2, Inhalation, H373	inhalation:ATE = 1,49 mg/l;chist/mist		
nonylphenol 0,1-< 1 % 25154-52-3 246-672-0		Aquatic Acute 1, H400 Skin Corr. 1B, H314 Acute Tox. 4, Oral, H302 Repr. 2, H361 fd Aquatic Chronic 1, H410	M acute = 10 M chronic = 10	SVHC ED	
Titanium dioxide 13463-67-7 236-675-5 01-2119489379-17	0,1-< 1%	Carc. 2, Inhalation, H351			

Tracking Space Materials Keeping the Data Relevant

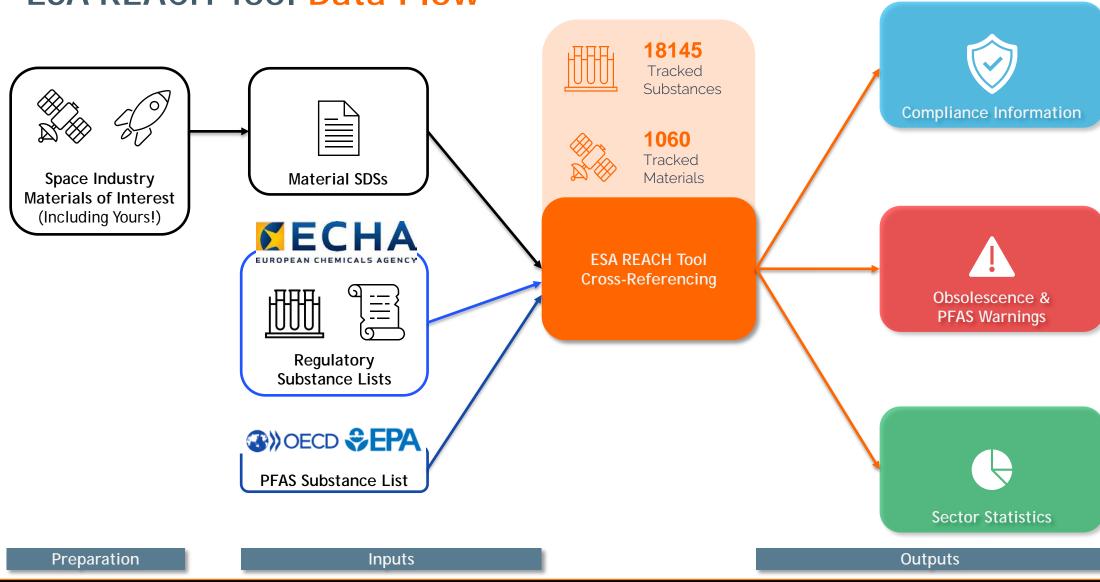


- The long-term challenge is to then keep the material use data relevant
- Initially we only input data that was <5 years old
- However, we now confidentially track the use level of materials, and will start to archive unused materials
- We also continually refresh the SDS data, updating the entries to the latest version

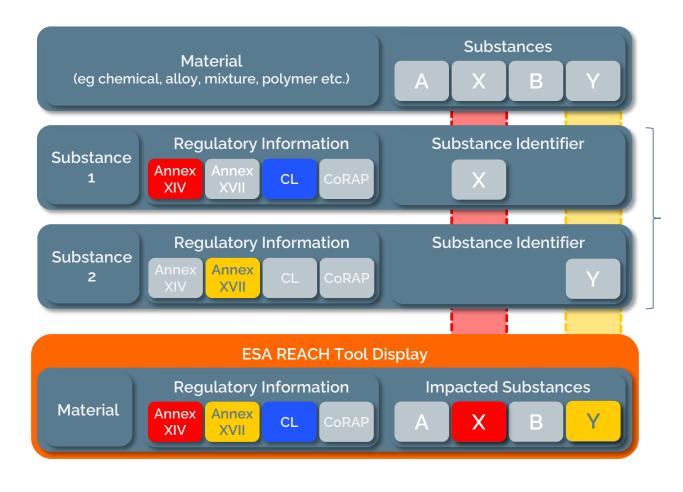
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ESA REACH Tool Data Flow



ESA REACH Tool Cross-Referencing In Detail



Material Content (SDS)



