Reference:

P. Janik, *ESA REACH office – Introduction and space sector-wide initiatives,* 7th ESA REACH Workshop, ESA ESTEC, Noordwijk, the Netherlands, 2nd June 2026

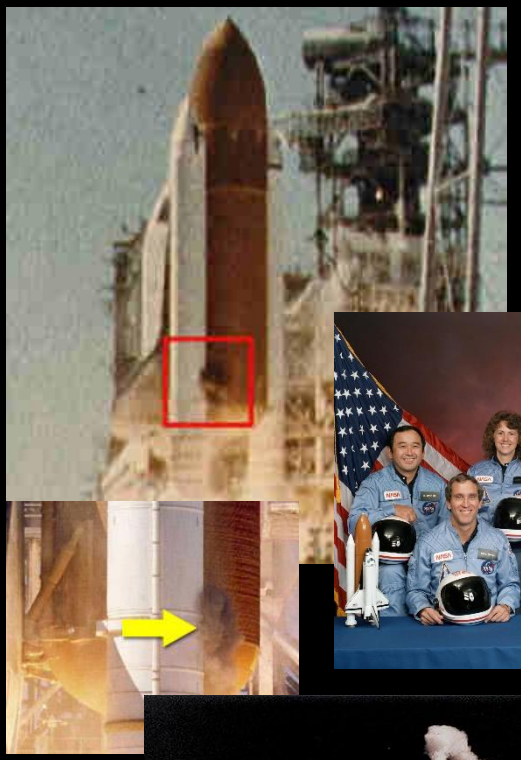
Author affiliation:
Premysl Janik, REACH Officer, European Space Agency

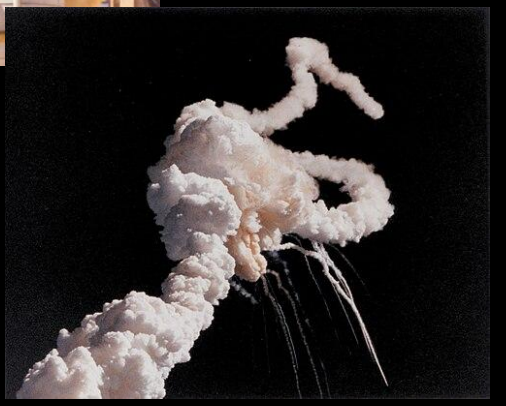
18

Apollo 1 (1967) – Cabin fire in a high-pressure oxygen environment. Flammable materials enabled rapid fire propagation, resulting in the loss of three astronauts.
https://www.nasa.gov/history/55-years-ago-tragedy-on-the-launch-pad
https://www.nasa.gov/specials/dor2020/

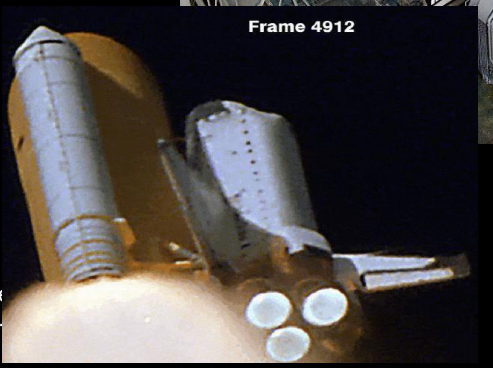
Soyuz 1 (1967) – Capsule wreckage after parachute system failure during landing.

https://www.spacesafetymagazine.com/wp-content/uploads/2014/08/vladimir-komarov-portrait.jpg





Challenger STS-51L (1986) – O-ring sealing failure outside the qualifi temperature envelope resulted in the loss of the vehicle and its seven- member crew.
From: https://www.space-shuttle.com/challeng.htm, https://www.nasa.gov/gallery/sts-51l/
And http://www.seasky.org/space-exploration/challenger-accident-analysis.html
credits: NASA



Insulation foam detached from the External Tank and struck Columbia's left wing during launch (STS-107), damaging the thermal protection system and ultimately leading to the loss of the orbiter during re-entry.
Credits: NASA, Multiple sources,
https://www.nasa.gov/columbia/caib/html/movies.html ,
Public Domain, https://en.wikipedia.org/wiki/Space_Shuttle_Columbia_disaster
https://commons.wikimedia.org/w/index.php?curid=123221423

ESA REACH Office

Introduction and space sector-wide initiatives

Premysl Janik, ESA REACH Officer, ESA/ESTEC
Sustainability Engineering & Standards Section

ESA-TECSFS-HO-2026-001764

02/06/2026

Objectives of the ESA REACH Workshop

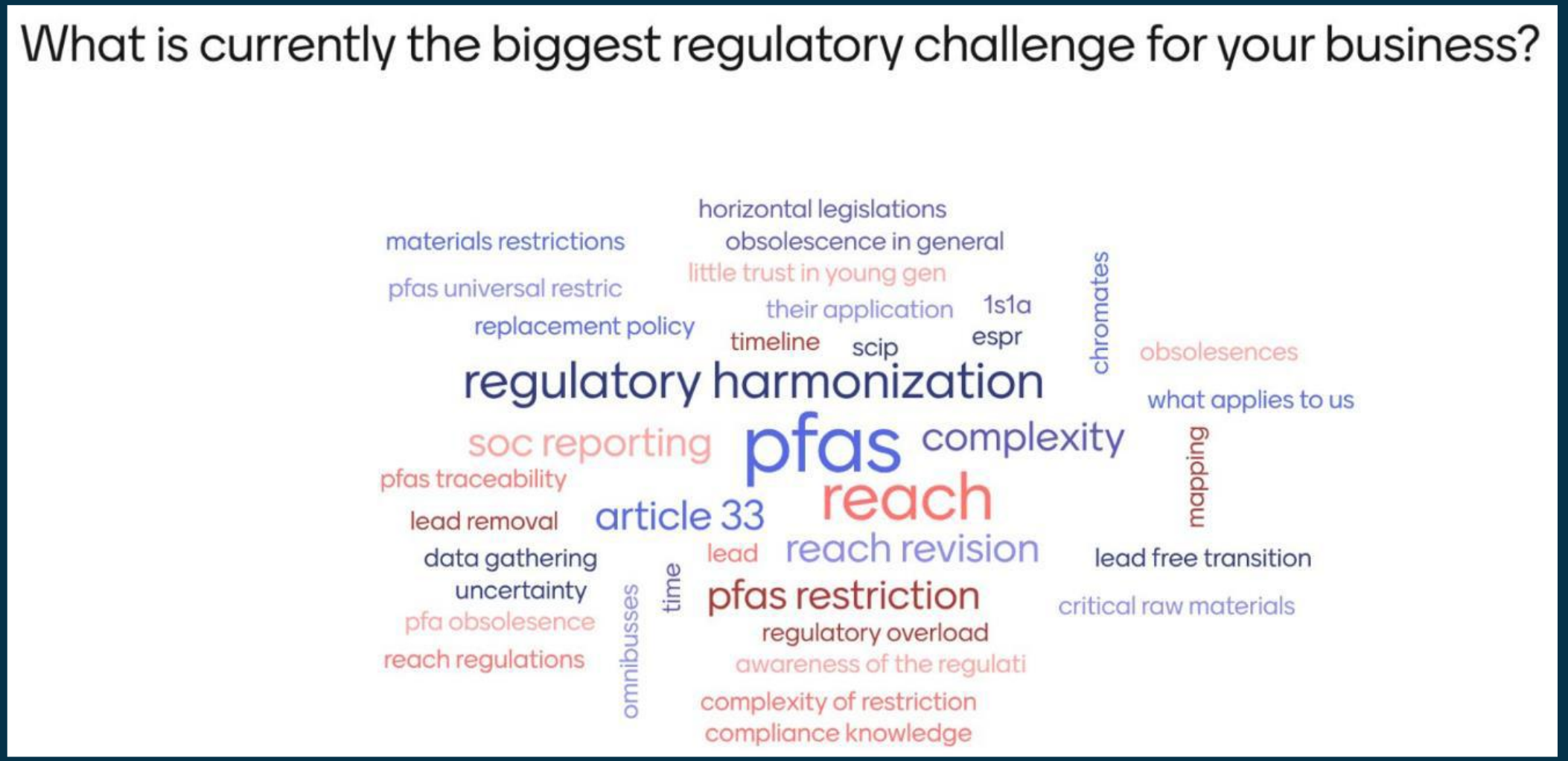
- Connect the entire European space ecosystem
- Identify regulatory risks before they become mission risks
- Bring all relevant stakeholders into one discussion
- Share sector-wide guidance and advocacy efforts
- Address common challenges and questions
- Facilitate open dialogue

6th ESA Workshop 2025 - reflections

>130 participants from 24 countries, 4 continents,
32 nationalities, ~30 on site + 100 online
10 presentations

Presentations and executive summary available on event pages:
https://atpi.eventsair.com/6th-esa-reach-workshop

