

REACH obsolescence risk and supply chain management for space programs

Thomas Rohr
REACH Officer
Product Assurance & Safety Department
ESA, ESTEC
Thomas.Rohr@esa.int

MPTB stakeholder day, 16th May 2017

Scope of workshop



REACH has far reaching supply-chain implications:

- Obsolescence risks of materials, processes, and technologies and consequently supply chain disruptions
- Need for hazardous substance replacement and consequently requalification
- Need for use of hazardous substances after sunset date (REACH authorization)
- Supply chain communication and management (technical, contractual)

Supply chains can be very complex, e.g. A5 consists of > 150000 parts, ~ 1500 subcos in tier 1, typically 3-5 tiers with 70% suppliers within and 30% outside EU.

The Materials and Processes Technology Board is a European platform participated by space industry, space agencies, and expert companies to establish a joint risk assessment and create awareness among European stakeholders. [Very difficult to overlook challenges as well as possible innovations deeper in the supply chain.](#)

This workshop opens the audience to smaller companies and SMEs to address the following questions:

- What are the needs and challenges in the area of M&P for stakeholders in the European space sector?
- How can we improve to share information and feed innovation effectively across the European space sector?
- Where can the MPTB provide support and how can we establish a functional communication network?



Workshop agenda



Time	Presenter	Title
09:00 – 09:10	T. Henriksen (ESA)	Opening
09:10 – 09:35	T. Rohr (ESA)	Introduction to activities from Materials and Processes Technology Board
09:35 – 10:00	T. Becker (REACHLaw)	Joint industrial activities to address REACH challenges
10:00 – 10:25	K. Kivela (ECHA)	REACH and space industry
10:25 – 10:45	Coffee break	
10:45 – 11:05	C. Durin (CNES)	CNES approach for M&P activities for SMEs
11:05 – 11:25	C. Puig (Airbus DS)	Airbus DS strategy (Alocrom 1200 substitution)
11:25 – 11:45	C. Bourrie (Surface Treatment)	REACH influence on surface treatments
11:45 – 12:05	R. Elvermann (cbprocess)	Digital Risk- and Process- Management for REACH and Obsolescence with Promcenter Framework and Method
12:05 – 13:15	Lunch break	
13:15 – 14:20	A. Coello-Vera (REACHLaw)	Open discussion on REACH supply chain management
14:20 - 14:45	J. Austin (ESA)	Clean Space initiative
14:45 – 15:10	T. Ghidini (ESA)	Advanced manufacturing for a competitive Europe
15:10 – 15:30	Coffee break	
15:30 – 15:55	A. Graham (ESA) H. Combes (CNES)	European space materials database
15:55 – 17:00	A. Coello-Vera (REACHLaw)	Open discussion on M&P needs for space applications



Introduction to activities from MPTB



Scope

- Introduction to REACH and its impact for space programmes
- European-wide coordination through MPTB
- General risk assessment for REACH obsolescence
- Example case chromium trioxide for CCC
- Challenges and conclusions



REACH – introduction



Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) ¹

REACH addresses

- the production and use of chemical substances
- their potential impacts human health
- their potential impact on the environment

It is the strictest law to date regulating chemical substances and has worldwide impact.

As a consequence many chemical substances will be ‘forced’ to be phased out (cost/benefit of continuous use, availability of alternatives) directly affecting the qualification status of materials, processes, and technologies.

The regulation is very desirable and ambitious to contribute to a safer and healthier environment, but it poses wide-reaching engineering challenges for the space sector which is by nature driven by performance and heritage design.

¹ EU Regulation 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the registration, evaluation, authorization and restriction of chemicals (REACH)



REACH obsolescence risks - examples



Chromium trioxide

e.g. corrosion protection of Al and Mg alloys
Authorisation list, sunset date 21.9.2017

Ammonium dichromate

Pyrotechnic devices
Authorisation list sunset date 21.9.2017

Boric acid

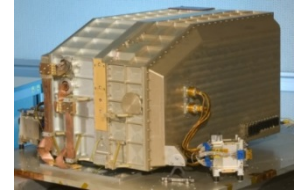
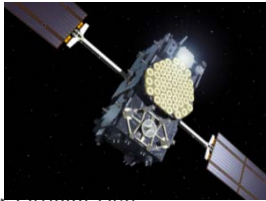
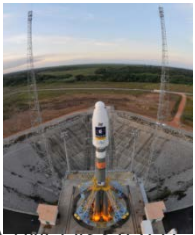
e.g. etching, pickling, electrolytic deposition metals
6th recommendations for Annex XIV inclusion

