

Environmental Regulations and Their Impact on European Space Sector

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Outline

- Summary of ongoing activities under EU's Green Deal – chemicals in focus
- REACH and other regulatory drivers for the obsolescence of materials and processes
- Regulatory status update – Lead metal and PFAS
- Additional legal constraints and new legislative initiatives
- Conclusions

(feedback from 4th ESA REACH Workshop +references)

EU GREEN DEAL – CHEMICALS STRATEGY

Chemicals Strategy for Sustainability Towards a Toxic-Free Environment

One of the key elements of the Green Deal – > how to deal with chemicals in EU?

Focus:

- 1) Sustainable chemicals for the green and digital transition
- 2) Toxic-free environment: new EU chemical policies (long-term vision)

Ambitions and goals focused on:

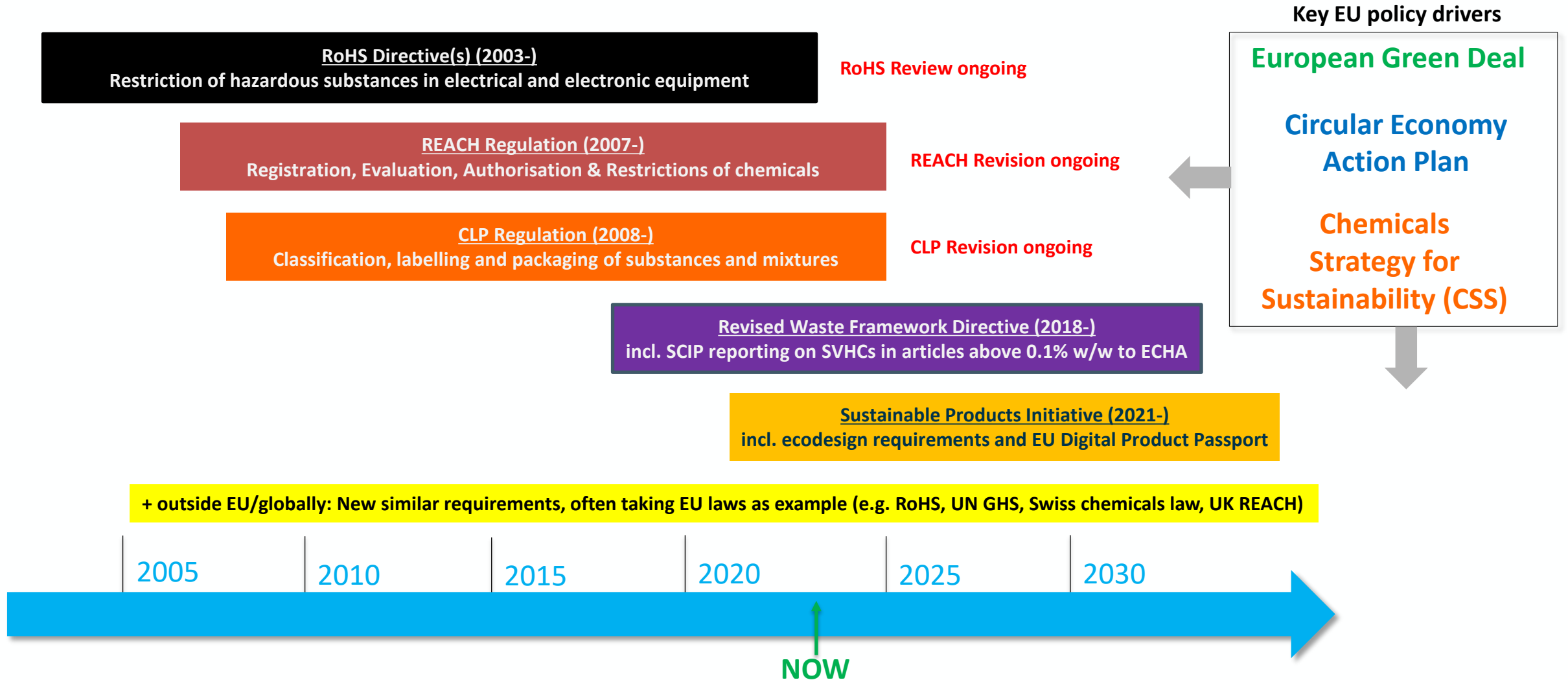
- The presence of Substances of Concern (SoCs), under Sustainable Product Policy Initiation (SPI)
- Information on chemical content and safe use
- Authorisations and derogations
- Investments in sustainable innovations
- Methodologies for chemical risk assessment