2025 6th ESA REACH WS – reflections

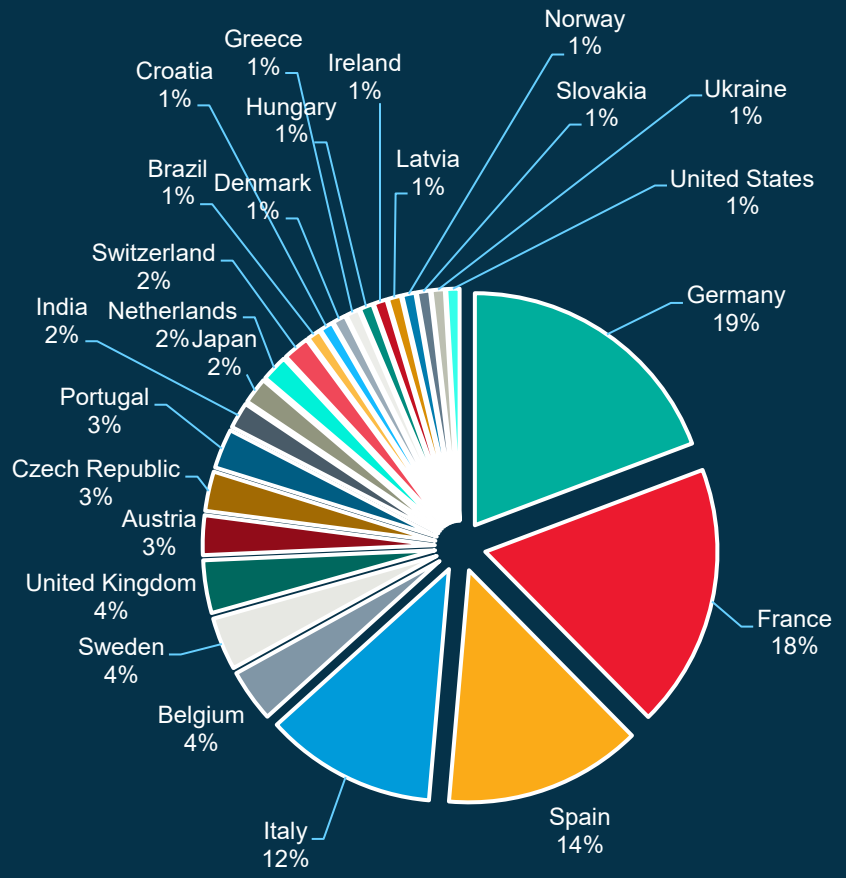


7th ESA REACH Workshop 2 June 2026

Time CEST	Speaker / Organisation	Title
09:10-09:20	Ross Findlay (ESA, TEC-SFS)	Introduction & Welcome
09:20-09:50	Premysl Janik (ESA REACH Officer)	ESA REACH Office - Introduction and space sector-wide initiatives
09:50-10:20	Simone Doyle (ECHA)	ECHA update: Authorisation, Restriction and new tasks
10:20-10:50	Edward Latter (DEFRA UK)	The UK PFAS Plan: Building a stronger future together
10:50-11:10	BREAK	
11:10-11:45	European Commission Julien Fabre (DG ENV) and Denis Mottet (DG GROW)	European Commission update on REACH and PFAS
11:45-12:15	Elisa Consoli (ASD Europe)	Updates from the Aerospace & Defence Industry Association on chemical legislation
12:15-12:45	Tim Becker (REACHLaw)	REACH & Space: Update on priority topics and joint contributions
12:45-14:00	LUNCH BREAK	
14:00-14:30	Oliver Reiff-Musgrove (REACHLaw)	How to use the ESA REACH Tool, AI and other software to identify PFAS and understand impact from REACH and other regulations.
14:30-15:00	Léo Fournier (ESA)	PFAS use mapping across ESA projects & update on obsolescence risk mitigation activities
15:00-15:30	David Liu (NASA)	Impact of PFAS-related regulations on the global space material supply chain
15:30-15:40	Mentimeter - interactive session	Have your say and give us feedback on the most challenging topics in regulatory landscape!
15:40-16:00	BREAK	
16:00-16:45	**Panel Discussion** *Panellists:* Josef Denzel (ADS) Thomas Rohr (ESA) Elisabeth laurent (CNES) Fabian Schueller (Materiales)	**PFAS and beyond: Impacts of wide group restriction initiatives and updates to the EU chemicals regulatory agenda on the European Space Sector** *PFAS (Mapping, Substitution, Reporting) – impact on the sector, Regulatory simplification (omnibuses)* *Digitalisation (Digital product passport, substance traceability)* *Dependencies of space technologies on chemicals in geopolitically-driven uncertainty* *Essentiality of space technologies for functioning industry and society*
16:45-17:00		Closing Remarks
17:00		END

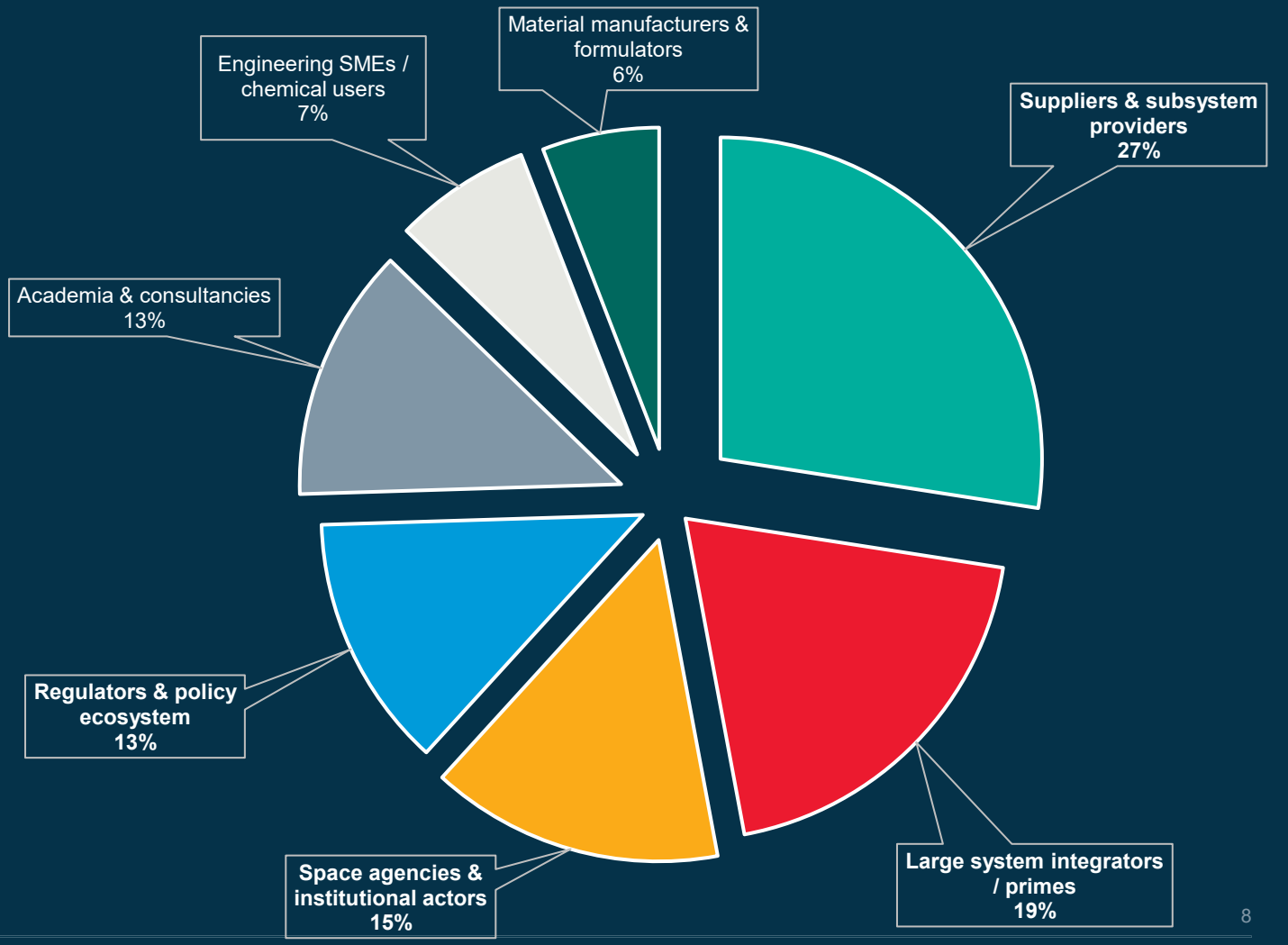
Todays Audience – Who cares about REACH?

Relative Representation by Country



110+ participants, 55 entities
25 countries, 4 continents
10 presentations + panel discussion

7th ESA REACH workshop: entities per category



REACH and Space

What is EU REACH in the Space Context?

