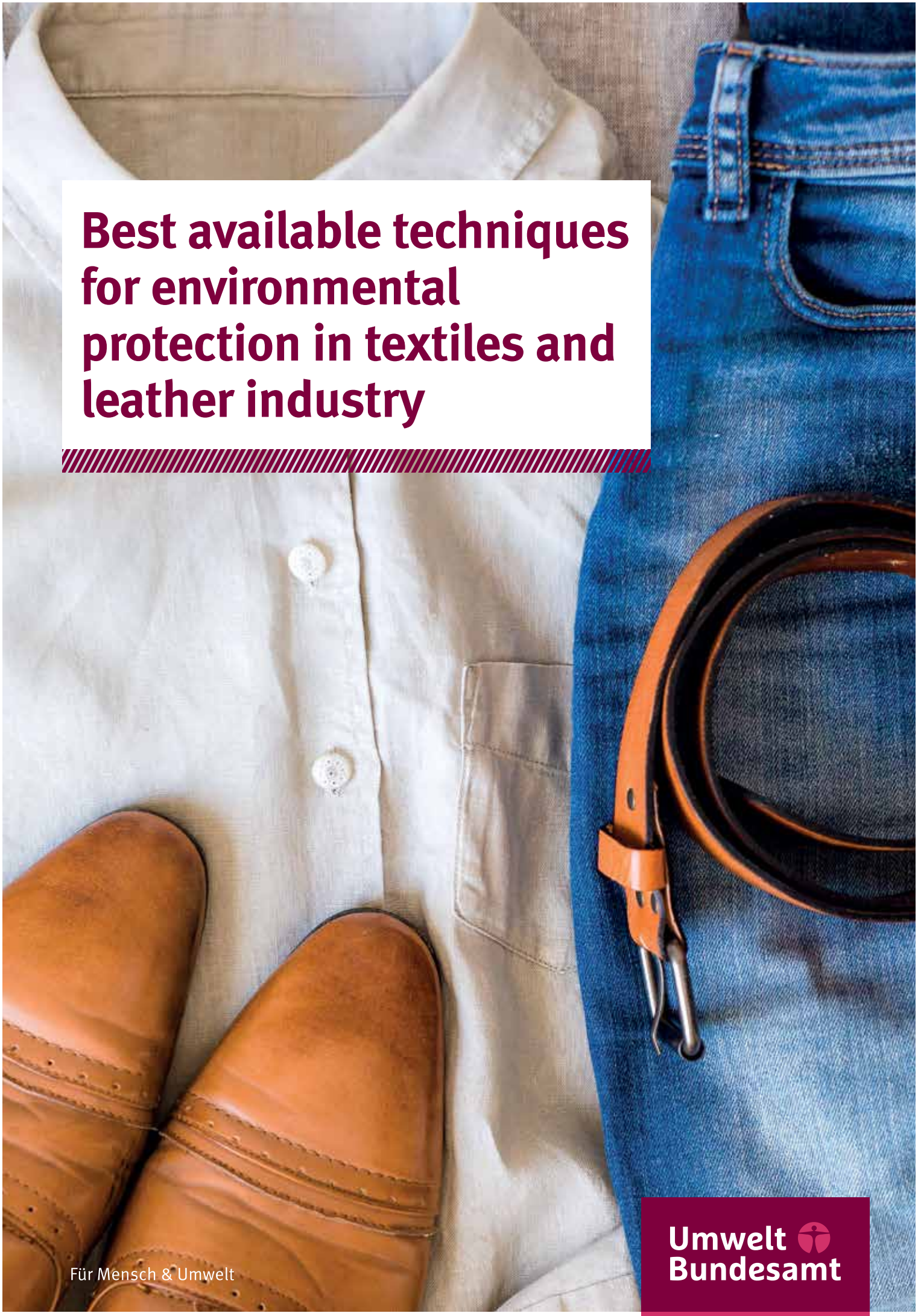
Best available techniques for environmental protection in textiles and leather industry



Für Mensch & Umwelt

Umwelt Bundesamt

Impressum

Published by:
Umweltbundesamt (The UBA) -
Federal Environment Agency of Germany
Wörlitzer Platz 1
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Layout:
ÖkoMedia GmbH
Stuttgart

Print:
Printed on 100% recycled paper.

