

New for 2024!
Additional Organotins
Flame Retardants
Limits on Bisphenols

Apparel and Footwear International RSL Management Group



PACKAGING RESTRICTED SUBSTANCES LIST

Version 07 | 2024

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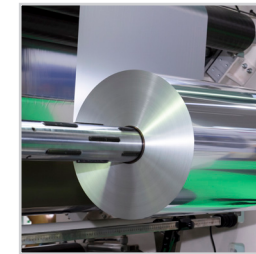
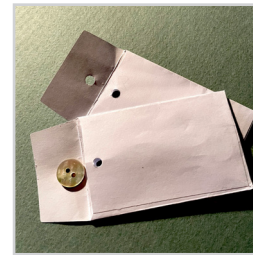
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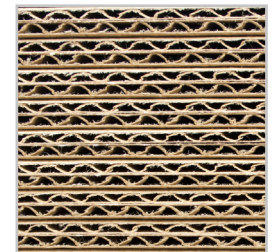
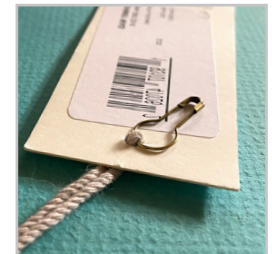
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For more information about AFIRM, visit www.afirm-group.com.



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AFIRM Mission & Vision

Mission

AFIRM Group (Apparel and Footwear International RSL Management Working Group, established in 2004) is on a mission to reduce the use and impact of harmful substances in the apparel and footwear supply chains.

Our purpose is to provide a forum to advance the global management of restricted substances in apparel and footwear, communicate information about chemicals management to the supply chain, discuss concerns, and exchange ideas for improving chemicals management.

Vision

AFIRM is recognized as a global center of excellence, providing resources to enable continuous advancement of chemicals management best practices.

We do this based on transparency, science, and collaboration with relevant industries and experts to build safer and more sustainable chemistry within the apparel and footwear supply chains.

As we implement this vision, AFIRM's mission, objectives, and projects will remain product-focused or RSL-related.

Legal Statement

The AFIRM Packaging RSL constitutes information from AFIRM only and does not represent any individual AFIRM member. Individual brand Packaging RSLs may differ in specific parameters.

The AFIRM Packaging RSL is not intended to and does not establish any industry standard of care. The AFIRM Packaging RSL may not always provide the most appropriate approach for any individual company's chemical management program. Many brands have implementation guidelines, and suppliers must follow those guidelines where required.

The AFIRM Packaging RSL does not constitute legal advice and is not a substitute for legal advice. There is no warranty, express or implied, as to the completeness or utility of the information contained in this AFIRM Packaging RSL, including, without limitation, that the information is current and error-free. AFIRM disclaims liability of any kind whatsoever resulting from any use of or reliance on the AFIRM Packaging RSL.

Policy Statement

AFIRM created this Packaging Restricted Substances List (AFIRM Packaging RSL) to assist and guide supply chain participants seeking to:

- Increase product quality and safety.
- Reduce their environmental impact by limiting the use of certain substances in packaging for apparel, footwear, accessories and related products including sporting good equipment, wearables, and home textiles.

Scope of the AFIRM Packaging RSL

The EU Packaging and Packaging Waste Directive defines packaging as:

All products made of any materials of any nature to be used for the containment, protection, handling, delivery, and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer.

AFIRM acknowledges that the definition of packaging may vary by jurisdiction. For this reason, it is important to note the scope of product packaging coverage for the AFIRM Packaging RSL, outlined in Table 1. This scope ranges from product packaging (e.g. shoe boxes) to retail packaging (e.g. shopping bags). Suppliers are advised to consult AFIRM member brands on specific requirements for some packaging products.

In addition, Table 2, on the next page, outlines examples of material types within the scope of the AFIRM Packaging RSL. Together, Tables 1 and 2 serve as a guide for brands and suppliers when identifying specific materials within each product packaging category.

Table 1. Examples of Products within the Scope of the AFIRM Packaging RSL

Hang Tags	Stickers	Protective Coverings	Trimmings	Sales Packaging	Transport Packaging
<ul style="list-style-type: none"> • Cords • Foil stamps • Hot stamp prints • Paper hang tags • Plastic hang tags • Price tags • Spot UV hang tags • UPC tags 	<ul style="list-style-type: none"> • Antimicrobial stickers • Labels, adhesive • Price tags • Tape 	<ul style="list-style-type: none"> • Lamination, matte or gloss • Foam material • Suit bags • Plastic cases • Poly bags • Poly bags, zippered 	<ul style="list-style-type: none"> • Bead chain • Collar bands • Clips, metal • Clips, plastic • Eyelets/grommets • Magnets • Pins • Tissue paper • Zippers • J-hooks • Plastic fasteners 	<ul style="list-style-type: none"> • Boxes/cartons • Gift boxes • Retail carry bags • Hangers (when sold with a clothing item) • Spot UV boxes • Suit bags • Thermal receipt paper • Tissue paper • UV coated boxes • Varnished coated boxes • Water-based (aqueous) lacquer coated boxes 	<ul style="list-style-type: none"> • Antimicrobial stickers • Boxes/cartons • Corrugated shipping boxes/cartons • J board • Silica gel/desiccant sachets • Stuffing materials, expanded foam materials • Water-based (aqueous) lacquer-coated boxes