EU REACH* was designed to protect human health and the environment

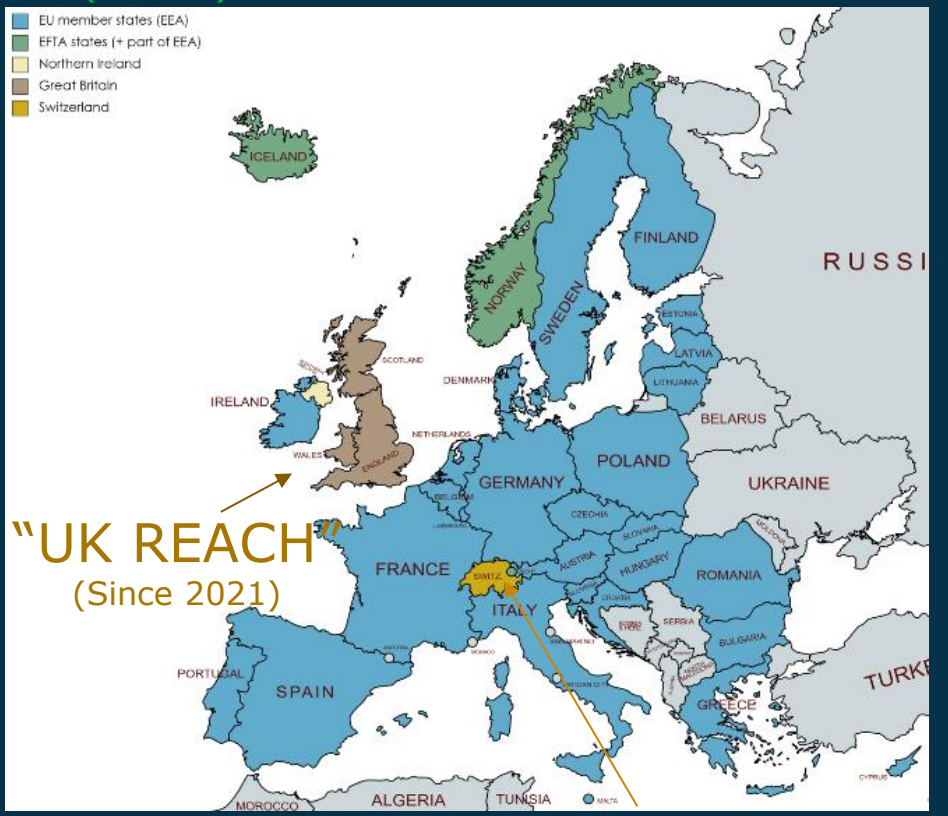
- ❑ Identification of hazardous substances
- ❑ Risk management across the supply chain
- ❑ Promotion of safer alternatives

For the space sector, REACH creates additional challenges

- ❑ Critical materials / chemicals face increasing regulatory pressure
- ❑ Substitution and requalification require significant engineering effort
- ❑ Long mission development cycles are often incompatible with regulatory timelines
- ❑ Multi-year space programmes depend on stable material availability

"EU REACH" territories

EU-27 + Iceland, Norway and Lichtenstein (= EEA) + Northern Ireland



Swiss chemicals regulation

* Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the **R**egistration, **E**valuation, **A**uthorisation and Restriction of **Ch**emicals (REACH)

ESA REACH Office

Mission:

- Safeguarding the availability of critical materials and technologies for European space programmes → From compliance to capability preservation.

What we do:

- Support ESA projects and programmes in regulatory compliance
- Monitor emerging regulations and anticipate risks
- Assess impacts on materials, technologies and supply chains
- Coordinate the European space sector response

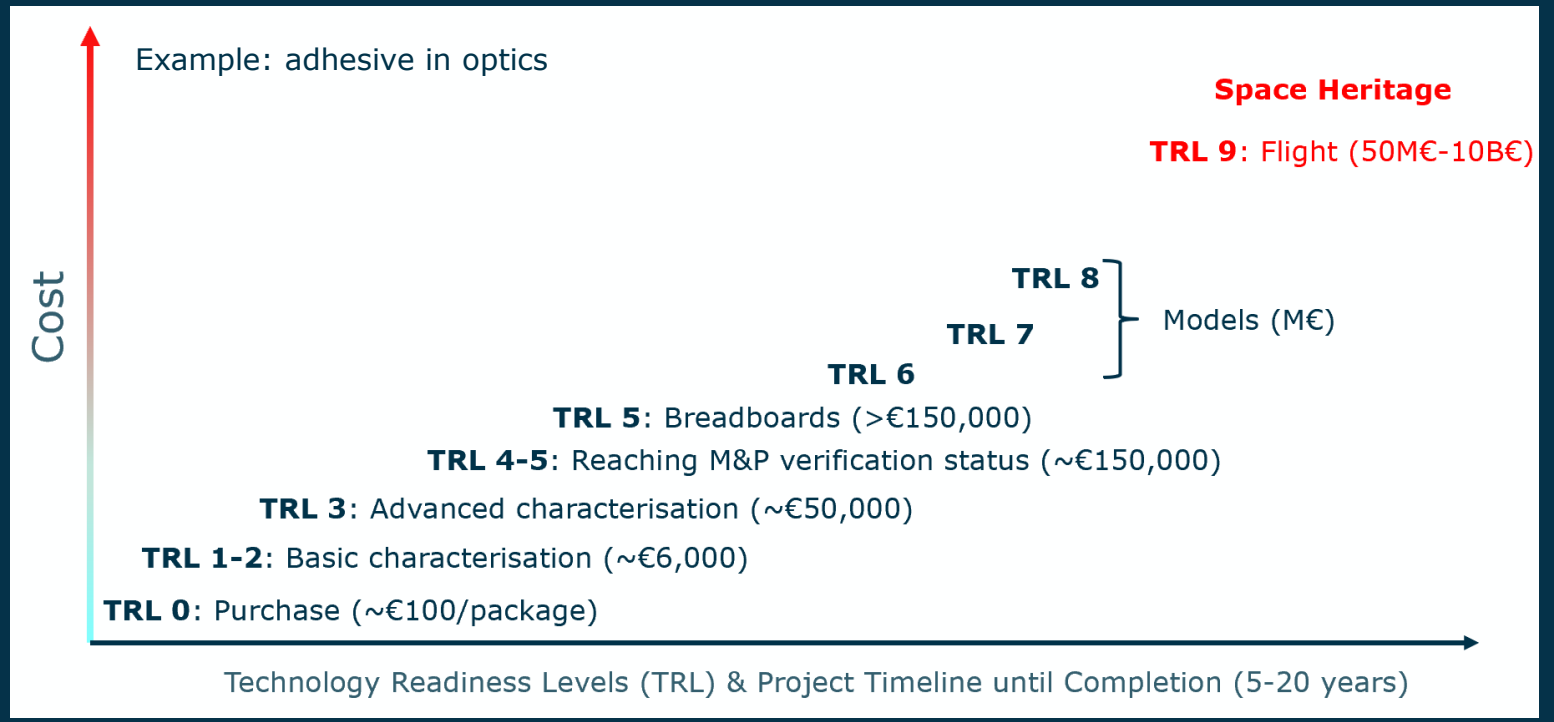
Key Contributions:

- Network of agencies, primes and SMEs for REACH implementation and updates.
- Engaged in public consultations, contributed to guidelines, internal reporting.
- Development of the ESA REACH Tool and REACH awareness sessions.
- ESA REACH workshops for external stakeholders and internal sessions for ESA.

Specificity of Space Missions

Development time, design phases and points of no return

Schematic cost impact of regulation-driven obsolescence at point of time



SRR -> PDR - > CDR -> QR -> FAR (LTS up to +15 years) ->
Launch + early operation phase, long duration mission (10+ years)

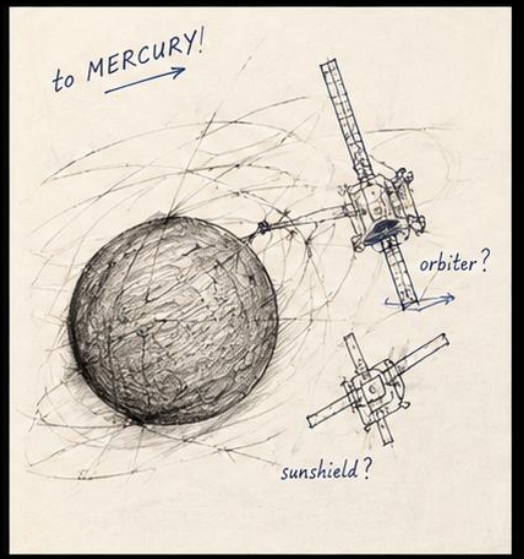
Integration of BepiColombo, ESA-JAXA mission

Loss of qualification heritage has massive impact on the costs of any future mission!

to select and fully qualify materials and processes for BepiColombo (ESA-JAXA science mission)

INFANCY

Early mission concept (~2000)



~2000

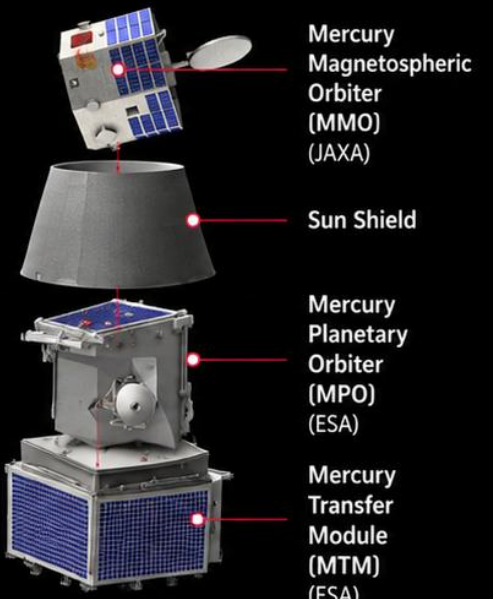
Mission concept

18 YEARS

Early studies → Technology maturation → Materials qualification → Process qualification → Manufacturing → Integration & test → Launch

MATURITY

Launch-ready spacecraft (2018)



2018

Launch-ready spacecraft

Complexity linked to overall regulatory compliance in materials

Strategic & geopolitical dimension

Supply chain resilience/ethics:
Conflict Minerals, Critical Raw Material Act, Chips Act,…
Export/import-limiting:
NEW: **Chinese export restrictions,**
multiple **EU sanctions (Russia, Belarus)**

Space-specific provisions (technical & procurement):
Additional requirements on suppliers and ESA projects, such as:
ECSS (material selection - technical),
ESSB's on space debris (safety),
ESA **CSR Code of Conduct** (social/ethics, sustainability)
NEW: EU Space Act… (mixed)

Company level, supplier level

Legislation focused on Circularity, Sustainability (Environmental Footprint, articles, processes)
Waste Framework Directive/**WFD/SCIP**, **EEE Waste directive,** Reg. on **batteries and waste batteries**
NEW: Ecodesign directive -> **ESP Reg. (PEFCR for space?)**; **Corporate Social Responsibility Reporting Directive** (CSRD), Directive on **Corporate Sustainability due diligence** (CSDDD), **Green Claims Directive,…** ***NEW:*** **Sustainable capital investments: EU Taxonomy reg.**

Substance and process level

Legislation focused on Chemicals & Materials
ROHS, REACH, CLP, CRMD, CAD, OELs
Mercury reg., POPs,…

(European space industry)

Regulations and obsolescence risk generate concerns

FAQ

- Could my mission depend on a material that may disappear from the market?
- Will hydrazine, chromates, PFAS or lead still be available when my spacecraft enters critical manufacturing phase?
- Is there a technically equivalent alternative—and how can I prove it?
- How much time is really needed to qualify a replacement?
- How much visibility do I need into my supply chain to remain compliant?
- What if there is no other solution than the current baseline?
- Where/how to advocate to maintain my space-specific chemicals use?

