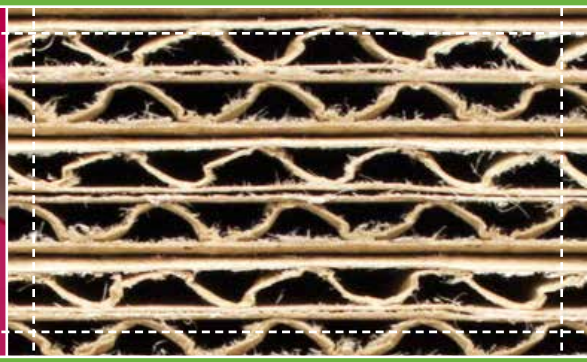




Apparel and Footwear International RSL Management Group

PACKAGING RESTRICTED SUBSTANCES LIST

Version 05 | 2022



Table of Contents

AFIRM Mission

AFIRM is the Apparel and Footwear International RSL Management (AFIRM) Working Group, established in 2004.

AFIRM's mission is "to reduce the use and impact of harmful substances in the apparel and footwear supply chain."

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

AFIRM Vision

AFIRM continues to be a recognized global center of excellence, providing resources to enable continuous advancement of chemical 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.

It is understood that in adopting this vision, AFIRM's mission, objectives, and projects will continue to be 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, or to reduce their environmental impact by limiting the use of certain substances in packaging of 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 coverage for the AFIRM Packaging RSL, outlined in Table 1. There are packaging products, such as clothing hangers, which are excluded from the scope. Suppliers are advised to consult AFIRM member brands on specific requirements for these products.

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

Hang Tags	Stickers	Protective Coverings	Trimmings	Sales Packaging	Transport Packaging
• Cords • Foil stamps • Hot stamp prints • Paper hang tags • Plastic hang tags • Price tags • Spot UV hang tags • UPC tags	• Antimicrobial stickers • Labels, adhesive • Price tags • Tape	• Lamination, matte or gloss • Foam material • Suit bags • Plastic cases • Poly bags • Poly bags, zippered	• Bead chain • Collar band • Clips, metal • Clips, plastic • Eyelets/grommets • Magnets • Pins • Tissue paper • Zippers	• Boxes/cartons • Gift boxes • Retail carry bags • Spot UV boxes • Suit bags • Thermal receipt paper • Tissue paper • UV coated boxes • Varnished coated boxes • Water-based (aqueous) lacquer coated boxes	• 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

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 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. Some 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 Chemistry Toolkit
www.afirm-group.com/toolkit

- English, Chinese, Vietnamese, Japanese, Indonesian, and Spanish versions

AFIRM Chemical Information Sheets
www.afirm-group.com/chemical-information-sheets

- English, Chinese, Vietnamese, Japanese, Indonesian, and Spanish versions

NEW for 2022! AFIRM Explainer Videos
www.afirm-group.com/start-here

- English available, with translations forthcoming

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

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 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, Endocrine Disruptors, Etc.

Some brands may have specific requirements regarding the use of substances of concern such as biocides, nanoparticles, and endocrine disruptors. AFIRM recommends checking with your customers regarding individual policies or requirements.

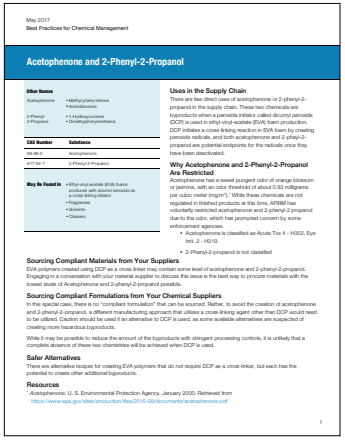
Bans on PVC Packaging

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.

AFIRM Chemical Information Sheets

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


May 2017
Best Practices for Chemical Management

Acetophenone and 2-Phenyl-2-Propanol

Other Names
Acetophenone
• Methyl phenyl ketone
• Acetobenzene
2-Phenyl-2-Propanol
• 1-Hydroxycumene
• Dimethylphenylmethanol

CAS Number | Substance
98-86-2 | Acetophenone
617-94-7 | 2-Phenyl-2-Propanol

May Be Found In
• Ethyl vinyl acetate (EVA) foams produced with diacetyl peroxide as a cross-linking initiator
• Fragrances
• Solvents
• Cleaners

Uses in the Supply Chain
There are few direct uses of acetophenone or 2-phenyl-2-propanol in the supply chain. These two chemicals are byproducts when a peroxide initiator called dicumyl peroxide (DCP) is used in ethyl-vinyl-acetate (EVA) foam production. DCP initiates a cross-linking reaction in EVA foam by creating peroxide radicals, and both acetophenone and 2-phenyl-2-propanol are potential endpoints for the radicals once they have been deactivated.