Reference: COM(2020) 667 final

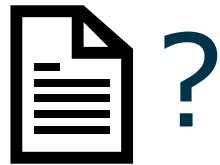
P. Janik et al. | Environmental Regulations... | CSID2023 | 10-13.10.2022 | ESA-TECQE-HO-2023-003011 | Slide 4

Evolution of Chemicals Regulatory Requirements*

*Important examples only, not exhaustive



REACH AND OTHER REGULATORY DRIVERS FOR OBSOLESCENCE



INTRODUCTION TO EU REACH & REACH STATUS UPDATE

Introduction to EU REACH

Registration, Evaluation, Authorisation and Restriction of Chemicals*

- Addresses potential impacts of chemicals to human health and on the environment, production & use of chemical substances.
- Strictest law to date regulating chemical substances.
- Managed by the European Chemicals Agency (ECHA)

☐ Very desirable and ambitious regulation to contribute to a safer and healthier environment but

☐ Many chemical substances face regulatory or commercial obsolescence, causing widespread impacts to downstream users.

☐ Causes wide-reaching engineering and management challenges for the space sector

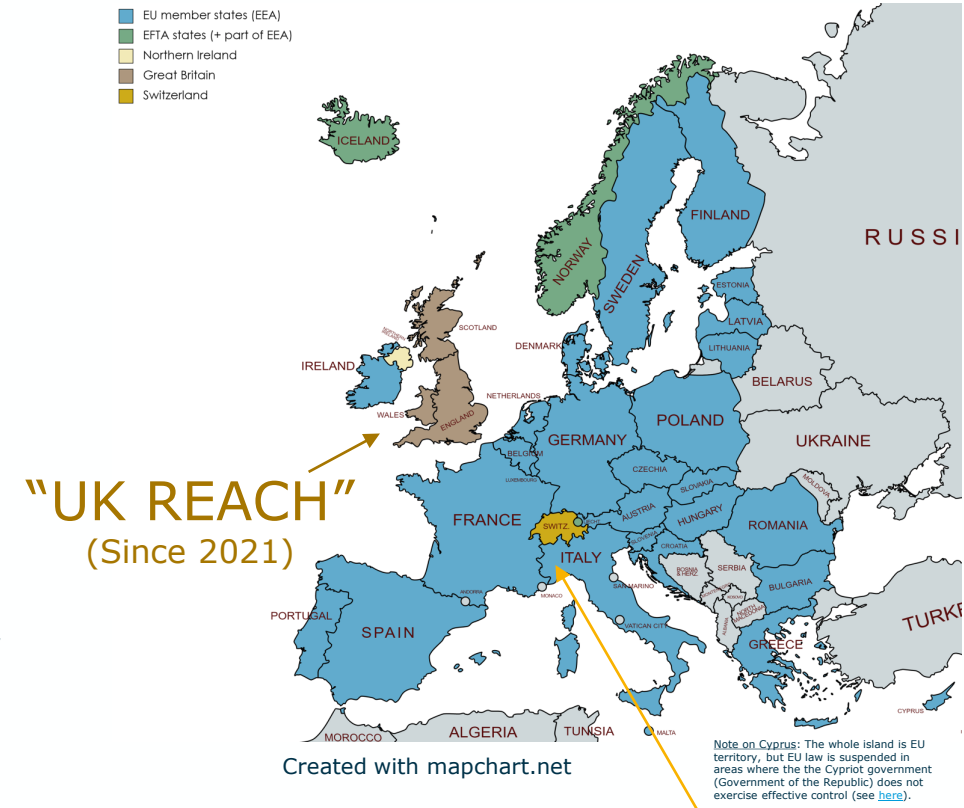
☐ Currently undergoes revision (expected outcome Q4/2023)

* Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

“EU REACH” territories

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

- EU member states (EEA)
- EFTA states (+ part of EEA)
- Northern Ireland
- Great Britain
- Switzerland



“UK REACH”
(Since 2021)