What can we do about this?

Monitor, Plan, Substitute and
Advocate

Good practices: summary

1. **Anticipate Early**

   Monitor regulatory developments throughout the project lifecycle

2. **Know Your Materials!**

   Maintain visibility of critical substances, materials and processes (compliance with ECSS-Q-ST-70 series!)

3. **Engage Your Supply Chain**

   Regularly discuss regulatory risks and obsolescence with suppliers

4. **Prioritise What Matters**

   Focus resources on mission-critical materials and single-source dependencies

5. **Avoid Last-Minute Substitutions**

   Assess alternatives early and allow sufficient time for qualification

6. **Build Evidence to Support Advocacy**

   Base decisions on test data, qualification results and technical evidence

7. **Share Information**

   Leverage sector networks, lessons learned and common guidance

8. **Treat REACH as a Project Risk**

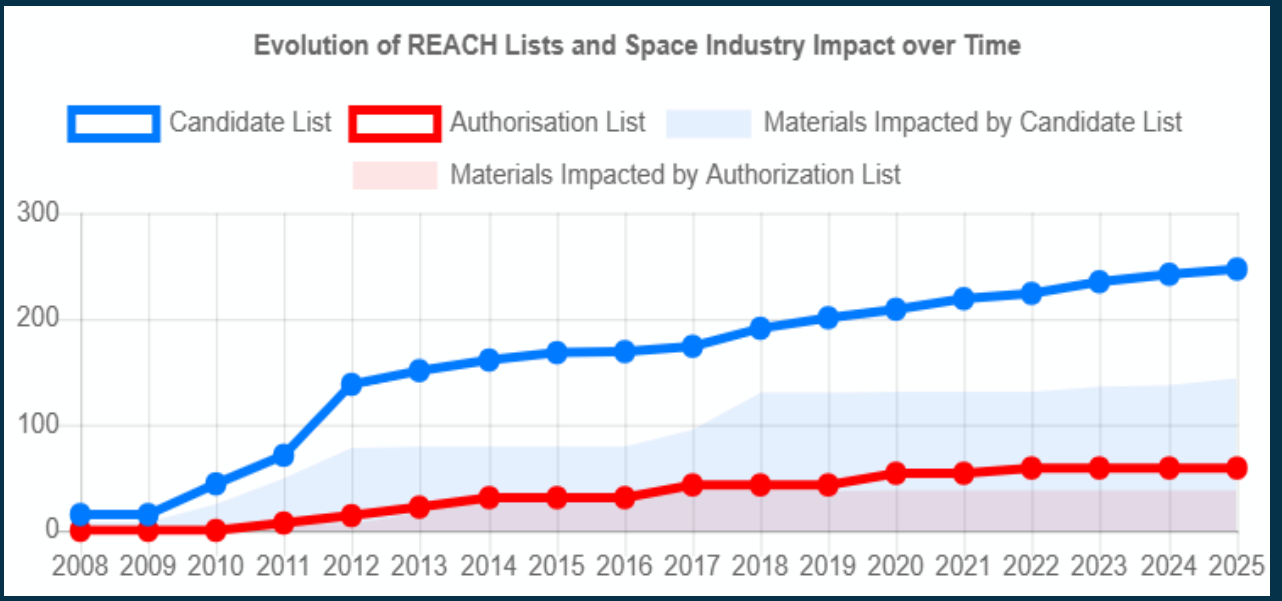
   Integrate regulatory risks into programme risk management

Identification of obsolescence risks: ESA REACH Tool

The **ESA REACH Tool** is a web-based materials obsolescence risk assessment tool developed for the European Space Sector, which can **automatically identify REACH impacted substances** in space-relevant materials

ESA REACH Tool functionalities include:

- ✓ Crude REACH obsolescence risk predictions based on current REACH lists (Annex XIV, Annex XVII, Candidate List, CoRAP, CLH)
- ✓ Real-time substance content analysis of EU REACH lists, using data directly from ECHA
- ✓ REACH status compliance guidance + risk score
- ✓ “My favourite” materials (personal BOM)
- ✓ Request materials to be added & tracked



~18,000 reg. listed substances

1386 Space-relevant Materials

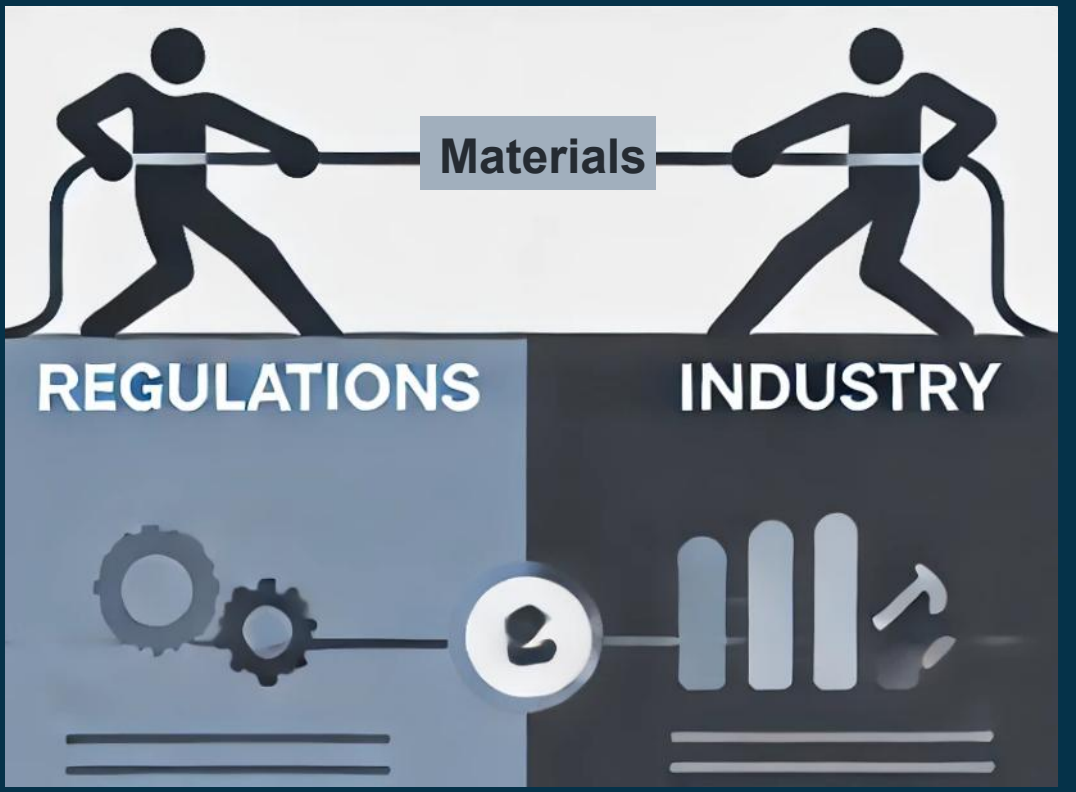
3885 Substances

Top Areas of Interest

Substance/Material traceability,
Space relevancy + regulatory risks

Identify high-priority chemicals

uPFAS restriction &
obsolescence



High priority substances - examples

Hydrazine (+ other energetic materials): essential substances in propulsion / attitude control

Chromates: chemical conversion coatings / corrosion protection of sensitive alloys

Lead metal: multiple applications, soldering, additives, alloying element…

Di-isocyanates: polyurethane chemistry, foams, coatings, paints, thermal insulation, batteries,…

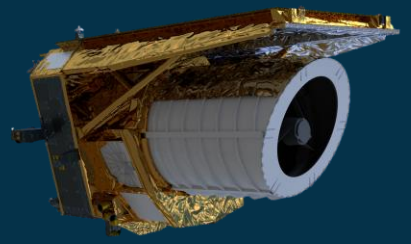
Bisphenol A and its derivatives: epoxy resins, pre-pregs, composites, adhesives…

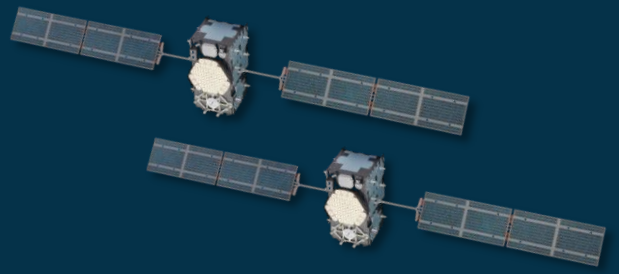
D4, D5 and D6 cyclic siloxanes: precursors for silicone elastomers, paints, conformal coatings,…

