Apparel and Footwear International RSL Management Group

CHEMISTRY TOOLKIT

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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.

Policy Statement and Uses of This Chemistry Toolkit

Apparel and Footwear International RSL Management (AFIRM) Working Group has developed this Chemistry Toolkit as part of its mission "to reduce the use and impact of harmful substances in the apparel and footwear supply chain."

This Chemistry Toolkit provides an overview of basic information on how to begin to implement an RSL program, which is a highly customized process that depends on many factors, including the products being produced and where they are sold.

Many brands also have implementation guidelines, and suppliers must follow those guidelines, where available. The reader should not rely on this document to address specific questions that apply to a particular set of facts: All questions should be directed to the specific brand company whose products are at issue.

There is no warranty, express or implied, as to the completeness or utility of the information in this document, including, without limitation, that the information contained herein will be error free. In addition, AFIRM assumes no liability of any kind whatsoever resulting from the use of or reliance upon the contents of this document.

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

1. Introduction

In response to feedback from the global supply chain, Apparel and Footwear International RSL Management Working Group (AFIRM Group) has updated this Chemistry Toolkit as part of our ongoing mission "to reduce the use and impact of harmful substances in the apparel and footwear supply chain."

Definition of "Restricted Substances"

Restricted substances are chemicals and other substances the use and/or presence of which has been banned or otherwise restricted by a brand.

Typically, a restricted substance must be absent from a finished product or present below maximum allowable levels.

Restricted substances may be restricted across many industries, across one industry, or in certain products or inputs.

Please see Appendix J for a glossary of other relevant terms.

Why Substances Are Restricted

Substances are restricted for many reasons. Some substances are restricted due to concern for the environment, while others are restricted due to health and safety concerns for workers or consumers. Some are restricted by legislation.

Substances are restricted in different ways. As noted above, some substances are banned from use during the manufacturing process or banned from finished products entirely. Other substances might be banned if they are present above certain concentration limits or if they leach a certain amount from a finished product under predefined conditions.

In each case, a substance restriction is usually accompanied by a test method that brands and suppliers can use to verify if a chemical is present and, if so, to ensure the chemical is below the restricted level.

This Chemistry Toolkit focuses on the needs of brands, suppliers, and upstream vendors—including raw material and chemical suppliers, mills, dye houses, trim and packaging suppliers, screen-printers, factories, and other business entities involved in the manufacture of apparel and footwear finished goods.

Notable additions to this update of the Toolkit include an extensive Chemical Guidance Document (Appendix H) and RSL Corrective Action Examples (Appendix D). Both references provide specific technical information to help eliminate or reduce restricted substances in finished goods to meet brand requirements for restricted substances.

While this Toolkit is primarily focused on eliminating restricted substances from finished products, extensive information about chemical discharge into wastewater, air emissions, and solid waste is available in Appendix G.

AFIRM Welcomes Your Feedback to Inform Future Toolkit Updates

The AFIRM training committee made a concerted effort to update this 2018 Chemistry Toolkit. Our aim is to make it as reader-friendly and useful as possible for brands beginning their journeys toward chemical compliance as well as for suppliers educating themselves on these topics. Reach out to us with suggestions for topics to include in future updates as well as feedback regarding content you found unnecessary.

Your comments will help us improve the Toolkit to meet your needs! Contact: nsponsler@phylmar.com

2. Restricted Substances Lists

The purpose of a restricted substances list (RSL) is to reduce the use of hazardous substances in the footwear and apparel supply chain. This includes certain accessories and equipment that fall within the scope of the AFIRM RSL. Brands publish RSLs to ensure that suppliers and vendors—as well as internal corporate employees—are aware of and can follow their restricted substance requirements.

Why RSLs Are Important for Suppliers

The AFIRM RSL and brand-specific RSLs clearly set forth for suppliers those chemicals that are restricted.

When placing orders, AFIRM brands will make it clear to suppliers that compliance with their RSL is required. It is expected that all footwear, apparel, accessories, and equipment comply with the requirements of the RSL on an on-going basis.

AFIRM recommends that suppliers understand the purpose of an RSL and develop their own programs to ensure they comply with their customers' RSL requirements.

A brand RSL is typically based on environmental and health and safety risk assessments, current and anticipated legal requirements of markets where products are distributed or sold, and industry best practices. If a brand has an RSL, it is essential to follow its RSL.

Because individual brand RSLs vary, it is critical to check with your customer to ensure that you are using the correct list. If a customer does not have an RSL, the AFIRM RSL is a good place to start.

The AFIRM RSL lists substances currently subject to legislated limits around the world, as well as limits based on best practices in the apparel and footwear industries.

The AFIRM RSL is available at http://afirm-group.com/afirm-rsl/. Its policy has been adopted by many brands—both AFIRM members as well as non-members.

Manufacturing Restricted Substances Lists

In addition to RSL requirements, brands often have a policy of adherence to a manufacturing restricted substances list (MRSL). MRSLs cover all input chemistries and place restrictions on substances used in the manufacture of goods. This should not be confused with an RSL, which restricts chemistries at the product level.

3. Where Are the Risks?

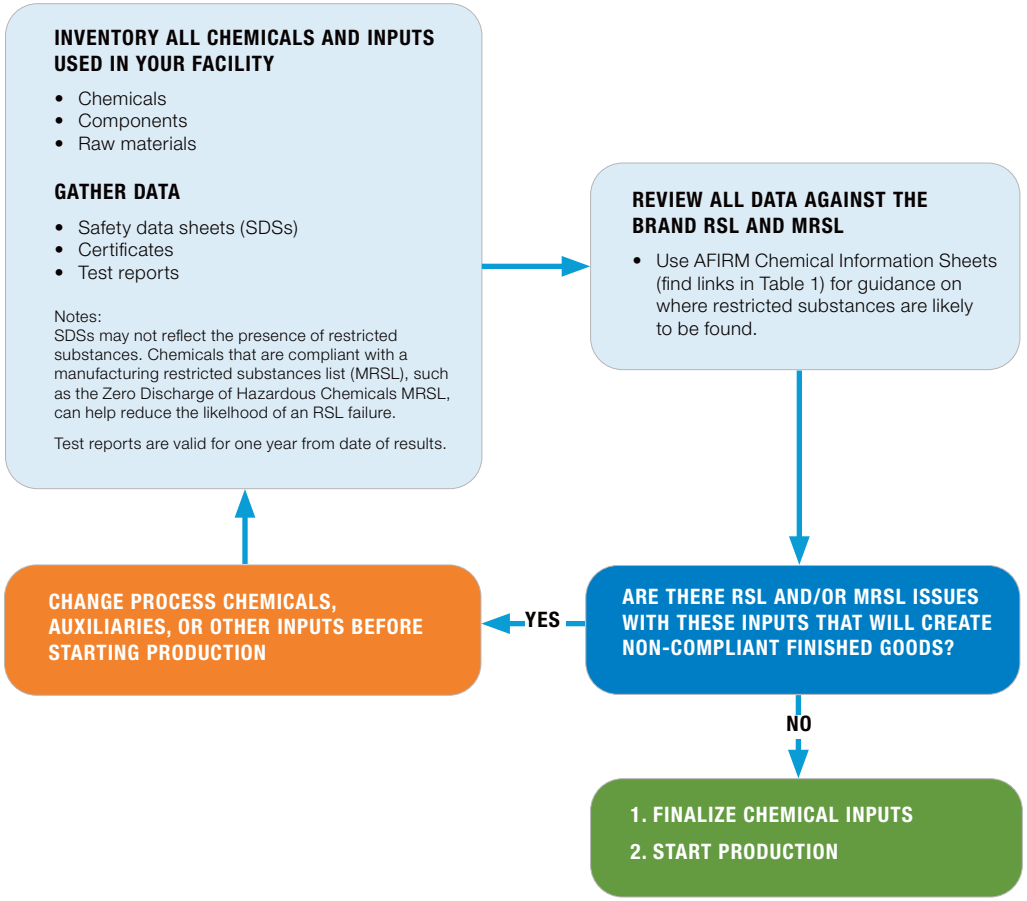
In the apparel and footwear supply chain, there are certain types of fibers and materials that are more likely to contain restricted substances. Many brands require testing of products prior to shipment to assure that the shipment does not contain articles not in compliance with their RSLs. (See Section 5 of this Toolkit for more information on testing and see Appendix B for a model testing program.)

Understanding Chemical Risks

The AFIRM RSL includes a risk matrix that indicates which substances are likely to be found in materials typically used in the manufacture of apparel, footwear, certain accessories, and equipment. This is a good starting point for understanding chemical risks in the supply chain.

The flowchart in Figure 1 will help suppliers review production methods and ensure that they meet brand RSL requirements.

Figure 1. Understanding Chemical Risks



AFIRM Chemical Information Sheets

Since 2017, AFIRM Group has published a series of Chemical Information Sheets. Table 1, on the next page, provides links to these publications in four languages.

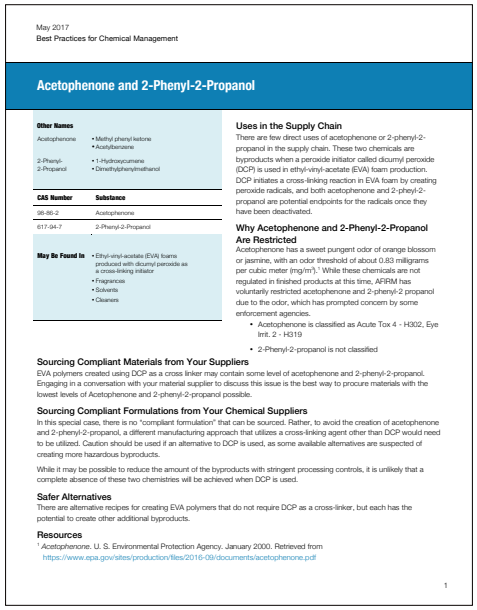
These documents serve as a single point of reference for the substances (or categories of substances) in the AFIRM RSL.

The sheets provide a brief background on where the substances are used in the supply chain, the reasons these substances are restricted, as well as guidance on sourcing compliant materials or safer alternatives.

Readers should not rely solely on these documents to address specific questions. All questions should be directed to the specific brand whose products are at issue.

AFIRM assumes no liability of any kind whatsoever resulting from the use of or reliance upon the contents of these documents.