Regulatory Status of Individual Substances



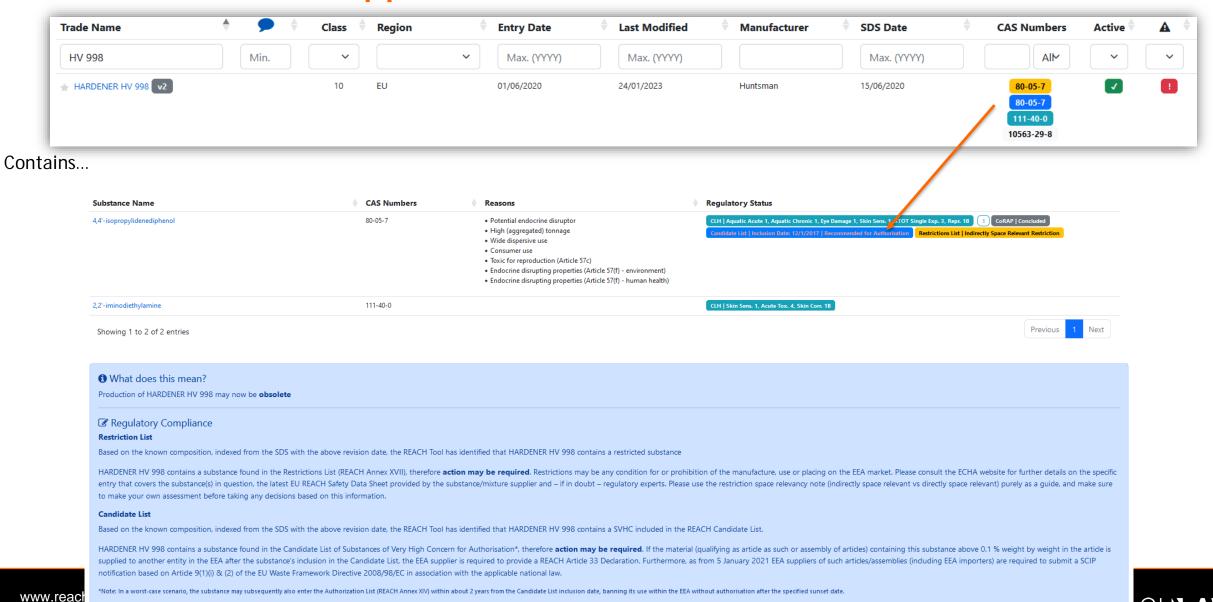
Dynamic Cross-Reference

Material Regulatory Status



Schematic demonstrating how the ESA REACH Tool provides REACH regulatory visibility through the process of dynamic cross-referencing.