Brochure orders:
Umweltbundesamt c/o GVP
Postfach 30 03 61
D-53183 Bonn
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Publication available as pdf:
www.umweltbundesamt.de/publikationen
February 2017
2. completely revised edition
ISSN 2363-832X
ISSN 2363-8311

Image sources:
Titel: Ludmilla Parsyak
Fotolia (S. 3)
Ricosta Schuhfabriken (S. 6)
picture alliance / dpa (S. 10, 12, 14, 25)
shutterstock (S. 15, 33)
Gebr. Elmer & Zweifel GmbH & Co. KG: (S. 17)
TEGEWA e.V. (S. 21)
Verband der Nordwestdeutschen
Textil- & Bekleidungsindustrie e.V. (S. 22, 38)
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TVU Textilveredlungsunion GmbH & Co. KG (S. 27)
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HELLER-LEDER GmbH & Co. KG (S. 40)
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Content

Preface

Best available techniques for the textile and leather industries: environmental protection reduces costs and secures market position

Today it is well known how to produce textiles, leather and shoes as environmentally friendly as possible. This is also clear to consumers. According to the 2016 Environmental Awareness Study more than 15 percent of respondents often buy clothes certified as being less harmful for the environment. Consequently, one of the goals of the textile and leather sector should be a more effective protection of our environment and a consideration of consumers' interests. This brochure shows the way to traders and producers.

Leading manufacturers and traders of the textile, leather and shoe industry in Germany with associations and the UBA worked jointly to write this brochure. This is something I welcome in particular, as the branch does not steer only their own production. They are also influencing the attitude of their subcontractors – often situated in developing and emerging countries. To design the whole textile supply chain in an environmentally and socially responsible manner the members of the Partnership for Sustainable Textiles elaborate common solutions. Import statistics show the buying power and hereby the responsibility of companies on this field: in 2015 the European Union imported clothes with a value of more than 93 billion euros and shoes with a value of more than 10 billion euros from countries outside of the EU (*Eurostat 2017*).

Furthermore, the brochure refers directly to industrial reality. It outlines the „best available techniques" (BAT), regularly defined jointly by EU member states as well as industrial and environmental associations. In the EU, BREF documents – Best Available Techniques Reference Documents – form the basis for permits for environmentally relevant industrial installations, and have demonstrated their value over many years. Global environmental protection will be promoted all the more if importers jointly and gradually implement the same standards at their subcontractors as respected at EU sites and requested by consumers.

And finally yet importantly this brochure shows that corporate environmental protection pays off monetary – and frequently without great expense. Paying attention to non-leaking pipes, well-calibrated dosing systems and the manufacturer details for chemicals can result in clear cost savings. A simple change in washing processes for instance can result in water savings of up to 75 percent. Since 2012, the UBA offers a detailed BAT checklist, providing additional assistance to producers for achieving reduction targets.

Corporate environmental protection is relevant in each production step – if this message is spread by the brochure and its involved stakeholders of industry, trade and society, then more and more producers will follow in their footsteps. Even though environmental protection in textiles, leather and shoe production is the main focus of this brochure: improving environmental and social standards need to interlink and overlap obviously – as part of a sustainable development.

Maria Krautzberger,
President of the German Federal Environment Agency

BAT information in short

Who is this brochure addressed to?

This brochure addresses you as a company in the textile or leather production chain – in particular if the following descriptions matches you:

- **You supply the European market as a player in the global textile chain or as a leather or shoe producer.**
- **You are looking for support to improve your environmental standards more effectively because your consumers in sales markets, your trading partners, or your customers in the processing industry request this.**
- **You are interested in environmental protection measures that reduce your operating costs or at least pay off in the medium term.**
- **You intend to attract new customers and want to use environmental protection measures to improve your image.**

What is it about?

Environmentally sound manufacturing technologies are becoming a product characteristic in major consumer markets of industrialised countries, same as the quality of material and its processing. This is justified because the impact of environmentally damaging business threatens humanity as a whole, and more and more consumers are aware of this fact.