Hydrazine

Propellant for spacecrafts and launch vehicles
Candidate list

Gallium Arsenide

EEE components and solar cells
CLP, currently not in authorization process



REACH corollary

Directly affects materials, processes and technologies

Adhesive, coating and primer formulations

Solvents, surface treatments

Fuels, energetic materials

EEE components, sensors, PCB assembly

Power generation



- Affects entire industrial sector through obsolescence of materials, processes, and technologies at unprecedented scale
- Exposure to projects depends on project life cycle
- Affects ground phase from moment of design
- Increasing remedy costs with increasing assembly complexity
- REACH exposure does not necessarily end after manufacturing (e.g. fuelling, pyrotechnics, repair, recurrent h/w)
- Uncertainty increases with increasing time (scientific payload vs. launcher or satellite platform)
- Legal compliance \neq risk management
- Space is a niche market



→ **Require appropriate management within space community**

European-wide coordination through MPTB



REACH is affecting European space industry as a whole. Coordination and information exchange of risk analysis and mitigation is to the benefit of the entire community.

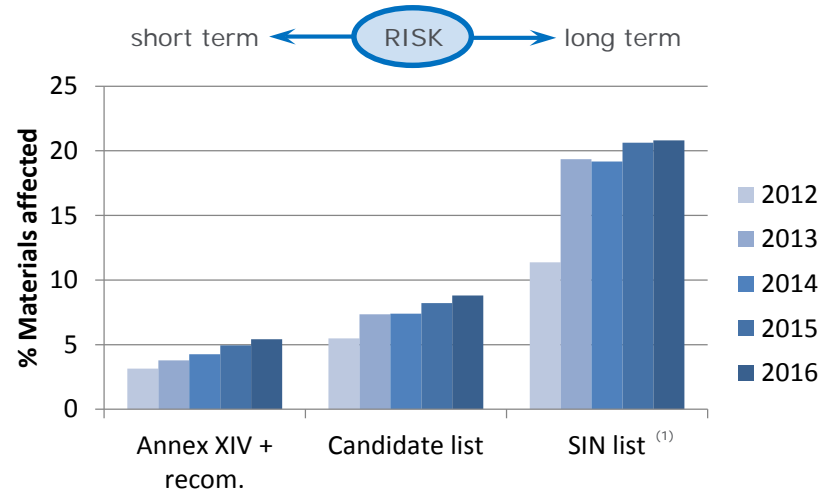
The **Materials & Process Technology Board** is a European platform that includes industrial partners and space agencies including members from Airbus DS, Airbus Safran Launchers, ASI, Avio, CNES, DLR, ESA, MAP, MT Aerospace, OHB, REACHLaw, RUAG, TESAT, and TAS. Tasks include:

- **Legislation:** Intelligence of legislative processes (e.g. REACH, RoHS) and coordination of actions.
- **Obsolescence risk management:** Identify in advance critical materials and processes.
Propose action plans to mitigate obsolescence risk of Materials & Processes.
Reduce programmatic risks and costs by early replacement.
- **Data exchange:** Share materials test data and avoid test duplication.
- **R&D activities:** Coordination of R&D activities, monitoring of alerts, analysis of in-orbit anomalies, *etc.*
- **Communication & information exchange:** Coordination of information via symposia, WGs, training. Development of synergies with other industrial sectors.
- **Splinter activities:** Chromate space task force, hydrazine task force, European Space Materials Database (ESMDB) steering board



Trend of REACH obsolescence risk

The Materials and Processes Technology Board (MPTB) with participation of system integrators, large equipment manufacturers, and space agencies performs risk assessment based on a joint materials database. Current estimates indicate ~ 8 % of our materials are probably affected in mid-term and 20% are possibly affected in long-term.