Why Acetophenone and 2-Phenyl-2-Propanol Are Restricted
Acetophenone has a sweet pungent odor of orange blossom or jasmine, with an odor threshold of about 0.83 milligrams per cubic meter (mg/m³).[1] While these chemicals are not regulated in finished products at this time, AFIRM has voluntarily restricted acetophenone and 2-phenyl-2-propanol due to the odor, which has prompted concern by some enforcement agencies.
• Acetophenone is classified as Acute Tox 4 - H302, Eye Irrit. 2 - H319
• 2-Phenyl-2-propanol is not classified

Sourcing Compliant Materials from Your Suppliers
EVA polymers created using DCP as a cross linker may contain some level of acetophenone and 2-phenyl-2-propanol. Engaging in a conversation with your material supplier to discuss this issue is the best way to procure materials with the lowest levels of Acetophenone and 2-phenyl-2-propanol possible.

Sourcing Compliant Formulations from Your Chemical Suppliers
In this special case, there is no "compliant formulation" that can be sourced. Rather, to avoid the creation of acetophenone and 2-phenyl-2-propanol, a different manufacturing approach that utilizes a cross-linking agent other than DCP would need to be utilized. Caution should be used if an alternative to DCP is used, as some available alternatives are suspected of creating more hazardous byproducts.

While it may be possible to reduce the amount of the byproducts with stringent processing controls, it is unlikely that a complete absence of these two chemistries will be achieved when DCP is used.

Safer Alternatives
There are alternative recipes for creating EVA polymers that do not require DCP as a cross-linker, but each has the potential to create other additional byproducts.

Resources
[1] Acetophenone. U. S. Environmental Protection Agency. January 2000. Retrieved from https://www.epa.gov/sites/production/files/2016-09/documents/acetophenone.pdf

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 plus symbol next to a chemical or class of chemicals in the AFIRM RSL indicates that an information sheet is available; simply click on the chemical name, and your web browser will load a PDF of the information sheet for that substance.

Reporting Limits

Definition: Reporting limits are values at or above the practical quantification limit (PQL) for the test method. The PQL represents the lowest level at which accurate, precise, and robust data can be reported. These limits are values above which labs should report detected substances for purposes of data capture and harmonization.

Reporting specific values, rather than using a simple PASS/FAIL model, allows the supply chain to capture information regarding the presence of substances below the Packaging RSL limit. Reporting limits also enable the harmonization of data between various testing labs.

AFIRM Packaging RSL reporting limits are widely achievable by laboratories across the global analytical testing industry and allow for combined (composite) testing where applicable.

Change Log for the 2022 AFIRM Packaging RSL

CAS No.	Substance/Material	Modification	Page
Various	Bisphenols	• Added Level 2 risk for leather and blended/synthetic fibers to the Risk Matrix (Table 2). • Added additional information about potential uses. • Added separate reporting limits for individual samples (0.1 ppm) and composite samples (1 ppm).	13
624-49-7	Dimethylfumarate (DMFu)	• Updated method to ISO 16186:2021 for all materials.	13
50-00-0	Formaldehyde	• Updated leather test method to EN ISO 17226-2:2019 with EN ISO 17226-1:2021 confirmation method in case of interferences.	14
Various	Organotin Compounds	• Added additional method: CEN ISO/TS 16179:2012	15
68515-50-4	Phthalates	• Corrected name for 1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear.	18

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

The risk matrix, shown in Table 2 on the next page, highlights the restricted substance risks associated with different fibers and materials, and is presented as a guidance tool. It is based on our many years of experience in manufacturing and in managing restricted substances across a wide range of materials. The aim is to provide information on those substances that have historically been deliberately used or found as reagent/contaminants in different materials.[B]

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.
- 3 Yellow indicates there is a very low but theoretical chance that a chemical could be used and/or detected.
- ☐ White indicates that we believe there is an almost negligible risk of a chemical being used and/or detected.

In the absence of a brand Packaging RSL and testing program, the matrix outlined in Table 2 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.