Per and Poly-Fluoro Alkyl Substances (PFASs): thousands of applications…

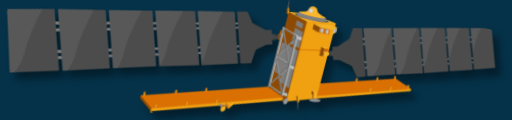
PFASs mapping in hardware launched in 2024

Euclid **

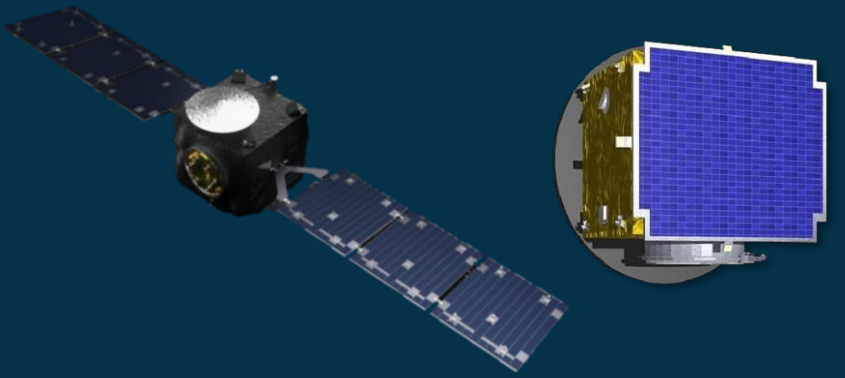




Copernicus Sentinel 1C

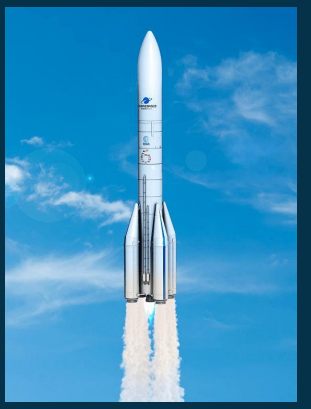


Hera ** & Proba 3 *

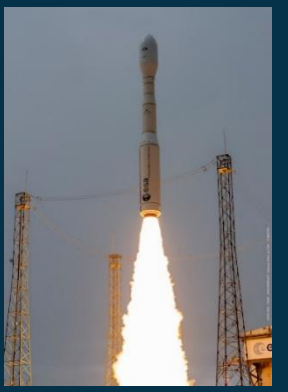


Galileo **

* PSLV (ISRO)
** Falcon 9 (Space X)



ARIANE 6



VEGA C

EarthCare **

Focus on 9 satellites units (full DML visibility as per ECSS)

>17000 items analysed, ~ 9% of ALL declared material items contain PFAS, nearly ALL uses we consider essential for ESA missions

What would uPFAS restriction mean for our technology domains?

Electronics (PCB, Connectors, Cables)

PTFE-based PCB laminates*
- FEP/ETFE harness insulation
- PFAS gaskets in connectors
- …

Satellite (Thermal Control, MLI, Harnesses)

- MLI with FEP outer layers
- Kapton-FEP film heaters*
- PTFE/FEP cable insulation
- …

Do we need PFAS/ fluoropolymers in space HW?

Launcher / Propulsion (Seals, Hoses, Lubricants, Insulation)

- FKM/FFKM elastomer seals
- PTFE/FEP hoses for propellant, valves
- PFPE lubricants for turbopumps*
- F-gases for insulation forming
- …

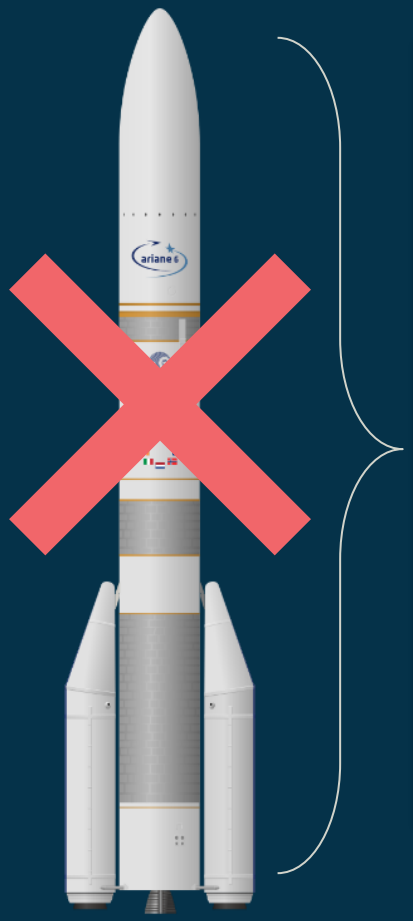
Cleanroom / Test Facilities (Filters, PFPE Oils)

- PTFE filter membranes
- PFPE vacuum pump oils, cooling fluids, hermeticity test fluids*
- Anti-stick PFAS coatings in tooling, moulds, contact materials

*= emerging obsolescence & shortages already happening

PFAS use cases in launchers & spacecraft

Ariane 6



PFAS is in some form used in following:

- Lubricants,
- Coatings,
- Creep barriers,
- Functionalised polymer surfaces,
- Cleaning agents,
- Coolant fluids,
- Fluoro-elastomeric sealants,
- Pyrotechnic compositions,
- Blowing agents for thermal insulation,
- Adhesives,
- Fire suppressants,
- Cables insulation,
- Shrink sleeves,
- PCBs,
- Processes for electronic assembly
- …

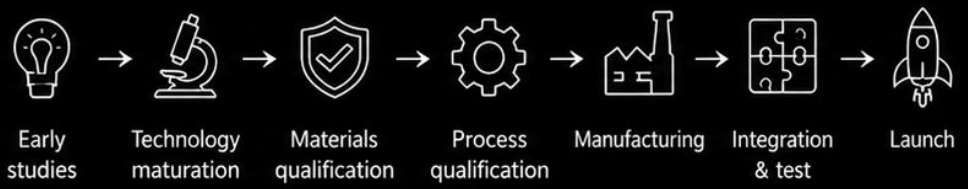
Exemplar spacecraft

Where are PFAS used in spacecraft?:
outer thermal insulation, printed circuit boards, lubricants, cables, connectors, gaskets, tubes, …

> 10% of all declared material items in average are or contain PFAS (tens of kilograms per spacecraft at maximum, compared to millions of tonnes for other sectors)

If EU REACH PFAS restriction is adopted without space-specific derogation, the production may need to stop!
(worst case scenario: to comply within **18 months** period after PFAS restriction adoption)

Read more: https://eurospace.org/universal-pfas-european-space-sector-comments-on-socio-economic-assessment-sent-to-echa-urging-eu-policy-makers-to-move-away-from-universal-ban-model/



18 years to qualify materials and processes for complex space mission

18

Only 18 months is proposed for transition period for nonderogated PFAS uses!!!

PFAS baseline

PFAS-free alternatives?

Ariane 6

???

Response of the European Space Sector

MPTB and REACH-Related activities

Materials and Processes Technology Board (MPTB)

Materials and Processes Technology Board of the European Space Components Coordination (ESCC MPTB).

The ESCC MPTB is a partnership between the **European Space Agency (ESA)**, **national space agencies**, and the European space industry represented by ASD-EUROSPACE. The European Defence Agency (EDA), Map Space Coatings, INVENT/AKRK are invited as observers.

Agencies

asi agenzia spaziale italiana
cnes
DLR
esa
UK SPACE AGENCY

Industry

ASD-EUROSPACE The Space group in ASD
AIRBUS DEFENCE & SPACE
ThalesAlenia Space
AVIO
arianeGROUP
OHB
beyond gravity
MT AEROSPACE
TESAT
LEONARDO
TNO
sener

Observers

EUROPEAN DEFENCE AGENCY

SMEs & Associations

MAP SPACE COATINGS
INVENT
akrk

REACH Task forces and Working group coordinator

REACHLAW

Note: slide not exhaustive!, additional entities and experts joined individual task forces and working groups

MPTB webpage: https://escies.org/webdocument/showArticle?id=1045&groupid=6

REACH-related Regulatory Task Forces under the MPTB

MPTB

REACH obsolescence risk analysis. Regulatory monitoring. General studies and sector positions

initiates

report

ASD-Eurospace

communicate

coordinate

exchange

EU institutions

ASD

REACH & CHEM WG

Third party groups & associations (SMEs, CEFIC)

Space Task Forces and WGs

REACH dossier development. Enhanced focus

Hydrazine Task Force** "HTF" (2011-2022)	Chromates Task Force* "STF" (2013-)	Lead Metal Task Force* "LTF" (2018-)	WFD / SCIP Task Force (2019-)	Energetic Materials WG ("EMWG") (2020-)	CSS Space Focus Group ("SFG") (2021-)	Restrictions Task Force* ("RTF") (2023-)

* Merged with Restriction Task Force, ** Absorbed by Energetic Materials WG

Summary

- ESA, together with MPTB, regulatory subgroup members and observers, continues to monitor REACH and other regulatory developments affecting the space sector.
- Sector-wide coordination, alignment with aerospace and defence stakeholders, and joint advocacy remain essential to preserve European space capabilities.
- ESA and MPTB contribute with technical evidence through public consultations, stakeholder engagement and regulatory dialogue.
- The proposed universal PFAS restriction would impose an unmanageable burden on the European space sector. Fluorinated materials enable critical space functions, and for many applications no technically equivalent, qualified alternatives currently exist.
- The pathways for communicating REACH impacts on strategic space technologies remain limited and should be strengthened.
- To avoid disproportionate impacts on strategic space technologies, ESA and its partners support evidence-based regulation, realistic transition pathways and continued dialogue between industry, regulators and policy makers.