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



May 2017
Best Practices for Chemical Management

Acetophenone and 2-Phenyl-2-Propanol

Other Names

Acetophenone	• Methyl phenyl ketone • Acetylbenzene
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 dicumyl 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

1

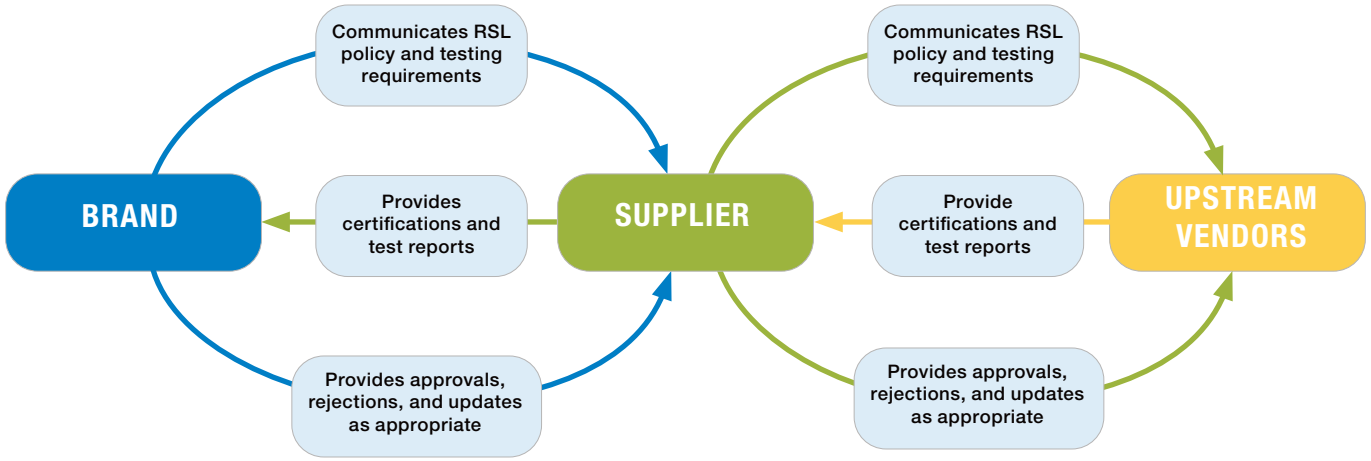
Table 1. AFIRM Chemical Information Sheets

Substance	Language	Substance	Language
Acetophenone and 2-Phenyl-2-Propanol		Heavy Metals, Total	
Alkylphenol Ethoxylates (NPEO, OPEO)		Heavy Metals, Extractable	
Alkylphenols (NP, OP)		Heavy Metals, Chromium VI	
Azo-amines		Heavy Metals, Nickel Release	
Bisphenol-A		Monomers, Styrene and Vinyl Chloride	
Chlorinated Paraffins, SCCP (C10-C13) and MCCP (C14-C17)		N-Nitrosamines	
Chlorophenols (Tri-, Tetra-, and Pentachlorophenols)		Organotin Compounds	
Chlororganic Carriers		Ortho-phenylphenol (OPP)	
Dimethylformamide (DMFa)		Ozone-depleting Substances	
Dimethylfumarate (DMFu)		Perfluorinated and Polyfluorinated Chemicals (PFCs)	
Dyes: Acid, Basic, Direct, Other, Navy Blue		Pesticides, Agricultural	
Dyes: Disperse		Phthalates	
Flame Retardants		Polycyclic Aromatic Hydrocarbons (PAHs)	
Fluorinated Greenhouse Gases		Volatile Organic Compounds (VOCs)	
Formaldehyde			

4. Educating the Supply Chain

Implementing a robust RSL policy, shown in Figure 2, is a collaborative effort between brands and suppliers. Brands are responsible for educating their contracted suppliers about their RSL requirements and procedures, including clear testing protocols. Ideally, suppliers communicate brand RSL requirements along with real-time updates to upstream vendors, keeping all links in the supply chain informed and compliant.

Figure 2. Implementing a Robust RSL Policy Across the Supply Chain



Communicating with Upstream Vendors

AFIRM suggests the following process for educating your own supply chain:

1. **Communicate all RSL and testing requirements to upstream vendors.**

   Ensure all subcontractors, accessory suppliers, dye mills, print mills, tanneries, chemical suppliers, etc. are aware of the brand's RSL requirements and have the latest version of the brand RSL on hand.

   See Appendices A and B for tips on how to establish a strategy for RSL management as well as a testing program.

2. **Use and encourage the use of chemistries from reputable manufacturers only.**

   Good resources include:

   - Ecological Toxicological Association of Dyestuffs www.etad.com
   - bluesign® www.bluesign.com

3. **Insist that chemical suppliers provide safety data sheets (SDSs) for dyes and textile auxiliaries.**

   SDSs may help reveal whether the materials contain restricted substances.

   See Appendix H for an overview and examples of SDSs.

4. **Make an effort to understand chemistries in use and where restricted substances may be found in the apparel and footwear supply chain.**

   See Figure 1 and Table 1 above, as well as Appendix G, for more specific technical information about where various restricted substances are introduced during the manufacturing process.

   Appendix D provides examples of RSL failures and the corrective actions taken to remediate them.

5. RSL Testing

Many brands have specific RSL testing requirements. If your customer does not have testing requirements, AFIRM recommends that all suppliers develop a testing program of their own. Appendix B represents a brand testing program, which is from the brand's point of view and may be helpful in understanding testing issues. If your customer does not have testing requirements, suppliers are encouraged to trust, but verify, that vendors are RSL-compliant through a testing program.

Brand-approved Laboratories

Typically, brands have their own lists of approved laboratories, and test samples must be sent only to laboratories approved by the brand.

Criteria for Selecting a Laboratory

If your customer does not have a list of approved laboratories, here are some considerations to keep in mind when choosing a laboratory for your own testing.

- Does the lab hold certifications or accreditations? From whom? (Accreditation is required by the U.S. Consumer Product Safety Improvement Act, enacted 14 August 2008.)
- Does the lab follow good laboratory practices (GLPs) or ISO 17025 guidelines?
- Does the lab have a quality policy statement or other document stating general quality procedures?
- What was the date and result of a recent external audit? Is a report available?
- Does the lab belong to a private quality assurance organization?
- Does the lab regularly participate in any round-robin or blind sample testing?
- Is the lab open to a site visit or audit?
- Are in-house protocols documented in manuals? Are they available to customers?
- Has the lab ever been denied or lost certification?
- Is a list of key scientists, including their degrees, certifications, etc. available?
- Is a list of major on-site analytical equipment available?
- Is a list of reference methods the lab routinely performs available?
- Is a list of sample handling and preparation capabilities available?
- Approximately how many analyses does the lab conduct per month or year?
- What percentage of the lab's analyses are subcontracted to a third party?
- In what languages are reports available?
- Are data processed by hand or computer?
- Does the lab have an automated laboratory information management system (LIMS)?

6. RSL Implementation

A well-governed RSL management program enables suppliers to meet various brand requirements and manage chemical risks. AFIRM recommends the following steps to implement an effective RSL program.

1 Ensure internal governance and communication.

- Develop and publish a company policy, including steps for implementation. (See Appendix A.)
- Ensure commitment from internal stake-holders and the senior management team.
- Assign responsibility to a department or a staff member, and ensure strong governance.
- Perform a risk assessment of your operations to identify areas of exposure to risk.
- Set an implementation schedule and train internal staff. (See Appendix A.)

Best practice: Track emerging legislation and industry standards, and align internal policies and standards with the most stringent regulations and best practices.

2 Communicate your requirements to production facilities and material suppliers.

- Send brand RSLs and testing requirements to upstream suppliers and collect confirmation that they have read, understood, and can meet these requirements.
- Advise vendors of material-specific risks and basic chemical legislation. (See the AFIRM RSL and Chemical Information Sheets.)
- Establish a strong due-diligence procedure to track, gather, and follow up with all vendors on a regular basis.
- Stop conducting business with suppliers that do not comply with your standards.

3 Set up a testing system for monitoring compliance with RSL requirements.

- Follow customer chemical test program at specified laboratories closely, or communicate testing needs to laboratories based on needs of customers or risk. (See the Risk Matrix in the AFIRM RSL.)
- Set up a system for how often finished products or materials are tested for restricted substances. Self-testing of materials will enable stronger performance in customers testing programs.

Best practice: Set up strong internal management systems controlling incoming materials are meeting the RSL, and incoming chemicals are meeting MRSL standards, including self-testing of incoming materials and chemicals as additional due-diligence.

4 Adopt best practices and work on continuous improvement.

- Track emerging legislation and industry standards, and perform ongoing risk assessments of your supply chain and operations.
- Identify the most relevant requirements from customers or industry standards, and adopt them as your own.
- Develop strong internal capacity, governance, and processes for controlling chemical risks in your supply chain and production, incorporating a chemical policy, due-diligence testing, and strong management of incoming materials and chemicals to ensure compliance to the RSL.
- Adopt industry-aligned MRSL standards in manufacturing to support compliance of products to the RSL.

