



Apparel and Footwear International RSL Management Group



PACKAGING RESTRICTED SUBSTANCES LIST

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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 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.

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

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 apparel and footwear packaging.

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. Scope of the AFIRM Packaging RSL

Paper & Wood	Plastic & Wrap	Finishing, Dyes, Inks & Coatings	Metal	Textiles	Other Items
<ul style="list-style-type: none"> • Boxes/cartons • Corrugated shipping boxes/cartons • Gift boxes • Hang tags • J board • Labels, adhesive • Stuffing • Tissue paper • UPC tags • Stickers • Tape • Thermal receipt paper 	<ul style="list-style-type: none"> • Boxes, single pack and multi-pack • Hang tags • Plastic cases • Poly bags • Poly bags, zippered • Price tags • Retail carry bags • Stickers • Tape 	<ul style="list-style-type: none"> • Cellulose laminates • Coatings containing heavy metals • Foil stamping • Hot-stamp printing • Lamination, matte or gloss • Soft-touch coatings • Spot UV • Uncoated • UV coatings • Varnish coatings • Water-based (aqueous) lacquer coatings 	<ul style="list-style-type: none"> • Magnets • Bead chain • Eyelets/grommets • Pins • Zippers 	<ul style="list-style-type: none"> • Synthetic textiles • Plant-based textiles • Natural fibers (i.e. silk, wool) 	<ul style="list-style-type: none"> • Silica gel/desiccant sachets • Antimicrobial stickers • Stuffing materials, expanded foam materials

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 may provide additional important information regarding chemical management and should be visited on a regular basis.

AFIRM Website

www.afirm-group.com

AFIRM Supplier Toolkit

www.afirm-group.com/toolkit/

- Chinese, Vietnamese, and Spanish translations are available.

Sustainable Packaging Coalition (SPC)

www.sustainablepackaging.org/

EU Packaging and Packaging Waste Directive

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

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 or users of these plastics should be aware that the EU may restrict them in the future. 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. AFIRM will address these substances in a future release. For more information, please visit http://europa.eu/rapid/press-release_IP-18-5_en.htm and <http://ec.europa.eu/environment/circular-economy/pdf/oxo-plastics.pdf>.

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 a future revision 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 plus symbol next to a chemical or class of chemicals in the AFIRM Packaging 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.

May 2017
Best Practices for Chemical Management

Acetophenone and 2-Phenyl-2-Propanol

Use Cases	Where to Find	Uses in the Supply Chain
<ul style="list-style-type: none"> • Adhesives • Coatings • Inks • Resins • Solvents 	<ul style="list-style-type: none"> • Acetophenone • 2-Phenyl-2-Propanol 	<p>These are the chemical names of acetophenone and 2-phenyl-2-propanol in the supply chain. These two chemicals are frequently referred to as acetophenone and 2-phenyl-2-propanol. DCP initiates a cross-linking reaction in EVA foam by creating polymerizable, and both acetophenone and 2-phenyl-2-propanol are potential candidates for the reaction once they have been dissolved.</p>
<ul style="list-style-type: none"> • Adhesives • Coatings • Inks • Resins • Solvents 	<ul style="list-style-type: none"> • Acetophenone • 2-Phenyl-2-Propanol 	<p>Acetophenone has a sweet pungent odor of orange blossom or perfume, with an odor threshold of about 0.03 milligrams per cubic meter (ppm). While these chemicals are not regulated in finished products at the time AFIRM has initiated research on acetophenone and 2-phenyl-2-propanol due to the odor, which has prompted concern by some environmental agencies.</p> <p>• Acetophenone is classified as Acute Tox 4 (H302, Eye Irrit 2 - H332)</p>

Sourcing Compliant Materials from Your Suppliers
EVA customers created using DCP as a cross linker may contain some level of acetophenone and 2-phenyl-2-propanol. If you are in compliance with your material supplier to reduce the use in the final step to process materials with the lowest levels of Acetophenone and 2-Phenyl-2-Propanol possible.

Sourcing Compliant Formulations from Your Chemical Suppliers
In the spirit of our "no compromise" policy, to avoid the creation of acetophenone and 2-phenyl-2-propanol, a different manufacturing approach that utilizes a cross-linker 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 chemicals will be achieved when DCP is used.

Solar 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
Acetophenone. U. S. Environmental Protection Agency. January 2003. Retrieved from <http://www.epa.gov/chemprod/chemprod03/0301acetophenone.pdf>

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 should be widely achievable by laboratories across the global analytical testing industry as well as allow for combined (composite) testing where applicable.

Materials in Which Restricted Substances Are Likely to Be Found

In the apparel and footwear packaging supply chain, 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:

-  Red indicates that a chemical has been in widespread use and/or frequently detected in a particular material.
-  Orange indicates that a chemical has been deliberately used and/or detected in a particular material occasionally.
-  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.