The quality, reliability and performance of materials are often pushed to their limits... and sometimes spacecraft operate beyond them.

18

In spaceflight, there is no acceptable degradation of mission-critical performance!

Physics does not accelerate to accommodate regulatory deadlines!

Thank you for your attention!

Enjoy your workshop!

Contact: reach.officer@esa.int

Mentimeter with instructions

Instructions

Go to

www.menti.com

Enter the code

8618 1349

Or use QR code

2026 WS interactive session: outcomes

What is currently the biggest regulatory challenge for your business?

30 / 42 80

Most popular

pfas	11

Also prominent

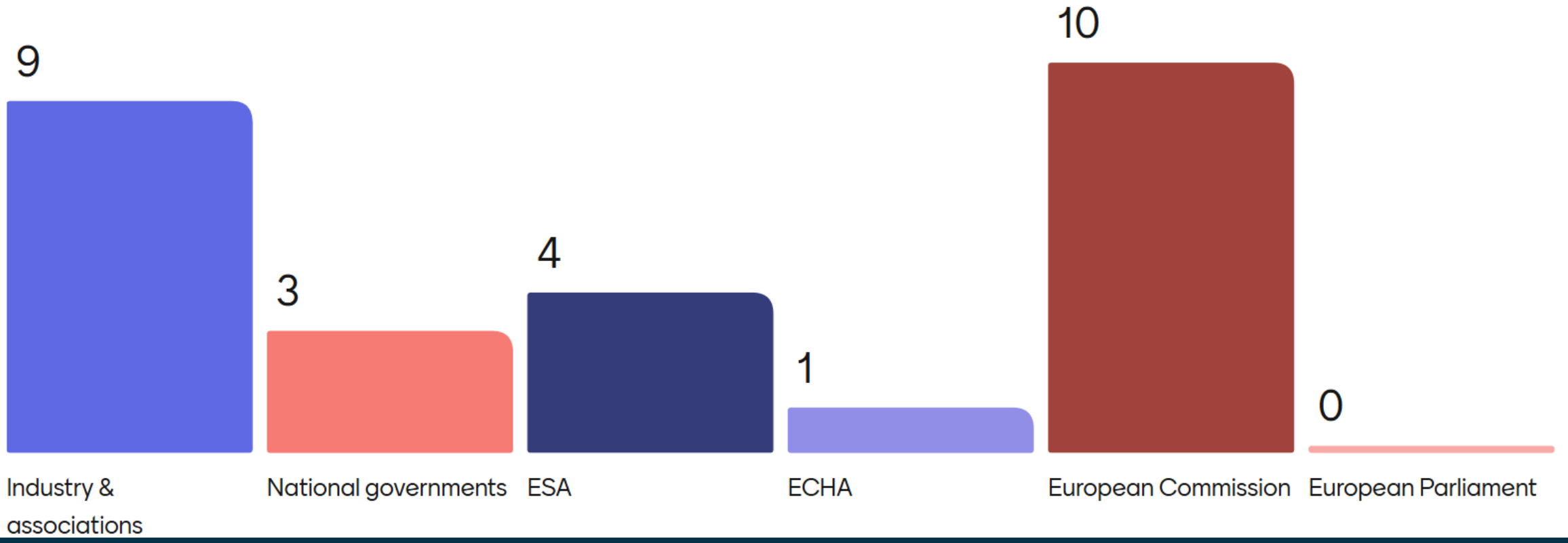
bureaucracy	4	paperwork	4	reach	4

Other responses

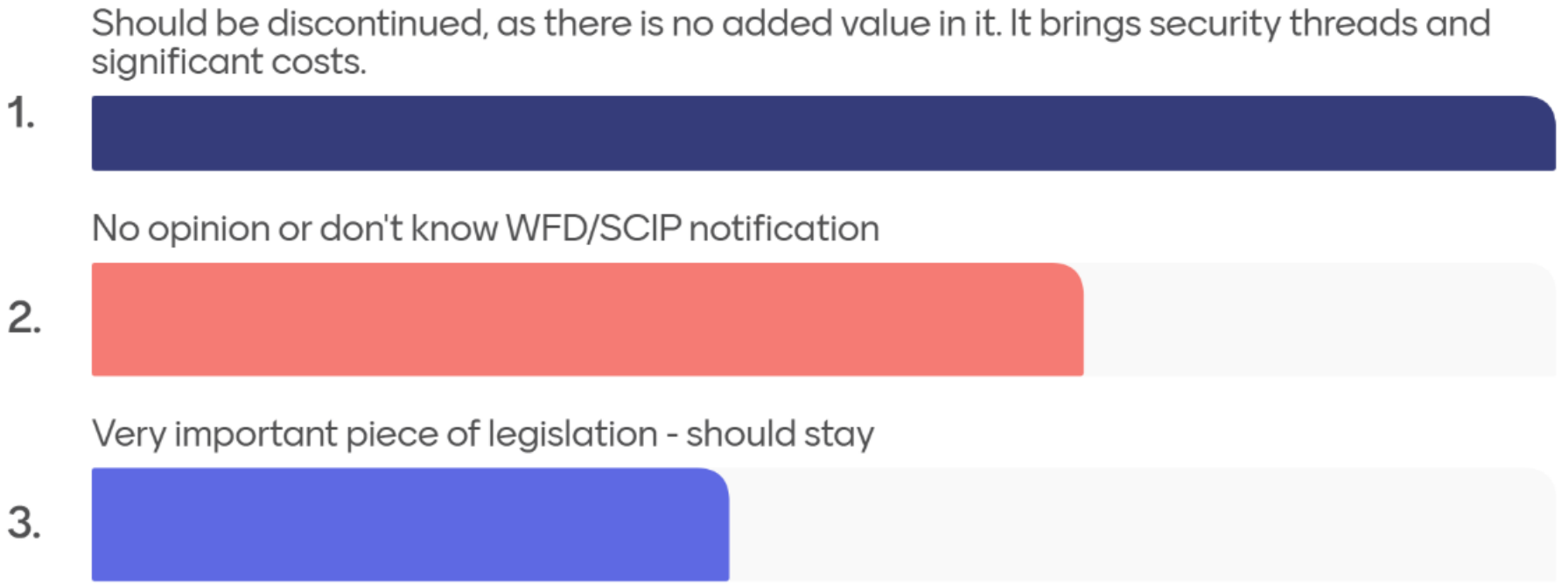
omnibus	3	regulatory dynamics	3	expertise	2	obsolescence	2
pfas restriction	2	soc	2	speed	2	substances of concern	2	uncertainty	2
administrative burden	1	alternatives to pfas	1	anticipation to changes	1		
certainty	1	complex legal texta	1	complexity	1	compliance burden for sme	1		
compliance resources	1	convincing board	1	crm	1	ddp	1	dependecy	1

Show more

Which entity do you think could be the most influential to minimise the impact of EU REACH regulation on the strategic space missions?(single choice!)

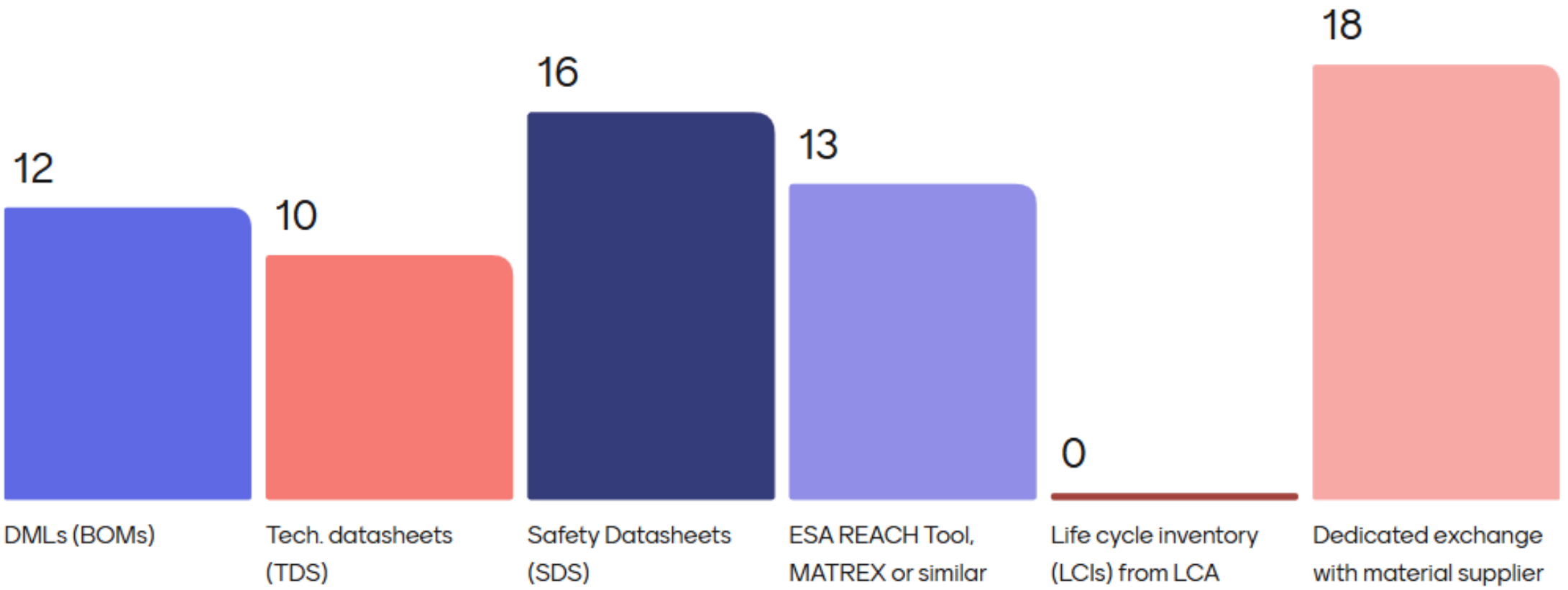


How useful do you see WFD/SCIP notification duty?