Appendix A. Brand Strategy for RSL Management

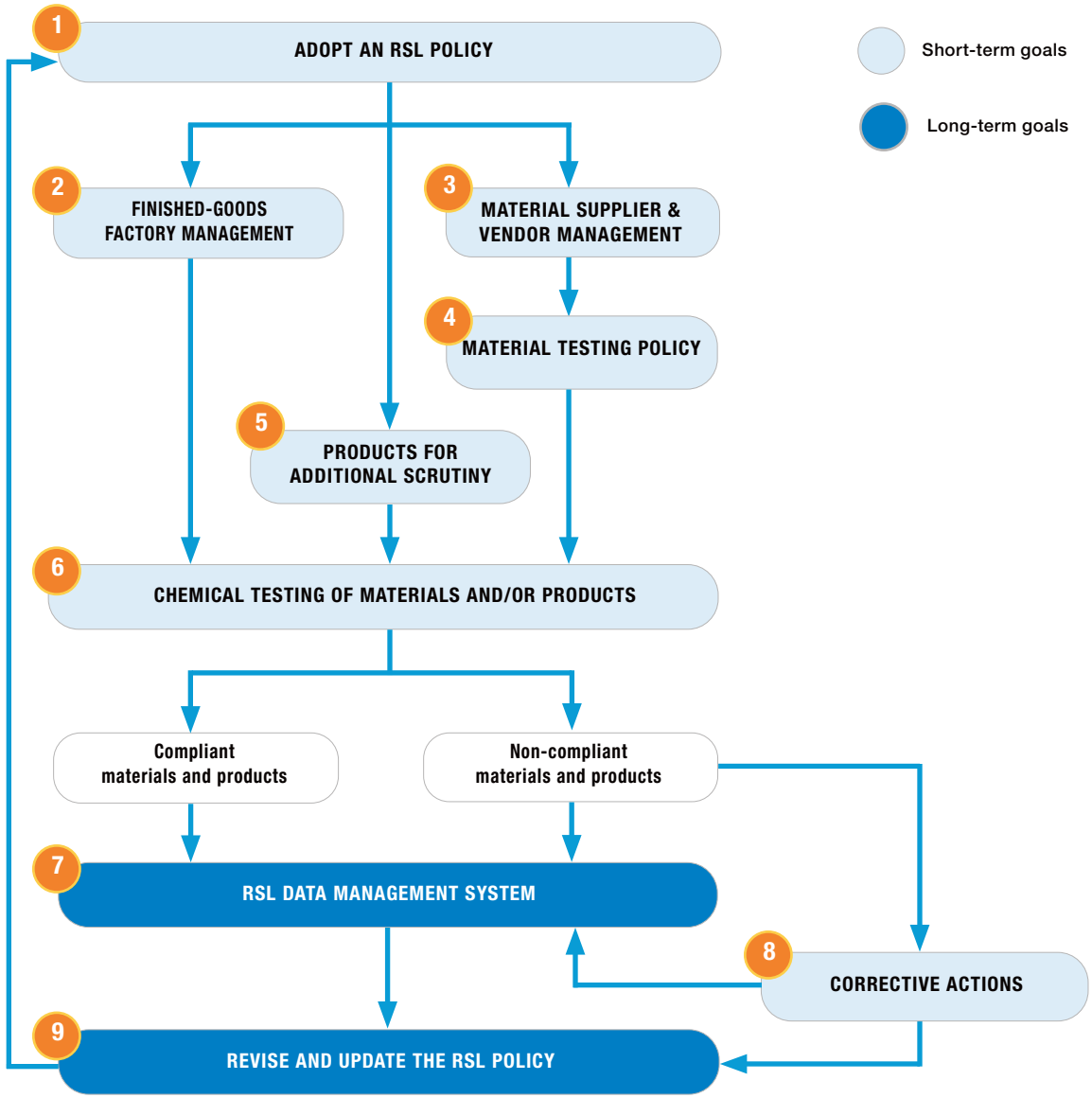
Appendix A outlines a path for brands commencing robust RSL compliance programs. Figure 3 shows each step, with corresponding best practices for managing a program described in text. AFIRM strongly suggests that brands build compliance with RSL requirements into the buying process so that it is an integral part of sourcing decisions.

1 Adopt an RSL Policy

The AFIRM RSL is a good starting point for brands beginning a journey into compliance. However, it is not the only policy, and it is important for a brand to adopt a policy that appropriately covers it range of products.

At the start of the journey, describe your overall management strategy to minimize RSL risk and identify short- and long-term goals. Examples of these goals are outlined on the next page.

Figure 3. Implementing a Robust RSL Policy



Examples of short-term goals:

- Identify RSL risk by materials. (See Section 3 and Appendices B and D.)
- Set up the RSL risk control strategy.
- Develop tracking report/system for strengthening RSL risk management.
- Report all RSL test results to management on a monthly basis.

Examples of long-term goals:

- Create an evaluation system to track factory and vendor compliance (i.e. a scorecard).
- Use the result of evaluation for future sourcing decisions.
- Share the RSL database with vendors.

2 Finished Goods Factory Management

Identify your factory locations and ensure you have a list that includes:

- Factory name
- Location
- Factory RSL contact name
- Factory RSL project team—the staff members responsible for RSL compliance

3 Material Supplier & Vendor Management

Risk from vendors can vary greatly. Your RSL management strategy should include verifying vendors' understanding of and commitment to global standards regarding restricted substances. Globally recognized vendors tend to have this knowledge, and non-global vendors may also have this knowledge through their efforts. Also consider supplier and product track records of RSL compliance, analyses, as well as passes and failures.

Formulate your management strategy to minimize risk from vendors:

- Do you classify vendors by RSL risk?
- How do you define high-risk and low-risk vendors?
- How do you ensure that new vendors understand and meet RSL requirements?

4 Material Testing Policy

List the material suppliers that your finished goods factories use and the materials they supply. Determine if any of these materials pose an increased risk. For example:

- High-risk materials might include leather, synthetic leather, TPU, metal, injection, ink, and paint.
- High-risk colors may include fluorescent colors, black-colored items, or items with a metallic finish.
- Items that come in direct contact with the skin can also be classified as high risk.

5 Products for Additional Scrutiny

You may have high-volume products, products for kids, or products that come into direct contact with the skin.

See Appendix B, Figure 7, for more details about performing additional testing on these products.

6 Chemical Testing of Materials and/or Products

The best way to manage the RSL is to employ staff with in-depth knowledge about product chemistry. Learning the processes and chemicals used by vendors is an important factor to understand product chemistry. This can be achieved either by studying the SDSs of materials or by speaking to suppliers and visiting their factories. (See Appendix H for examples and an explanation of SDSs.)

Chemical testing is another tool to better understand product chemistry. A thorough knowledge of the chemistry of the manufacturing process is also necessary to identify additional RSL risks that might be introduced during manufacture.

Any testing should prioritize components that pose the highest risk. (See Section 3 and Appendix D.) If required, chemical testing of components and products is preferable to testing upstream materials.

7 RSL Data Management System

RSL testing as described by the AFIRM group covers approximately 300 chemistries across 12 product types. Not all tests are appropriate for all material types. However, even with a small sub-set of analytes being tested, there will eventually be a large set of data for your brand.

A robust data-management system is essential for brands to have a state-of-the-art compliance program.

Such a system will allow a brand to:

- More closely assess their own supply chain with respect to product types.
- Pinpoint reliable and unreliable suppliers.
- Identify analytes of high concern in different materials.
- Prove compliance to appropriate legislators.
- Effectively track failure resolutions and corrective actions.
- Be transparent with vendors and suppliers.

8 Corrective Action

Though we would like to eliminate all risks, we recognize that there will be some component failures. The cause(s) of individual failures can be many and varied. Root-cause analysis should be performed to determine how to best reduce risk of RSL violations. See Appendix C for a failure resolution form useful for recording and retaining this information for future reference and to provide to brand customers.

Formulate a corrective action plan that works best for non-compliance issues. Important things to do immediately:

- Stop all further production of the non-compliant material/product.
- Assess scope of the problem and the current location of the non-compliant material.
- Work with the vendor/supplier to ensure they do not ship non-complaint material.

Follow-up actions can include:

- Understanding the root cause of the problem.
- Putting systems in place to make sure the issue does not arise again.
- Increased monitoring of the vendor/supplier with the issue.

9 Update and Revise the RSL Policy

Worldwide legislation is constantly changing. It is important to revise your policy on a yearly basis. AFIRM updates the AFIRM RSL in January each year, for example. The data gathered in the previous years' testing can be used to inform updates to the policy as well. For example, shifting focus onto materials your supply chain is struggling to meet the policy on and moving focus away from lower risk materials in your supply chain.

Appendix B. Model RSL Testing Program for Brands

This appendix provides an example of what a brand's testing program might look like. It is included to help suppliers understand the kind of testing requirements they can expect from customers and how to design their own internal testing protocols to meet them. Please note that no two brands have the same protocols and you should always check with your customer to make sure you fully understand their requirements.

1 Aim

To ensure chemical compliance and the safety of finished goods.

2 Objective

All finished goods must be reviewed according to an agreed-upon testing program to ensure that they are safe and legal.

3 Scope

This testing program applies to all brand finished goods, including clothing, accessories, jewelry, footwear, sport equipment, packaging, etc.

The protocol also covers products not branded but for which the brands have legal responsibility.

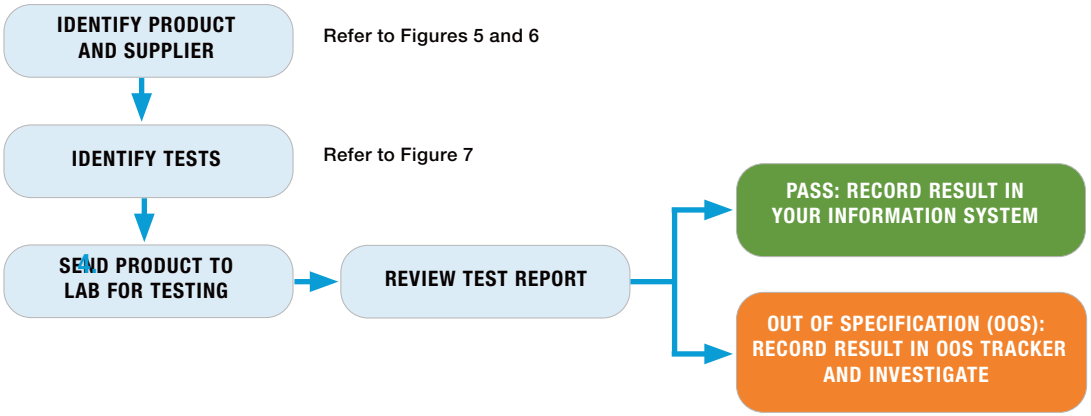
4 Introduction

As part of their responsibilities, it is important that brands perform a degree of analytical testing to monitor and prove product and supplier performance. Auditing suppliers and setting specifications alone is insufficient to ensure products are legal and safe.

Analytical testing is not designed as a tool to manage quality, although the information gathered from this testing may be used to monitor this indirectly.

- This product data will be used to ensure its chemical compliance and safety
- This product data could be used as part of their defense to prove compliance when challenged by trading standards / courts / media / consumer groups / NGOs.
- Test results will be used internally to demonstrate that management processes are in place and operating correctly.

Figure 4. Procedure for Product Surveillance



5 Procedure

Figure 4 outlines an example of a general, high-level procedure for product surveillance. Details on the first two steps are found in following sections.