For this reason, this brochure aims to show you that best available techniques (BAT) for environmentally sound production do not lead to benefits for only the environment, but first of all to benefits for your company. In addition, this brochure shows many approaches of techniques you can implement and thereby achieve savings effects – some even in short time and without high investments.

What are "best available techniques"?

Worldwide there are already some consulting services regarding environmental protection in the textile, leather and shoe sectors. The special approach of this brochure: it is oriented towards the BREF documents

„Consideration of BREF documents is the best way to offer ecological products requested by customers."

Monika Büning, vzbv - Federation of German Consumer Organisations

„BREF documents assist companies with the continuous implementation of environmental standards in operational practice."

Andreas Tepest, Deichmann SE

– Best Available Techniques Reference Documents – the world's largest practice-proven compilation of technical measures for environment protection, which is constantly improving.

In the European Union, the use of best available techniques is a precondition for receiving a production permit. In search for suppliers outside the EU, retailers and brands are also interested to import from companies implementing environmentally sound techniques. This brochure shows you the first steps towards positioning your company well in this area.

This brochure presents only selected measures from the collection of best available techniques. However, technical details on all best available techniques, including those not presented here, could be found in the extensive BREF documents themselves. Free downloads are available on the websites of the EU (*eippcb.jrc.ec.europa.eu/reference*) and the Federal Environment Agency (*www.bvt.umweltbundesamt.de*).

Participants

Based on a first edition published in 2009, the Federal Environment Agency once more developed this brochure on environmental standards for the textiles, leather and shoe sector in cooperation with stakeholders of industry and society. The suggestions and expert contributions of each of the following representatives facilitated the realization of this practice-oriented publication:

- adidas AG
- A&E Gütermann
- C&A Mode GmbH & Co. KG
- Deichmann SE
- Gebr. Elmer & Zweifel GmbH & Co. KG
- HELLER-LEDER GmbH & Co. KG
- Hess Natur-Textilien GmbH
- Hugo Josten Berufskleiderfabrik GmbH & Co. KG
- IKEA Deutschland GmbH & Co. KG
- Lederfabrik Josef Heinen GmbH & Co. KG
- LIDL Stiftung & Co. KG
- OTTO Group
- Richard Hoffmanns GmbH & Co. KG
- RICOSTA Schuhfabriken GmbH
- Schöffel Sportbekleidung GmbH
- Schoeller GmbH & Co. KG
- PUMA SE
- Tchibo GmbH
- VAUDE Sport GmbH & Co. KG
- JACK WOLFSKIN AUSRÜSTUNG FÜR DRAUSSEN GMBH & Co. KGaA
- Wortmann Schuh-Holding KG

- Association of the textile and clothing industry in Northwest Germany
- BUND – Friends of the Earth Germany
- Clean Clothes Campaign
- Confederation of the German Textile and Fashion Industry
- CS Research – Dr. Claudia Schafmeister
- GOTS – Global Organic Textile Standard
- HDS/L – German Federal Association of the Footwear and Leather Goods Industry
- Hydrotox Labor für Ökotoxikologie und Gewässerschutz GmbH
- I-T-G GmbH Ingenieurgemeinschaft für Umwelttechnologie Tübingen-Graz
- Ökopol - Institut für Ökologie und Politik GmbH
- Partnership for Sustainable Textiles
- PFI – Test and Research Institute for Footwear Production
- Systain Consulting GmbH
- TEGEWA Association
- terre des hommes Germany
- TVU Textilveredlungsunion GmbH & Co. KG
- VDL – German Leather Federation
- vzbv - Federation of German Consumer Organisations

Environmental standards pay off

The advice of BAT Reference Documents: Technical improvements and methods of the environmental management system should work hand in hand. Environmental management doesn't prepare only the ground in your company for corresponding technical measures such as the integration of environmental standards in the production. Additionally, it has a broader effect, for example on sales, human resources or marketing. In this regard, you may get support by instruments such as the quality management standards EN ISO 9000 ff, the environmental management standard EN ISO 14 001, the European Eco-Management and Audit Scheme (EMAS) or the energy management standard ISO 50 001.

