EXCELLENT IN ACTION.
ELEVATING OUR GAME

An Approach to Alternative Adhesives

Greg Montello, Product Chemistry Manager

History of adhesive alternatives

In 1995, New Balance began moving away from using solvent-based adhesives to attach uppers, soles, linings and other components during production with the introduction of reactive hot-melt systems.

History of adhesive alternatives

- Use of alternatives required extensive testing and, in some cases, redesigns to improve manufacturing efficiencies and meet product performance objectives.
- In our U.S. factories, we have virtually eliminated conventional solvent use in compliance with air quality regulations limiting VOCs and with OSHA exposure standards.

History of adhesive alternatives

- Outside the U.S., we are transitioning away from solvent-based adhesives, transferring our experience with hot-melt systems in our domestic factories to our contract manufacturers, and encouraging the use of water-based adhesives.

LET'S MAKE EXCELLENT HAPPEN.

Adhesives In Manufacturing

Adhesives have replaced most means of mechanical fastening in athletic shoes because they provide:

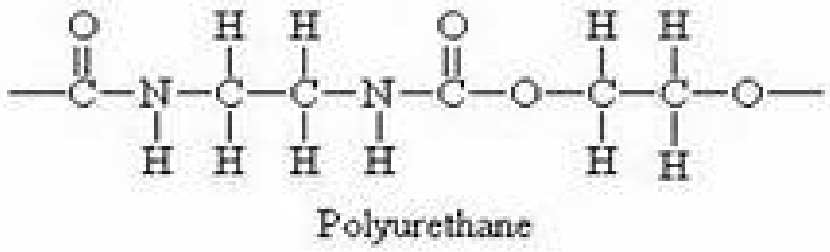
- great latitude in design,
- are durable under a variety of environmental conditions,
- and maintain integrity throughout numerous repetitions of multiple stresses (bending, flexing, compressing, etc.).

Adhesives In Manufacturing

They are also useful for a wide variety of shoe materials, including leather, rubber, synthetic and bio-based textiles, synthetic leather (polyester with a polyurethane coating), and polyurethane and EVA foams.

Adhesives In Manufacturing

A polymer (usually either polyurethane or polychloroprene, also known as neoprene) is dissolved in a solvent (e.g., methyl ethyl ketone), which can then be brushed on the materials to be joined.



Polyurethane

Adhesives In Manufacturing

- The solvent evaporates as it is a volatile compound, and the two surfaces are joined (sometimes with heat) to create a high-strength bond.
- Unless controlled, the volatile solvents are a hazard in the workplace and to the environment.
- Solvents may also be used as cleaners, in primers to facilitate better bonding, and in hardeners for adhesives.

Adhesives In Manufacturing

- New Balance has been actively working towards alternatives such as water-based and hotmelt adhesives in a move to minimize any potential impact to the environment and workers.

LET'S MAKE EXCELLENT HAPPEN.

Adhesives In Manufacturing

- Water-based and HMMC (hot-melt moisture cure) cements have other advantages for quality and process ease.

LET'S MAKE EXCELLENT HAPPEN.

Adhesives In Manufacturing

- Unlike water-based or solvent-based adhesives, hot melt adhesives do not require drying. Hot melts begin bonding almost immediately after application, as they cool down to their solidification point. This fast solidification is ideal for use on manufacturing lines – sole adhesion requires rapid bond formation.

Adhesives In Manufacturing

- As contract manufacturers learn how to use alternative adhesives, NB is changing our specifications to mandate the use of these alternatives, tracking shipments of alternative and solvent-based adhesives from chemical suppliers to our contract manufacturers, and matching these shipments against the expected ratio of water-based/hot-melt systems to solvent-based adhesives given the types of products that we order with our contract factories.