ESA REACH Tool Application

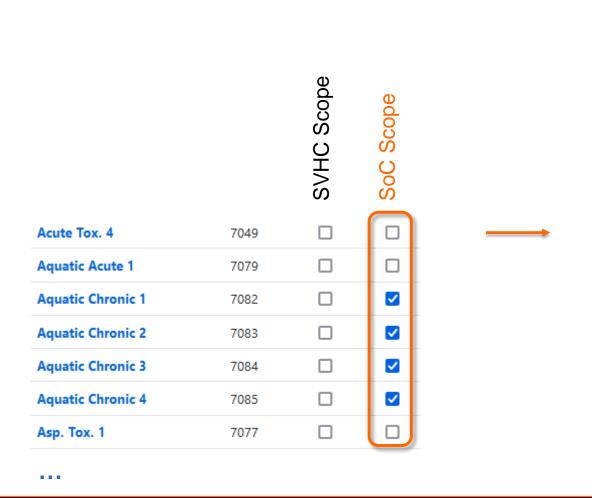


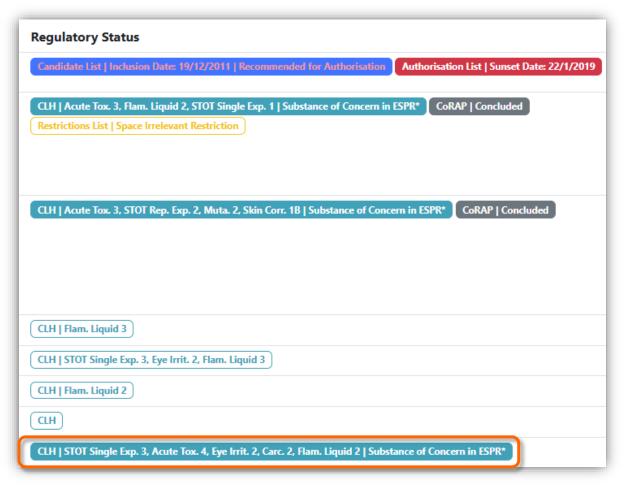
ESA REACH Tool Risk Thermometer

Substance Name	Risk	EC Numbers	CAS Numbers	Reasons	CLH ♦	CoRAP	CL •	Restr	Auth
form					~	~	~	~	~
				CMR Exposure of workers					
formaldehyde%	2/7	200-001-8	50-00-0		✓ !	×	×	×	×
formaldehyde and formaldehyde releasers formaldehyde and formaldehyde releasers	4/7	200-001-8	50-00-0		×	×	×	✓	×
Formaldehyde, oligomeric reaction products with aniline	6/7	500-036-1	25214-70-4	Carcinogenic (Article 57a)	×	×	✓	x	✓
N,N-dimethylformamide	5/7	200-679-5	68-12-2	Toxic for reproduction (Article 57c)	×	×	V	✓	×
N,N-dimethylformamide dimethyl formamide	2/7	200-679-5	68-12-2		1	×	×	x	×
Chloroform trichloromethane	6/7	200-663-8	67-66-3			×	×	1	×
Reaction products of 1,3,4-thiadiazolidine-2,5-dithione, formaldehyde and 4-heptylphenol, branched and linear (RP-HP)	5/7	300-298-5	93925-00-9 1471311-26-8	 Endocrine disrupting properties (Article 57(f) - environment) 	x	×	7	x	✓
Formamide	3/7	200-842-0	75-12-7	Toxic for reproduction (Article 57c)	1	×	7	×	x
C,C'-azodi(formamide)	4/7	204-650-8	123-77-3	 Respiratory sensitising properties (Article 57(f) - human health) 	2	×	✓	x	×
Octene, hydroformylation products, low-boiling	1/7	273-110-1	68938-03-4	High (aggregated) tonnageSuspected PBT/vPvBConsumer use	×		×	×	x

ESA REACH Tool SoC Tracking

Another bonus is that the ESA REACH Tool allows for SoC tracking based on hazard codes



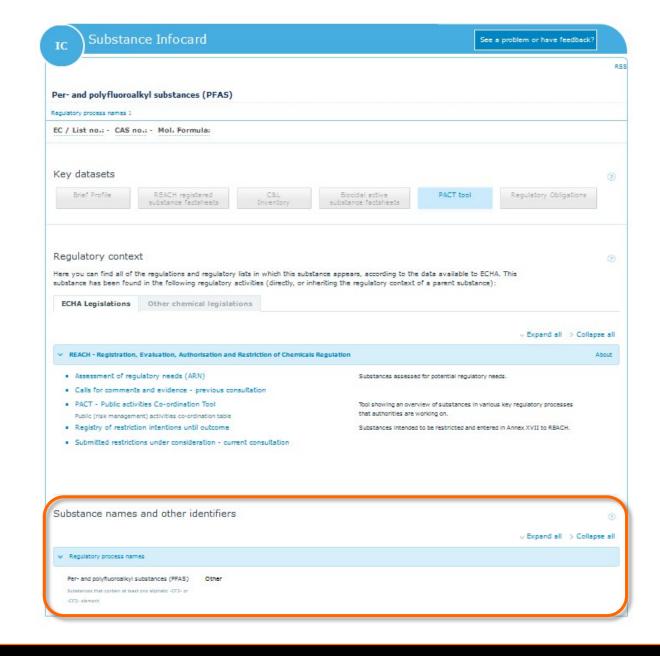


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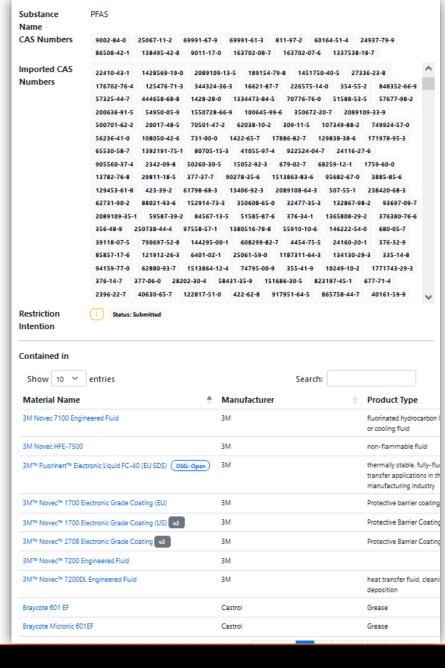
The Unique Challenge of PFAS PFAS Identifiers