Gain new markets – secure existing ones

As a supplier in the textile, leather and shoe industry, your chances rise for acquiring new sales markets and securing existing ones if you can demonstrate better environmental performance than your competitors. Consumers ask increasingly for products not causing negative environmental impacts during their manufacture, use and disposal (Environmental Awareness Study 2014, BMUB/UBA). Therefore, trading companies and brands are increasingly marketing more products with additional environmental benefits. Follow-up this global development by integrating relevant environmental standards into your production.

Reduce operating costs

With environmental management and good housekeeping alone, your company can save large amounts of energy, raw materials and waste – with low or even no personnel and financial input. Additional environmental measures which are technically more demanding may require more personnel and funds commitments. However, the results of these measures will also pay off in the medium or long term. The more efficiently your company uses energy, fresh water or chemicals, the lower is its environmental impact. At the same time your costs are reduced.

Most important savings potential:

- **Cost savings due to lower consumption and more efficient use of raw materials and energy.**
- **Less expenses due to waste reduction and recycling income.**
- **Cost reduction by avoiding hazardous substances, as well as more efficient treatment of waste gas and wastewater.**

With the help of this brochure you can calculate that many environmental measures will pay off in a short time.

Traders, brands and banks demand environmental standards

Civil society organisations and the press keep a close eye on the environmental management of manufacturing industry – even along international supply chains. Publications about abuse of environmental or social standards can lead to sales reduction and image loss.

For this reason, traders and brands are increasingly searching for suppliers fulfilling high standards and participating in initiatives like the Partnership for Sustainable Textiles (page 9), ZDHC (page 22), Tannery of the Future (page 43) or Leather Working Group (page 48).

Similarly, banks and other investors calculate precisely the risks of possible environmental impacts when granting company loans. For example, the DEG - Germany's development bank for developing and emerging countries – as well as the International Finance Corporation (IFC) – a subsidiary of the World Bank and the world's largest source of credit for private industrial projects - oblige borrowers to take environmental protection requirements into account based upon the EU BAT Reference Documents. Make your company an attractive partner for traders, brands and banks: document compliance with national environmental legislation and incorporate the best available techniques in your production. Thus, you will minimise your liability and reputation risks.

„Thanks to certification through environmental and social labels everyone - from supplier to consumer - has a clear orientation and alternatives for action.“

Barbara Küppers, terre des hommes Deutschland e. V.

„The implementation of environmental and social standards creates trust amongst customers and offers companies security against public attacks from workers‘ associations and NGOs.“

Christiane Schnura, Clean Cloth Campaign

„Do good things and talk about it”

„We produce textiles, leather and shoes in an environmentally sound manner“ – the clearer you communicate this environmental commitment inside and outside your company, the stronger will be the positive effect of your engagement, even beyond the effects of environmental protection. In this regard, the strategies and measures of public relations (PR) will support you.

Increasing your own visibility, becoming a better accepted trading partner that is frequently preferred, gaining reputation as an opinion leader in the sector – in brief: establishing trust – these are all communication goals that you can achieve more easily if you specifically make awareness of your environmental engagement. If you are ready and have formulated your environmental agenda, have built up your environmental management system, or reached your first positive environmental impacts, then use your success to address your dialogue groups. Check which groups these might be.

Dialogue groups for your environmental commitment:

- **Current and potential trading and production partners.**
- **Clients of your clients – for example brands marketing your products.**
- **Own staff and potential future personnel.**
- **Investors.**
- **Civil society at your location.**

Your environmental commitment has a high value for all of these dialogue groups – whether as a sign of qualitative reliability, know-how, sustainability or social responsibility. The specific message you want to address to „your“ dialogue group and the strategy you intend to follow depend on the individual circumstances – this could be for example searching for an active dialogue, informing or reacting.

The press is an important communication channel for reaching your dialogue group. For this reason you should inform the editorial offices of the trade press about the environmental activities of your company – just as many companies have done by presenting their good practice examples in this brochure. Or you may inform the public press at your location about your commitment for clean water, clean air and improved capacity building for your personnel. When informing, make sure you stick to facts to avoid greenwashing. The press is just one of many effective communication channels. Consider presenting your environmental commitment on the internet. Seek out partnerships with associations or start yourself an initiative working on environmental standards. Check whether you can be certified according to nationally or internationally recognised product labels. Independent ecolabels enjoy great trust – both with business partners as well as with consumers. The appendix contains sources for further information on this topic.