Adhesives In Manufacturing

http://www.youtube.com/watch?v=OmZCovkbpAY&NR=1&feature=endscreen

Restricted Substance Program

Introduced into the NB Supplier Evaluation Criteria in 2006

Objective:

- Minimize the amount of hazardous substances in products that affect the:
    - Production Worker
    - Consumer
    - Environment
- Prohibit or restrict the use of substances in the RSL Manual
- Encourage NB Suppliers to take a proactive approach to RSL management
- Protect the brand
- Partner with Suppliers who are **willing** and **able** to consistently meet RSL requirements
- www.newbalance.com/restrictedsubstanceprogram

AG

AFIRM GROUP

Introduction to the AFIRM Supplier Toolkit

LET'S MAKE EXCELLENT HAPPEN.

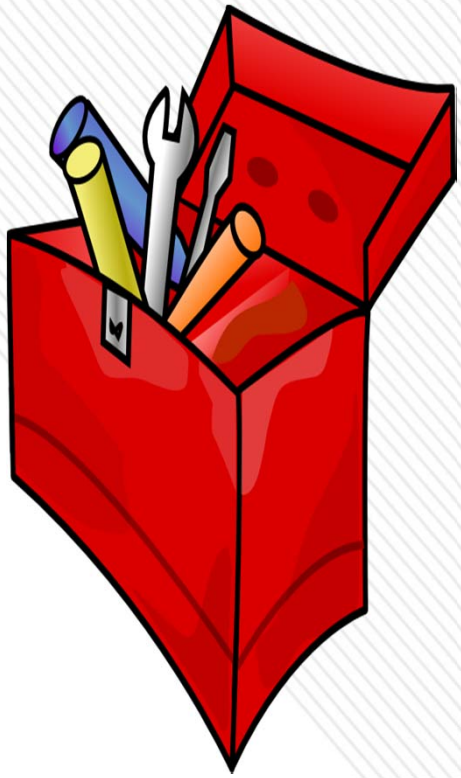
Who is AFIRM?

- Apparel & Footwear International RSL Management Group
- Established in July 2004
- AFIRM Mission: To reduce the use and impact of harmful substances in the apparel and footwear supply chain

Current Members

- adidas-Group
- BESTSELLER
- Carhartt
- ESPRIT
- Gap, Inc.
- Gymboree
- H&M
- Hugo Boss
- J.CREW
- Levi Strauss & Co.
- New Balance
- Nike
- Pentland
- PUMA
- s.Oliver
- Warnaco
- Wolverine World Wide
- VF Corporation

What Exactly is the Toolkit?



- Collection of resources to help the global apparel/footwear supply chain understand and reduce the use and impact of harmful substances

LET'S MAKE EXCELLENT HAPPEN.

AFIRM Toolkit History

- First version published October 2008

- Supplier Feedback:
  - Seemed geared toward brands
  - More technical information and examples requested
  - Request for AFIRM combined RSL to meet all brand requirements

New 2011 AFIRM Supplier Toolkit

- Published November 2011
- Responds to Supplier Feedback
  - Geared toward suppliers
  - More detailed information on more chemicals
  - Improved formatting and internal links
- Available in Chinese & Vietnamese
  - More languages planned in 2013

LET'S MAKE EXCELLENT HAPPEN.

New 2011 AFIRM Supplier Toolkit

- Key Additions
  - RSL Failures with corrective action examples in simple format
  - Detailed Chemical Guidance Document with full Index
- ***Resources available for all levels of technical expertise***

Toolkit Table of Contents

Where are the risks?

	Natural fibres	Synthetic fibres	Natural and synthetic blends	Artificial leather with fibre backing	Natural leather	Plastic, rubber, paint, and coatings	Natural materials (e.g., paper, wood)	Metal	Fusing, padding, feather, and down
AP / APEO	•	•	•	•	•	•			•
AZO	•	•	•		•				
Cationic Surfactant		•	•						
Chlorinated Organic Carriers		•	•						
Chloroparaffins (SCCP and MCCP)					•				
Chromium VI					•				
Disperse Dyes		•	•						
Flame Retardants	If special finish								•
Formaldehyde	•	•	•		•	•	•		•
Metals, extractable	•		•		•				
Metals, total				•		•		•	
Nickel release								•	
Perflurooctane Sulfonate (PFOS) and PFOS-related substances Perfluorooctane Acid (PFOA) and its salts	If water-repellent finish								
pH-value	•		•						
Phenols	•		•		•		•		•
Phthalates				•		•			
Polycyclic Aromatic Hydrocarbons (PAHs)						•			
PVC				•		•			
Tin Organic Coumpounds				•		•			

