Aerospace, Security and Defence
Industries Association of Europe

Halon Replacement

Risk Assessment Workshop

Friday 11th April

13:00 to 15:00

Agenda

1. Introduction – (5 min)
2. OEM Perspective – Airbus – (40 min)
3. Engine Manufacturers – Rolls-Royce – (5 min)
4. Certification & Airworthiness – ASD – (10 min)
5. REACH – ASD – (10 min)
6. ICAO– ASD – (5 min)
7. Open Discussion & Way Forward – (40 min)
8. AOB & Wrap-up – (5 min)

HALON USE IN AIRCRAFT
FIRE EXTINGUISHING SYSTEMS

Halon Replacement status and Regulatory Pathway

2025-04-11

AIRBUS

Halon in aviation

AGENDA

01 **Introduction to Halon**
Uses in civil aviation

02 **Regulatory Framework**
Substitution pressures from regulations

03 **Airbus efforts to replace Halon**
Substitution efforts and challenges

04 **Proposed way forward**

ASD workshop
11th of April 2025

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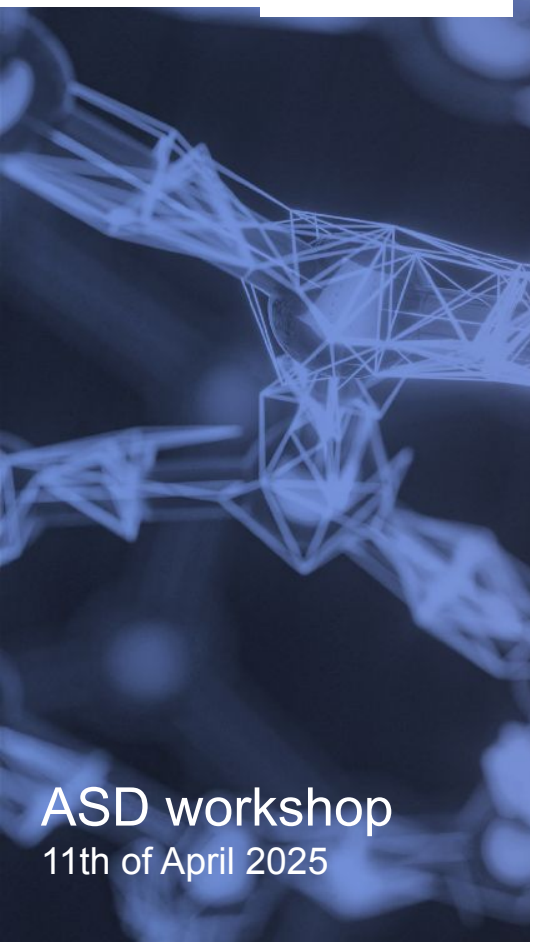

01

Introduction to Halon

Uses in civil aviation

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11th of April 2025

01 Introduction to Halon

Uses in civil aviation fire extinguishing systems

- Halon has been widely used as a **fire extinguishing agent in aircraft** both in fixed and portable systems:
  - ***Engine/Auxiliary Power Unit (Halon 1301)***
  - ***Lavatory (Halon 2402, 1211, 1301)***
  - ***Cabin and Cockpit handheld (Halon 2402, 1211)***
  - ***Lower deck cargo hold (Halon 1301)***

- Halon has properties which are highly effective against fires:
  - ***Clean agent***: electrically non-conductive, non-volatile and does not leave residue upon evaporation, and
  - ***Low-toxicity***: Allowing it to be used safely in occupied and unoccupied spaces on aircraft.

- Any alternative to halon must meet safety **Minimum Performance Standards** related to different fire scenarios such as for class C Cargo: bulk-load fire, containerised-load fire, flammable liquid fire (surface burning), aerosol can explosion simulation and Multi Fuel Fire Threats.

- However, halon is also an **ozone depleting substance** and so the aviation sector has committed to find alternatives since the 1990s.

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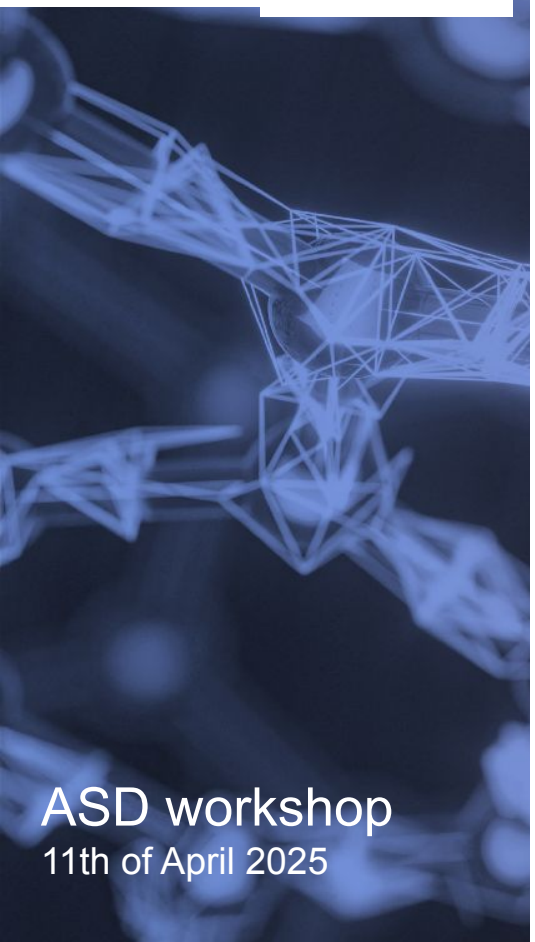

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Regulatory Framework

Substitution pressures from regulations

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02 Regulatory Landscape
Halon replacement

Vienna Convention MONTREAL PROTOCOL

Montreal Protocol: Halon 1211, halon 1301 and halon 2402 are Annex A-Group II substances with 100% reduction applicable to production and consumption (*domestic production+imports*) with essential use exemptions (*Definition in backup slide*).