Scope of the AFIRM Packaging RSL

Table 2. Examples of Material Types within the Scope of the AFIRM Packaging RSL

Fibers			Coatings, Dyes & Prints	Natural Materials	Polymers, Plastics, Foams, Natural Rubber & Synthetic Rubber	Metal	Glue	Natural Leather	Synthetic Coated Fabric
Natural	Blended	Synthetic							
<ul style="list-style-type: none"> • Cotton • Linen • Silk • Wool • Lyocell (semi-synthetic) • Rayon (semi-synthetic) • Cellulose 	<ul style="list-style-type: none"> • Cotton-Polyester • Ramie-Polyester • Wool-Nylon 	<ul style="list-style-type: none"> • Acrylic • Nylon • Polyamide • Polyester 	<ul style="list-style-type: none"> • Foil stamping • Hot-stamp printing • Spot UV • Soft-touch coatings 	<ul style="list-style-type: none"> • Cork • Paper • Straw • Stone • Wood • Cardboard • Jacron (semi-synthetic paper product) 	<ul style="list-style-type: none"> • Acrylonitrile butadiene styrene (ABS) • Ethylene vinyl acetate (EVA) • Polystyrene (PS) • Polyethylene (PE) • Neoprene • Polypropylene (PP) • Polycarbonate (PC) • Polyamide (PA) • Polyurethane (PU) • Polyvinyl chloride (PVC) • Thermoplastic polyurethane (TPU) • Thermoplastic elastomer (TPE) • Styrene ethylene butylene styrene (SEBS) 	<ul style="list-style-type: none"> • Aluminum • Brass • Copper • Stainless Steel 	<ul style="list-style-type: none"> • Contact adhesive • Epoxies • Powdered adhesive • Flock adhesive • Hot melt adhesive • Latex glue • Neoprene cement • Polyurethane glue • Silicone adhesive • UV-cured adhesive 	<ul style="list-style-type: none"> • Leather • Fur & Hides 	<ul style="list-style-type: none"> • Polyurethane (PU) • Polyvinyl Chloride (PVC)

Uses of the AFIRM Packaging RSL

AFIRM member brands may differ on individual parameters; suppliers are advised to check with the customer regarding brand-specific requirements.

The AFIRM Packaging RSL should leverage AFIRM's mission — to reduce the use and impact of harmful substances in the apparel and footwear supply chain — by providing a single set of information for maximum and in-depth implementation within the supply chain.

Examples of uses for the AFIRM Packaging RSL, depending on the objectives of the user, include:

- Providing a tool for vendors to establish chemical management knowledge and processes.
- Building base compliance with AFIRM member chemical restrictions.

- Providing a common base for testing packaging, which may be accepted by multiple AFIRM brands.

AFIRM member companies determine and communicate to their vendors their testing requirements and acceptance of test reports.

Links and References

Be proactive! These links provide additional important information regarding chemical management and should be visited on a regular basis.

AFIRM Restricted Substances List

www.afirm-group.com/afirm-rsl

- Available in English, Simplified Chinese, Traditional Chinese, Vietnamese, Japanese, Indonesian, Spanish, and Turkish.

AFIRM Chemistry Toolkit

www.afirm-group.com/toolkit

- Available in English, Simplified Chinese, Traditional Chinese, Vietnamese, Japanese, Indonesian, Spanish, and Turkish.

AFIRM PFAS Phaseout Guidance

www.afirm-group.com/pfas-phaseout-guidance

- Available in English, Simplified Chinese, Traditional Chinese, Vietnamese, Japanese, Indonesian, Spanish, and Turkish.

AFIRM Explainer Videos

www.afirm-group.com/start-here

- Available in English, Simplified Chinese, Vietnamese, Japanese, Indonesian, and Spanish, with Traditional Chinese and Turkish translations forthcoming.

AFIRM Chemical Information Sheets

www.afirm-group.com/chemical-information-sheets

- Available in English, Simplified Chinese, Vietnamese, Japanese, Indonesian, and Spanish, with Traditional Chinese and Turkish translations forthcoming.

AFIRM Sampling Guidance

<http://afirm-group.com/sampling-guidance>

- Available in English

EU Packaging and Packaging Waste Directive

http://ec.europa.eu/environment/waste/packaging/index_en.htm

Sustainable Packaging Coalition (SPC)

www.sustainablepackaging.org

Toxics in Packaging Clearinghouse (TPCH)

<https://toxicsinpackaging.org>

Regulated fluorinated greenhouse gases; Regulation (EU) No 517/2014

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG&toc=OJ:L:2014:150:FULL

Regulated substances that deplete the ozone layer; EC 1005/2009

<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:286:0001:0030:EN:PDF>

Zero Discharge of Hazardous Chemicals (ZDHC) Foundation — Manufacturing Restricted Substances List (MRSL)

<https://mrsl.roadmapzero.com>

Additional Substances and Parameters to Consider

EU REACH Substances of Very High Concern

Based on scientific evidence indicating potential hazards to human health or the environment, the European Commission (EC) and European Union (EU) member states propose substances of very high concern (SVHCs) for placement on the European Chemicals Agency (ECHA) “Candidate List of Substances of Very High Concern for Authorisation.”

Placing a substance on the Candidate List triggers specific obligations for importers, producers, and suppliers of any article that contains one or more of these substances above 0.1 percent by weight per component. The obligations include providing sufficient information to allow safe use of the article to brand and retail customers or, upon request, to a consumer within 45 days of receipt of the request.

In addition, ECHA must be notified if the substance(s) are present in article components above 0.1 percent in quantities totaling over one ton per producer or importer per year. Notification is not required if the substance has already been registered for that use or when the producer or importer of an article can exclude exposure of humans and the environment during the use and disposal of the article. In such cases, the producer or importer must supply appropriate instructions to the recipient of the article.

ECHA periodically updates the Candidate List; find the most current version at <https://www.echa.europa.eu/candidate-list-table>.

AFIRM member brands may differ on how they address SVHCs as well as the legal obligations. AFIRM advises suppliers to consult with their customers regarding brand-specific requirements for SVHCs.

California Proposition 65 Substances

Each year, California publishes a list of chemicals known to the state to cause cancer or reproductive toxicity.

Businesses that expose individuals to one or more of these chemicals must provide a clear and reasonable warning before the exposure occurs. For consumer products, this is typically through warning labels on the products or retail signage. Note that this warning is not the same as a regulatory requirement indicating that the product is “unsafe” if a specific concentration is exceeded. Enforcement is carried out through civil lawsuits brought by the California attorney general, district attorneys, or private parties acting in the public interest.

Additional information can be found at <https://oehha.ca.gov/proposition-65>.

AFIRM member brands may differ on how they address warning-label requirements. AFIRM advises suppliers to consult with their customers regarding brand-specific requirements for Proposition 65 substances.

Oxo-degradable Additives

The EU Commission on Waste and the Ellen MacArthur Foundation consider oxo-degradable and oxo-biodegradable plastics to be problematic in current recycling/circular systems.

Manufacturers and users of these plastics should be aware that as of July 2021, the EU restricts placing oxo-degradable plastic on the market. Concurrently, several countries, including Saudi Arabia and the UAE, have legislation that requires plastics of certain grades to be oxo-degradable. These substances are subject to conflicting policies or legislation globally, and manufacturers should be aware and prepare accordingly.