Background on Restricted Substances

Restricted Substances	Description & Where they may be found
Alkyphenol Ethoxylates (APEOs) / Alkylphenols (AP) *Nonylphenol Ethoxylates (NPEO)* *Octylphenol Ethoxylates (OPEO)* *Nonylphenol (NP)* *Octylphenol (OP)*	APEOS are non-ionic surfactants including NPEOs, OPEOs, NP, and OP. NPEOs and OPEOs degrade into NP and OP, respectively. APEOs can be used as or found in: • Detergents • Scouring agents • Wetting agents • Softeners • Emulsifier/dispersing agents for dyes and prints • Impregnating agents • Degreasing agents for leather • Leather Finishing • De-gumming for silk production • Dyes and pigment preparations • Polyester padding • Down/feather fillings

LET'S MAKE EXCELLENT HAPPEN.

Appendix B - Factory Management Plan

7. Data Management

7.1. Access to RSL data throughout the supply chain is a key component in management strategy for the RSL. Strategic testing of materials is critical for streamlining RSL management.

7.2. Describe how you manage data you collect from sample analysis/testing and how you share that information with your partners

- Do you have a database for all testing data?
- Do you send this data for management review on a regular basis?
- Do you identify suppliers with repeated failures and put them on notice?

8. Tracking Time Table

8.1. Set up a time table which identifies your RSL Plan of each year. Some items must be included, such as: Four deadlines of reviewing of your RSL Data trend; One training/meeting on RSL to your vendors; Summary of your RSL tracking from Purchasing at the end of the year.

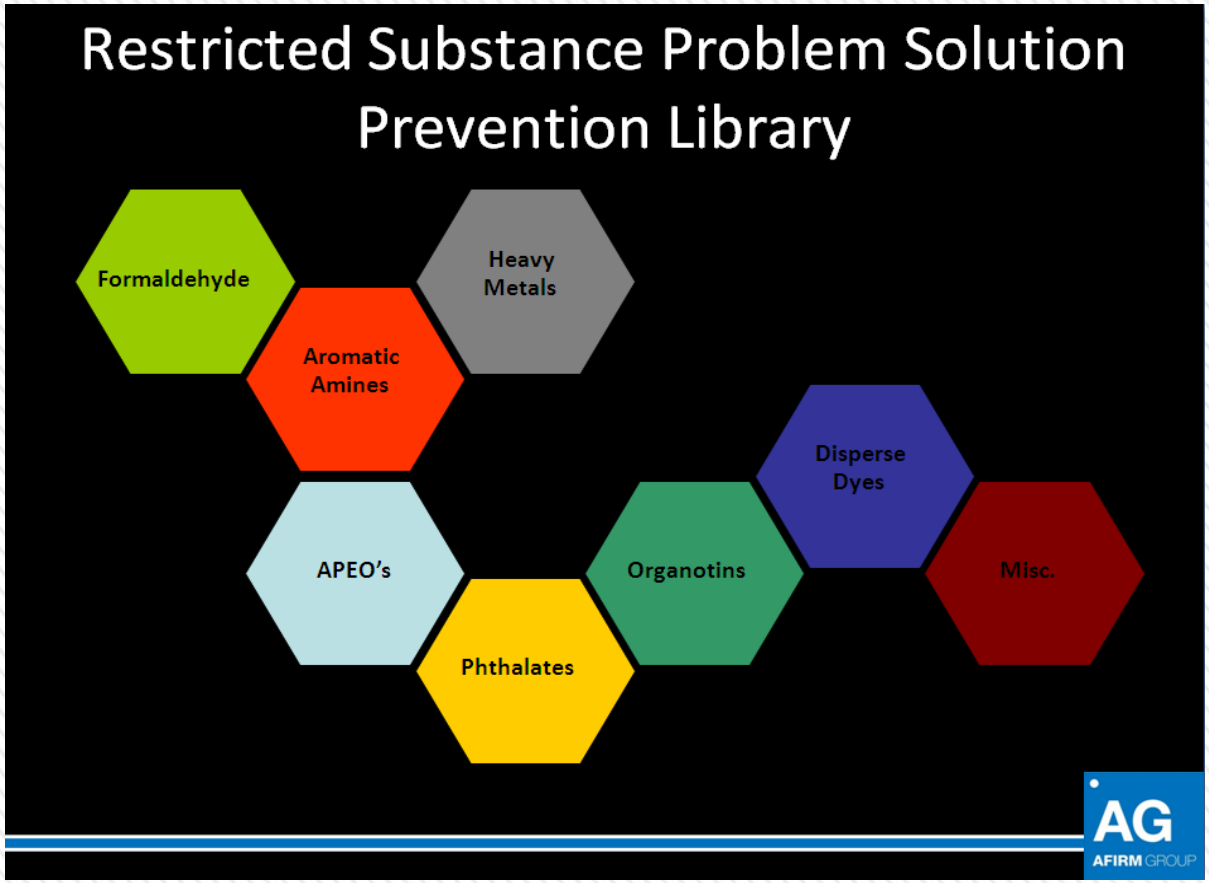
Example:

Progress	Target Date	Finish Date
Complete RSL Plan and present to factory management	1/20/13	
Discuss RSL Plan with vendors	2/20/13	
Set up the RSL Action Plan Schedule	4/20/13	
Prepare material for RSL testing	5/20/13	
Finish RSL testing	6/20/13	
Review RSL data trend with vendors	7/20/13	
Review and revise RSL plan for continuous improvement	8/20/13	

Appendix D – Best Practices to Avoid RSL Issues

	Restricted Substance	Manufacturing Technology that Could Introduce The Substance	Steps to Avoid Restricted Substance in Finished Products
Natural Fibers (cotton, rayon, wool, hemp, etc.)	Formaldehyde	Resins to prevent shrinkage	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
		Resins to prevent wrinkling	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
		Resins to permanently include wrinkles	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
		Discharge Printing	Water based discharge printing systems rely on Zinc Formaldehyde Sulfonate (ZFS). Discharge prints must be used according to manufacturers instructions to meet adult formaldehyde requirements.
		Pigment print binder	Use formaldehyde free binders; Use low formaldehyde binders & fully cure to chemical supplier specifications to remove free formaldehyde.
	Heavy metals (mercury, lead, cadmium)	Dye stuff	Use dyestuff from internationally recognized dye stuff suppliers with commitments to chemical compliance.
		Pigment prints	Use pigments from internationally recognized dye stuff suppliers with commitments to chemical compliance.
	Azo amines	Dye stuff	Use dyestuff from internationally recognized dye stuff suppliers with commitments to chemical compliance.
		Pigment prints	Azo structures in pigments can cleave into one of the harmful amines. With low solubility the consumer risk is minimal, but GC/MS will detect amines. LC/MS can be used for proper confirmation. Check with ETAD www.etad.com for a list of pigments that pose this risk.
Synthetic Fibers (polyester, nylon, acetate, acrylic, etc.)	Formaldehyde	Resins to prevent shrinkage	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
		Resins to prevent wrinkling	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
		Resins to permanently include wrinkles	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
		Cross linking agent in coating processes	Use formaldehyde free resins; Use low formaldehyde resins & fully cure to chemical supplier specifications to remove free formaldehyde.
	Heavy metals (mercury, lead, cadmium)	Dye stuff	Use dyestuff from internationally recognized dye stuff suppliers with commitments to chemical compliance.
		Stabilizer	More likely in molded plastics than fibers, but cadmium should not be used as a stabilizer.
		Polymer extrusion contamination	Heavy metals such as lead, cadmium and mercury are not likely intentionally used in polymer extrusion, but could be present due to contamination.
	Disperse dyes	Dye stuff	Use dyestuff from internationally recognized dye stuff suppliers with commitments to chemical compliance. Orange 37/76 is the most common failure and is commonly found in dark colors which use Orange 37/76 in the recipe.
	Azo dyes	Dye stuff	Synthetic fibers with a PU or fluorinated coating may give a false positive for azo amines if tested using GC/MS. LC/MS can be used for confirmation. Use dyestuff from internationally recognized dye stuff suppliers with commitments to chemical compliance.