- **Production ban** in 197 countries since 2010 (1994 for developed countries)
- The **Montreal Protocol does not prescribe dates by which the use of halon is no longer considered essential for aviation**, and **stocks of reclaimed and recycled halon** were deemed sufficient to satisfy the critical use without further production.
- Any further production would require substantiation that there are no substitutes and sufficient quantities remaining to satisfy the critical use.

To encourage the aviation industry to find halon substitutes, the following types of deadlines were introduced.

ICAO Cutoff dates: *Do not use halon in new type certified aircraft (ICAO and EU)*

- ***Decision A37-9*** (Urges countries to accelerate the development of alternatives and introduces cutoff dates for specific firex applications) and ***Decision A38-9*** (updates cutoff date (2024) for cargo).

ICAO Cutoff dates place no constraints on existing fleets and line-fit for Cargo and Engine/APU

European Union

EU End Dates: In addition to cut-off dates, the EU has introduced end dates to stimulate halon replacement in the EU Ozone Regulation (2024/590):

- **End dates** are the dates after which the use of halon in existing fire extinguishing systems must end and be replaced for all EU registered aircraft (***retrofit requirement***).

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02 Regulatory Landscape

*EU Commission **intention** with the EU ODS Regulation*

European Union

The main objectives of the current Ozone Regulation (Regulation (EU) 2024/590) and previous iterations are to:

- Ensure that the EU is **compliant with international agreements** put in place to protect the ozone layer; and
- Have a **high level of ambition** for protecting the ozone layer and fighting climate change.

IMPORTANT: Advocacy efforts should systematically aim to convey that our efforts are **consistent with these objectives**, rather than challenging them **(to avoid where possible that it is considered politically sensitive)**

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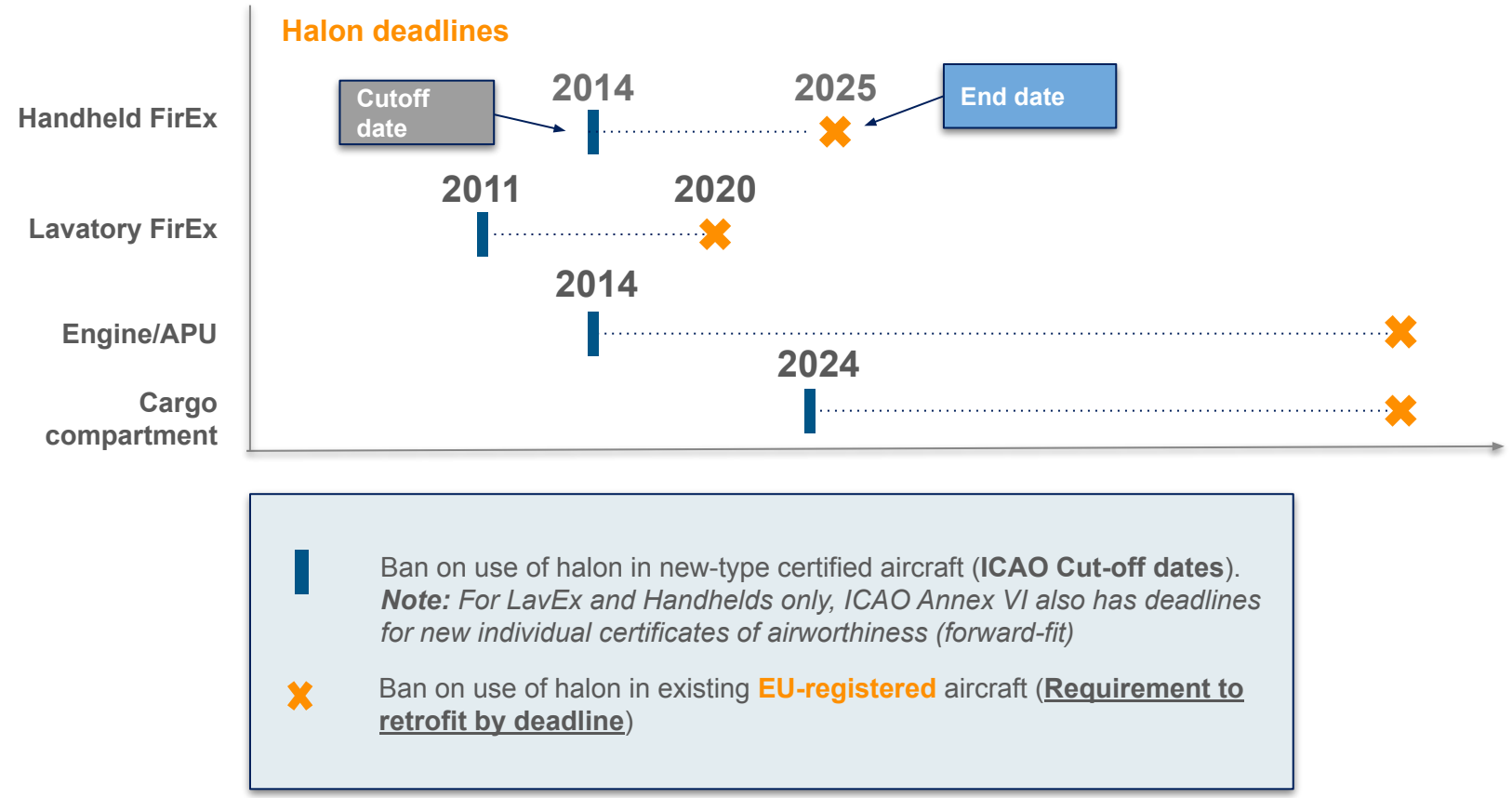
02 Regulatory Landscape

Stimulating halon replacement: ***Deadlines***

In the EU (and UK post-Brexit) ODS Regulations, the deadlines for halon use are defined **per specified use** both for cutoff dates and EU end dates.