Swiss chemicals regulation

REACH Update by Numbers in 2023 Q3

Registration, Evaluation, Authorisation and Restriction of Chemicals

- ❑ EU REACH Registered substances: **>22,480**
- ❑ EU REACH registrations: **>103,815**
- ❑ ECHA's Cand. List -Substances of Very High Concern (SVHCs): **236** entries (**479** ref. substances)
- ❑ REACH Annex XIV –Authorization list: **59**
- ❑ REACH Annex XVII – chemical(s)-specific restrictions: **72** (multiple substance entries)

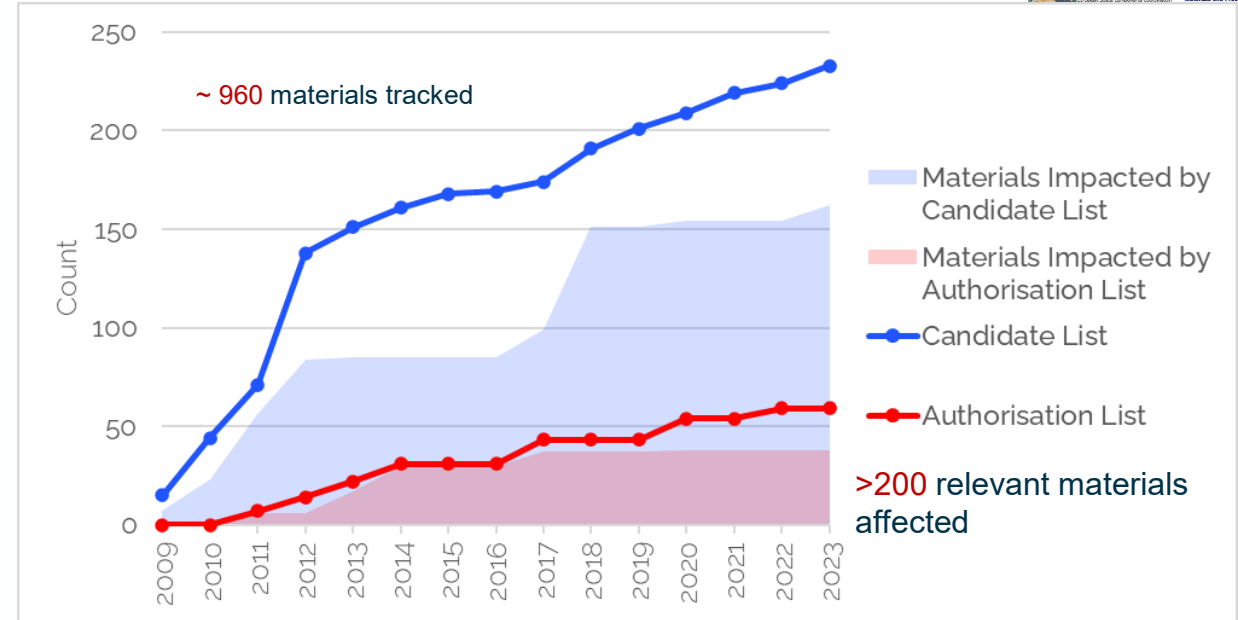


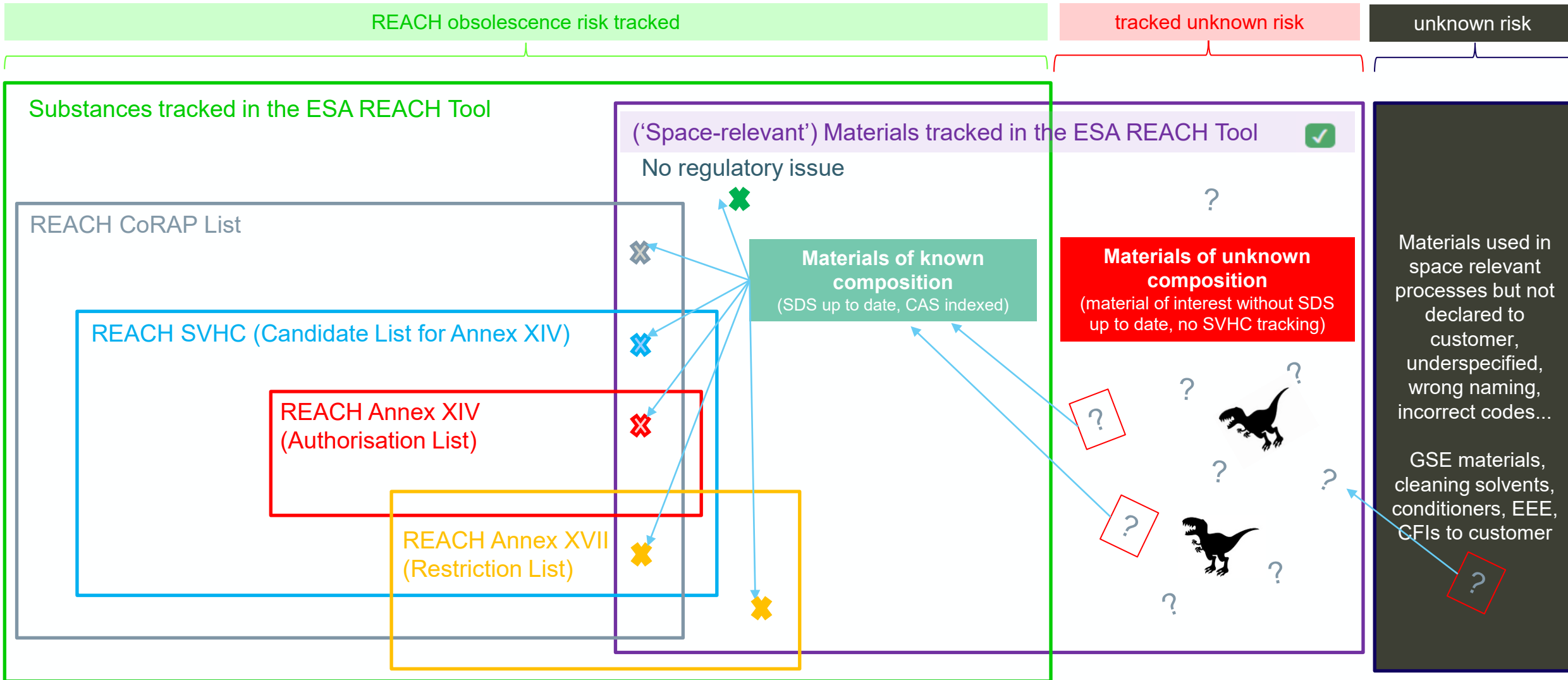
Figure 1. Evolution of entry count in relevant REACH lists and subsequent space relevant materials impact of over time, based on the bill of materials in the ESA REACH Tool.