6 Risk Assessment

Understanding the chemical risks in your supply chain, processes, and product is critical in making good and appropriate decisions. (See Understanding Chemical Risks on page 7).

It is important to know the composition of your products in order to adapt your testing protocol. For example:

- Leather components could contain Chromium VI, Short-chain Chlorinated Paraffins, Azo Dyes, or Formaldehyde
- Some leathers have a PVC coating; they could also contain Lead, Cadmium and Phthalates
- Some leathers have a PU coating; they could also contain Organotins and DMFa (as well as DMFu for PU-coated natural leathers)

To create your own testing protocol, you need to:

- Decide what kind of testing is required for each supplier (see Figure 5).
- Decide what testing is required for each product (see Figure 6 on the next page).
- Identify any chemical and physical testing required (see Figure 7 on the next page).

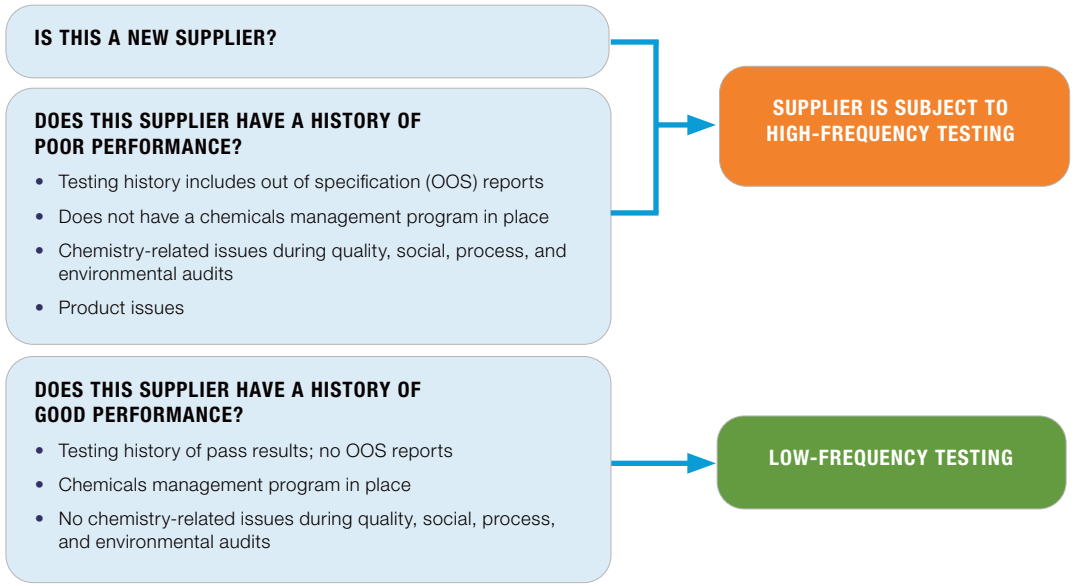
7 Tips for Deciding What to Test

All new suppliers should be deemed high risk and subject to a high-frequency testing until a level of confidence is established.

Low-frequency testing can be implemented for all suppliers who have, at a minimum, met the following requirements:

- Supplier has a chemical management system in place (e.g. policy, internal control plan, collection of certificates, training, etc.) and has been certified by bluesign® or ZDHC on that topic.
- Supplier has historically performed well in testing (e.g. no fail results in the past 12 months).
- Supplier has historically performed well in the chemical aspects of quality, process, environment, and social audits.

Figure 5. Supplier Risk Assessment



- All products classified as toys (items designed for use in play for children 14 years old or younger) should be tested as such according to existing international standards (e.g., dressing up out-fits/ disguise costumes, soft toys). It also applies to products that are not specifically sold as toys but have an obvious play value.

  Note: This is not exclusively a chemical requirement, but can encompass several product safety requirements.

- All infant, baby, and children's products are considered high risk and frequency of testing should reflect this as well as children's specific chemical limits, restrictions, or bans.

- All continuity products (permanent offer) should be tested once per year or whenever changes to materials or processes are made.

- In addition to chemical testing, all products with a promotional claim on its function should be tested to prove the claim. This is not a chemical requirement, but is worth noting to prove compliance. For example:

  - Nightwear flammability
  - Stain resistant
  - Waterproof / water resistant
  - Non-iron

Figure 6. Product Risk Assessment

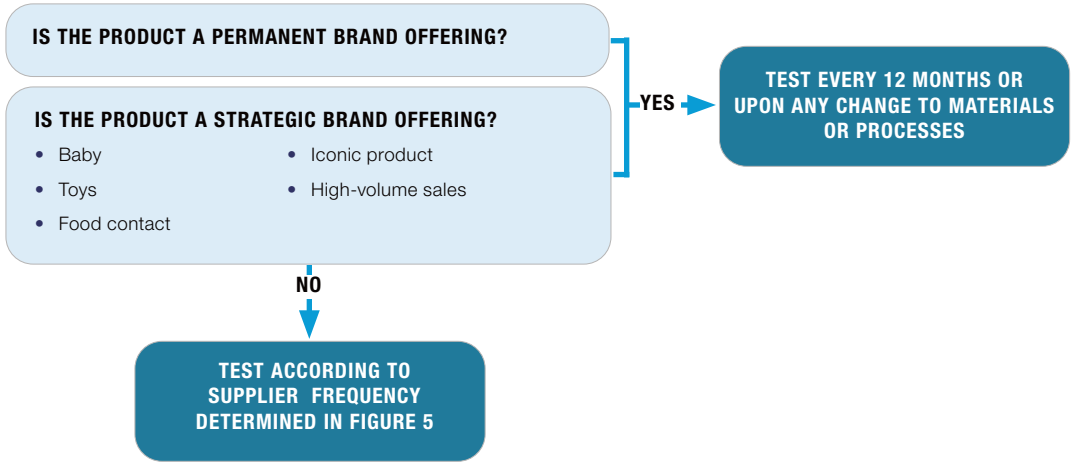
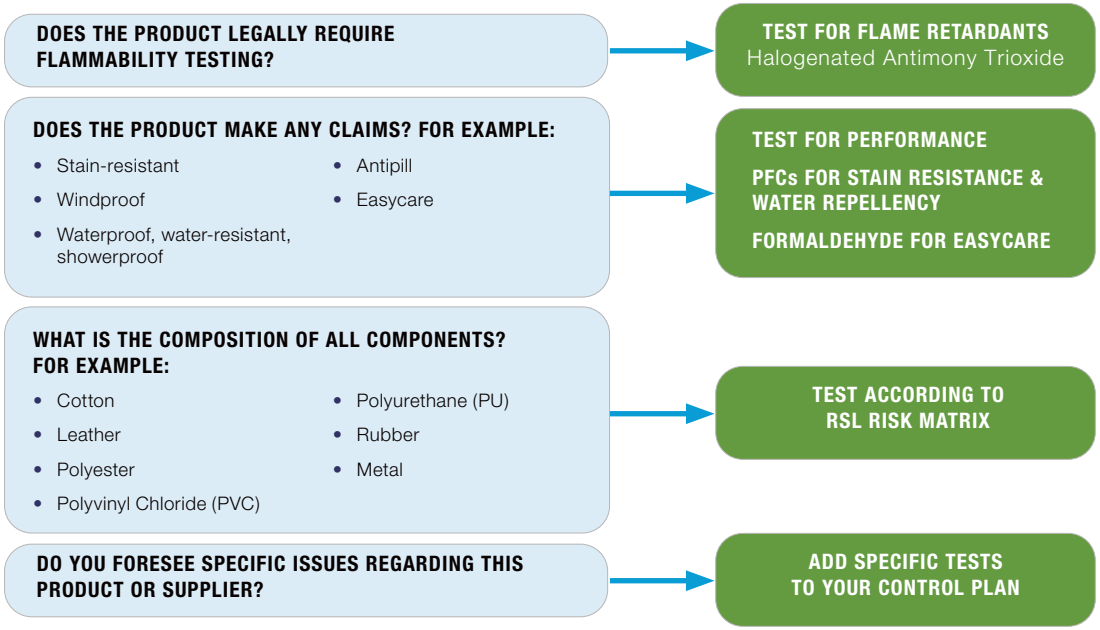


Figure 7. Testing Risk Assessment



Appendix C. Failure Resolution Form

A failure resolution form (FRF) is a useful tool for collecting, organizing, and retaining information about RSL failures to submit to your brand customers or for your own records.

There are a variety of tools available to define, analyze, solve, and prevent any future instances of the problem. One such tool is 8D. Further information on 8D methodology can be found at https://quality-one.com/8d/.

Figure 8. Example of a Failure Resolution Form

RSL Failure Resolution Form (FRF) Fields marked with * are required	
Which Brand was the sample tested for	Product type
Lab where sample was tested	Lab reference #
Sample Submitter Information	
Sample Submitter Company*	Sample Submitter Contact Name*
Sample Submitter Contact Info (phone/fax/email)*	
Vendor Information	
Vendor Name*	Vendor Code
Sample Information	
Material or Product Name*	Material Type*
Material Number or Product Code (or SKU)	Date Material Made
Color Name 1*	Color Code 1*
Sample Type* ○ Production-quality material ○ Research & development material ○ Finished product	
Follow up actions	
How much material is affected by this failure?	
Where is the affected material now?	
Describe your immediate next steps (for example) • material on hold. • material will be dropped. • formal root cause analysis to be performed.	
Please list any additional corrective and preventitive actions:	
Name of the person filling this form*	Date*

Appendix D. Examples of RSL Failures and Corrective Actions

This appendix draws content from a slide deck of actual RSL failures, with the corrective actions taken to resolve them. It includes recommendations for preventing the failures from happening again. Please note that this information is meant to provide high-level examples of where specific chemistry failures may be found in a range of product categories. This will not provide detailed guidance on how to avoid all such issues in the future. There are two valuable resources in this regard: AFIRM Chemical Information Sheets and Appendix G—Detailed Chemical Guidance Document.

Table of Contents

Alkylphenol Ethoxylates (APEOs)

FABRIC

Problem

APEOs were found on fabric in excess of the RSL limit.

Many scouring agents, which are used to remove oils and fats from textiles, contain APEOs as a surfactant.

There are many alternatives currently available without APEOs.