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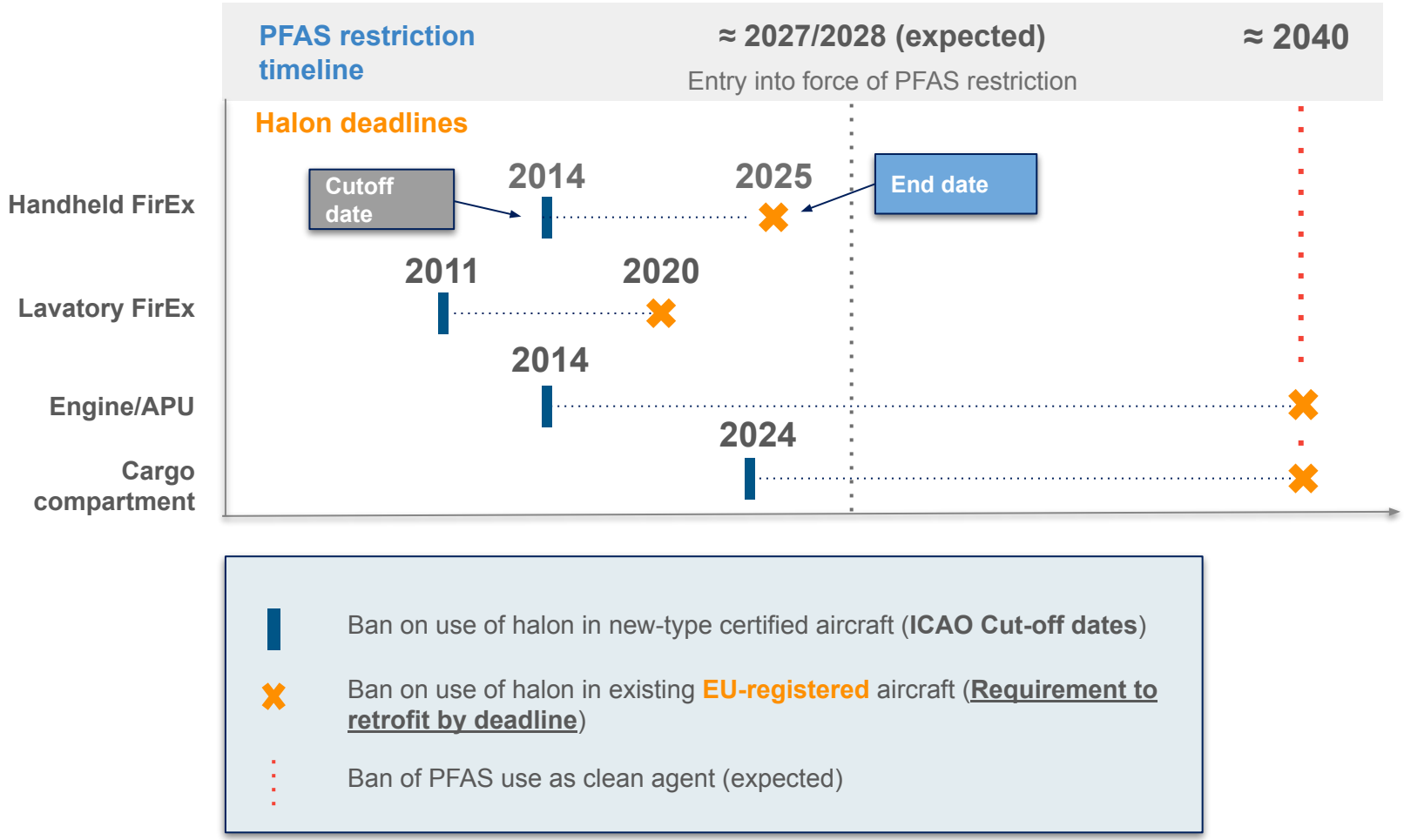
02 Regulatory Landscape
*PFAS Challenge: **Deadlines***

The deadlines for halon use are defined **per specified use** both for cutoff dates and EU end dates.



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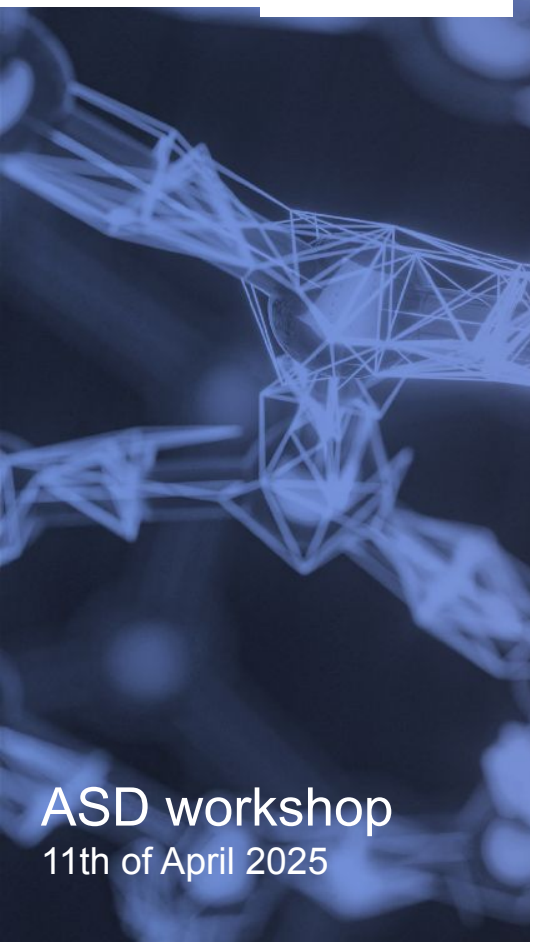

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03

Airbus efforts to replace Halon

Substitution efforts and challenges

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03 Airbus efforts to replace Halon
Substitution efforts and challenges