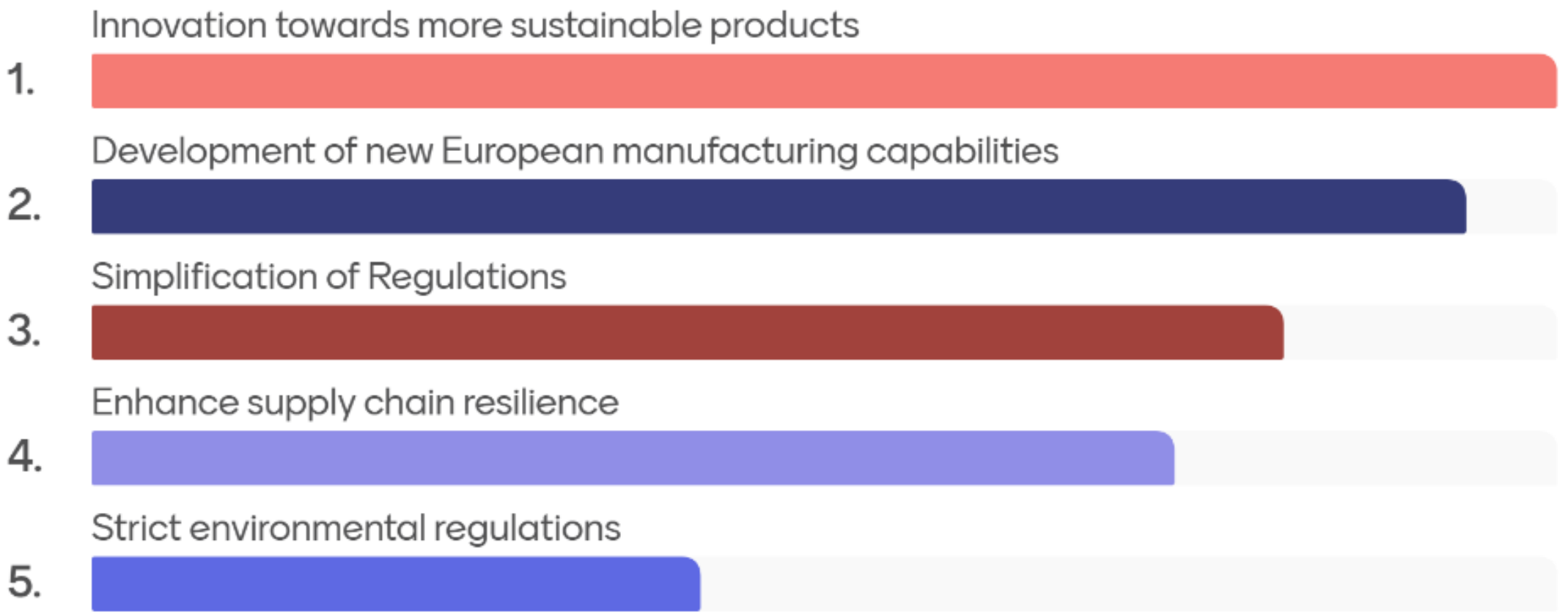


Which substance(s) would drag the biggest uncertainty for future use in space products?

Identify top 3 sources of information for PFAS identification



Which priorities should we focus on to boost European competitiveness in space?



MPTB REACH-related info, templates and guidelines

Link to the MPTB's page with publications: https://escies.org/webdocument/showArticle?id=1049&groupid=6

Short title	Latest update	Reference number with hyperlink
Slides on the universal PFAS restriction proposal – sectorial update	8.12.2025 (v2)	MPTB-ES-HO-0214
Guidelines for users of Chromium Trioxide in Chemical Conversion Coatings for European Space Programmes	28.07.2025 (v8)	MPTB-RL-GD-0200
Best-Practice Guidance for the European Space Sector to Comply with SCIP Notification	03.03.2025 (v1.3)	MPTB-ES-GD-0158
Bisphenol A vs EU REACH: Brief note to ESA projects on regulatory status of BPA	14.10.2024 (v1.0)	MPTB-RL-MO-0164
Comparison between EU REACH Annex XIV (Authorisation) and Annex XVII (Restriction)	02.12.2024 (v2)	MPTB-RL-HO-0171
Template for REACH Article 33 Declaration on Substances in Articles – Incl. WFD/SCIP Data	08.10.2024 (v1.2)	MPTB-RL-TPL-0092
Lead Metal vs EU REACH: Brief Note to Projects	11.07.2024 (v1.2)	MPTB_RL_MO_0156

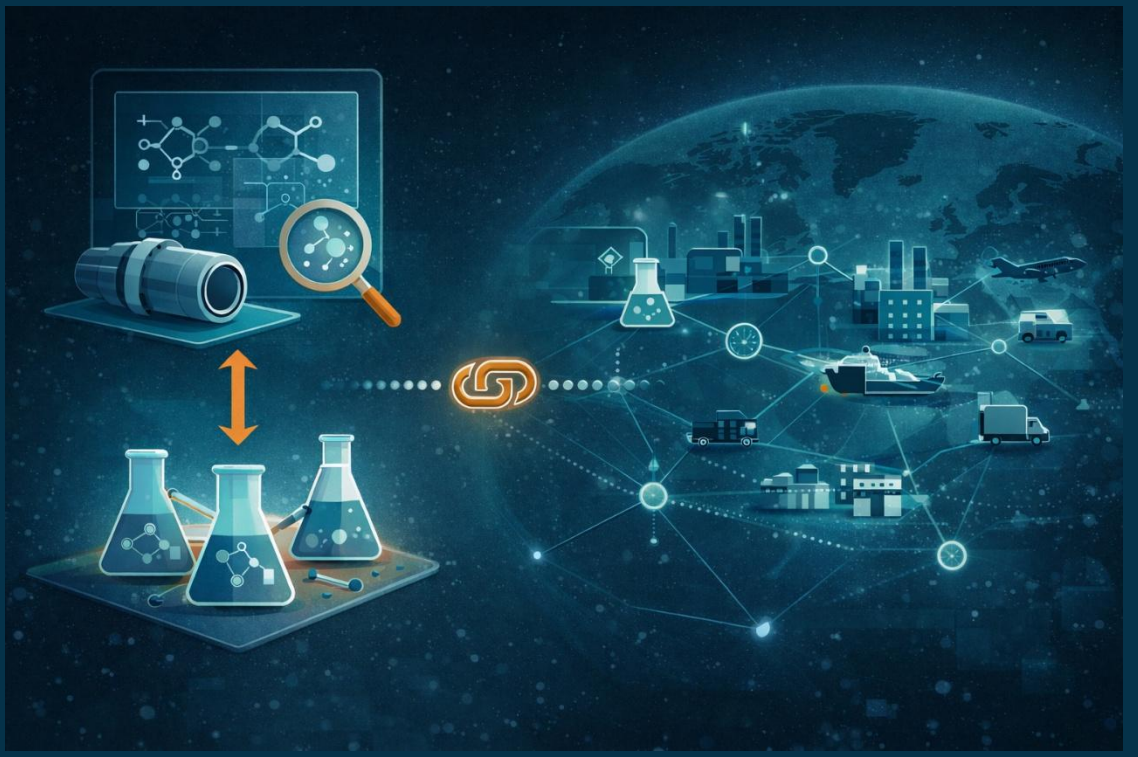
List of important presentations and sectoral positions

- **Eurospace (RTF) response submitted on 22 May 2026 to the ECHA public consultation on the SEAC Draft Opinion** (internal ref. # MPTB-ES-PO-0225) – The response will be published on the ECHA website here
- **Sectoral contribution and response to EU's Advanced Material's Act – Call for evidence**, 13th January 2026, (MPTB-ES-PO-0215, EU COM reference: F33364493), available online
- "European Space Sector comments of 17 September 2025 on the ECHA restriction proposal for certain chromium(VI) oxides, oxyacids and salts, ref. MPTB-ES-PO-0202, ECHA ID ref. 9662, (link)
- European Space Sector Feedback on Commission Call for Evidence: Simplification of Administrative Burdens in Environmental Legislation, Joint contribution by MPTB's WFD/SCIP Task force, 8th September 2025, MPTB-ES-PO-0204, link to consultation reference F3698765,
- 6th ESA REACH Workshop presentations and summary, ESA/ESTEC, Noordwijk, The Netherlands, 17th June 2025 (link)
- P. Janik, **Impact of environmental regulations on availability of space-relevant materials and manufacturing processes**, International Astronautical Congress, Milan, Italy, 14-18.10.2024 (link)
- T. Becker, **ESA REACH Office – Introduction and Space Sector-wide Initiatives**, 5th ESA REACH Workshop, ESA ESTEC, Noordwijk, the Netherlands, 19 June 2024, (link)
- MPTB views reflected in Eurospace response to **European Commission of a Transition Pathway for the Aerospace and Defence (ASD) ecosystem,** 2-11-2023 (here)
- **Environmental Regulations and Their Impact on European Space Sector**, 16-19 October 2023, CSID 2023, ESA/ESTEC, the Netherlands, (link)
- European Space Sector **comments on the Annex XV restriction report for per- and polyfluoroalkyl substances (PFAS)** of 22 September 2023 (here)
- European Space Sector **comments on the REACH restriction proposal for certain bisphenols**, 22-05-2023 (here)
- European Space Sector **feedback on New Product Priorities for Ecodesign for Sustainable Products**, 23-5-2023,(here)

A list of further contributions is available at https://eurospace.org/compliance/ . In addition, a number of contributions have been submitted by ASD, with the support of MPTB/its task forces and working groups.