Corrective Actions

- Vendor sourced an APEO-alternative scour agent, with no cost increase.
- Brand communicated concern about APEOs to vendor.

SHOE INSOLE

Problem

APEO was detected in an insole board.

APEOs occur in many steps of the production process, as they are commonly found in surfactant-based chemistries.

Contamination from APEOs can be a common problem.

Corrective Actions

- Vendor sourced an APEO alternative scour agent with no cost increase.
- Brand communicated concern about APEOs with vendor.

LEATHER BAG

Problem

NPEO was detected in a pigskin handbag.

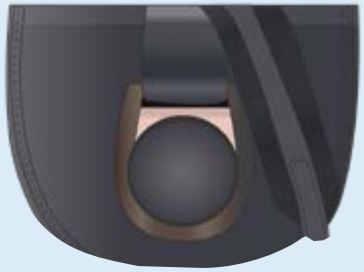
NPEOs are usually associated with degreasing agents.

Root Cause

- Due to a ban on raw material products from Japan, supplier had switched to a new degreasing agent for leather. This formula was found to contain NPEOs.

Corrective Action

- Using the ZDHC chemical gateway, the supplier found a decreasing agent that complied with the ZDHC MRSL and did not contain NPEOs.



Azo Dyes

DRAWCORD

Problem

Cord supplier used a dyestuff that contained prohibited Azo Dyes in a corded children's sweater.

Corrective Actions

- Product was not sold.
- Supplier integrated RSL-compliant dyestuff from a quality chemical company with little to no cost impact.
- RSL requirements were communicated to all suppliers.

Disperse Dyes

WOVEN LABEL

Problem

Restricted disperse dye was found in a woven label.

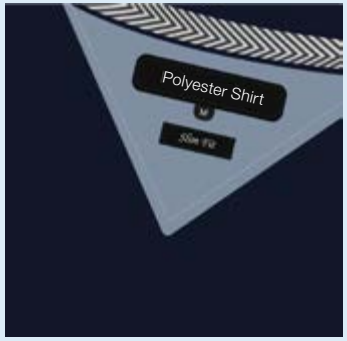
Restricted disperse dyes are used in polyester dyeing and can cause allergic reactions.

Root Cause

- Label was from well-known compliant suppliers, and yarns were not dyed with disperse dyes.
- Backer to label was found to fail for dyes.

Corrective Action

- Supplier changed backer and destroyed all inventory of failed backer color.



Chlorinated Phenols (PCPs)

SHOE ADHESIVE

Problem

PCPs were detected in shoes.

PCPs can be used as precursors in the manufacturing process for adhesives. If this process is not optimized, Phenols can be found as contaminants. They also can be found as biocides in preservatives.

Root Cause

- PCPs were found as contaminants in the adhesive used to manufacture the shoe.

Corrective Action

- Supplier worked with chemical supplier to obtain a PCP-free adhesive that was compliant with the ZDHC MRSL.

PRINTED SILK FABRIC

Problem

Chlorinated Phenol was detected on printed silk fabric.

Chlorinated phenols can be used as anti-microbials in the guar gum thickeners used in silk production.

Corrective Action

- Printer switched from guar gum to alginate thickener to avoid contamination problems.

Formaldehyde

DISCHARGE SCREEN PRINT

Problem

Discharge screen print failed RSL limit for Formaldehyde.

Many ink systems contain Formaldehyde to break down the color of the garment-dyed fabric.

Root Cause

- Printer found ink system was using Zinc Formaldehyde Sulfoxylate (ZFS) catalyst.

Corrective Actions

- Printer worked with ink supplier to optimize printing concentrations and to find a Formaldehyde-free catalyst system for discharge prints.
- Curing times and temperatures were kept consistent to meet RSL requirements.

BASEBALL HAT

Problem

Backing fabric treated with resin stiffener failed the RSL limit for Formaldehyde.

Urea Formaldehyde resins are common chemicals used in durable press resins.

Corrective Actions

- In the short term, caps were washed to reduce the amount of Formaldehyde.
- Backing fabric was replaced with passing fabric for some of the hats.
- No process control could be established to prevent Formaldehyde failure; new material was developed to meet standards.
- Factory had not switched materials for all customers, so contamination from drying units needed to be monitored.

WRINKLED-FINISH T-SHIRT

Problem

Cotton t-shirt treated with resin stiffener failed the RSL limit for Formaldehyde.

Urea Formaldehyde resins are common chemicals used in durable press resins to produce a wrinkled effect.

Root Cause

- Wrinkle finish was originally cured for too short a period of time and at a lower temperature than recommended.

Corrective Actions

- In the short term, garments were washed to reduce the amount of Formaldehyde.
- Processes were changed to improve durability and RSL compliance
- Conditions were carefully controlled to manage finished product compliance.

Formaldehyde

PIGMENT-PRINTED GARMENTS

Problem

Formaldehyde-releasing melamine resin failed the RSL limit for Formaldehyde.

Formaldehyde-releasing melamine resin is commonly used as a crosslinker in pigment-printed garments.

Corrective Actions

- Diisocycanate crosslinker was employed as an alternative approach.
- Measurements were taken to prevent occupational hazards when utilizing diisocyanate crosslinker alternatives:
  - Proper cure time, correct ratios, controlled printing conditions.
- Chemical supplier provided a Formaldehyde-free option, but EH&S needed to be considered for new chemistries.

COTTON FABRIC

Problem

Cotton fabric failed children's Formaldehyde standard.

Urea Formaldehyde resins are common chemicals used in durable press resins.

Root Cause

- A typo found in the fabric batch formula caused the Formaldehyde concentration to exceed the RSL limit.

Corrective Actions

- Supplier changed quality control procedures to review the formula before commencing production for future orders.
- Testing for affected products was increased during development and production.

LEATHER

Problem

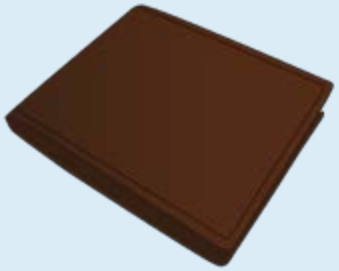
Formaldehyde was found in a full-grain leather wallet.

Root Cause

- Formaldehyde was present in a re-tanning chemical without an intended chemical function.

Corrective Actions

- In the short term, the leather supplier decreased the percent of Formaldehyde-containing tanning chemical in the material formula to reduce Formaldehyde amount in finished products.
- Leather supplier found a Formaldehyde-free chemical to replace the contaminated chemical in the re-tanning process.



Heavy Metals

CADMIUM IN PVC PRODUCT

Problem

Cadmium exceeded the RSL limit in Polyvinyl Chloride (PVC) product.

PVC contains Heavy Metal stabilizers, such as Cadmium, and Phthalates for flexibility. Cadmium may also be used in pigments.

Corrective Actions

- PVC layer was substituted with a thermoplastic polyurethane (TPU).
- New material substitutes were investigated.

LEAD IN INFANT SHOES

Problem

Red paint on trim of an infant shoe contained Lead in excess of RSL limits.

Lead, which is acutely toxic in high concentrations, can be used as a pigment in paints.

Corrective Actions

- In the short term, the brand recalled the product.
- Factory began a more comprehensive testing program for sourced raw materials.

LEAD IN PU-COATED FABRIC

Problem

Polyurethane (PU) coated fabric contained high levels of Lead.

The presence of Lead could be due to its use as a stabilizer or pigment; it is not likely caused by contamination.

Corrective Actions

- Increased testing of raw materials.
- Brand gave RSL requirements to garment factory and communicated requirements with PU fabric vendor.

Heavy Metals

LEAD IN SOCK LINERS

Problem

Lead was detected in the coating on the top cover fabric of sock liners.

Heavy metals, including lead, are often used in low-cost pigments and inks.

Root Cause

- Lead was used the heat transfer print on the sock liner.

Corrective Actions

- Factories communicated brand requirements to upstream suppliers.
- Products were strategically tested at all stages of production.

CHROMIUM IN WOOL & NYLON FABRICS

Problem

Chromium was detected on wool and nylon fabrics.

Chromium can be used in metalized dyes.

Root Cause

- Chemicals were tested and no metalized dye was used. Mill had old non-compliant fabric in the factory that was incorrectly sent for testing.

Corrective Actions

- Supplier implemented a better inventory management system, storing non-compliant materials in clearly marked areas.
- Long term, only compliant materials should be produced to avoid contamination issues.

CHROMIUM (VI) IN LEATHER SHOES

Problem

Chromium (VI) was detected in leather shoes above the RSL limit.

Chromium (III) can oxidize into Cr(VI) with high temperatures, exposure to sunlight, and low humidity.

Root Cause

- Article was originally tested without using an aging preparation and no Chromium VI was detected. When the sample was re-tested with an aging step, Chromium VI was found.

Corrective Action

- The tannery was alerted to the issue and improved their processes to minimize the risk of Chromium VI formation. Subsequent batches of leather from this tannery were closely monitored using the aging preparation of the leather to ensure the issue did not arise again.

Heavy Metals

MERCURY IN HEAT TRANSFER

Problem

Printed heat transfer failed for mercury.

Mercury can be used as a pigment but often contamination is the reason for Mercury failures.

Root Cause

- The source of mercury was a cleaning solvent that contaminated a mixing beaker.

Corrective Actions

- In the short term, the heat transfer supplier eliminated the suspected cleaning agent.
- Processes were changed to mix inks in disposable mixing containers.
- Time frames were established for keeping custom-mixed inks.

Organotin Compounds

FOIL SCREEN PRINT

Problem

Foil screen prints on children's t-shirts were found to contain Organotins.

Organotins are often used as heat stabilizers in low-quality adhesives and prints used in printing and transfer processes. Many non-Organotin alternatives exist.

Root Cause

- The cheap adhesive used in the original foil print contained Organotins as a heat stabilizer.

Corrective Action

- Supplier used a higher quality adhesive that had a non-Organotin heat stabilizer.

Perfluorinated and Polyfluorinated Chemicals (PFCs)

WATER-REPELLENT FABRIC

Problem

PFOA was detected in a webbing fabric.

Long-chain Perfluorinated and Polyfluorinated Chemicals (PFCs), such as PFOA, are used as cheaper alternatives to short-chain PFCs in DWR treatments. They can also be found as contaminants in short-chain PFC finishes.