Don’t be afraid to approach the PR departments of big brands doing the final marketing of your product. These companies are often interested in your good practice examples to incorporate them into their own brand PR.

Unfortunately, for large branded companies it is often difficult to research their complex supply chains of general importers and subcontractors. This is your chance to put yourself in perspective.

„Comprehensive PR work and an EMAS-compliant sustainability report are good opportunities to lend your company transparency and trustworthiness.“

Hilke Patzwall, VAUDE Sport GmbH & Co. KG

Textile Partnership for social, ecologic and economic improvements along the textiles supply chain

Partnership for Sustainable Textiles

Germany is the biggest consumer market for textiles in Europe. About 90 % of textiles bought in Germany are produced in developing countries and emerging economies, with the majority in Asia. Unfortunately, it is common to find lacking environmental management, little work place safety and low salaries. Against this background, the Minister for Economic Cooperation and Development, Dr Gerd Müller, initiated the Partnership for Sustainable Textiles (Textilbündnis) in 2014.

Today, the partnership is an initiative with about 160 partners comprising the private sector, non-governmental organisations, trade unions, standards organisations and the Federal Government. The common aim is to achieve social, ecological and economical improvements along the textile supply chain.

The members of the Textile Partnership coordinate individual activities and elaborate common solutions. The cooperation leads to equal competitive conditions for all members. In working groups, the partners elaborate specific proceedings for improvement of production conditions in areas like chemicals, natural fibres or social standards and living wages. As of 2017, the key questions and indicators developed by the partnership are substantiated by each member with individual targets, formulated as annual roadmaps.

Objectives of the partnerships

- **Improvement of working conditions in the production of fibres and textiles.**
- **Reduction of environmental impacts of the production of fibres and textiles, e.g. by exchanging expertise on best available techniques.**

Strategy elements of the partnership

- **Common definition of implementation requirements and related indicators for continuous improvement.**
- **Common improvement of the framework conditions in the manufacturing countries and recommendations for a harmonized policy of Germany and of the European Union.**
- **Transparent communication by publications on the progress of the partnership and its members to ease the identification of sustainable textiles for consumers.**
- **Platform of the Partnership for revision and support on progress and enforceability regarding implementation, and for exchange of experience and learning from each other’s.**

www.textilbuendnis.com/en

BAT in the textiles, leather and shoe industries

„When complying with environmental standards and achieving own sustainability goals, companies do not only avoid risks to image and consequently to sales but can also increase energy and resource efficiency in their value chains.“

Stefan Dierks, Tchibo GmbH

„The BREF documents should be globally-valid references for the operation of industrial plants.“

Markus Reinken, LIDL Stiftung & Co. KG

„We are members of the Partnership for Sustainable Textiles to achieve social, ecologic and economic improvements along the textiles supply chain.“

Dr. Hartmut Spiesecke, Confederation of the German Textile and Fashion Industry

From raw fibres to final products

Main environmental impacts of the textiles industry

	Production of raw fibres		Yarn production	Grey cloth production	Textile Finishing	Making-up
Process steps	Production of natural fibres	Production of man-made fibres	Spinning, Twisting	Weaving, Knitting	Pre-treatment, Dyeing, Printing, Finishing	Cutting, Assembly, Finishing, Packing
Relevant environmental impacts	Land use, Pesticides, Preservatives, Water demand	Waste water pollution, Air emissions, Poorly biodegradable textile auxiliaries	Textile auxiliaries and chemicals use, Fibre waste, Noise pollution, Dust emissions	Textile auxiliaries and chemicals use, Noise pollution, Dust emissions, Waste, Poorly biodegradable sizing agents	Water demand, Waste water pollution, Textile auxiliaries and chemicals use, Air emissions, Energy demand	Energy demand, Solid Waste, VOC

The European Union aims to achieve a high level of environmental protection of the most relevant industrial sectors in the EU member states. To this end, the EU adopted in 1996 the Directive on Integrated Pollution Prevention and Control (IPPC Directive). In 2010, the Directive was amended by the Industrial Emissions Directive (IED). It obliges many production facilities in the EU member states to prevent or reduce emissions to air, water and soil, and to minimize waste. To achieve this, the directive foresees the definition of best available techniques (BAT), described in the so-called BREFs – Best Available Techniques Reference Documents. Without applying BAT, the concerned industrial facilities will not receive an operating permit.