The test methods listed in the Packaging RSL for specific materials correspond to the risk matrix. A risk rating of white for any material will not have a corresponding test method. For example, metal has a risk rating of white for APEOs, and therefore no test method is listed for APEOs for metal in the Packaging RSL. If the RSL states “All Materials” or “All Materials Except,” this means the test method is applicable to all materials listed with a risk rating of 1, 2, or 3 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 2. Risk Matrix

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	Leather	
	Natural	Blended	Synthetic						Natural	Artificial
Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs), including all isomers	1	1	1	1	1	1A		1	1	1
Azo-amines and Arylamine Salts	1	1	1		1				1	1
Bisphenols		2	2	2B	1C	2D			2	2
Butylhydroxytoluene (BHT)						2E				
Dimethylfumarate (DMFu)						2F			2	
Formaldehyde	2	2	2	1	1	3		1	2	2
Heavy Metals, Chromium VI[1]				2	2	3G	3		1	2
Heavy Metals, Cadmium Total[1]				2	2H	3J	2		2	2
Heavy Metals, Lead Total[1]				2	2H	3J	2		2	2
Heavy Metals, Mercury Total[1]				2	2	3			2	2
Organotin Compounds	3	3	3	1		1		1	3	1
Perfluorinated and Polyfluorinated Chemicals (PFCs) or "PFAS"	2K	2K	2K	2K	2K			2K	2K	2K
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.
B Level 1 for PVC.
C Level 1 for thermal receipt and recycled paper.
D Level 2 for tapes, Polycarbonate, and recycled plastic cases.
E Level 2 for poly bags.
F Level 2 for silica gel packets and foam packaging.
G Level 3 for colored bags.
H Level 2 for materials with high recycled content.
J Level 2 for PVC.
K Level 2 if a fluorinated finish is applied.
L Level 1 for plastisol prints.
M Level 1 for PVC.
N Level 2 for patent or coated leather.

AFIRM Packaging RSL

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	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. 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. 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.	Textiles and Leather: EN ISO 21084:2019 with determination of LC/MS or LC/MS/MS Polymers and all other materials: 1 g sample/20 mL THF, sonication for 60 minutes at 70 degrees C, analysis according to EN ISO 21084:2019	Sum of NP & OP: 10 ppm
Various	Octylphenol (OP), mixed isomers				
Various	Nonylphenol ethoxylates (NPEOs)	Total: 100 ppm		All materials except Leather: EN ISO 18254-1:2016 with determination of APEO using LC/MS or LC/MS/MS Leather: Sample prep and analysis using EN ISO 18218-1:2015 with quantification according to EN ISO 18254-1:2016	Sum of NPEO & OPEO: 20 ppm
Various	Octylphenol ethoxylates (OPEOs)				

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	Azo dyes and pigments are colorants that incorporate one or several azo groups (-N=N-) bound with aromatic compounds. Thousands of azo dyes exist, but only those which degrade to form the listed cleavable amines are restricted. Azo dyes that release these amines are regulated and should no longer be used for dyeing textiles.	All materials except Leather: EN ISO 14362-1:2017 Leather: EN ISO 17234-1:2015 p-Aminoazobenzene: All materials except Leather: EN ISO 14362-3:2017 Leather: EN ISO 17234-2:2011	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-Diaminoanisole				
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				

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	5 ppm
	Bisphenols ✢				
80-05-7	Bisphenol-A (BPA)	1 ppm	Used in the production of epoxy resins, polycarbonate plastics, flame retardants, PVC, polyamide dye-fixing agents, and sulfone- and phenol-based leather tanning agents. May be found in recycled polymeric and paper materials due to polycarbonate plastic and thermal receipt paper made with bisphenols entering waste streams. BPA is formally prohibited from use in receipt paper. AFIRM is currently investigating all relevant sources of bisphenols and their concentrations in products and packaging with legislation imposing strict limits pending in multiple jurisdictions. Restriction of these substances is likely in a future update.	All materials: Extraction: 1 g sample/20 ml THF, sonication for 60 minutes at 60 degrees C, analysis with LC/MS	Individual samples: 0.1 ppm Composite samples: 1 ppm
80-09-1	Bisphenol-S (BPS)	AFIRM recommends testing synthetic textiles & blends, polycarbonate plastics, and natural leather to assess concentrations of bisphenols in preparation for restriction in the future.			1 ppm each
620-92-8	Bisphenol-F (BPF)				
1478-61-1	Bisphenol-AF (BPAF)				
	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