OSG/REACH Tool analysis by Q3 2023

- ❑ **40** SVHC entries impact **133 (15%)** of tracked materials
- ❑ **13** REACH Annex XIV entries impact **38 (4%)** of tracked materials
- ❑ **13** Space-relevant Annex XVII entries impact **93 (~10%)** of tracked materials
- ❑ **55** materials/mixtures in active use have very high risk of obsolescence!
(last number are active materials impacted by either Annex XVII or Annex XIV)

Substances vs. REACH lists – overview of “intersections”

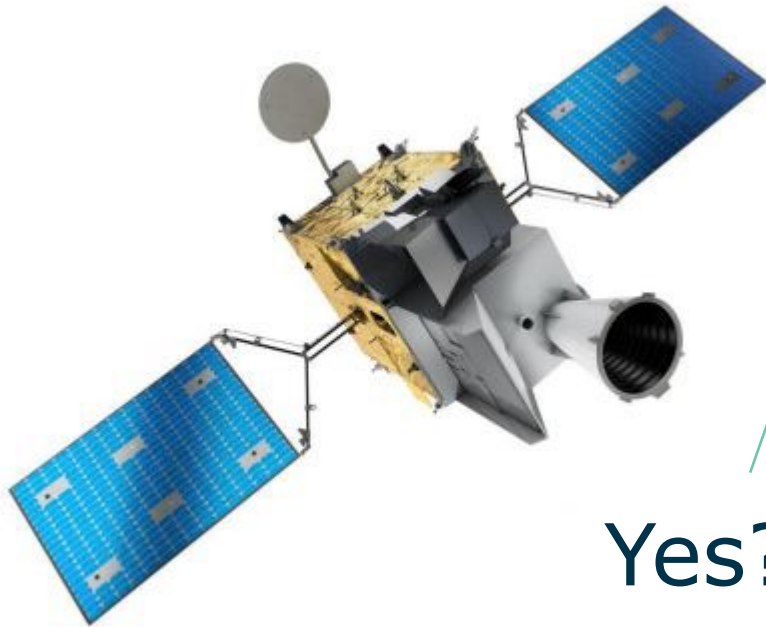


Note: It is impossible to perform any REACH cross-check/regulatory risk assessment if the substances present in materials & process are not traced/identified