Appendix E – RSL Corrective Actions



LET'S MAKE EXCELLENT HAPPEN.

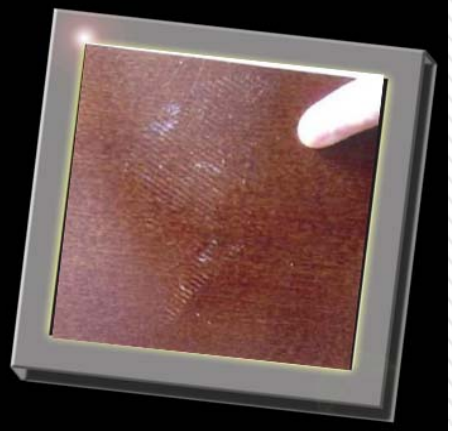
Appendix E – RSL Corrective Actions

Restricted Substance	Issue	Slide #
Formaldehyde	Discharge Printing	2
Formaldehyde	Cap Stiffener	5
Formaldehyde	Wrinkle Effect	8
Formaldehyde	Pigment Print	11
Formaldehyde	Recipe Calculation	14
Formaldehyde	Leather Tanning	17
Aromatic Amines	Drawcord Dyestuff	21
Heavy Metals - Cadmium	PVC pigment	23
Heavy Metals - Lead	Paint pigment	26
Heavy Metals - Lead	Polyurethane coating	29
Heavy Metals - Lead	Heat transfer	32
Heavy Metals - Chromium	Metalized Dye	34
Heavy Metals - Mercury	Solvent cleaner	36
Phthalates - DEHP	Spray adhesive	38
Phthalates - alternative	Solvent plasticizer	41
APEO	Scouring agent	44
APEO	Fiber board emulsion	47
APEO	Leather degreasing	49
Organotins	Adhesive heat stabilizer	51
Miscellaneous - Phenol	Adhesive contamination	54
Miscellaneous - PAH	Rubber formula	57
Miscellaneous - PFOA	Non-wicking treatment	60
Miscellaneous - VOC	Solvent contamination	63
Miscellaneous - Phenol	Print paste thickener	65
Miscellaneous - VOC	Yarn lubricant	67
Disperse Dyes	Woven label	69

Appendix E – RSL Corrective Actions

Problem #2

- Consumer complaints that the flip flops had sticky feeling and were removing lacquer finish on wood floors
- Laboratory analysis detected tributycitrate (TBC) instead of ATBC as manufacturer claimed
- TBC is a known solvent for decoating furniture
- Manufacturer substituted TBC as a cheaper alternative for ATBC