Root Cause

- After checking the SDS, the supplier found PFOA was in the DWR finishing chemical formula.

Corrective Action

- Supplier substituted an MRSL-compliant alternative, which was free of long-chain PFCs (PFOS / PFOA).

Phthalates

SCREEN PRINTS

Problem

In testing, screen-print inks containing PVC failed for DEHP (Phthalate).

Phthalates are often used to soften ink and prevent cracking. There are many non-Phthalate plasticizers available.

Root Cause

- The spray adhesive used to hold the garment in place during printing contained DEHP, contaminating the finished garment.

Corrective Actions

- Printer substituted a different spray adhesive to achieve compliance.
- Supplier then looked to substitute a silicone-based print for the PVC-based screen print.

PLASTIC SOLE

Problem

Company received consumer complaints that flip-flop sandals had a sticky feeling and were removing finishes on wood floors.

Plasticizers are commonly used in plastics and foams to increase flexibility and improve performance. Many Phthalate-based plasticizers have been banned. Suppliers can use safer alternatives such as Acetyltributylcitrate (ATBC).

Root Cause

- Manufacturer claimed to use ATBC as a plasticizer in the sole of the flip-flop, but instead used TBC as a cheaper substitute. TBC is known as a solvent that de-coats furniture.

Corrective Action

- Brand communicated with manufacturers that chemical substitutions should not be made based on price alone without looking at safety, quality, and performance impacts.

Polycyclic Aromatic Hydrocarbons

RUBBER LOGO

Problem

Molded black rubber logo failed testing for Polycyclic Aromatic Hydrocarbons (PAHs).

PAHs can be found as a contaminant in carbon black and are sometimes used in rubber production.

Root Cause

- Supplier found that Naphthenic oil was used to produce the rubber.

Corrective Action

Supplier reformulated material and substituted Naphthenic oil out of the formula.

Volatile Organic Compounds

SCREEN PRINT

Problem

Small amounts of Volatile Organic Compounds (VOCs) were detected in the ink at screen-print facility.

VOCs are often used in solvents for a variety of manufacturing processes.

Root Cause

- Printer investigated and discovered contamination from its solvent supplier's recycling tanks.

Corrective Actions

- Tools were better handled, stored, and sanitized to prevent contamination.

BLACK SOCKS

Problem

Consumers complained of a solvent smell in cotton-rayon socks. Testing revealed they contained Dimethylformamide (DMFa) and Methylene Chloride.

Root Cause

- Supplier was lubricating the knitting yarn with an unlabeled solvent with no SDS information. When the yarn was tested, it contained restricted VOCs.

Corrective Actions

- Production was stopped immediately.
- All current stock and shipments were destroyed.
- The supplier switched to an RSL-compliant lubricant.

Appendix E. Best Practices for Screen-Printing Applications and Finishing

Brand RSLs may restrict substances not subject to usage bans to certain concentrations in finished products. These substances may be used, but appropriate steps must be taken to ensure that residual amounts or accidental contaminants do not exceed documented limits. Solvents, for example, may be used with careful attention to drying/curing times to greatly reduce or eliminate the amount remaining on the finished product. This appendix provides general guidance on drying/curing best practices as well as examples of good and bad practices for maintaining screen-print production areas.

Curing Overview

Many applications and finishes require curing, such as resin finishing for a 3-D effect, easy-care, or screen printing. "Curing" is not limited to drying materials or garments, but involves chemical reactions that begin at specific temperatures and take time to complete. It is important to understand and control the curing temperature and duration to fully react chemicals.

Information about appropriate curing conditions can be obtained from chemical suppliers. Improper or incomplete curing may lead to both chemical product safety (RSL) and performance issues (e.g., losing the 3-D/easycare effect after a few home launderings).

Best Practices

Suppliers working with resins, screen prints, or other applications that require curing should:

- Request technical data sheets (TDSs) from chemical suppliers and follow the listed curing condition instructions.
- Document the finishing/screen-print formulation and curing conditions.
- Calibrate the oven regularly and keep a calibration record. (Note: The digital display attached to the oven should be confirmed to represent the actual temperature in the oven.)
- If a conveyor belt oven is used in factories located in colder climates, understand the temperature gradient at different parts of the oven, as this may result in inconsistent quality or concentrations of residual chemicals in the finished garments.
- Start the curing time requirement when the garment surface temperature reaches the required curing temperature, not simply when the garment is placed in the oven.

Temperature checking stickers are available, but these only record the highest temperature on the garment surface. There are also digital devices that can check the garment surface temperature at regular time intervals. These devices can give a more detailed profile of garment surface temperature differences, which allows for better control of the curing process.

RESOURCE: Best Practices for Screen-Printing Applications & Printing

This slide deck provides examples and pictures of best and worst practices at screen-print facilities.

Appendix F. Benefits of Water-based Polyurethane

This appendix briefly describes the development of water-based Polyurethane dispersions for use in apparel and footwear products, along with the various benefits of transitioning to this technology.

Solvent-based Polyurethane Drawbacks

Solvent-based Polyurethane (PU) production involves the use of volatile organic solvents with links to reproductive toxicological issues.

The harmful properties of these solvents make them the subject of regulatory action restricting their use and allowable concentrations in finished products. These substances are increasingly the target of various authorities.

Commonly used solvents in the production of PU, synthetic PU-leather, and PU coatings include *N,N*-dimethylformamide (DMF), Toluene, *N*-Methylpyrrolidone (NMP), Methyl Ethyl Ketone (MEK) and *N,N*-dimethylacetamide (DMAC).

Most AFIRM companies restrict these substances in finished products, and they are a regular cause of RSL failures due to improper drying/curing conditions during production. Improperly equipped and incorrectly configured factories regularly release these solvents into the ambient air, which harms factory workers directly and the environment generally. Residual amounts of these substances on finished products present consumer product safety issues for customers.

Polyurethane-Waterborne NMP-free Dispersions

Water-based PU is not a new technology, but it has typically not been used in the apparel and footwear industry. New technology, however, has enabled the development of high-quality synthetic PU leather with minimal use of volatile organic solvents. This synthetic leather can be used in footwear, apparel, and accessories with minimal investments. A new foam generator is necessary, but traditional equipment such as a coating line and mixing units can usually be left unchanged.

Although water-based PU uses a dry process, it can be used in plants that currently use the wet process.

There are multiple benefits associated with transitioning to water-based PU, including:

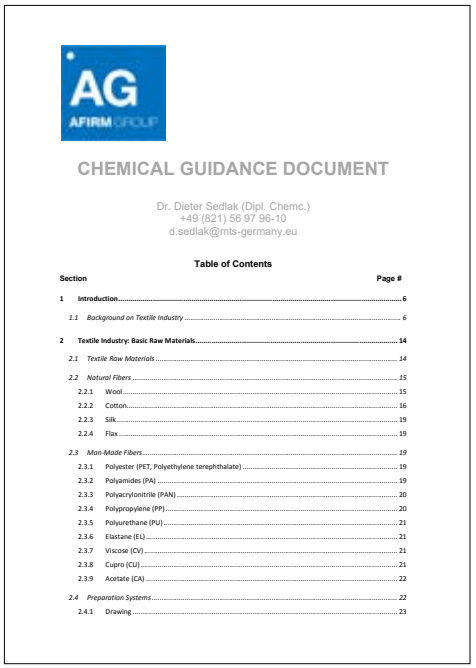
- Dramatic reduction of toxic solvent use (worker/consumer/environmental safety)
- Reduced energy use (cost savings)
- Reduced use of solvents (cost saving as prices for solvents are expected to go up)
- Reduced greenhouse gas (GHG) emissions

Appendix G. Detailed Chemical Guidance Document

This Chemical Guidance Document provides readers with a detailed overview of the types of chemicals used in textile and leather goods manufacturing. It also offers information on many aspects of apparel manufacturing, from raw materials to finishing and applications. It is best used as a reference for understanding particular aspects of manufacturing and the chemical risks involved.

RESOURCE: Detailed Chemical Guidance Document

The document is divided into sections with a table of contents and index of chemicals for easy reference and navigation. If viewed onscreen, it can be searched for specific terms using the Find (Ctrl-F) function in the PDF viewer.



CHEMICAL GUIDANCE DOCUMENT

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Appendix H. Safety Data Sheets

Safety data sheets (SDSs) were formerly known as material safety data sheets (MSDSs). SDSs provide valuable information about a chemistry, which can be used to assess risk and establish controls to protect human health and the environment. In addition, SDSs contain valuable regulatory and ingredient-level information to help suppliers avoid restricted substances issues.

Safety Data Sheets Based On Global Harmonized System Standards

SDSs can vary widely in format. AFIRM advises suppliers to require high-quality SDSs from their chemical suppliers that use the Global Harmonized System (GHS). GHS is a widely accepted global standard managed by the United Nations that, when combined with local country regulations, offers the most comprehensive information.

For additional information, including examples of SDS files and in-depth documentation of each SDS section, please visit the Outdoor Industry Association website: https://outdoorindustry.org/chemical-manuals/1/en/topic/safety-data-sheets-sds

Limitations of Safety Data Sheets

SDSs represent only the specific chemistry they were designed to describe. Therefore, an SDS that represents a chemical used in the manufacture of a product will not necessarily apply to the final product itself.

For example, an ink may be applied to change the color of a shirt, but much of the chemicals (by volume) of the ink may be washed away or evaporated before the product is ready for market. An additional caveat of an SDS for chemical mixtures is that, in many circumstances, only chemicals present above 1% (or 0.1% if the chemical is a carcinogen) are required to be disclosed. This can, in effect, lead to an incomplete comprehension of the risk associated with the use of a particular chemical product. So, while an SDS documents a chemistry chosen to create a product, additional expertise is needed to understand manufacturing processes to accurately document chemicals that may be present in a final product.