- ECHA does not provide its own list of PFAS identifiers
- Instead, it points to the:
 - OECD List from 2018 (4730 substances) and
 - US EPA PFAS Master list from 2022 (12039 substances)
- Without identifiers it is almost impossible to map PFAS uses in complex supply chains



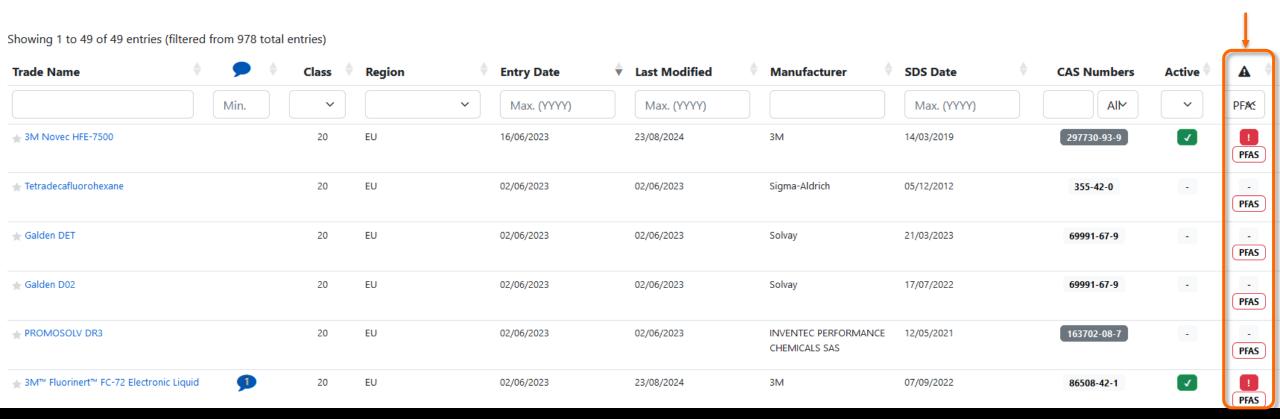
The Unique Challenge of PFAS PFAS Identifiers

- The EPA PFASMASTER list was imported into the REACH Tool resulting in 10595 trackable CAS Numbers
- These are cross-referenced against all materials in the ESA REACH Tool, to establish an estimate of known PFAS uses in the European Space Sector
- This formed the basis for PFAS use mapping in the Eurospace response
- However, major limitations include:
 - Not all PFASs have CAS Numbers, so cannot be tracked
 - The majority of PFASs currently do not have harmonised classifications, so not always declared in SDSs



The Unique Challenge of PFAS PFAS Badge

- Materials with PFAS have a unique and evolving obsolescence risk
- We now have a mark for PFAS materials to help alert REACH Tool users and prevent their use



The Unique Challenge of PFAS Identifiers UPDATE

- The EPA PFASMASTER List is the best (arguably only) consolidated list of PFAS substances
- However, it has now been 'retired' in favour of PFASSTRUCT and PFASDEV
- Note the lists are only on US Government websites, which could be removed at any time...

https://comptox.epa.gov/dashboard/chemical_lists/EPAPFASRL is an EPA research list of PFAS compiled from various internal, literature and public sources.

https://comptox.epa.gov/dashboard/chemical_lists/EPAPFASINV is a complete list of DMSO-solubilized PFAS in EPA's ToxCast inventory.

https://comptox.epa.gov/dashboard/chemical_lists/EPAPFAS75S1 list is a prioritized subset of this larger chemical inventory.

https://comptox.epa.gov/dashboard/chemical_lists/EPAPFASINSOL is a list of chemicals procured, but found to be insoluble in DMSO above 5mM.

https://comptox.epa.gov/dashboard/chemical_lists/PFASOECD is a list of PFAS chemicals in the OECD New Comprehensive Global Database.