Biocides, Nanoparticles, Sensitizers, Endocrine Disruptors, Etc.

Some brands may have specific requirements regarding the use of substances of concern such as biocides, nanoparticles, sensitizers, and endocrine disruptors.

AFIRM recommends checking with your customers regarding individual policies or requirements.

Bans on PVC Packaging

Countries around the world, including Canada, Spain, South Korea, and the Czech Republic, have banned or restricted PVC packaging.

AFIRM recommends that suppliers check with brand customers to understand whether they have a global PVC-free policy or, if not, if the products and packaging suppliers produce will be sold in these markets. Please note that this is an evolving space with additional markets potentially imposing this ban.

Additional and Upcoming Packaging Regulations

The EU Packaging Directive 94/62/EC gives provisions to member states on the essential requirements for packaging material (e.g. material composition).

However, member states can still implement additional rules. For example, France’s anti-waste law, the Loi AGECE, bans the use of mineral oils in ink formulations for packaging prints. (See <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045733481>.) The packaging regulatory space is evolving at a fast pace, with several jurisdictions working on new/updated requirements (e.g. the EU will revise its Packaging Directive). AFIRM recommends checking with your customers for their own policies on packaging labelling.

AFIRM Chemical Information Sheets

AFIRM member brands have produced a comprehensive set of educational materials advising suppliers about best practices for chemicals management.

Each chemical information sheet covers a chemical or class of chemicals, giving an overview of the substance(s), where they are likely to be found in the material manufacturing process, and how to maintain compliance with the AFIRM RSL.

The sheets contain some information relevant to packaging, and future revisions will include more specific information.

The complete library of chemical information sheets is available on the AFIRM website at <http://afirm-group.com/information-sheets>; additionally, links to individual information sheets are embedded in the pages that follow.

The download icon next to a chemical or class of chemicals in the AFIRM RSL indicates that an information sheet is available.



Click on the icon or chemical name, and your web browser will open and download a PDF of the information sheet for that substance.

Definition of “Limit”

Some restrictions require that substance limits not be exceeded while others require that substance concentrations be below designated limits.

Test results should always be below designated restriction limits to ensure compliance with all requirements in all markets.

Definition of “Reporting Limits”

Values above which labs should report substances detected for purposes of data capture and harmonization.

By reporting these values, instead of a simple PASS/FAIL, the supply chain can capture information regarding the presence of substances below Packaging RSL limits. The reporting limits also allow data to be harmonized between various testing labs.

Reporting limits are values at or above the method Practical Quantification Limit (PQL). The PQL represents the lowest level at which accurate, precise, and robust data can be reported. AFIRM Packaging RSL reporting limits are widely achievable by laboratories across the global analytical testing industry and allow for combined (composite) testing where applicable.

AG
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Chemical Information Sheet
Version 2.0 | March 2021

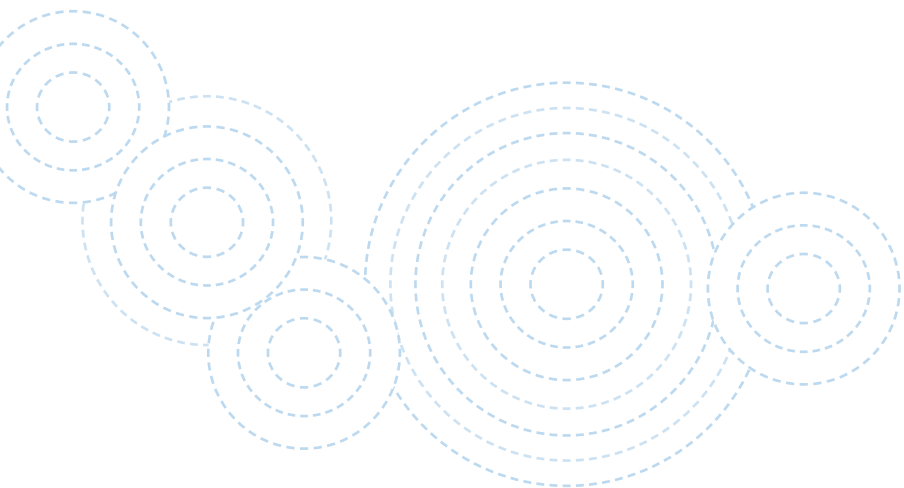
FORMALDEHYDE

Other Names	Formalin, Methanol, Oxymethylene, Methylaldehyde, Chromethane, Methyl aldehyde, Methylene glycol, Methylene oxide, Formal, Carbonyl hydride	Formaldehyde is a chemical with widespread uses, occurring naturally at low levels in foods and used in a variety of synthetic preparations. At room temperature, formaldehyde is a colorless, flammable gas that has a distinct, pungent smell. Small amounts of formaldehyde are naturally produced by plants, animals, and humans.¹
CAS Number	Substance	
50-00-0	Formaldehyde	
May Be Found In	<ul style="list-style-type: none">Wrinkle free (permanent press, easy care, non-iron), stiffen (starch (SD)), stain resistantResins or coatings applications using phenolic, urea-, melamine-formaldehyde and PE resinsTinting and over-dye in spraying and dippingPrints such as flock and dischargeHeat transferAdhesives and glue applications including patchingOther content	Uses in the Supply Chain Formaldehyde may be used in the production of fertilizer, paper, plywood, and urea-formaldehyde resins. It is also used as a preservative in some foods and in many household products, such as antiseptics, medicines, and cosmetics. ¹ Formaldehyde can be used as one of the starting materials in auxiliaries imparting textile performance features such as wrinkle free, dimensional stability, and stain resistant characteristics to cotton and cotton blend fabrics. Formaldehyde can be found in resins, binders, and fixing agents for dyes and pigments (especially those with fluorescent effects). It can also be used as a catalyst in certain printing, adhesive and heat transfer processes.
Why Formaldehyde is Restricted	<ul style="list-style-type: none">Legislation in major markets around the world restricts the presence of formaldehyde in finished products.Formaldehyde is classified as a probable human carcinogen and is an irritant which can affect the eyes, nose, and throat. In high concentrations formaldehyde can cause severe pain, gastrointestinal effects, vomiting, coma or death.	
Sourcing Compliant Materials from Your Suppliers	<ul style="list-style-type: none">Contact your suppliers and explain that you require materials to be compliant with the current AFIRM RSL limits.²Materials should have no intentionally added formaldehyde, in the processing or as residues for the following:<ul style="list-style-type: none">Heat transferPrints (such as flock and discharge)Adhesives or glueFinishing agentsRequire suppliers to submit a confirmation of material compliance or a test report from a third-party laboratory.When materials are received, consider performing risk-based testing to ensure the current AFIRM RSL limits are met.²Check the Safety Data Sheets (SDS) of adhesives and glues to ensure formaldehyde is not listed as an ingredient.	