Airbus Amber

- To comply, Airbus and the aviation sector have undertaken decades of research (since 1990s) to find alternatives that meet the **required minimum performance and safety standards**.
- **Status of Airbus substitution efforts**:

Alternatives		Airbus Technology Readiness Level	Aircraft impact *Weight & Physical Integration*	Regulatory Risk Environment / Health & Safety	Environmental Footprint
Engine & APU	KSA™ *Powder*	TRL 4	Medium *Weight & Physical Int*	Ok	
	CF3i *Liquid/Gas*	TRL 4	Medium *Weight & Physical Int*	Risk *ODS*; CMR** 2*	
Lavatory	HFC-236 *Gas*	TRL 9	Low *Weight*	Risk ***PFAS****, *F-Gas******	
Cabin Handheld	2-BTP *Liquid/Gas*	TRL 9	Low *Weight*	Risk ***PFAS****; *CMR** 1; ODS*; ED*****	
Cargo *Class C only*	Verdagent™ *CO2 gas + 2-BTP liquid/gas*	TRL 6	High *Weight (CO2) & Physical Int*	Risk ***PFAS****; *CMR** 1; ODS*; ED*****	
	Inert Gases (such as N2) *Gas*	TRL 5 *for new TC only*	Very High *Weight & Physical Int*	Ok	

(*) non-zero Ozone Depleting Substance; (**) Carcinogenic, Mutagenic and Reprotoxic substances; (***) EU per- and polyfluoroalkyl substances per OECD definition (****) suspected Endocrine Disruptor ; (*****) Fluorinated gases

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03 Airbus efforts to replace Halon

Substitution efforts and challenges for **Cargo**

Because of **lower fire extinguishing performance**, the currently identified substitute for existing Cargo (Verdagent™) leads to **mass penalties (100-400 kg depending on aircraft type)** resulting in increased fuel burn and CO2 emissions during use phase of the aircraft.

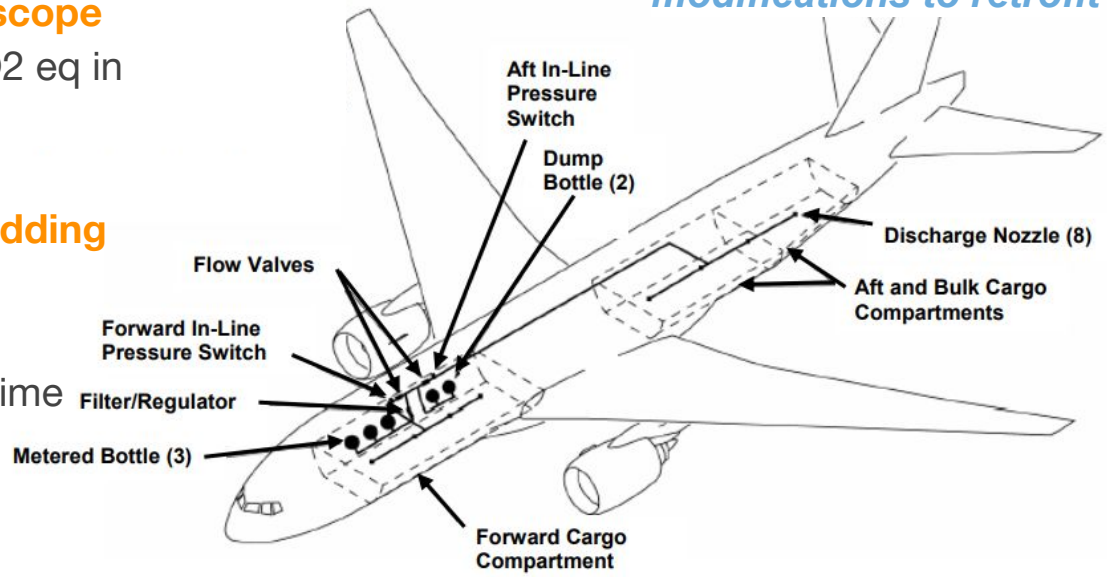
At Airbus fleet level, substituting Halon by currently identified alternatives would result **additional yearly CO2 emissions of 600 kt CO2 eq/y** *(*)* relative to current CO2 fleet emissions.

These emissions at the scale of the current Airbus in-service fleet are **comparable to Airbus scope 1 & 2 emissions** (757 kt in 2022, 645 kt CO2 eq in 2023)

In absolute terms, this amount represents **adding per A/C**:

- ~45 tonnes CO2 eq per year,
- ~1,000 tonnes CO2 eq over its lifetime

Fixed system in cargo requiring significant modifications to retrofit



(*) Considering around 12,000 A/Cs ; around 2 % of installed quantity yearly emissions
Halon free mass penalties between 100 - 400 kg depending aircraft type (~90% due to cargo)

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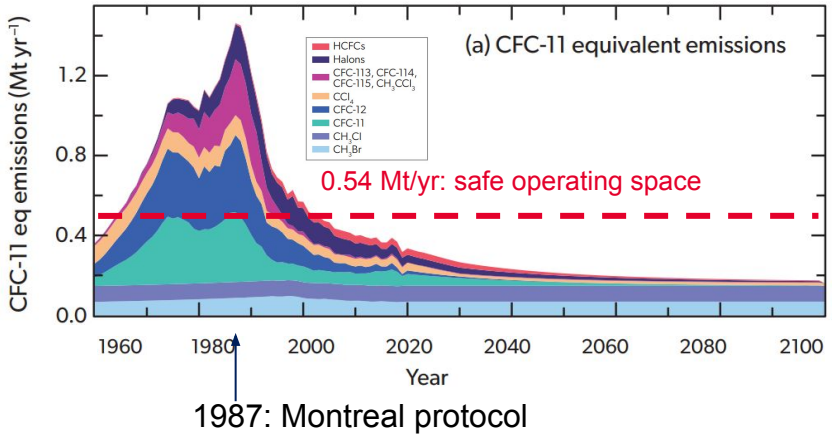
03 Airbus efforts to replace Halon