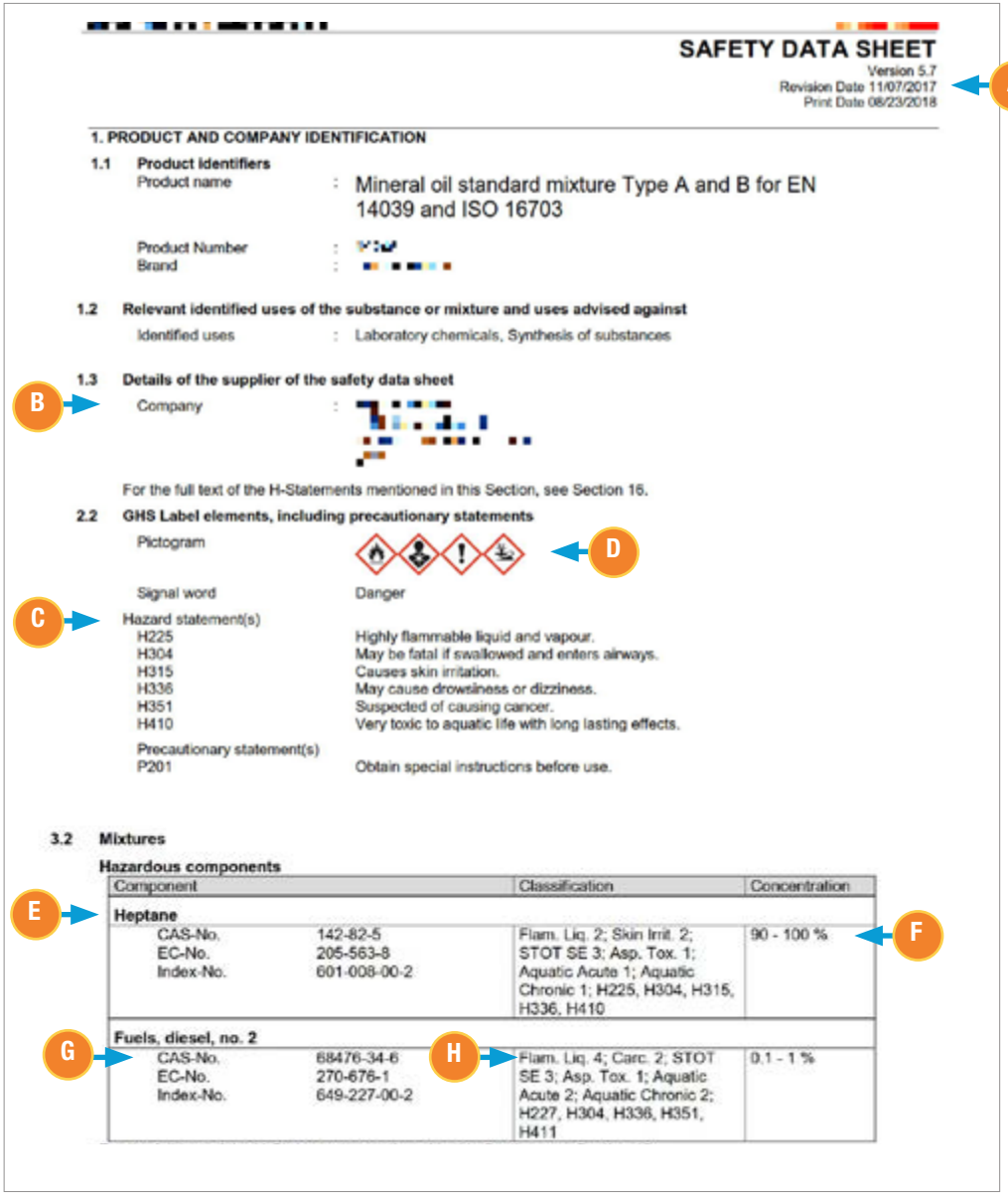
Important Sections

An SDS is often a dense document with a wealth of information. However, there are certain sections that need particular attention. These are highlighted in Figure 9.

- **A** A **version date** within the last three years.
- **B** **Contact information** for the supplier in case the reader has further questions regarding the product.
- **C** **Hazard statements** to enable a rapid assessment of the risks.
- **D** **Pictograms**, which can be used in in-house labelling to clearly communicate risks to workers.
- **E** **Component common name** so that the chemical can be further researched.
- **F** **Concentration of each component**, which allows suppliers to determine relative risk.
- **G** **CAS numbers** of the chemical components—useful for keeping up to date with legislation related to the product.
- **H** **Hazards at a component level**; used with concentration to determine relative risk.

Although SDSs can vary in format, AFIRM suppliers should require their chemical suppliers to provide SDSs like the preferred example here.

Figure 9. Key Elements of a Safety Data Sheet



SAFETY DATA SHEET

Version 5.7
Revision Date 11/07/2017
Print Date 08/23/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Mineral oil standard mixture Type A and B for EN 14039 and ISO 16703

Product Number :
Brand :

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company :

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word: Danger

Hazard statement(s)

H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.

3.2 Mixtures

Hazardous components

Component		Classification	Concentration
Heptane			
CAS-No.	142-82-5	Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315, H336, H410	90 - 100 %
EC-No.	205-563-8		
Index-No.	601-008-00-2		
Fuels, diesel, no. 2			
CAS-No.	68476-34-6	Flam. Liq. 4; Carc. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 2; Aquatic Chronic 2; H227, H304, H336, H351, H411	0.1 - 1 %
EC-No.	270-676-1		
Index-No.	649-227-00-2		

Appendix I. Online Resources

Restricted Substance Lists & RSL Resources

AAFA Restricted Substance List
https://www.aafaglobal.org/AAFA/Solutions_Pages/Restricted_Substance_List

This RSL was created by a special working group of the American Apparel & Footwear Association's (AAFA) Environmental Task Force. The RSL is intended to provide apparel and footwear companies with information related to regulations and laws that restrict or ban certain chemicals and substances in finished home textile, apparel, and footwear products around the world.

AFIRM Member Brands
www.afirm-group.com/members/

AFIRM Restricted Substances List
www.afirm-group.com/afirm-rsl/

This RSL was created by the Apparel & Footwear International RSL Management Group (AFIRM). This RSL lists substances currently subject to legislated limits around the world, as well as limits based on best practices in the apparel and footwear industries.

bluesign®
https://www.bluesign.com/index.html

The bluesign® system aims to link all stages of the manufacturing supply chain and remove harmful chemicals through the use of input technology.

ChemSec – SIN List
http://chemsec.org/sin-list/

The SIN List is published by ChemSec and used to identify hazardous chemicals under the definitions and standards used by REACH. This list is meant to provide a glimpse into harmful chemicals that may be regulated in the future.

Ecological Toxicological Association of Dyestuffs (ETAD)
http://etad.com/en

An industry group with the operating goal of being active wherever the safety of colorants is discussed, to provide scientific know-how so that any risk for customers as well as end users is minimized.

OEKO-TEX®
https://www.oeko-tex.com/en/business/business_home/business_home.xhtml

OEKO-TEX® is an association of textile research and testing institutes that have developed assessment standards in manufacturing to certify entities in the areas of chemicals management, environmental performance, environmental management, social responsibility, quality management, and occupational health & safety.

Zero Discharge of Hazardous Chemicals Programme
https://www.roadmaptozero.com/

The Zero Discharge of Hazardous Chemicals (ZDHC) Programme aims to remove hazardous chemicals in the textile, leather, and footwear supply chain for the improvement of the environment and human health. Made up of a number of stakeholder brands, value chain affiliates, and associates, ZDHC focuses on Manufacturing Restricted Substances List (MRSL) guidance, wastewater quality, audit protocol, and research to advance their mission.

ZDHC Manufacturing Restricted Substances List
https://www.roadmaptozero.com/programme/manufacturing-restricted-substances-list-mrsl-conformity-guidance/

The ZDHC Programme created this MRSL to target restricted chemicals during the manufacturing stage. Instead of restricting chemicals at the finished product stage, the MRSL manages chemical input within manufacturing facilities prevent any intentional use.

Meeting Customer Needs for Chemical Data: A Guidance Document for Suppliers

Green Chemistry and Commerce Council (GC3)
https://greenchemistryandcommerce.org/resources/gc3-publications

Business-to-business communication of chemical data, such as chemical identity and health and safety impacts, along supply chains is critically important to product manufacturers' efforts to make informed decisions on the health and environmental impacts of the products that they put on the market.

Forward-looking companies working to bring safer products to market need the active engagement of suppliers to provide relevant chemical information. This document provides tools and examples in support of improved supply chain communication between suppliers and their customers, and in the development of more sustainable products.

Laboratory Resources

List of CPSC-accepted Testing Laboratories
https://www.cpsc.gov/cgi-bin/labsearch/

To provide an up-to-date resource to find a reputable testing lab, the CPSC-accepted list of testing labs is a good place to start. This is a list of entities that have been accredited to assess conformity with children's product safety rules as required by the CPSIA. The laboratories in this list have been accepted as accredited to test products to one or more of these children's product safety rules, as identified in the accreditation scope for each laboratory.

Global Regulation & Chemical Resources

European Chemicals Agency
https://echa.europa.eu

The European Chemicals Agency (ECHA) is an agency of the European Union that manages the technical, scientific and administrative aspects of the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) system.

Information about the following can be found on ECHA website:

REACH Legislation Information. REACH is the Regulation for Registration, Evaluation, Authorisation and Restriction of Chemicals. It entered into force on 01 June 2007 to streamline and improve the former legislative framework on chemicals of the European Union (EU).

Substances of Very High Concern (SVHC). Substances that are included in the Candidate List have been identified as Substances of Very High Concern. Substances on the Candidate List may subsequently become subject to authorisation by decision of the European Commission. Substances are added to the Candidate List by ECHA. The inclusion of a substance in the List may have legal obligations on companies.

Information on Registered Substances
https://echa.europa.eu/information-on-chemicals/registered-substances

Here you can search in the ECHA database for information on registered substances.

The information in the database was provided by companies in their registration dossiers. You can find a variety of information on the substances which companies manufacture or import: their hazardous properties, their classification and labeling and how to use the substances safely.

Consumer Product Safety Improvement Act
www.cpsc.gov/en/Regulations-Laws--Standards/Statutes/The-Consumer-Product-Safety-Improvement-Act/

The Consumer Product Safety Improvement Act (CPSIA) of 2008 is a U.S. law imposing testing and documentation requirements, and sets new acceptable levels of several substances. It imposes requirements on manufacturers of apparel, shoes, personal care products, accessories and jewelry, home furnishings, bedding, toys, electronics and video games, books, school supplies, educational materials and science kits.