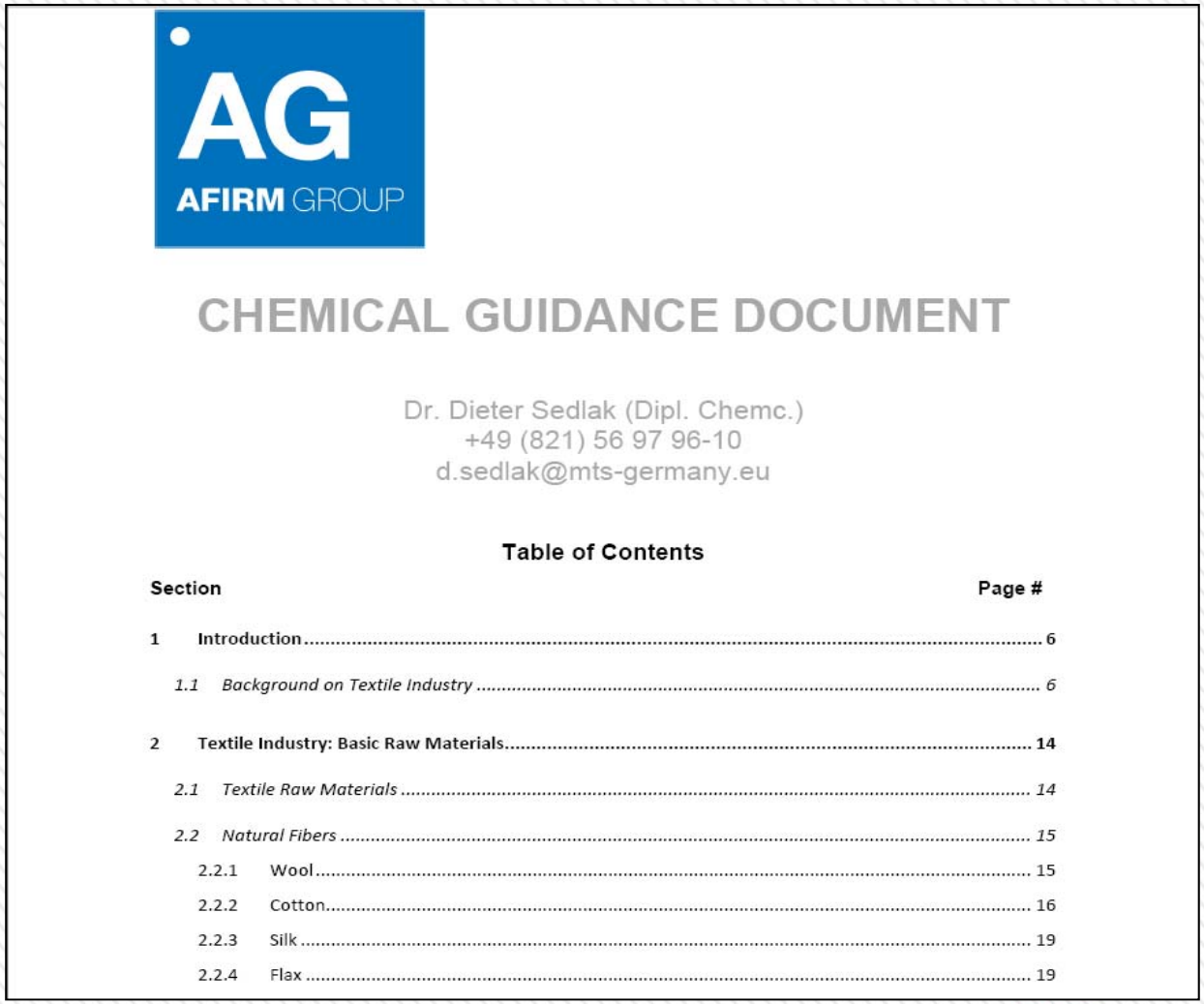


AG AFIRM GROUP

Phthalates

LET'S MAKE EXCELLENT HAPPEN.