Supply chain → Supply Network → Supply System

- What does it* contain?
- Where did it* come from?
- How certain am I in getting the same stuff tomorrow?
- How well do I understand materials supply system?



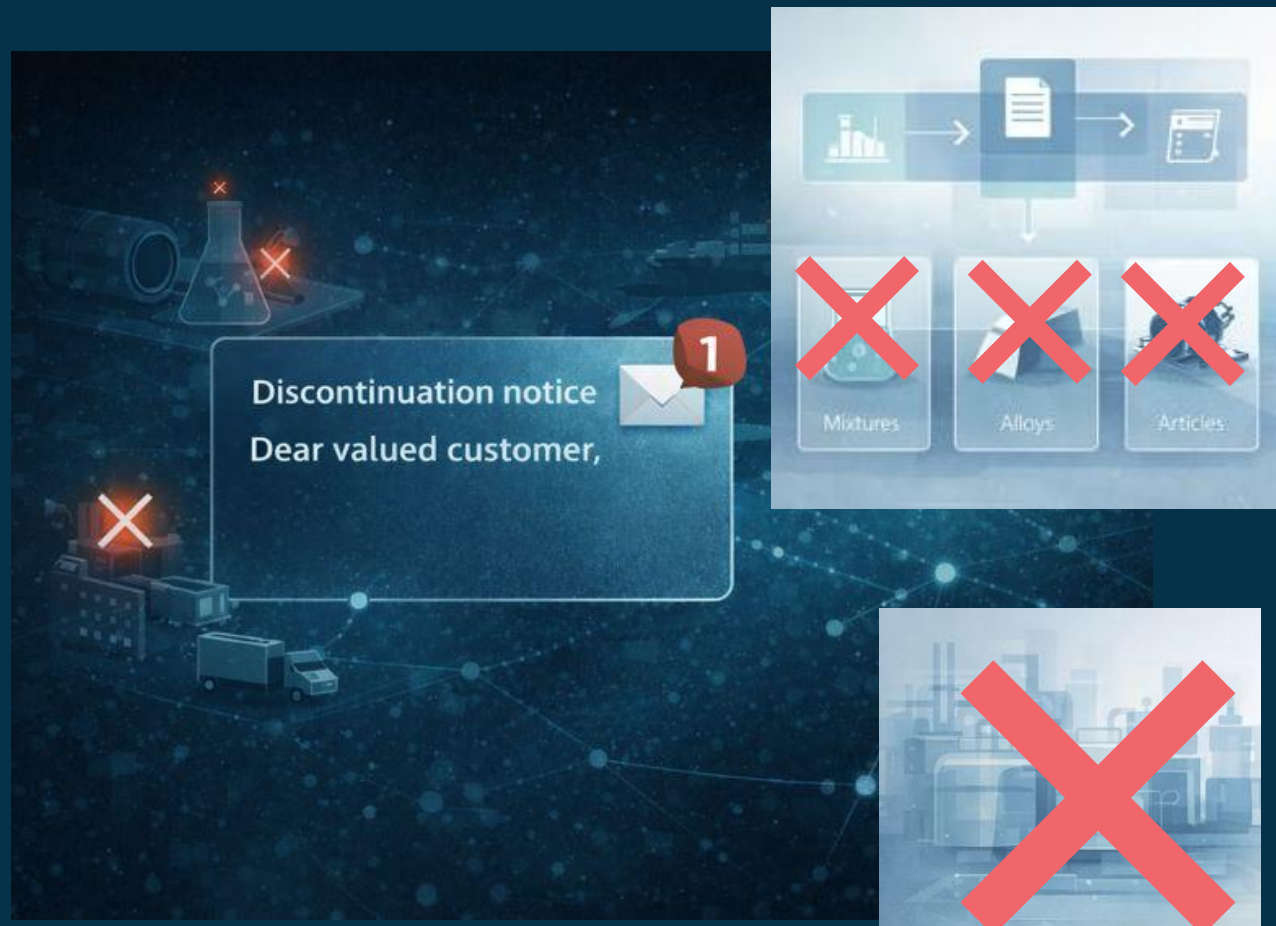
*It = chemical, mixture, material, EEE component, article, finished product (e.g. component, sub-system, satellite, launcher, antenna)

APS = **A**rticle, **P**reparation or **S**ubstance

Article (in REACH terminology) = an object which during production is given a special shape, surface, or design that determines its function to a greater degree than its chemical composition

Obsolescence Management of Materials and Processes

Obsolescence as consequence of REACH / Regulations



- Formulations are evolving
- Direct substitutions are often mandatory
- Certain materials or complete components are being phased out
- Manufacturing facilities are shutting down or moving

In summary:

- Adhering to updated REACH regulations is becoming increasingly difficult
- Reliance on materials from outside the EU is rising

ECSS Requirements on Obsolescence Mgmt.

ECSS-Q-HB-70-23A (2017)

- Recommendations to tackle obsolescence at a project level
- OM team: PM/TO + Procurement + M&P support + PA/QA + Design/Production + H&S + REACH/Legal support
- Obsolescence management to be covered within MPCBs
- Clear examples of OM plans, templates, and REACH regulation process flow

ECSS-Q-ST-70C rev2 (in 2019) has new requirement

4.1.3.i.6, ***...Identify and mitigate the risks linked to obsolescence of materials, processes, or mechanical parts at all levels of the customer-supplier chain...***

and refers to ECSS-Q-HB-70-23A (recommendations)

Note: ECSS Q-ST-70**C** family will be replaced by **D** series

Examples of REACH-driven changes and obsolescence

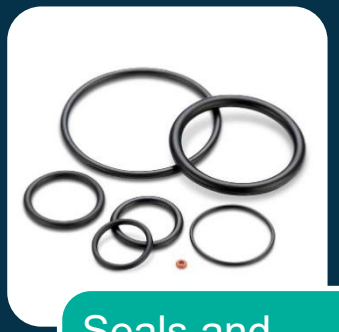
Category	Material / Process	Regulatory Driver /Trigger	Impact on Product / Programme
Modification of products / processes	Epoxy resins formulation	REACH, company policies, (**BPA removal**)	Formulation change → significant impact on mechanical properties
	Epoxy resins diluents	REACH Annex XVII (**Toluene**, Entry 48)	Change of curing system → process and performance impact
	Silicone purification processes	Carcinogens, Mutagens & Reprotox. Directive (2004/37/EC), **CMR solvents**	Removal of toxic ingredient → altered material properties
	Polyurethane potting & conformal coatings	REACH Annex XVII (Entry 74, **di-isocyanates**)	Risk of import discontinuation → need for requalification
	Polyurethane-based paints	REACH restrictions (**toluene, di-isocyanates**)	Discontinuation of heritage products → costly requalification of alternatives
Discontinuation of products	Epoxy resins high temp. hardener	REACH Annex XVII (Entry 71, **NMP**)	High-temperature hardener discontinued → loss of space heritage OR higher compliance costs
	$SrCrO_4$-containing primer	**no authorisation requested/granted for this particular use**	→ **No legal use possible** for that particular supply chain! → discontinuation of import to Europe
	4,4′-Methylenedianiline (MDA)	REACH Annex XIV (**no application for authorisation**)	Substitution unavoidable → **no legal use possible,** legacy process lost
Other drivers	Various materials & products, PFAS	Sanctions, trade limits, procurement rules, user tracking, **legal settlement costs**	Supply delays, uncertainty, **3M PFAS phase out!**

PFAS Challenge: use mapping and quantification

Non-exhaustive list of PFAS uses in space applications

Cable insulation

- Used for cables aboard spacecrafts, satellites…



Seals and Gaskets

- Will not degrade under space conditions

Thermal Protection

- MLI for spacesuits, spacecrafts…

Lubricants

- For moving parts such as robotic arms, antennae, solar array mechanisms

Fluid handling Systems

- In hoses, containers that carry rocket fuel or coolants

…

PFAS use mapping exercise

- PFAS in delivered HW to ESA (satellites dry mass, launchers fuelled)
- Qualitative – substance level
    - Qualitative – material level
        - Qualitative – impacted processes
            - Qualitative – impacted (sub) systems,
- Quantitative: one sum for payload and one sum for platform then summed for all HW (reflected in ESA contribution to consultation response on SEAC opinion, MPTB-ES-PO-0225)
- Qualitative: as per ECSS category – impacting all categories from Cat. 10 Co Cat. 20, nearly all processes
- Quantitative – per company (in case of ESA – reference year 2024, PFAS declared)

Methodology described in my slides in 6th ESA REACH workshop:

https://airdrive.eventsair.com/eventsairwesteuprod/production-atpi-public/f1e3b6db2e7841c59bbb0679f9d5e6c9

EXAMPLE – Qualitative PFAS mapping - substance level

- *Majority of PFAS relevant to ESA programmes belong to the wide group of solid fluoropolymers such as*
  - *PTFE*
  - *PVDF*
  - *ETFE*
  - *PFA*
  - *FKM*
  - *Fluorotelomer sulfonates (FTS)*
  - *FEP*
  - *ECTFE*
  - *FVMQ*
  - *PCTFE and*

liquids

Perfluoropolyether (PFPE) fluids, sometimes also referred as unspecified fluoropolymer or fluorocarbon.