Example of REACH-affected Manufacturing Processes

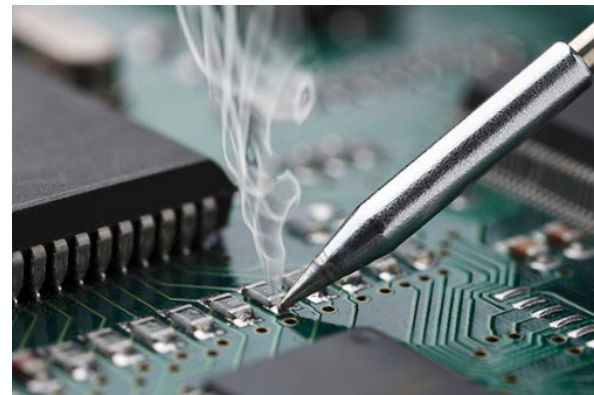
Are there any materials* with Candidate List SVHCs $c > 0.1\%$ w/w?

*"Articles" as defined in REACH Art. 3(3)



Arbitrary examples (Art. 33 declaration & WFD/SCIP reporting):

- Solar arrays – Cr^{6+} based primers
- Pyro valves – phthalates
- PCDUs – B_2O_3 contained in insulators
- ...
- Electronic units – lead in solders



Lead metal

REACH Regulatory Status and Outlook - Update

Current baseline: Reporting on presence in articles $c > 0.1\%$ w/w (REACH Art. 33(1) & WFD/SCIP); OEL revision (*COM proposal of 13.2. available*) and specific REACH Restrictions

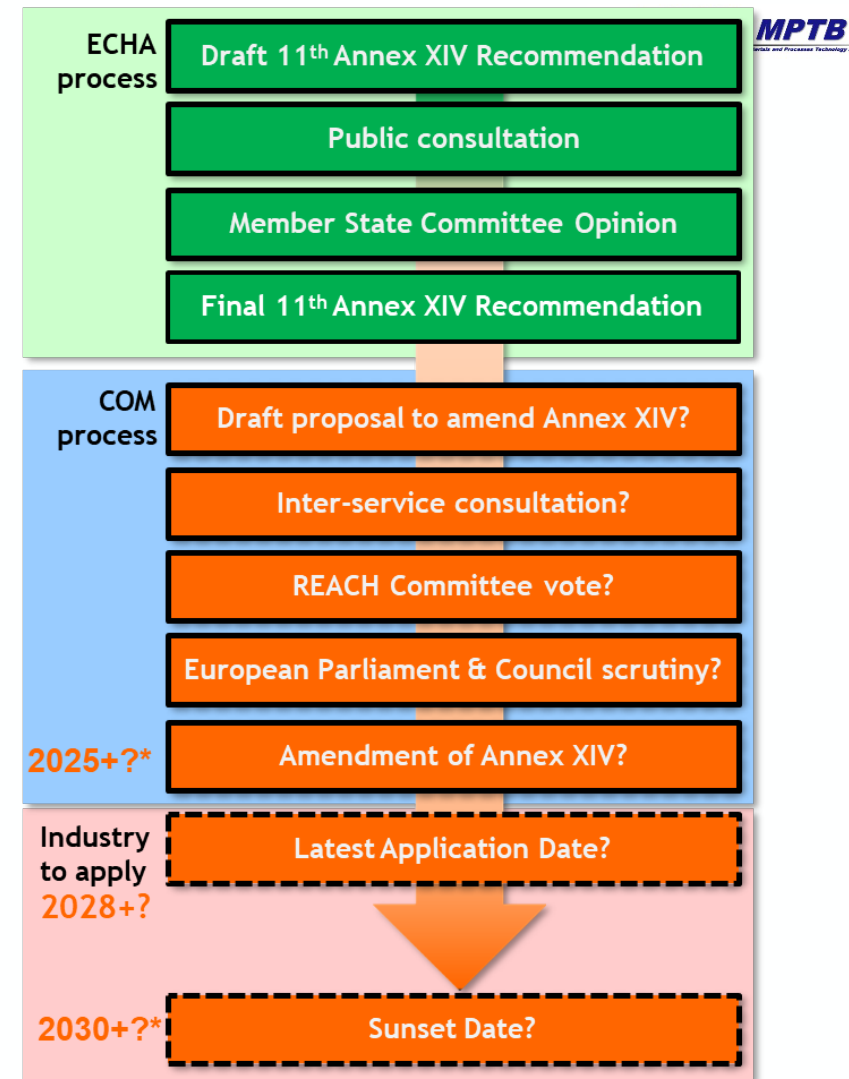
Likelihood of REACH Annex XIV inclusion?