A. See Section 5 of the AFIRM Supplier Toolkit for more information on testing and Appendix C of the AFIRM Supplier 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

Substance	Wood & Paper	Plastic & Wraps	Finishing, Dyes, Inks & Coatings	Metal	Textiles	Other Items
Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs), including all isomers	1	1	1		1	
Bisphenol-A	1 Thermal receipt paper					
Butylhydroxytoluene (BHT)		2 Poly bags				
Dimethylfumarate (DMFu)						2 Silica gel packets, foam packaging
Formaldehyde	1		1		2	
Heavy Metals, Chromium VI	2	3 Colored bags	3	3		
Heavy Metals, Cadmium Total	2 Materials with high recycled content	3	2	2		
Heavy Metals, Lead Total	2 Materials with high recycled content	3	2	2		
Heavy Metals, Mercury Total		3	3			
Organotin Compounds			3		3	
Perfluorinated and Polyfluorinated Chemicals (PFCs)	2 Only with waterproofing finishes		2 Only with waterproofing finishes		2 Only with waterproofing finishes	
Phthalates		1	1 Plastisol prints		2 PVC	

AFIRM Packaging RSL

CAS No.	Substance	Limits Raw Material & Finished Product	Potential Uses 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>Extraction: 1 g sample/20 mL THF, sonication for 60 minutes at 70 degrees C Analysis: EN ISO 18857-2:2011</p>	Sum of NP & OP: 10 ppm
Various	Octylphenol (OP), mixed isomers				
Various	Nonylphenol ethoxylates (NPEOs)	Total: 100 ppm	<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. This limit aligns with forthcoming EU legislation applicable to textiles and was set to provide suppliers direction for continuous improvement.</p>	<p>Textiles: EN ISO 18254-1:2016 with determination of AP using LC/MS or GC/MS Leather: EN ISO 18218-1:2015</p>	Sum of NPEO & OPEO: 20 ppm
Various	Octylphenol ethoxylates (OPEOs)				

CAS No.	Substance	Limits Raw Material & Finished Product	Potential Uses 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.	ASTM D4275	5 ppm
Bisphenol-A †					
80-05-7	Bisphenol-A (BPA)	1 ppm	Used in the production of epoxy resins, polycarbonate plastics, flame retardants, and PVC. It is often used as a coating in thermal receipt paper as a developer.	Sample preparation: Extraction: 1 g sample/20 ml methanol, sonication for 60 minutes at 70 degrees C Measurement: DIN EN ISO 18857-2:2011 (mod)	1 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.	CEN ISO/TS 16186:2012	0.05 ppm

CAS No.	Substance	Limits Raw Material & Finished Product	Potential Uses 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 existing California and forthcoming 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>Textiles, wood, and paper: JIS L 1041-1983 A (Japan Law 112) or EN ISO 14184-1:2011</p> <p>Plastics: EN ISO 1484-2</p> <p>Leather: ISO 17226-2:2008 with ISO 17226-1:2008 confirmation method in case of interferences</p>	16 ppm

CAS No.	Substance	Limits Raw Material & Finished Product	Potential Uses Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
Heavy Metals (Extractable + and Total Content +)					
7440-43-9	Cadmium (Cd)	100 ppm (Sum)	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.	Total: Textiles, plastics, and metal: DIN EN 16711-1:2016 Leather: DIN EN ISO 17072-2:2017	Total: 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.	Textiles: DIN EN 16711-2:2016 with EN ISO 17075-1:2017 if Cr is detected Leather: EN ISO 17075-1:2017 and EN ISO 17075-2:2017 for confirmation in case the extract causes interference Conditions for leather ageing: 24 hours, 80 degrees C, maximum 5% relative humidity, no ventilation Ageing test is used at brand discretion.	Extractable: Leather: 3 ppm Textiles: 0.5 ppm
7439-92-1	Lead (Pb)		May be associated with plastics, paints, inks, pigments, and surface coatings.	Total: Non-metal: CPSC-CH-E1002-08.3 Metal: CPSC-CH-E1001-08.3 Lead in paint and surface coating: CPSIA Section 101 16 CFR 1303	Total: 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.	Total: Textiles, plastics, metal: DIN EN 16711-1:2016 Leather: DIN EN ISO 17072-2:2017	Total: 0.1 ppm

CAS No.	Substance	Limits Raw Material & Finished Product	Potential Uses Processing for Packaging Materials	Suitable Test Method Sample Preparation & Measurement	Reporting Limit Limits Above Which Test Results Should Be Reported
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.	CEN ISO/TS 16179:2012	0.1 ppm each
Various	Dioctyltin (DOT)				
Various	Monobutyltin (MBT)				
Various	Tricyclohexyltin (TCyHT)				
Various	Trimethyltin (TMT)				
Various	Trioctyltin (TOT)				
Various	Tripropyltin (TPT)	0.5 ppm each			
Various	Tributyltin (TBT)				
Various	Triphenyltin (TPhT)				
Perfluorinated and Polyfluorinated Chemicals (PFCs) †					
Various	Perfluorooctane Sulfonate (PFOS) and related substances	1 µg/m ² each	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). Long-chain PFC technology is restricted from use, with a 25-ppb limit on PFOA and its salts and a 1000 ppb total limit on PFOA-related substances in all materials. See Commission Regulation (EU) 2017/1000. This is effective 04 July 2020. RSL limits will be revised in a subsequent update.	CEN/TS 15968:2014	1 µg/m ² each
Various	Perfluorooctanoic Acid (PFOA) and related substances				

CAS No.	Substance	Limits Raw Material & Finished Product	Potential Uses 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 components (e.g., PVC) • Print pastes • Adhesives • Plastic buttons • Plastic sleeves • Polymeric coatings <p>The listed Phthalates are those most commonly used and regulated across industry sectors.</p> <p>Find more information about additional Phthalates on the REACH substances of very high concern (SVHC) candidate list, which is updated frequently.</p>	<p>Sample preparation: CPSC-CH-C1001-09.3</p> <p>Measurement: Textile: GC-MS, EN ISO 14389:2014 Leather: GC-MS Plastics: EN 14372</p>	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)				
84-61-7	Dicyclohexyl phthalate (DCHP)				



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