1

Change Log for the 2024 AFIRM Packaging RSL

CAS No.	Substance/Material	Modification	Page
Various	Alkylphenols (APs) Alkylphenol Ethoxylates (APEOs) including all isomers	<ul style="list-style-type: none"> Updated APEO leather method to EN ISO 18218-1:2023. 	12
Various	Bisphenols	<ul style="list-style-type: none"> Added limit of 1000 ppm each for listed bisphenols in all materials (excluding BPA in receipt paper). Added method EN ISO 11936:2023 and 10 ppm reporting limit for leather. Added note for testing textiles. Removed BPAF due to lack of relevance for the apparel and footwear industry as well as existing coverage under PFAS. 	14
Various	Flame Retardants	<ul style="list-style-type: none"> Added category since they can be found as impurities in recycled content, e.g., polystyrene, and are regulated under the Stockholm Convention. Included level 2 risk level for polymers with recycled content in risk matrix 	11, 15
Various	Organotin Compounds	<ul style="list-style-type: none"> Added multiple organotins with a limit of 1 ppm to align with best practice consistent with other industry restricted substances lists. 	18
Various	Per- and Polyfluoroalkyl Substances (PFAS)	<ul style="list-style-type: none"> Updated methods ASTM D7359 and EN ISO 23702-1 to 2023 versions. Added important note about draft test method prEN 17681-1:2023 for targeted PFAS analysis. Added information about pending revision to EU POPs PFOS and related substances restriction. Added new sub-group of PFHxA, its salts, and related substances with note about anticipated new limits based on pending EU legislation. 	19
26040-51-7	Phthalates	<ul style="list-style-type: none"> Added Bis(2-ethylhexyl) tetrabromophthalate due to inclusion on EU REACH SVHC list. 	20



Materials in Which Restricted Substances Are Likely to Be Found

In the supply chain for apparel, footwear, and sporting equipment packaging, certain types of materials are more likely to contain restricted substances.

Brands may require packaging product or material testing prior to shipment to ensure that packaging articles comply with their Packaging RSLs; this information is included in brand-specific requirements.^A

AFIRM Group member brands agree on the chemicals included in the AFIRM Packaging RSL, the allowable limits, and the test methods. The responsibility for managing testing programs—the specific restricted chemicals that should be tested in specific materials and the frequency of such tests—remains with individual brands.

The AFIRM Packaging RSL Risk Matrix, shown in Table 3 on the next page, is presented as a guidance tool. It highlights the restricted substance risks associated with different fibers and materials. It is based on our many years of experience in manufacturing and in managing restricted substances across a wide range of materials.^B

The aim is to provide information on those substances that have historically been deliberately used or found as reagent/contaminants in different materials.

It uses the following color code:

- 1 Red indicates that a chemical has been in widespread use and/or frequently detected in a particular material.
- 2 Orange indicates that a chemical has been deliberately used and/or detected in a particular material occasionally.
- White indicates that we believe there is an almost negligible risk of a chemical being used and/or detected.

See footnotes for material-specific testing recommendations and exceptions.

In the absence of a brand Packaging RSL and testing program, the matrix outlined in Table 3 is a good starting point until you gain a true understanding of the risks within your specific supply chain. Use of this matrix should be accompanied by due diligence across all chemistries of concern.

The unified approach of the AFIRM Packaging RSL enables member brands to share test data more easily. We anticipate that the risk matrix will evolve to reflect realistic risks at any given time, which can then translate to testing options. Individual brand testing programs, to the extent they are different, supersede this guidance tool.

Determining Test Methods Using the AFIRM Packaging RSL Risk Matrix

The test methods listed in the Packaging RSL for specific materials correspond to the AFIRM Packaging RSL Risk Matrix.

A blank color code for any material will not have a corresponding test method.

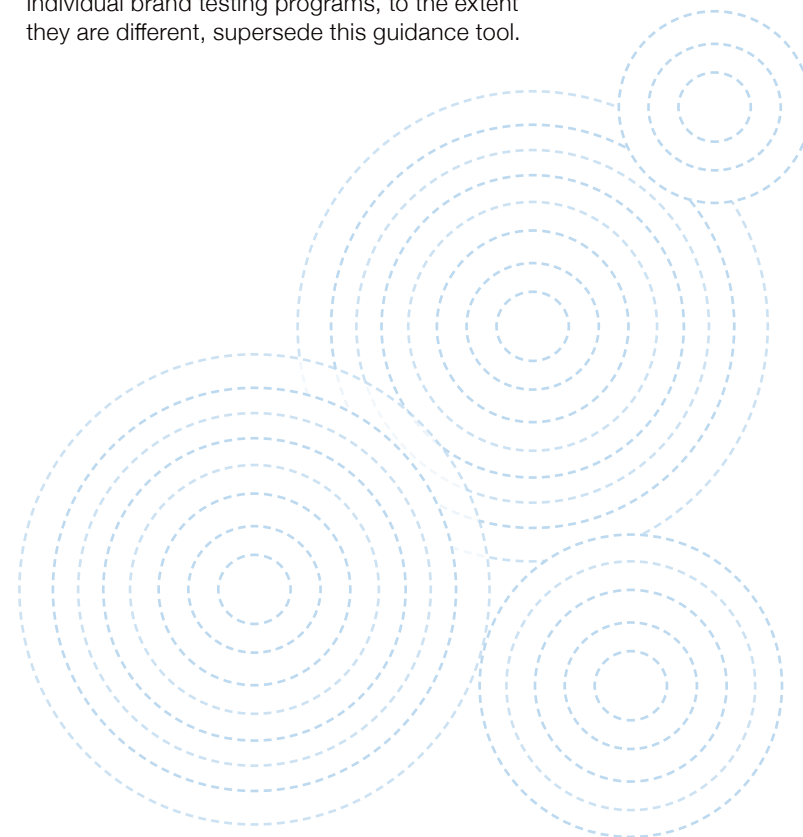
For example, Metal has a blank color code for APEOs and therefore no test method is listed for APEOs for Metal in the RSL.