- Numerous steps ahead (*see diagram*) – **No automatism!**
- Further uncertainties mainly due to on-going REACH Revision (incl. Authorisation & Restriction Reform)

In case of Annex XIV inclusion: Good case for authorisation of space applications without alternatives could be made, but **disproportionate impact and efforts expected (up to 200+ AfAs for soldering only!)**

NOTE: No REACH authorisation requirement for lead today nor decided – but substitution pressure is increasing

So far it is very unlikely lead metal would enter authorisation listing



PRIORITY ACTIONS PFAS AND OTHER SUBSTANCES

Universal PFAS: Comments on Restriction Proposal



Paris, 22 September 2023

EUROPEAN SPACE SECTOR
COMMENTS ON THE ANNEX XV
RESTRICTION REPORT FOR
PER- AND POLYFLUOROALKYL
SUBSTANCES (PFAS)

ECHA Public Consultation of 22 March 2023 on the proposed restriction on the manufacture, placing on the market and use of PFASs



- Assessed by space sector represented by MPTB (more [here](#))
- **Space Restrictions Task Force (RTF)** between **March – September 2023**, in coordination with the Aerospace, Security and Defence Industries Association of Europe (ASD)
- **Investigations conducted:** ESA Internal PFAS Survey and REACH Tool Analysis; RTF survey ... 5 progress meetings
- **Elements:** Contribution paper (MPTB-ES-PO-0131) ([link](#)) **submitted to ECHA on 22.9.2023**; (Eurospace News Alert of 25.9.2023 ([link](#)))
- **PFAS types:** fluoropolymers: fluoroelastomers, non-polymeric liquids,...
- **Case Studies:** **#1** Ariane 6 launcher; **#2** Orbital propulsion systems as satellite subsystems; **#3** Scientific mission for ESA: The ATHENA Wide Field Imager; **#4, 5** Use cases specific for ESA projects; **#6** Vapor phase soldering for electronic assemblies; **#7** Lubricants for space mechanisms; **#8** Power wires and cables

Chemicals phase-out and formulation changes

Recap from CSID2022:

- Elimination of **Toluene** (resins, hardeners) -> product modification -> costly **requalification**
- **Bisphenols (BPA)** (resins, hardeners) -> product modification -> costly **requalification**
- Chromates (Cr6+), in chemical conversion coatings, systematically replaced by Cr3+-based alternatives

New:

- Further elimination of Toluene from formulations (even tiny amounts in silicone primers) -> costly **requalification**
- 3M's announcement of **discontinuation of production of all 3M's PFAS substances** and PFAS-based **products by 2025 globally!** ([link](#)) -> Impact is being assessed (**no alternatives identified so far!**)
- **Global shortages of PFAS-based materials:**
 - Cooling fluids, creep barriers and coatings,
 - HFE fluids for the vapour phase soldering,
 - PFPE hermeticity test fluids
 - ...

EU REACH AND BEYOND

List of other regulations with impact (not exhaustive)

RoHS Directive(s), “RoHS 2” Directive 2011/65/EU: Restriction of hazardous substances in EEE

- Impacting space indirectly (COTS), as there is specific exemption for *equipment designed to be sent to space*

Carcinogens and Mutagens Directive “CMD” (2004/37/EC) and **Chemical Agents Directive “CAD”** (98/24/EC) on worker protection from risks related to exposure to substances found in the workplace

- Caused already significant obsolescence, especially in areas where organic solvents are used, including analytics! (Toluene, Xylene, Chloroform, etc... impacting adhesives, paints, coatings, surface treatments...)