A primary objective is coordinated risk mitigation:

- Perform a risk assessment of identified materials and processes.
- Identify in advance potential critical materials and processes.
- Propose corrective actions (e.g. use of alternatives, replacement program, authorisation, exemption)

⁽¹⁾ The SIN list (www.sinlist.org) is an NGO driven project to speed up the transition to a toxic free world. Chemicals are identified as Substance of Very High Concern (SVHC) based on the criteria established by REACH. The latest update from February 2017 consists of 913 substances.

The case of chromium trioxide



A major use of CrO_3 is for conversion coatings for corrosion protection for Al and Mg alloys (Alodine 1200) for a very large diversity of configurations.

- Aluminum is the major manufacturing material of structures and components for space hardware; consequently, the processing and maintenance of this material against degradation and corrosion is of prime importance in preserving space operation capabilities.
- The replacement of hexavalent chromium in the processing of aluminum for aviation and aerospace applications remains a goal of great significance within the aerospace community.
- The European space community continues to search for an alternative to hexavalent chrome in coatings and plating applications that meet their performance requirements in corrosion protection, cost, operability, and health and safety; while underlining that performance must be equal to or greater than existing systems.
- The challenge is not limited to European space industry, a similar process applies to US industry through a DoD directive for minimizing the use of Cr(VI) (FR Doc No: 2011-10882).
- Coordinated collaboration on studying the performance of commercially available hexavalent chrome-free coatings by industry, partly supported by funding of space agencies as well as collaboration between ESA and NASA.



Chromate conversion coatings

A major use of CrO_3 is in conversion coatings for corrosion protection for Al and Mg alloys (e.g. Alodine 1200).

Challenges

Very large diversity of configurations

Replacement is technically very demanding

21 Sep 2017: Sunset date, readiness for qualified alternatives

21 Mar 2016: Latest submission window for REACH authorisation



Bring qualification programs on European/international platform to avoid duplication and give industry access to data.

1. Replace what can be replaced by Sep 2017 → Test and qualification campaigns
2. Standardisation → Revisit corrosion requirements, ECSS-Q-ST-70-14C 'Corrosion'
3. Ensure authorisation for the remaining for sufficiently long time for entire supply chain → Formation of Space task force ⁽¹⁾
Space uses covered by CTACSub ⁽²⁾

⁽¹⁾ Eurospace information note: <http://www.eurospace.org/space-chromate-task-force-concludes-reachauthorisation-dossier-development-for-chromium-trioxide.aspx>

⁽²⁾ Surface treatment for applications in the aeronautics and aerospace industries, ...: <http://echa.europa.eu/addressing-chemicals-of-concern/authorisation/applications-for-authorisation-previous-consultations/-/substance-rev/10107/term>

Awareness

Challenges to [reach all stakeholders including SMEs](#) and other small entities (with limited resources) to ensure awareness and improve visibility to security of complete supply chain.

Communication

Relevant materials or process information may be proprietary or deep in the supply chain. Supplier alternatives typically driven by requirements from non-space sector. Engage in and maintain dialogue within supply chain, upstream and downstream.

[Establish closer communication network to suppliers and SMEs through MPTB.](#)

Authorities cannot be expected to have the depth of knowledge to recognise all possible consequences of regulatory decisions. Space community is a niche sector and decisions often driven by needs of larger industry entities.

[Dialogue towards authorities crucial for obsolescence risk mitigation.](#)

Significant future investments will be necessary by industry for

- **Product replacement:** R&D, testing, qualification, industrialisation
- **Maintenance of production capabilities:** Demonstration of compliance, REACH authorisation

Ongoing and future coordinated MPTB initiatives



- Regular obsolescence risk assessment of materials and processes
- Proposition of actions for risk mitigation
- Coordinated testing and qualification of replacements
- Joint efforts to address regulatory milestones (public consultations, REACH authorisation, position papers, *etc.*)
- Development of information website with focus on obsolescence management of M&P
- Consideration of space-specific aspects for REACH article 33 declaration
- Development of REACH obsolescence management tool
- Development of European Space Materials Database

- What are the needs and challenges in the area of M&P for stakeholders in the European space sector?
- How can we improve to share information and feed innovation effectively across the European space sector?
- Where can the MPTB provide support and how can we establish a functional communication network?