If the RSL states “All Materials” or “All Materials Except,” this means the test method is applicable to all materials listed with a color of 1 or 2 that do not have a specific test method listed.

AFIRM recommends consulting your testing laboratory to determine the best test method for any material not currently listed in this document.

A. See Section 5 of the AFIRM Chemistry Toolkit for more information on testing and Appendix B of the AFIRM Chemistry Toolkit for a model testing program if your customer does not have one of its own.

B. If a substance is a component of a combined material (for example, a laminated component like polymer material + cardboard), we recommend testing according to different material types.



Materials in Which Restricted Substances Are Likely to Be Found

Table 3. AFIRM Packaging RSL Risk Matrix

NOTE: This matrix provides representative examples of materials within each category but is not all-inclusive.

Substance	Fibers			Coatings, Dyes & Prints	Natural Materials Including paper and cardboard	Polymers, Plastics, Foams, Natural Rubber & Synthetic Rubber	Metal	Glue	Natural Leather	Synthetic Coated Fabric
	Natural	Blended	Synthetic							
Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs), including all isomers	1	1	1	1	1	1A		1	1	1
Azo-amines and Arylamine Salts	1B	1B	1B		1B				1B	1B
Bisphenols		1	1	1C	1D	2E			1	1
Butylhydroxytoluene (BHT)						2F				
Dimethylfumarate (DMFu)						2G			2	
Flame Retardants						2J				
Formaldehyde	2	2	2	1	1	2H		1	2	2
Heavy Metals, Total Content (Cd, CrVI, Pb, Hg) ¹				2	2J	2K	2		2	
Organotin Compounds				1		1		1	2	1
Per- and Polyfluoroalkyl Substances (PFAS)	Prohibited									
Phthalates				1L		1M		1	2N	1



1 Please note that Chromium VI, Cadmium, Lead, and Mercury are restricted to a sum total of 100 ppm in several jurisdictions. Cadmium, Lead, and Mercury are analyzed using the same method even if the risk of finding them varies across different materials.

A Level 1 for foams only; Level 2 for all other materials.
B Level 1 for dyed/colored materials (non-white) only.
C Level 1 for PVC only; Level 2 for all other materials.
D Level 1 for thermal receipt and recycled paper only; Level 2 for all other materials.
E Level 2 for tapes, polycarbonate, and recycled plastic cases only; no testing requirement for other materials.


F Level 2 for poly bags only; no testing requirement for other materials.
G Level 2 for silica gel packets and foam packaging only; no testing requirement for other materials.
H Level 2 for rubber only, no testing requirement for other materials.
J Level 2 for materials with recycled content only; no testing requirement for other materials.

K Level 2 for PVC only, no testing requirement for other materials.
L Level 1 for plastisol prints; Level 2 for all other materials.
M Level 2 for polycarbonate and ABS, Level 1 for all other polymers.
N Level 2 for patent or coated leather; no testing requirement for other materials.


AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Alkylphenols (APs)  Alkylphenol Ethoxylates (APEOs)  including all isomers					
Various	Nonylphenol (NP), mixed isomers	Total: 100 ppm	<p>APEOS are used as surfactants in the production of plastics, elastomers, paper, and textiles. These chemicals can be found in many processes involving foaming, emulsification, solubilization, or dispersion. APEOs can be used in paper pulping, lubrication oils, and plastic polymer stabilization.</p> <p>APs are used as intermediaries in the manufacture of APEOs and antioxidants used to protect or stabilize polymers. Biodegradation of APEOs into APs is the main source of APs in the environment.</p> <p>APEOs and formulations containing APEOs are prohibited from use throughout supply chain and manufacturing processes. We acknowledge that residual or trace concentrations of APEOs may still be found at levels exceeding 100 ppm and that more time is necessary for the supply chain to phase them out completely.</p>	<p>Textiles and Leather: EN ISO 21084:2019</p> <p>Polymers and all other materials: 1 g sample/20 mL THF, sonication for 60 minutes at 70°C, analysis according to EN ISO 21084:2019</p>	Sum of NP & OP: 3 ppm
Various	Octylphenol (OP), mixed isomers				
Various	Nonylphenol ethoxylates (NPEOs)	Total: 100 ppm		<p>All materials except Leather: EN ISO 18254-1:2016 with determination of APEO using LC/MS or LC/MS/MS</p> <p>Leather: Sample prep and analysis using EN ISO 18218-1:2023 with quantification according to EN ISO 18254-1:2016</p>	Sum of NPEO & OPEO: 20 ppm
Various	Octylphenol ethoxylates (OPEOs)				


AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Azo-amines and Arylamine Salts 					
92-67-1	4-Aminobiphenyl	20 ppm each	<p>Azo dyes and pigments are colorants that incorporate one or several azo groups (-N=N-) bound with aromatic compounds.</p> <p>Thousands of azo dyes exist, but only those which degrade to form the listed cleavable amines are restricted.</p> <p>Azo dyes that release these amines are regulated and should no longer be used for dyeing textiles.</p>	<p>All materials except leather: EN ISO 14362-1:2017</p> <p>Leather: EN ISO 17234-1:2020</p> <p>p-Aminoazobenzene: All materials except leather: EN ISO 14362-3:2017</p> <p>Leather: EN ISO 17234-2:2011</p>	5 ppm each
92-87-5	Benzidine				
95-69-2	4-Chloro-o-toluidine				
91-59-8	2-Naphthylamine				
97-56-3	o-Aminoazotoluene				
99-55-8	2-Amino-4-nitrotoluene				
106-47-8	p-Chloraniline				
615-05-4	2,4-Diaminoanisoole				
101-77-9	4,4'-Diaminodiphenylmethane				
91-94-1	3,3'-Dichlorobenzidine				
119-90-4	3,3'-Dimethoxybenzidine				
119-93-7	3,3'-Dimethylbenzidine				
838-88-0	3,3'-dimethyl-4,4'-Diaminodiphenylmethane				
120-71-8	p-Cresidine				
101-14-4	4,4'-Methylen-bis(2-chloraniline)				
101-80-4	4,4'-Oxydianiline				
139-65-1	4,4'-Thiodianiline				
95-53-4	o-Toluidine				
95-80-7	2,4-Toluenediamine				
137-17-7	2,4,5-Trimethylaniline				
95-68-1	2,4 Xylidine				
87-62-7	2,6 Xylidine				
90-04-0	2-Methoxyaniline (= o-Anisidine)				
60-09-3	p-Aminoazobenzene				
3165-93-3	4-Chloro-o-toluidinium chloride				
553-00-4	2-Naphthylammoniumacetate				
39156-41-7	4-Methoxy-m-phenylene diammonium sulphate				
21436-97-5	2,4,5-Trimethylaniline hydrochloride				


AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Bisphenols 					
80-05-7	Bisphenol-A (BPA)	Receipt paper: BPA: 1 ppm Other packaging: 1000 ppm each In preparation for forthcoming restrictions, significantly lower levels of bisphenols should be achievable, e.g., in polyamide, over time or better alternatives should be substituted if possible.	BPA may be used in the production of epoxy resins, polycarbonate plastics, flame retardants, and PVC. BPS may be used as a substitute for BPA for some specific uses, including in thermal receipt paper.	Leather: EN ISO 11936:2023 All other materials: Extraction: 1 g sample/20 ml THF, sonication for 60 minutes at 60°C, analysis with LC/MS Note for textiles: For precipitation, draw the extract to another container and add methanol or acetonitrile. This keeps the extraction process consistent.	Leather: 10 ppm each All other materials: 0.1 ppm for individual samples 1 ppm for composite samples
80-09-1	Bisphenol-S (BPS)		BPS and BPF can be found in polyamide dye-fixing agents and in sulfone- and phenol- based leather synthetic tanning agents. BPA and BPS can be found in recycled polymeric and paper materials due to polycarbonate plastic and thermal receipt paper made with bisphenols entering waste streams.		
77-40-7	Bisphenol-B (BPB)		BPA, BPS, and BPB are included on the REACH SVHC list. Additional restrictions on the entire class of bisphenols are expected, with a revised restriction proposal forthcoming in the European Union.		
620-92-8	Bisphenol-F (BPF)		AFIRM recommends testing relevant materials for bisphenols according to the Testing Matrix and to work with suppliers to minimize residual concentrations or replace them with better alternatives where possible.		



AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Butylated Hydroxytoluene (BHT) 					
128-37-0	Dibutylhydroxytoluene (BHT)	25 ppm	Used as an additive in plastics as an antioxidant to prevent aging. Can cause phenolic yellowing of textiles.	All materials: ASTM D4275:2017	5 ppm
Dimethylfumarate 					
624-49-7	Dimethylfumarate (DMFu)	0.1 ppm	DMFu is an anti-mold agent used in sachets in packaging to prevent the buildup of mold, especially during shipping.	All materials: ISO 16186:2021	0.05 ppm
Flame Retardants 					
1163-19-5	Decabromodiphenyl ether (DecaBDE)	Total: 500 ppm	Flame retardant substances, including the entire class of organohalogen flame retardants, should no longer be applied to packaging materials during production. Listed here are relevant flame retardants included in the Stockholm Convention. These substances should not be used for any other purpose, e.g., as plasticizers or softeners. Impurities found may come from electronic waste recycling streams, e.g., polystyrene, and can impede future recycling opportunities.	All materials: EN ISO 17881-1:2016	5 ppm each
32534-81-9	Pentabromodiphenyl ether (PentaBDE)				
3194-55-6	Hexabromocyclododecane (HBCDD)				
79-94-7	Tetrabromobisphenol A (TBBP A)				
40088-47-9	Tetrabromodiphenyl ether				
36483-60-0	Hexabromodiphenyl ether				
68928-80-3	Heptabromodiphenyl ether				


AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Formaldehyde 					
50-00-0	Formaldehyde	150 ppm	<p>Formaldehyde can be found in polymeric resins, binders, and fixing agents for dyes and pigments, including those with fluorescent effects. It is also used as a catalyst in certain printing, adhesives, and heat transfers. Formaldehyde can be used in antimicrobial applications for odor control.</p> <p>Formaldehyde found in packaging can off-gas directly onto product.</p> <p>Composite wood materials (e.g., particle board and plywood) must comply with California and U.S. formaldehyde emission requirements (40 CFR 770). Though formaldehyde legislation does not specifically apply to packaging, suppliers are advised to refer to brand-specific requirements for these materials.</p>	<p>Wood: EN 717-3:1996</p> <p>Paper: DIN EN 645:1994 & EN 1541:2001</p> <p>Textiles, Finishings, Dyes, Inks & Coatings: JIS L 1041-2011 A (Japan Law 112) or EN ISO 14184-1:2011</p> <p>Leather: EN ISO 17226-2:2019 with EN ISO 17226-1:2021 confirmation method in case of interferences.</p> <p>Alternatively, EN ISO 17226-1:2021 can be used on its own.</p>	16 ppm


AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported	
Heavy Metals (Total Content) 						
7440-43-9	Cadmium (Cd)	Total: 100 ppm	Cadmium compounds are used as pigments (especially in red, orange, yellow and green) and in paints. It can also be used as a stabilizer for PVC.	All materials: Total heavy metals (Cd, Cr, Pb & Hg): DIN EN 16711-1: 2016 If the total of four heavy metals exceeds 100 ppm and Cr contributes to the sum, test for Cr VI.	5 ppm	
7439-92-1	Lead (Pb)		May be associated with plastics, paints, inks, pigments, and surface coatings.		This test method detects metal elements (Cd, Cr, Hg, Pb). When the final value >100 ppm and Cr contributes to the sum, the Cr VI method described below should be used to exclude the presence of Cr VI.	10 ppm
7439-97-6	Mercury (Hg)		Mercury compounds can be present in pesticides and as contaminants in caustic soda (NaOH). They may also be used in paints.			5 ppm
18540-29-9	Chromium VI 		Though typically associated with leather tanning, Chromium VI also may be used in pigments, chrome plating of metals, and wood preservatives.	Metal: IEC 62321-7-1:2017 The testing laboratory will convert the test result into ppm. Natural leather and natural materials: EN ISO 17075-1:2017 and EN ISO 17075-2:2017 for confirmation in case the extract causes interference. Alternatively, EN ISO 17075-2:2017 may be used on its own. All other materials: IEC 62321-7-2:2015	3 ppm	


AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Organotin Compounds 					
Various	Tributyltin (TBT)	0.5 ppm each	<p>Class of chemicals combining tin and organics such as butyl and phenyl groups.</p> <p>Organotins are predominantly found in the environment as antifoulants in marine paints, but they can also be used as biocides (e.g., antibacterials), catalysts in plastic and glue production, and heat stabilizers in plastics/rubber.</p> <p>In textiles and apparel packaging, organotins are associated with plastics/rubber, inks, paints, metallic glitter, polyurethane products and heat transfer material.</p> <p>AFIRM recommends restricting “Other Organotins” as a matter of best practice consistent with other industry restricted substances lists.</p>	<p>All materials: CEN ISO/TS 16179:2012 or EN ISO 22744-1:2020</p>	0.1 ppm each
Various	Triphenyltin (TPhT)				
Various	Dibutyltin (DBT)	1 ppm each			
Various	Dioctyltin (DOT)				
Various	Monobutyltin (MBT)				
Various	Monooctyltin (MOT)				
Various	Tricyclohexyltin (TCyHT)				
Various	Trimethyltin (TMT)				
Various	Trioctyltin (TOT)	Other Organotins: 1 ppm each			
Various	Tripropyltin (TPT)				
Various	Dimethyltin (DMT)				
Various	Diphenyltin (DPhT)				
Various	Dipropyltin (DPT)				
Various	Monomethyltin (MMT)				
1461-25-2	Tetrabutyltin (TeBT)				
597-64-8	Tetraethyltin (TeET)				
3590-84-9	Tetraoctyltin (TeOT)				

AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported	
Per- and Polyfluoroalkyl Substances (PFAS) 						
Various	All PFAS as measured by total organic fluorine	100 ppm by 2025 50 ppm by 2027	<p>Regulations around the world ban the use of PFAS in packaging.</p> <p>PFAS may be used in commercial water-, oil-, and stain-repellent agents as well as in breathable membranes that remove moisture, e.g., PTFE.</p> <p>Refer to Appendix A for a list of PFAS substances and CAS Numbers for which testing can be conducted to indicate whether PFAS chemistry is present above restricted levels due to intended use or unintended contamination.</p> <p>See AFIRM PFAS Phaseout Guidance for a recommended testing approach to ensure compliance with all global regulations using the methods included in this section.</p>	EN 14582:2016 or ASTM D7359:2023	50 ppm total	
Various	Perfluorooctane Sulfonate (PFOS) and related substances	1 µg/m ² total		<p>The 1 µg/m² total area-based limit for PFOS and related substances is in the process of revision under the EU POPs Regulation and will transition to a 25 ppb total sum limit on PFOS and its salts and a 1000 ppb total sum limit on PFOS-related substances. This will bring EU PFOS restrictions into alignment with other existing PFAS restrictions included here.</p> <p>Important note: New draft updated method prEN 17681-1:2023 for targeted PFAS analysis is likely to be finalized and adopted in a future version of the AFIRM RSL. AFIRM anticipates higher findings of various PFAS analytes, especially FTOHs, with this new method, and industry should prepare accordingly.</p>	All materials: EN ISO 23702-1:2023 or EN 17681-1:2022 & 17681-2:2022	1 µg/m ² total
Various	Perfluorooctanoic Acid (PFOA) and its salts	25 ppb total			25 ppb total	
Various	PFOA-related substances	1000 ppb total			1000 ppb total	
Various	Perfluorohexane-1-sulphonic acid (PFHxS) and its salts	25 ppb total			25 ppb total	
Various	PFHxS-related substances	1000 ppb total			1000 ppb total	
Various	C9-C14 Perfluorocarboxylic acids (PFCAs) and their salts	25 ppb total			25 ppb total	
Various	C9-C14 PFCA-related substances	260 ppb total			260 ppb total	
Various	PFHxA, its salts, and related substances	Anticipated regulated limits in the EU: PFHxA and its salts: 25 ppb PFHxA-related substances: 1000 ppb			PFHxA and its salts: 25 ppb PFHxA-related substances: 1000 ppb	

AFIRM Packaging Restricted Substances List

CAS No.	Substance	Limits Component Materials	Potential Uses & Additional Information Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Phthalates 					
28553-12-0	Di-Iso-nonylphthalate (DINP)	500 ppm each Total: 1000 ppm	<p>Esters of ortho-phthalic acid (Phthalates) are a class of organic compound commonly added to plastics to increase flexibility. They are sometimes used to facilitate the moulding of plastic by decreasing its melting temperature.</p> <p>Phthalates can be found in:</p> <ul style="list-style-type: none"> • Flexible plastic packaging • Components (e.g., PVC) • Plastisol print pastes • Adhesives • Plastic sleeves • Polymeric coatings <p>The REACH substances of very high concern (SVHC) candidate list is updated frequently. Suppliers should assume that the AFIRM Packaging RSL includes all Phthalates on the SVHC list — whether itemized here or not.</p>	All materials: CPSC-CH-C1001-09.4, analysis by GC/MS	50 ppm each
117-84-0	Di-n-octylphthalate (DNOP)				
117-81-7	Di(2-ethylhexyl)-phthalate (DEHP)				
26761-40-0	Diisodecylphthalate (DIDP)				
85-68-7	Butylbenzylphthalate (BBP)				
84-74-2	Dibutylphthalate (DBP)				
84-69-5	Diisobutylphthalate (DIBP)				
84-75-3	Di-n-hexylphthalate (DnHP)				
84-66-2	Diethylphthalate (DEP)				
131-11-3	Dimethylphthalate (DMP)				
131-18-0	Di-n-pentyl phthalate (DPENP)				
84-61-7	Dicyclohexyl phthalate (DCHP)				
71888-89-6	1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich				
117-82-8	Bis(2-methoxyethyl) phthalate				
605-50-5	Diisopentyl phthalate (DIPP)				
131-16-8	Dipropyl phthalate (DPRP)				
27554-26-3	Diisooctyl phthalate (DIOP)				
68515-50-4	1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear				
71850-09-4	Diisohexyl phthalate (DIHxP)				
68515-42-4	1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (DHNUJ)				
84777-06-0	1,2-Benzenedicarboxylic acid Dipentyl ester, branched and linear				
68648-93-1	1,2-Benzenedicarboxylic acid, di-C6-10-alkyl esters or mixed decyl and hexyl and octyl diesters with ≥ 0.3% of dihexyl phthalate; 1,2-Benzenedicarboxylic acid, mixed decyl and hexyl and octyl diesters; 1,2-Benzenedicarboxylic acid, di-C6-10-alkyl esters				
68515-51-5					
776297-69-9	n-Pentyl-isopentylphthalate (nPIPP)				
26040-51-7	Bis(2-ethylhexyl) tetrabromophthalate				