Substitution efforts and challenges for Cargo

We are confronted with the risk of a regrettable substitution

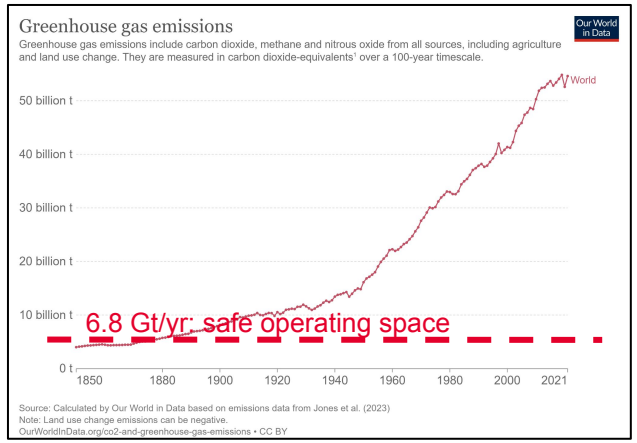
Emissions of ozone-depleting substances



1987: Montreal protocol

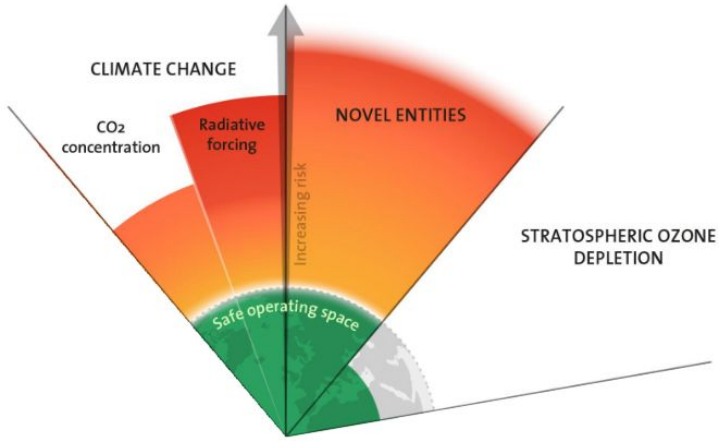
Source: WMO 2022 report

Greenhouse gas emissions



Source: Our world in Data

Substituting Halon in Cargo contributes to improving stratospheric ozone depletion (**already within safe limits**) but at the **cost of increasing negative contributions** to other area(s) already far beyond acceptable limit(s) – **climate change** and **emissions of novel entities.**



cf: Planetary boundaries

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04

PROPOSED WAY FORWARD

EU Regulatory pathways and process

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04 Airbus proposed way forward
Avoiding regrettable substitution

According to the Montreal Protocol Decision XXVI/9, **an alternative must pass all the following criteria to be acceptable:**

- *Commercially available*
- *Technically proven*
- *Environmentally sound*
- *Economically viable and cost effective*
- *Safe to use*
- *Easy to service*

These criteria are also confirmed in the **EU Commission Communication on Essential Use (2024)**:

- *To be acceptable, the alternative must sufficiently deliver the expected service and be safer. Assessment of acceptability can also include a technical and/or economic feasibility assessment (e.g. analysis of production capacities in light of legal requirements).*

Airbus considers that **for Cargo, the identified substitute Verdagent (2-BTP blend) is not acceptable** given increased aircraft CO2 emissions and risk to economic viability due to expected PFAS restriction **(in that order).**

After more than 30 years of research, Airbus and other actors in the sector are unlikely to identify other alternatives and even less likely to develop & implement it within the defined EU regulatory deadlines for replacing halon (2040 for Cargo).

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04 Proposed way forward
Pathways for avoiding regrettable substitution

EU Ozone Regulation (2024/590) Article 9 offers two options

Article 9(3) Option 1: The Commission is empowered to adopt delegated acts to amend Annex V [deadlines] where:

- Technically and economically feasible alternatives or technology is not available within the timeframes set out
- OR not acceptable due to their effect on the environment or health
- OR where it is necessary to ensure compliance with international commitments of the Union concerning critical uses of halon (e.g. Montreal Protocol, ICAO, etc.)

Option 1 corresponds to the needs of the aviation sector (the end date of 2040 for cargo affects the in-service fleet of numerous European aircraft operators and manufacturers).

IMPORTANT: We would not be challenging the essential elements of the EU ODS Regulation
Annex V can be amended via delegated act (at EU Commission initiative) if certain factors materialise as stipulated in Article 9(3). The foreseen process is governed by well-defined EU legislative procedures.

Article 9(4) Option 2 (already exercised by France in 2020): The Commission may adopt implementing acts following a substantiated request of the competent authority of the State that **grant time-limited derogations** from the end-dates or cut-off dates where it is demonstrated that no technically or economically feasible alternative is available for that particular application

To avoid the Article 9(4) route, avoid using the word 'derogation'

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04 Pathways

Delegated Act route: What does the ODS Regulation say?

Article 9(3) Option 1: The Commission is empowered to adopt **delegated acts** to amend Annex V [deadlines]

Article 29: Exercise of delegation (by the EU Commission DG-Clima)

4. **Before adopting a delegated act, the Commission shall consult experts designated by each Member State** in accordance with the principles laid down in the Interinstitutional Agreement of 13 April 2016 on **Better Law-Making**.

5. **As soon as it adopts a delegated act, the Commission shall notify it simultaneously to the European Parliament and to the Council.**

6. A delegated act adopted pursuant to Article 6(2), Article 7(4), Article 8(7), Article 9(3), Article 16(13), Article 18(1), Article 19(2), Article 20(7), Article 22, Article 23(3) and Article 24(4) **shall enter into force only if no objection has been expressed either by the European Parliament or by the Council within a period of two months of notification of that act to the European Parliament and the Council or if, before the expiry of that period, the European Parliament and the Council have both informed the Commission that they will not object.** That period shall be extended by two months at the initiative of the European Parliament or of the Council.