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	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. Formaldehyde found in packaging can off-gas directly onto product. 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.	Wood: EN 717-3 Paper: DIN EN 645:1994 and EN 1541:2001 Textiles, Finishings, Dyes, Inks & Coatings: JIS L 1041-2011 A (Japan Law 112) or EN ISO 14184-1:2011 Leather: EN ISO 17226-2:2019 with EN ISO 17226-1:2021 confirmation method in case of interferences. Alternatively, EN ISO 17226-1:2021 can be used on its own.	16 ppm

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 ISO 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.		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 62321-7-1:2015 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
	Organotin Compounds ✢				
Various	Dibutyltin (DBT)	1 ppm each	Class of chemicals combining tin and organics such as butyl and phenyl groups. 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. In textiles and apparel packaging, organotins are associated with plastics/rubber, inks, paints, metallic glitter, polyurethane products and heat transfer material.	All materials: CEN ISO/TS 16179:2012 or EN ISO 22744-1:2020	0.1 ppm each
Various	Dioctyltin (DOT)				
Various	Monobutyltin (MBT)				
Various	Tricyclohexyltin (TCyHT)				
Various	Trimethyltin (TMT)				
Various	Trioctyltin (TOT)				
Various	Tripropyltin (TPT)				
Various	Tributyltin (TBT)	0.5 ppm each			
Various	Triphenyltin (TPhT)				

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
	Perfluorinated and Polyfluorinated Chemicals (Regulated PFCs or "PFAS") ✛				
Various	Perfluorooctane Sulfonate (PFOS) and related substances	1 µg/m^2 total	PFOA and PFOS may be present as unintended byproducts in long-chain and short-chain commercial water-, oil-, and stain-repellent agents. PFOA may also be used in polymers like polytetrafluoroethylene (PTFE). Refer to Appendix A for the full list of substances and CAS Numbers included in this restriction. In addition to this list, all PFOA-related substances are prohibited from use.	All Materials: EN ISO 23702-1	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

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	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. Phthalates can be found in: • Flexible plastic packaging • Components (e.g., PVC) • Plastisol print pastes • Adhesives • Plastic sleeves • Polymeric coatings 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.	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 (DHNUP)				
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)				

Appendix A. Perfluorinated and Polyfluorinated Chemicals (PFCs) or "PFAS"

CAS No.	PFC (PFAS) Name	CAS No.	PFC (PFAS) Name
	PFOS and Related Substances		**PFOA and Its Salts**
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	335-67-1	Perfluorooctanoic acid (PFOA)
2795-39-3	Perfluorooctanesulfonic acid, potassium salt (PFOS-K)	335-95-5	Sodium perfluorooctanoate (PFOA-Na)
29457-72-5	Perfluorooctanesulfonic acid, lithium salt (PFOS-Li)	2395-00-8	Potassium perfluorooctanoate (PFOA-K)
29081-56-9	Perfluorooctanesulfonic acid, ammonium salt (PFOS-NH_4)	335-93-3	Silver perfluorooctanoate (PFOA-Ag)
70225-14-8	Perfluorooctane sulfonate diethanolamine salt (PFOS-$NH(OH)_2$)	335-66-0	Perfluorooctanoyl fluoride (PFOA-F)
56773-42-3	Perfluorooctanesulfonic acid, tetraethylammonium salt (PFOS-$N(C_2H_5)_4$)	3825-26-1	Ammonium pentadecafluorooctanoate (APFO)
4151-50-2	N-Ethylperfluoro-1-octanesulfonamide (N-Et-FOSA)		**PFOA-related Substances**
31506-32-8	N-Methylperfluoro-1-octanesulfonamide (N-Me-FOSA)		
1691-99-2	2-(N-Ethylperfluoro-1-octanesulfonamido)-ethanol (N-Et-FOSE)	39108-34-4	1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)
24448-09-7	2-(N-Methylperfluoro-1-octanesulfonamido)-ethanol (N-Me-FOSE)	376-27-2	Methyl perfluorooctanoate (Me-PFOA)
307-35-7	Perfluoro-1-octanesulfonyl fluoride (POSF)	3108-24-5	Ethyl perfluorooctanoate (Et-PFOA)
754-91-6	Perfluorooctane sulfonamide (PFOSA)	678-39-7	2-Perfluorooctylethanol (8:2 FTOH)
		27905-45-9	1H,1H,2H,2H-Perfluorodecyl acrylate (8:2 FTA)
		1996-88-9	1H,1H,2H,2H-Perfluorodecyl methacrylate (8:2 FTMA)

www.afirm-group.com