Appendix A. Per- and Polyfluoroalkyl Substances (PFAS)

NOTE: This list is a subset of PFAS and is not exhaustive. Findings would indicate intentional use or significant contamination.

CAS No.	PFC (PFAS) Name	CAS No.	PFC (PFAS) Name
	PFOS and Related Substances		PFHxS and Its Salts
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	355-46-4	Perfluorohexane Sulfonic acid (PFHxS)
2795-39-3	Perfluorooctanesulfonic acid, potassium salt (PFOS-K)	3871-99-6	Perfluorohexane Sulfonic acid, potassium salt (PFHxS-K)
29457-72-5	Perfluorooctanesulfonic acid, lithium salt (PFOS-Li)	55120-77-9	Perfluorohexane Sulfonic acid, lithium salt (PFHxS-Li)
29081-56-9	Perfluorooctanesulfonic acid, ammonium salt (PFOS-NH ₄)	68259-08-5	Perfluorohexane Sulfonic acid, ammonium salt (PFHxS-NH ₄)
70225-14-8	Perfluorooctane sulfonate diethanolamine salt (PFOS-NH(OH) ₂)	82382-12-5	Perfluorohexane Sulfonic acid, sodium salt (PFHxS-Na)
56773-42-3	Perfluorooctanesulfonic acid, tetraethylammonium salt (PFOS-N(C ₂ H ₅) ₄)		PFHxS-related Substances
251099-16-8	Didecyl dimethyl ammonium perfluorooctane sulfonate (PFOS-N(C ₁₀ H ₂₁) ₂ (CH ₃) ₂)	68259-15-4	N-Methylperfluoro-1-hexanesulfonamide (N-Me-FHxSA)
4151-50-2	N-Ethylperfluoro-1-octanesulfonamide (N-Et-FOSA)	41997-13-1	Perfluorohexane sulfonamide (PFHxSA)
31506-32-8	N-Methylperfluoro-1-octanesulfonamide (N-Me-FOSA)		C9 – C14 PFCAs and Their Salts
1691-99-2	2-(N-Ethylperfluoro-1-octanesulfonamido)-ethanol (N-Et-FOSE)	375-95-1	Perfluorononanoic Acid (PFNA, C9-PFCA)
24448-09-7	2-(N-Methylperfluoro-1-octanesulfonamido)-ethanol (N-Me-FOSE)	335-76-2	Perfluorodecanoic Acid (PFDA, C10-PFCA)
307-35-7	Perfluoro-1-octanesulfonyl fluoride (POSF)	2058-94-8	Perfluoroundecanoic Acid (PFUnA, C11-PFCA)
754-91-6	Perfluorooctane sulfonamide (PFOSA)	307-55-1	Perfluorododecanoic Acid (PFDoA, C12-PFCA)
	PFOA and Its Salts	72629-94-8	Perfluorotridecanoic Acid (PFTrDA, C13-PFCA)
335-67-1	Perfluorooctanoic acid (PFOA)	376-06-7	Perfluorotetradecanoic Acid (PFTeDA, C14-PFCA)
335-95-5	Sodium perfluorooctanoate (PFOA-Na)	172155-07-6	Perfluoro-3-7-dimethyloctanecarboxylate (PF-3,7-DMOA)
2395-00-8	Potassium perfluorooctanoate (PFOA-K)		C9 – C14 PFCA-related Substances
335-93-3	Silver perfluorooctanoate (PFOA-Ag)	17741-60-5	1H,1H,2H,2H-Perfluorododecyl acrylate (10:2 FTA)
335-66-0	Perfluorooctanoyl fluoride (PFOA-F)	2144-54-9	1H,1H,2H,2H-Perfluorododecyl methacrylate (10:2 FTMA)
3825-26-1	Ammonium pentadecafluorooctanoate (APFO)	865-86-1	1H,1H,2H,2H-Perfluorododecanol (10:2 FTOH)
	PFOA-related Substances	34598-33-9	2H,2H,3H,3H-Perfluoroundecanoic acid (H4PFUnA)
39108-34-4	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	678-39-7	Perfluorocyclohexanol 8:2 (8:2 FTOH)
376-27-2	Methyl perfluorooctanoate (Me-PFOA)	39239-77-5	1H,1H,2H,2H-perfluorotetradecan-1-ol (12:2 FTOH)
3108-24-5	Ethyl perfluorooctanoate (Et-PFOA)	120226-60-0	1H,1H,2H,2H-Perfluorododecanesulphonic acid (10:2 FTS)
678-39-7	2-Perfluorooctylethanol (8:2 FTOH)	2043-54-1	1H,1H,2H,2H-Perfluorododecyl iodide (10:2 FTI)
27905-45-9	1H,1H,2H,2H-Perfluorodecyl acrylate (8:2 FTA)	30046-31-2	1H,1H,2H,2H-Perfluorotetradecyl iodide (12:2 FTI)
1996-88-9	1H,1H,2H,2H-Perfluorodecyl methacrylate (8:2 FTMA)		PFHxA, Its Salts, and Related Substances
27854-31-5	2H,2H-Perfluorodecanoic acid (H2PFDA)	307-24-4	Perfluorohexanoic Acid (PFHxA, C6-PFCA)
		27619-97-2	1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)
		647-42-7	1H,1H,2H,2H-Perfluorooctanol (6:2 FTOH)



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