Waste Framework Directive (WFD, revised Directive 2008/98/EC on waste), impacting space sector without any exemption so far, especially new obligation of **notification to SCIP database** (applies since 5 January 2021, cost effort, targets Candidate List SVHCs in articles → may result in obsolescence, companies may withdraw some articles), potentially conflict of laws (e.g. due to strict export restrictions/national differences on dual use goods)

UK REACH – consequence of Brexit (in force since January 2021)

- Impact for companies: Duplication of requirements, added burden for following another regime, possible source of obsolescence (divergence of EU REACH vs. UK REACH already happening)

Other regulations (cont.)

Conflict minerals Regulation (EU) 2017/821, since January 2021 (– tin, tantalum and tungsten, their ores, and gold), due diligence and reporting obligations for importers to EU, potential impact on effort → costs impacting final users (electronics)

Swiss chemicals regulation corresponding to EU REACH & CLP: **Chemicals Act, Chemicals Ordinance (ChemO)** and the **Chemical Risk Reduction Ordinance (ORRChem)**, similar scope as EU REACH.

New & future!

➤ Ecodesign for Sustainable Products Regulation (ESPR):

- ✓ Recital (16): *“Similarly, the space industry is strategic for Europe and for its technological non-dependence. As space technologies operate in extreme conditions, any ecodesign requirements for space products should balance sustainability considerations with resilience and expected performance.”*
- ✓ Eurospace feedback to COM of 20.6.2022 ([link](#)) and of 11.5.2023 on new product priorities ([link](#))

EU sanctions imposed on Russia - update, (latest 11th package Regulation (EU) 2023/1214, amending No 833/2014), restricting **import of steel, coal, oil and gold**, and **restricting export of wide range of chemicals, energetic materials, additives, dual goods in general...** ([link](#)) + additional entities sanctioned -> **impacting access of European companies to materials produced by sanctioned entities.**

Chinese export control for Ge and Ga! In force from 1st August 2023 ([link](#))

Other EU Green Deal-related initiatives

- Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023 concerning **batteries and waste batteries**: **Scope exclusion for equipment designed to be sent into space (Art. 1(5)(b))**
- **RoHS Directive Review ('RoHS3')**: Status of COM Proposal?
- **Green Claims Directive** (Commission Proposal COM(2023) 166 of 22 March 2023) governing environmental claims in business-to-consumer practices: Question over the rationale for space reference in recital (31)
"Concerning space, the PEFCR should reflect defence and space-specific environmental impact categories, including the orbital space use."
- **European Critical Raw Materials Act**: *Space launchers and satellites* identified as one of the key technologies affected by supply risks, (any implications to the sector? Space projects = strategic to EU?, *stress test?*)
- **Directive on corporate sustainability due diligence (CSDDD)** - 2023, any impact on space, anything conflicting/irrelevant to space industrial practice?
- **Transition pathway for a resilient, sustainable and digital aerospace and defence industrial ecosystem**: deadline on 15 October 2023 -> 3rd November 2023; MPTB is preparing input for Eurospace;
- **EU Space Law**: Targeted stakeholder consultation survey (until 2nd November 2023)

“Space” in EU chemicals/product/safety legislation*

*Important examples tracked only, not exhaustive!

Exclusion from the scope for space applications	In scope – no exemption/exclusion	Product-specific requirements
<p>« <i>Shall not apply to ... equipment designed to be sent into space</i> »</p> <ul style="list-style-type: none"> ➤ Batteries Directive 2006/66/EC: <i>Batteries and accumulators</i> -> reg 2023/1020 ➤ RoHS Directive 2011/65/EU & since 15 August 2018 ➤ Waste EEE Directive 2012/19/EU: <i>Electrical and Electronic Equipment (EEE)</i> ➤ Mercury Regulation (EU) 2017/852: <i>New mercury-added products</i> 	<ul style="list-style-type: none"> ➤ REACH Regulation (EC) No 1907/2006: <i>Chemicals</i> registration, evaluation, authorisation and restriction; Article 33 reporting for Candidate List substances above 0.1% w/w in <i>articles supplied in EU</i> ➤ Revised Waste Framework Directive (WFD) 2008/98/EC: Reporting to ECHA SCIP Database for Candidate List substances above 0.1% w/w in <i>articles supplied in EU</i> ➤ CLP, CMD, CAD, Conflict Minerals Regulation, etc. 	<ul style="list-style-type: none"> ➤ Proposal for a Regulation establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC (ESPR) (COM(2022) 142 final), recital (16): - [...] “<i>Similarly, the space industry is strategic for Europe and for its technological non-dependence. As space technologies operate in extreme conditions, any ecodesign requirements for space products should balance sustainability considerations with resilience and expected performance.</i>” [...]