U.S. Environmental Protection Agency
www.epa.gov

The U.S. Environmental Protection Agency (EPA) is an agency of the United States federal government charged with protecting human health and the environment, by writing and enforcing regulations based on laws passed by Congress. This agency administers laws such as the Clean Air Act (CAA), Clean Water Act (CWA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund), Resource Conservation and Recovery Act (RCRA), and Toxic Substances Control Act (TSCA).

EPA Integrated Risk Information System
www.epa.gov/iris/index.html

The Integrated Risk Information System (IRIS) is a human health assessment program that evaluates quantitative and qualitative risk information on effects that may result from exposure to environmental contaminants. IRIS was initially developed for EPA staff in response to a growing demand for consistent information on substances for use in risk assessments, decision-making, and regulatory activities.

The information in IRIS is intended for those without extensive training in toxicology, but with some knowledge of health sciences.

California State Safer Consumer Products Act
Formerly Green Chemistry Initiative
California Department of Toxic Substance Control
https://dtsc.ca.gov/scp/

California state government is developing an alternative analysis framework to stimulate the rapid acceleration of replacing harmful chemicals and ingredients with safer alternatives in products sold in California. Work performed under this initiative will become regulation under California law.

California Department of Toxic Substance Control (DTSC) has released of an outline of the Draft Regulations for Safer Products as a second step in identifying chemicals of concern and fostering the design of safer products sold in California.

The outline proposes guidelines for scientific and systematic prioritization of chemicals and products of concern, certification of alternatives assessment and development of DTSC's regulatory response. With this outline, DTSC will continue its collaboration with all stakeholders, governmental agencies, and the public to transform the outline into the Green Chemistry Regulations for Safer Products. The outline builds from the conceptual framework completed in March of 2010. The next step is creating draft regulations based on the outline and framework. The draft regulations will be released in the very near future.

California Proposition 65 (Prop 65)
http://oehha.ca.gov/prop65.html

Proposition 65 is a California law intended to eliminate exposures to those chemicals identified as harmful to the environment and the citizens of the State of California.

Proposition 65 regulates substances officially listed by California as causing cancer or birth defects or other reproductive harm in two ways. The first regulatory arm of Proposition 65 prohibits businesses from knowingly discharging listed substances into drinking water sources or onto land where the substances can pass into drinking water sources. The second regulatory arm of Proposition 65 prohibits businesses from knowingly exposing individuals to listed substances without providing a clear and reasonable warning.

Washington State Children's Safe Products Act
Washington Department of Ecology
https://ecology.wa.gov/Waste-Toxics/Reducing-toxic-chemicals/Childrens-Safe-Products-Act

As of August 2012, the Washington State Child Safe Product Act (CPSA) requires apparel companies to report concentrations of 66 substances down to the component level of children's apparel and footwear products.

Chemical & Risk Assessment Resources

Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

The Agency for Toxic Substances and Disease Registry (ATSDR), based in Atlanta, Georgia, U.S.A., is a federal public health agency of the U.S. Department of Health and Human Services. ATSDR serves the public by using the best science, taking responsive public health actions, and providing health information to prevent harmful exposures and diseases related to toxic substances.

European Chemical Substances Information System
https://echa.europa.eu/information-on-chemicals

The European Chemical Substances Information System (ESIS) is a publicly available IT system from the European Commission Institute for Health and Consumer Protection Joint Research Center. ESIS provides information on chemicals, related to:

- EINECS (European Inventory of Existing Commercial Chemical Substances) O.J. C 146A, 15.6.1990,
- ELINCS (European List of Notified Chemical Substances) in support of Directive 92/32/EEC, the 7th amendment to Directive 67/548/EEC,
- NLP (No-Longer Polymers),
- BPD (Biocidal Products Directive) active substances listed in Annex I or IA of Directive 98/8/EC or listed in the so-called list of non-inclusions,
- PBT (Persistent, Bioaccumulative, and Toxic) or vPvB (very Persistent and very Bioaccumulative),
- CLP/GHS (Classification, Labelling and Packaging of substances and mixtures), CLP implements the Globally harmonised System (GHS), Regulation (EC) No 1272/2008,
- Export and Import of Dangerous Chemicals listed in Annex I of Regulation (EC) No 689/2008,
- HPVCs (High Production Volume Chemicals) and LPVCs (Low Production Volume Chemicals), including EU Producers/Importers lists
- IUCLID Chemical Data Sheets, IUCLID Export Files, OECD-IUCLID Export Files, EUSES Export Files,
- Priority Lists, Risk Assessment process and tracking system in relation to Council Regulation (EEC)

Global Portal to Information on Chemical Substances
https://www.echemportal.org/echemportal/

The eChemPortal provides free public access to information on the properties of chemicals:

- Physical chemical properties
- Ecotoxicity
- Environmental fate and behavior
- Toxicity

eChemPortal allows simultaneous searching of reports and datasets by chemical name and number, and by chemical property. Direct links to collections of chemical hazard and risk information prepared for government chemical review programmes at national, regional, and international levels can be obtained. Classification results according to national/regional hazard classification schemes or to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) are provided when available.

The eChemPortal is an effort of the Organisation for Economic Co-operation and Development (OECD) in collaboration with the European Commission (EC), the European Chemicals Agency (ECHA), the United States, Canada, Japan, the International Council of Chemical Associations (ICCA), the Business and Industry Advisory Committee (BIAC), the World Health Organization's (WHO) International Program on Chemical Safety (IPCS), the United Nations Environment Programme (UNEP) and environmental non-governmental organizations.

Appendix J. Glossary of Terms

Article. An object that is given a special shape, surface, or design during production, which determines its function to a greater degree than it does its chemical composition (fibers, textile fabrics, buttons, zippers, etc.).

Bioaccumulative. Substances that cannot be eliminated by living organisms and tend to bioaccumulate, which means they become more concentrated throughout the food chain. Concentrations of these substances can reach levels that are harmful to human health or the environment.

Carcinogenic. A carcinogenic substance is one where a relationship has been established between exposure to the substance and human cancer.

CAS. CAS registry numbers are unique numerical identifiers for chemical elements, compounds, polymers, biological sequences, mixtures, and alloys. Chemical Abstracts Service (CAS), a division of the American Chemical Society, assigns these identifiers to every chemical that has been described in the literature. The intention is to make database searches more convenient, as chemicals often have many names. Almost all molecule databases allow searching by CAS number.

Chemical substance. A chemical element and its compounds with constant composition and properties. It is defined by the CAS number.

Globally Harmonised System of Classification and Labelling of Chemicals (GHS). GHS is a technical approach developed to define the specific hazards of each chemical, to create classification criteria using available data on the chemicals and their already defined hazards, and to organize and facilitate the communication of hazard information on labels and SDSs

Limit of detection (LOD). A value 1x to 4x above the MDL, analyzed to verify the calculated MDL is within reason. This is variable across labs.

Limit of quantitation (LOQ). LOQ (also known as PQL) is the limit at which the test method is reproduceable and robust, with analyte recovery within established acceptance criteria. Samples must be analyzed and meet recovery limits (such as 70% to 130% of true value). This is variable across labs.

Limit value. The maximum amount of chemical substances permitted in articles.

Manufacturing restricted substances list (MRSL). An MRSL establishes concentration limits for substances in chemical formulations used within manufacturing facilities. MRSL limits are designed to eliminate the possibility of intentional use of restricted substances by addressing process chemicals used to produce materials, but that may not end up in the finished product.

Material safety data sheet (MSDS). A form containing data regarding the properties of a particular substance. The exact format of an MSDS can vary from source to source within a country depending on how specific the national requirement is. The MSDS has now been replaced by a standardized SDS.

Method detection limit (MDL). A mathematically derived limit based on several replicates of a sample at a specific concentration. Designed to avoid false negatives, but prone to false positives (because data is inaccurate at this level). This is variable across labs.

Preservative. A chemical substance used to preserve organic materials from decomposition or fermentation.

REACH. The European Union's regulation concerning the Registration, Evaluation, Authorization and Restriction of Chemicals aims to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances and 'articles'. REACH regulation must be met for all articles entering the EU. Additional information can be found at www.echa.europa.eu.

Reporting limit. The AFIRM RSL uses reporting limits—arbitrary limits set by the Laboratory Technical Advisory Committee—based on the LOQ across laboratories. Reporting limits are useful for AFIRM brands, enabling them to capture data below a regulated limit, but not collect data down to the detection limit and encounter false positives or inaccurate data.

Restricted substances list (RSL). Defines those chemicals that are restricted or banned from finished products.

Safety data sheet (SDS). An SDS is provided by the chemical manufacturer containing safety data relating to the properties of a particular substance. It is an important component of product stewardship and workplace safety, intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner, and includes information such as physical data, toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill handling procedures. The SDS is made up of sixteen sections, and each section includes specific information using a standardized classification method. This standardized method has replaced the "MSDS". See Appendix H for examples and explanation of an SDS.

Solvent. A substance that could dissolve other substances, such as oils, or in which another substance is dissolved, forming a solution.

Substances of very high concern (SVHCs). SVHCs are identified in REACH, which calls for the progressive substitution of the most potentially dangerous chemicals (referred to as "SVHCs") when suitable alternatives have been identified.

Technical data sheet (TDS). Documentation provided by chemical manufacturers containing a detailed technical description of a chemical substance, along with specific areas and scope of use.

Usage ban. For several chemical substances or substance groups a usage ban may be defined. For these substances or substance groups intentional use in manufacturing of articles is prohibited. That means that chemical products (e.g. colorants or textile auxiliaries) used for manufacturing of articles must not intentionally contain these substances or substance groups. The aim of a usage ban is to avoid release of harmful substances to the environment and to avoid occurrence in the manufactured article by applying the precautionary principle.

Volatile. A substance is considered volatile if it has a low boiling point at normal atmospheric pressure. Volatile chemicals (e.g. Formaldehyde) can cross-contaminate products because they can more easily vaporize and travel.

Zero Discharge of Hazardous Chemicals (ZDHC) Programme. ZDHC Foundation oversees the ZDHC Programme. Their aim is to advance towards zero discharge of hazardous chemicals in the textile, leather, and footwear value chain to improve the environment and peoples' well-being. The programme includes an industry-aligned MRSL, Wastewater Guidelines, and a Gateway for the distribution of chemical and wastewater quality data.

www.afirm-group.com