https://comptox.epa.gov/dashboard/chemical_lists/PFASKEMI is a list of PFAS chemicals from a KEMI Swedish Chemicals Agency Report (provided by Stellan Fischer).

https://comptox.epa.gov/dashboard/chemical_lists/PFASTRIER is a list of PFAS compiled by a community effort in 2015.

https://comptox.epa.gov/dashboard/chemical_lists/EPAPFASCAT is a list of structure-based Markush PFAS categories (capabilities under development).

https://comptox.epa.gov/dashboard/chemical_lists/PFASSTRUCT is a list of all PFAS structures containing a specific defined substructures.

https://comptox.epa.gov/dashboard/chemical_lists/PFASDEV1 is a list of PFAS chemicals without explicit structures - polymers and other UVCB chemicals.

Source: https://comptox.epa.gov/dashboard/chemical-lists/PFASMASTER

14753 Substances

1072 Substances

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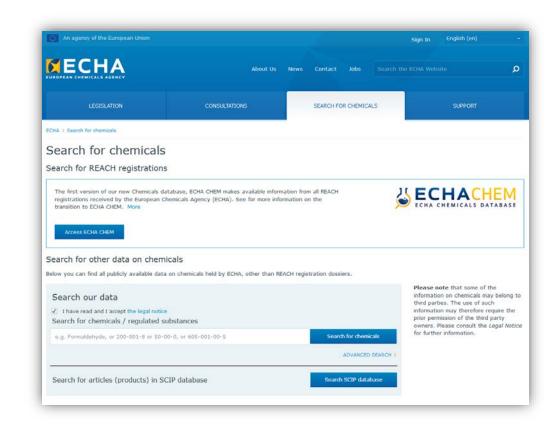


Outlook Limitations

- We cannot guarantee that all regulatory lists will be up to date
 - Always check the ECHA information on chemicals page (for EU REACH) see right

https://echa.europa.eu/information-on-chemicals

 We cannot guarantee the accuracy of the materials data, it should only be used for guidance



Outlook Take Home Messages



CAS Number lists are vital for substance mapping



There are currently no mechanisms for ESA and the European Space Sector to fully map its chemical use

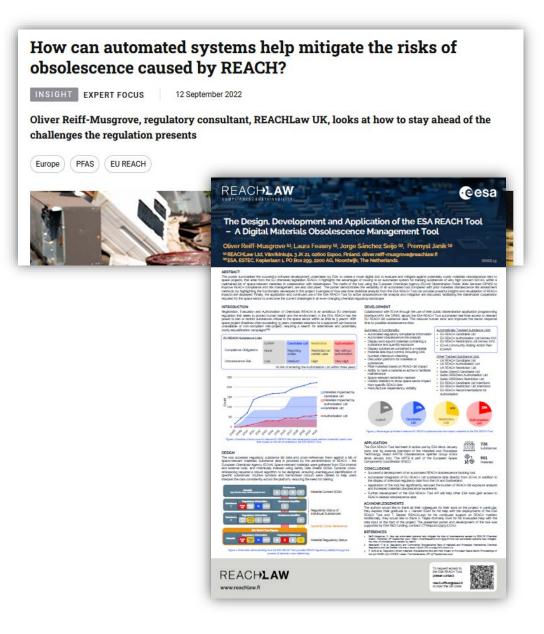


APIs and common data formats are the best way to facilitate compliance and obsolescence risk management in real time

Outlook Acknowledgements & Further Reading

I would like to thank the following for their continued support on the ESA REACH Tool project:

- Premysl Janik (ESA REACH Officer)
- Leo Fournier (ESA)
- ESA TEC-Q IT Support (Terma)
 - Joao Martins Pedro
 - Rahul Rathore
 - Gosse Mol
- Tim Becker (REACHLaw)
- For more information on automated materials obsolescence management systems, please read my article in Chemical Watch & ISMSE Poster



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Thank you for listening!

Any Questions?

REACHLaw

Aleksanterinkatu 19 FI-00100 Helsinki Finland

www.reachlaw.fi info@reachlaw.fi sales@reachlaw.fi

Oliver REIFF-MUSGROVE

Senior Product Manager oliver.reiff-musgrove@reachlaw.fi

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