Details on the above procedures are available in the Better Law-Making guidelines

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04 EU Delegated Act Pathway
Process overview

Airbus Amber

Visual simplification based on the EU Better Regulation Guidelines and Toolbox

Impact assessment
Slide 24

DG Clima decides if and how to plan the delegated act process

Slide 18

Interservice consultation on draft involving experts from Member States
Slide 19

Public consultation for 4 weeks

Adoption

Challenge period by EU Parliament and Council (2 months) before publication in EUOJ

Can take 12+ months if considered politically sensitive

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04 Conclusion

***Problem Statement** and proposed strategy seeking alignment within ASD*

Engine/APU

CF3i and/or KSA™ **alternatives** *(still under study)* **foreseen acceptable** ⇒ **Mature and deploy**

Lavatory

FE-36 *& (FM-200)* **alternatives targeted by** EU F-Gas and emerging PFAS **regulations** ⇒ **Seek other potential non-Halon alternatives** *(non-ODS, non-GWP, non-PFAS)*

Cabin and Cockpit handheld

2-BTP **alternative targeted by EU emerging PFAS regulations** ⇒ **Monitor EU PFAS and advocate** *when relevant/possible* **keeping 2-BTP** *if recognized by authorities as acceptable Halon alternative*

- **Absence of potential alternative and low likelihood to find/deploy one in mid future**

Lower deck cargo hold *(class C)*

Verdagent(™) and inert gases **alternatives foreseen unacceptable** ⇒ **Ask to postpone EU ODS Cargo end_date** *(Annex V amendment via delegated act)*

- **Increased aircraft CO2 emissions** *(impact transfer from Ozone to Climate Change)*

- **Targeted by EU emerging PFAS regulations** *(Verdagent™ only)*

Absence of potential alternative and low likelihood to find/deploy one in mid future

Ask to postpone ICAO ODS Cargo cut_off date *(Annex 8 amendment via ICCAIA Working Paper)*

Solicit support for Halon supply de-risking

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Thank you

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4. Airworthiness and Certification

S. Anderson

Halon replacement in the aviation industry guide 2025

Guide jointly developed by the EC and EASA to support aviation industry with complying with the requirements of Regulation (EU) 2024/590 (the Ozone Regulation) on halon replacement.

Mainly for Type Certificate applicants, to help them to determine when their proposed new design needs to comply with the Ozone Regulation.

Provides in particular clarifications on the interpretation of the cut-off dates applicability, as well as information on the derogation process.

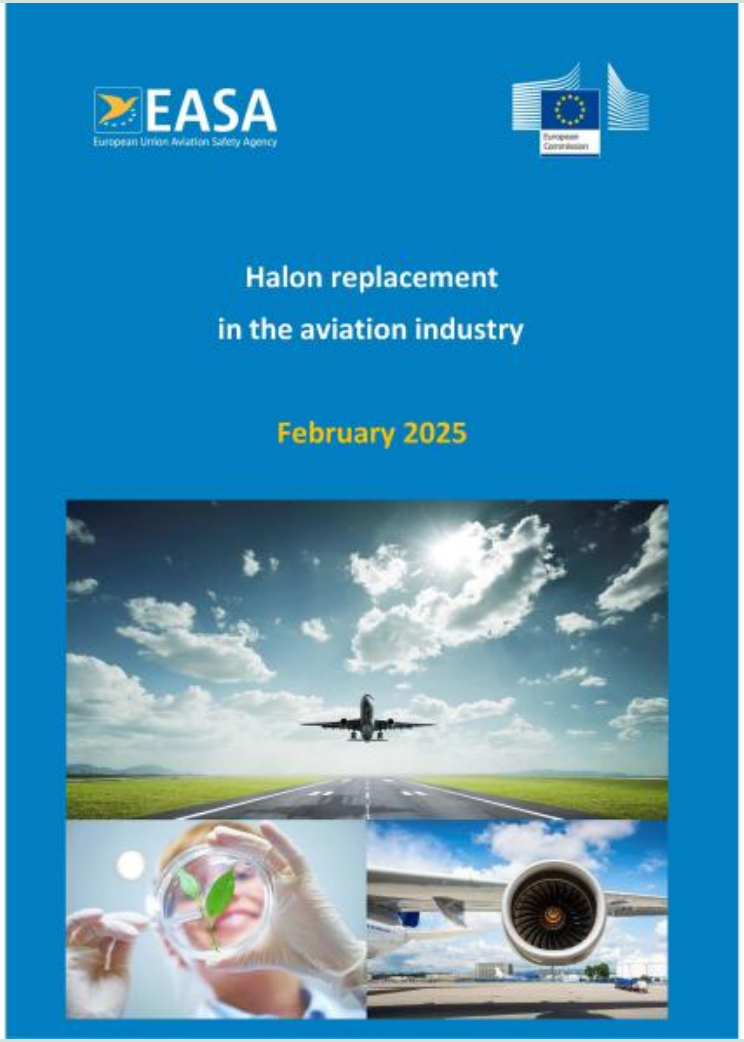
Originally published in 2019 and updated in March 2025.

Next important deadline for halon replacement in the portable extinguishers used for protecting cabins and crew compartments, as per Annex V of Regulation (EU) 2024/590, is 31 December 2025.

Sets out examples to illustrate possible scenarios and clarify the uses of halons that are acceptable under the Ozone Regulation.