Appendix F – Detailed Chemical Guidance Document



AG
AFIRM GROUP

CHEMICAL GUIDANCE DOCUMENT

Dr. Dieter Sedlak (Dipl. Chemc.)
+49 (821) 56 97 96-10
d.sedlak@mts-germany.eu

Table of Contents

Appendix F – Detailed Chemical Guidance Document

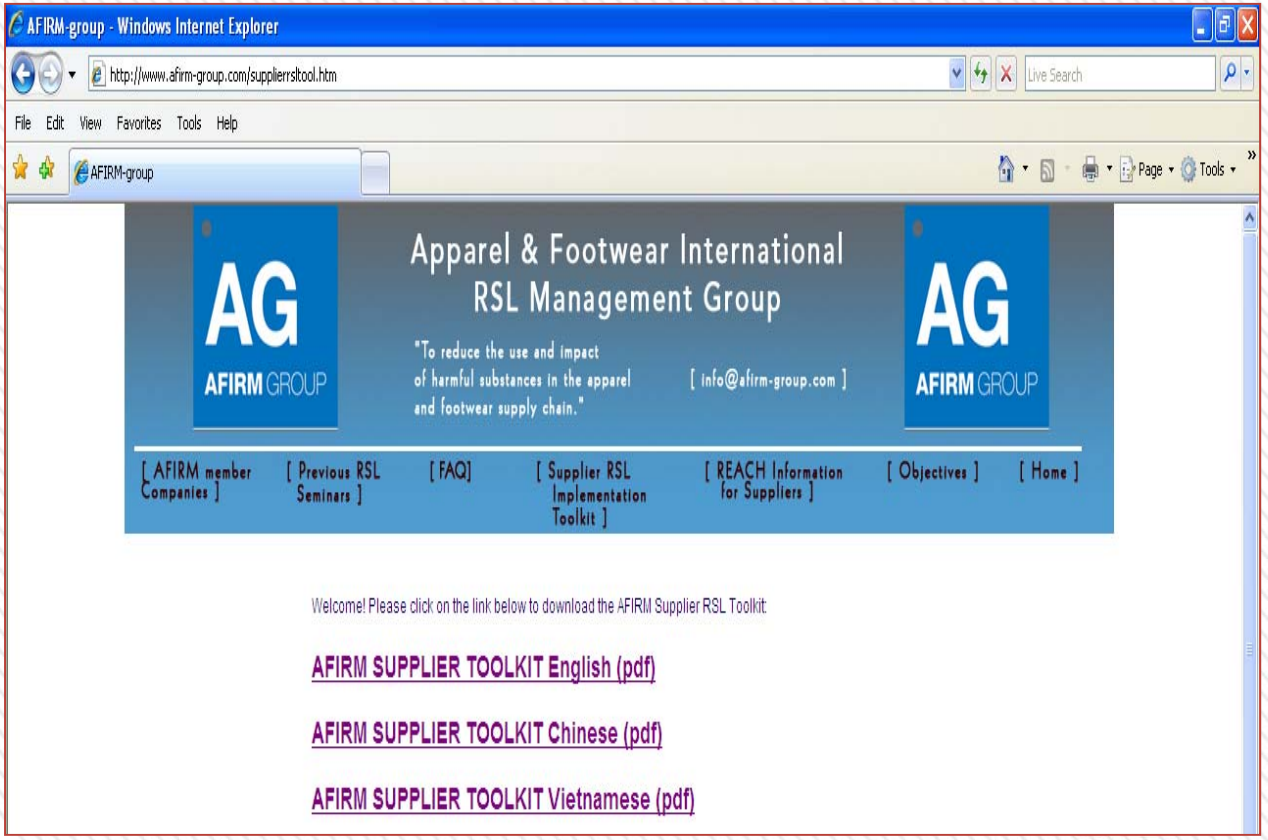
6.2.4.1 Unintended Oxidation of Chromium III to Chromium VI in Leather and Leather Products

Chromium (VI) is not intended or used in the production process and must be regarded as cross contamination by avoidable oxidation of trivalent Chromium to hexavalent chromium, which is a harmful substance. Oxidation of Cr (III) into Cr (VI) normally occurs in presence of strong oxidation agent in acid environment but it can also take place in presence of mild oxidation agents at high pH. In leather processing neutralization is a stage where such conditions are created; therefore, leather and leather products sometimes contain Cr (VI) although only chromium compounds in the form of Cr (III) were used in the tanning process.

Also the hydrogen peroxide left over from the first step of tanning will contribute to unintended oxidation of Cr (III) to Cr (VI).

AFIRM Toolkit Website

- http://www.afirm-group.com/supplierrsltool.htm
  - Contact: info@afirm-group.com



Thank you!