Complexity linked to overall regulatory compliance

Not exhaustive...

Supply chain resilience/ethics

Conflict Minerals, Critical Raw Material Act, Chips Act, multiple EU sanctions,...

ESA's additional requirements on suppliers, such as **ESA CSR Code of Conduct** (reflecting on Procedure 2022/0051/COD Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937), status?

Legislation focused on Circularity, Sustainability (Environmental Footprint)

Waste Framework Directive/**WFD/SCIP**, **EEE Waste directive**, Reg. on **batteries and waste batteries**

NEW:

Ecodesign directive -> **ESP Reg. ; Corporate Social Responsibility Reporting Directive (CSRD)**, Directive on **Corporate Sustainability due diligence (CSDDD)**, **Green Claims Directive,...**

Legislation focused on Chemicals & Materials

ROHS, REACH, CLP, CMD, CAD, OELs
Mercury reg., POPs,...



CONCLUSIONS



Conclusions

- Regulatory evolution in Europe leads to significant obsolescence in the M&P domain, impacting directly the space industry. REACH is just one EU regulation of many.
- PFAS restriction (if adopted) represents an enormous challenge; essential use of PFAS + specific derogations for space applications will be unavoidable for decades to come to secure European Space sector competitiveness and high reliability of space applications
- Beyond REACH there are multiple new EU regulations and directives (on circularity and environmental footprint control), that will make legal compliance much more complex!
- Collaboration and communication on regulatory issues within the space sector and beyond (aerospace & defence, automotive, electronics, etc.) is critical
- More information about Space Sector activities on REACH and related:
<https://europspace.org/working-groups/#reach>

Thank you for your attention!
Questions?

Contact: reach.officer@esa.int

Feedback from 4th ESA REACH Workshop 2022 in Paris



Main highlights:

- 100+ participants (physical & online) from 21 countries
- 17 speakers

Topics covered: ESA & Sustainability, REACH & other regulations, M&P obsolescence & ecodesign

- All materials are available on the events webpage: <https://atpi.eventsair.com/esa-4th-reach-workshop>
- If you want to learn more, pls read the REACH workshop [summary report](#)
- For further info about REACH and related ESA events please contact reach.officer@esa.int

List of important contributions with references

in reverse chronological order



- 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](#))
- Materials and Process Technology Board (MPTB): presentation on ESCCON 2023, available [here](#)
- 4th ESA REACH Workshop on the EU REACH Regulations... (18thOctober 2022), all presentations available [here](#)
- Regulatory-driven materials' obsolescence risks and their impact on the European Space Sector, CSID 2022, available [here](#)

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



Acknowledgements



I would like to thank to all members involved in ESCC/MPTB-related activities, in particular those following individual task forces and working groups associated with regulatory challenges for M&P domain!

Special thanks to the team in REACHLaw for their excellent work in support of previous REACH/obsolescence-related ESA's projects, 4000112903 CCN1, *REACH & Obsolescence Management for Material and Processes*, Their and further under contract 4000139751/22/NL/AS



Important references and links

EUROSPACE, trade association of the European Space Industry: <https://eurospace.org/>

MATREX, CNES space materials and regulatory risk tracking database: <https://matrex.cnes.fr>

MAPTIS, Materials And Processes Technical Information System of NASA: <https://maptis.nasa.gov/>

REACH-Related:

ECHA list of Annex XIV substances (authorisation list): <https://echa.europa.eu/authorisation-list>

ECHA list of Annex VXII restrictions (restriction list): <https://echa.europa.eu/substances-restricted-under-reach>

ECHA's SVHC list (Candidate list for Annex XIV): <https://echa.europa.eu/candidate-list-table>

ECHA SCIP database: <https://echa.europa.eu/scip-database>

REACH & Obsolescence management relevant ECSS (<https://ecss.nl/>)

ECSS-Q-ST-70C rev2 - Materials, mechanical parts and processes

ECSS-Q-HB-70-23A – Materials, mechanical parts and processes obsolescence management HB

Databases M&P & EEE component relevant info:

ESA REACH Tool: <https://reachtool.esa.int>

MODESA, outgassing database: <https://modesa.esa.int/>

ESCIES: European Space Component Information Exchange System: <https://escies.org/>