- New product vs changed product
- Original application for type certification vs extension requests
- Non-EU products

Link



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The REACH perspective

ADS WS on Halons substitution

11 April 2025

Elisa Consoli, ASD REACH & Chemicals Manager

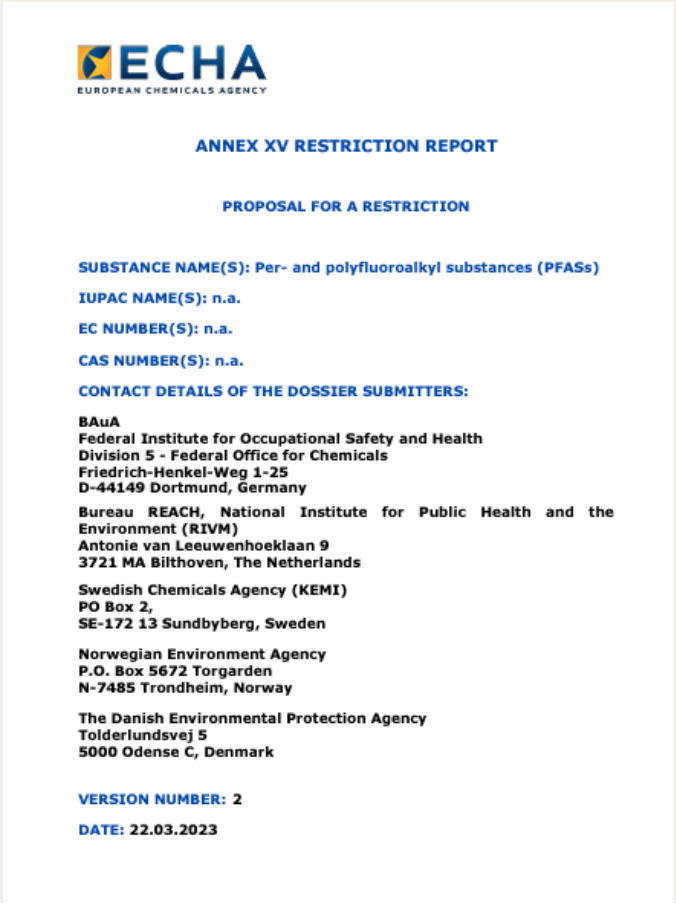
PFAS

PFAS proposal

- **5 countries** (DE, DK, NL, SE, and NO) submitted extensive proposal for PFAS restriction (ban) in January 2023
- **Public consultation** March-Sept 2023; ASD provided 2 inputs covering: partial mapping of uses; 20 case studies; derogations requests
- ECHA committees currently assessing the proposal → **unprecedented process** due to the extremely large scope in terms of substances and uses impacted (assessment ongoing sector-by-sector)

Issues:

- **A&D sector not specifically recognised**; aviation somewhat considered under transport, but defence not assessed.
- A&D uses **scattered across sectors** → difficult to see overall impact & plan for concrete requests
- **Timeline extremely uncertain** due to the size of the file
- **Review process** for time limited-derogations is **not foreseen** yet in cases where substitutions will not be completed on time



ECHA
EUROPEAN CHEMICALS AGENCY

ANNEX XV RESTRICTION REPORT

PROPOSAL FOR A RESTRICTION

SUBSTANCE NAME(S): Per- and polyfluoroalkyl substances (PFASs)

IUPAC NAME(S): n.a.

EC NUMBER(S): n.a.

CAS NUMBER(S): n.a.

CONTACT DETAILS OF THE DOSSIER SUBMITTERS:

BAuA
Federal Institute for Occupational Safety and Health
Division 5 - Federal Office for Chemicals
Friedrich-Henkel-Weg 1-25
D-44149 Dortmund, Germany

Bureau REACH, National Institute for Public Health and the Environment (RIVM)
Antonie van Leeuwenhoeklaan 9
3721 MA Bilthoven, The Netherlands

Swedish Chemicals Agency (KEMI)
PO Box 2,
SE-172 13 Sundbyberg, Sweden

Norwegian Environment Agency
P.O. Box 5672 Torgarden
N-7485 Trondheim, Norway

The Danish Environmental Protection Agency
Tolderlundsvej 5
5000 Odense C, Denmark

VERSION NUMBER: 2

DATE: 22.03.2023

- **RO1** – full ban after 18 months
- **RO2** – full ban after 18 months with time-limited derogations (5-12 yrs)
- **RO3 (?)** – ban with extended derogations and Risk Management Measures (20/11)

Assessment status

- **ECHA opinion expected not before the end of 2026** → 2025 expected to be still assessment of sectors

- **March plenaries** (*RAC: 4 March & SEAC: 12-13 March)*
    - ***Transport*** *(concluded in RAC; preliminary discussion in SEAC)*
    - ***F-gases****(concluded in both committees)*
    - ***Energy*** *(concluded in RAC; preliminary discussion in SEAC)*

- **June plenaries** *(RAC: 2-6 June & SEAC: 10-13 June)*
    - ***Medical devices*** *(RAC and SEAC)*
    - ***Lubricants*** *(RAC and SEAC)*
    - ***Transport*** *(continuation in SEAC)*
    - ***Electronics and semiconductors*** *(introductory discussion in RAC)*

- **After June**
    - ***Electronics and semiconductors;***
    - ***Energy;*** *and*
    - ***Remaining applications***

PFAS – REACH restriction timeline

TENTATIVE TIMELINE!

ECHA COMMITTEES PROCESS

H1 2023 | H2 2023 | H1 2024 | H2 2024 | Q1 2025 | Q2 2025 | Q3 2025 | Q4 2025 | H1 2026 | H2 2026 | 2027

COM & REACH COMMITTEE*

PUBLIC CONSULTATION

13 January 2023
Restriction Dossier Submitted

Consumers mixtures
Cosmetics
Ski wax
Metal plating
Hazard

TULAC
FCM & packaging
Petroleum and mining
Construction products

March 2025
RAC & SEAC
F-gases
Transport
Energy

June 2025
RAC & SEAC plenaries
Lubricants
Medical devices
Electronic & semiconductors
Transport

Sept 2025
RAC & SEAC plenaries

Dec 2025
RAC opinion?
SEAC draft opinion?

Mid 2026
SEAC consultation?

Dec 2026
Final opinion?

RECORD NUMBER OF COMMENTS
All **5642** comments submitted are available on the ECHA website

ASD submissions:
- *Nr **4419** (pt 17)*
- *- Nr **8661** (pt 98)*

- *Ban use of PFAS in **consumer uses***
- ***If no adequate alternatives** (performance and safety), **continued use** of PFAS in industrial applications, in particular critical ones*
- *Continued use under **strictly controlled conditions** with strict emission and disposal rules to limit their release into the environment.*

The final list will be made available in June!

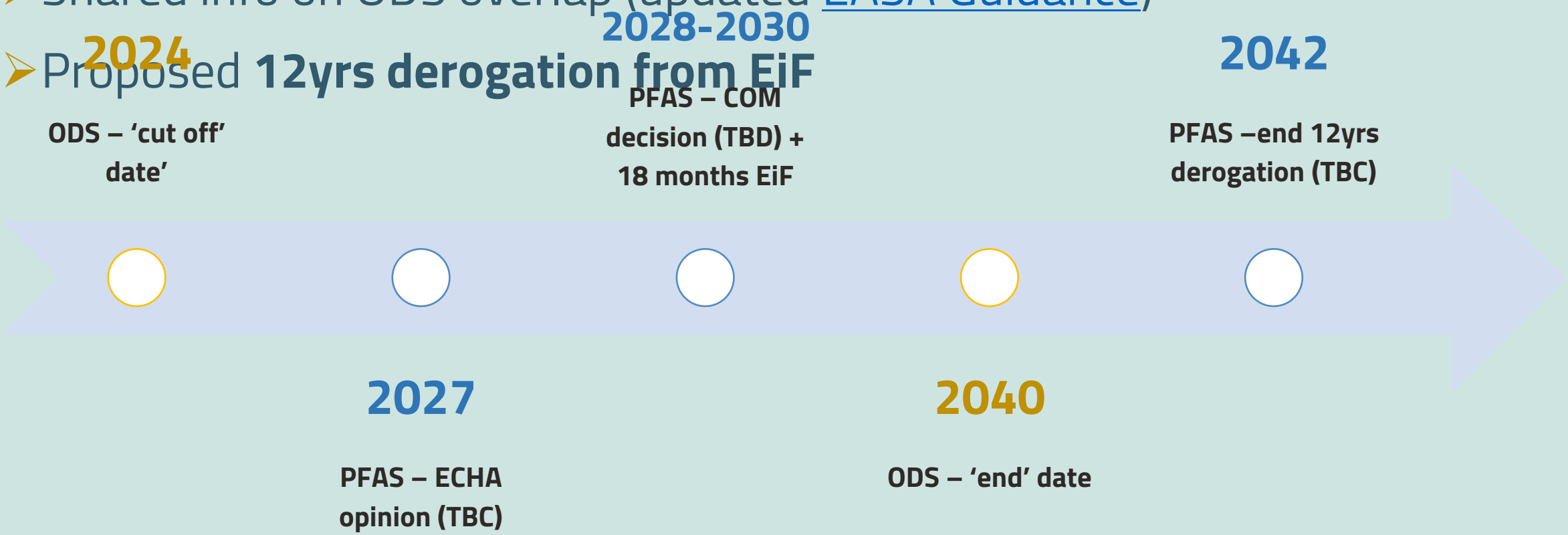
Sectors listed in the 2023 proposal
Sectors developed after the consultation – non definitive

PFAS sectors

MANUFACTURE	TULAC	FOOD CONTACT MATERIAL	METAL PLATING & MANUFACTURE OF METAL PRODUCTS	CONSUMER MIXTURES AND MISCELLANEOUS CONSUMER ARTICLES	COSMETICS
SKI WAX	APPLICATIONS OF FLUORINATED GASES	MEDICAL DEVICES	TRANSPORT	ELECTRONICS AND SEMICONDUCTORS	ENERGY SECTOR
CONSTRUCTION PRODUCTS	LUBRICANTS	PETROLEUM AND MINING	SEALING APPLICATIONS	MACHINERY	TECHNICAL TEXTILES
	PRINTING APPLICATIONS	OTHER MEDICAL APPLICATIONS	MILITARY APPLICATIONS	EXPLOSIVES	

F-gases in Fire suppression

- **Lack of granularity** in assessment of specific uses
- ASD intervention during March SEAC plenary to **highlight missed uses** → follow-up tbd
- Shared info on ODS overlap (updated EASA Guidance)
- Proposed **12yrs derogation from EiF**



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Industries Association of Europe

THANK YOU!

Elisa Consoli, REACH & Chemicals Manager, ASD

elisa.consoli@asd-europe.org

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Industries Association of Europe

What about ICAO

Belarmino PARADELA
Sr. Environment Manager

WP - Cargo Compartment Halon Replacement

Lead:	Andre Freiling
Paper Title:	**Cargo Compartment Halon Replacement**
Purpose:	Addressing the progress and challenges in phasing out Halon in aviation applications, as mandated under environmental and safety standards. Acknowledging that the alternatives so far identified to replace halon would be subject to limitations/ban by PFAS regulations and that while we continue to seek alternatives, nothing has shown a sufficient level of promise at this stage
Potential Actions/Output:	**On this basis, move the effectiveness date in Annex 8 for the replacement of halon for firefighting in the cargo compartment in New Types from November 2024 to 31 December 2035** Ask that ICAO, specifically the CAEP, (and its States in accordance with Resolution A38-9) support efforts to reach out to UNEP to obtain an exemption for “Essential Use” of halon as a firefighting agent in aeroplane cargo compartments in the Montreal Protocol until such time as a viable alternative has been identified, tested and confirmed as suitable
Reference (ICAO Resolution)	A38-9

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Open Discussion & Way Forward

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AOB