As a reference for the operation of industrial facilities, the BREFs also apply beyond their legal EU area of influence. For example, the UN ECE (United Nations Economic Commission for Europe) uses information from the BREFs in its protocols for the Convention on Long-Range Transboundary Air Pollution, specifying threshold values for environmental pollutants.

Depending on the type of the facility, a BREF describes the currently most ecologically advantageous and economically viable techniques and procedures. These techniques are defined and updated on regular basis after being agreed by the EU member states, industry and environmental associations.

In the production of textiles and shoes, particular environmental relevant processes are textile finishing and leather production. The BREF documents on “Textile industry” and “Tanning of hides and skins” focus on these production stages and describe environmentally sound techniques in detail.

The production of textiles, leather and shoes places a burden on the environment

Environmental impact of the textile industry

The textile and clothing industry is one of the world's most important industries. It is one of the oldest and most complex sectors of the manufacturing industry. Several hundred million employees work primarily in small and medium-sized enterprises to produce clothing, technical textiles (such as vehicle seat covers, tarpaulins or tyre fabrics) as well as house and home textiles (such as towels, bed linen or curtains). All necessary production steps have an impact on the environment.

Environmental impact of the shoe industry

The global shoe market has changed enormously. The majority of shoes traded is not produced in Europe. In 2015, EU member states imported nearly 2.3 billion pairs of shoes. The major part originated from Asia, dominating China with 69 % and Vietnam with 12 % (*eurostat*).

As is the case with textile production, the manufacture of shoes is broken down into numerous sub-stages, such as the manufacturing of the materials for shoes and soles. Emissions to air and water can be generated as well as in all of the production stages, and can be reduced or even prevented by applying best available techniques (BAT).

From raw materials to finished shoes

Main environmental impacts of shoe manufacturing

	Manufacture of upper materials			Manufacture of bottom materials			Upper manufacturing	Shoe assembly	Surface treatment
Process steps	Leather (scope of the BREF)	Fabrics from natural or man-made fibres	Plastics	Leather (scope of the BREF)	Rubber	Plastics	Cutting, Preparing of parts, Stitching of parts	AGO lasting, Flexible lasting, Strobel lasting, Direct injection	Cleaning/ pre-treating of shoe, Waxing/ spraying/ Polishing of shoes
Relevant environmental effects	Water demand/ Waste water pollution, Chemicals, Waste	Water demand/ Waste water pollution, Chemicals Waste	Waste, Air emissions (VOC)	Water demand/ Waste water pollution, Chemicals, Waste	Use of chemicals, Air emissions (VOC)	Waste, Air emissions (VOC)	Air emissions (VOC), Waste, Use of chemicals	Air emissions (VOC), Waste, Use of chemicals	Air emissions (VOC), Use of chemicals, Waste water pollution

Benchmarks: Impacts on the environment can be limited when producing textiles, leather and shoes

Every reduction of energy, chemicals or water use will benefit the environment and reduce operating costs. Sector-specific figures regarding consumption, emissions and waste provide a good orientation about the performance of your company compared with a good international industrial standard and can assist for identifying saving potentials within your company.

The benchmarks listed below are based on the Environmental, Health and Safety Guidelines for „Textile Manufacturing“ and for „Tanning and Leather Finishing“. The publisher of these guidelines, the International Finance Corporation (IFC), uses the BAT reference documents as a key source of information.

Benchmarks for textile production

Energy Consumption

Process	Electric Energy (kWh/kg textile substrate)	Thermal Energy (MJ/kg textile substrate)
Wool scouring	0.3	3.5
Dyeing loose fibres	0.1 - 0.4	4 - 14
Yarn dyeing	0.8 - 1.1	13 - 16
Finishing knitted fabric	1 - 6	10 - 60
Finishing woven fabric	0.5 - 1.5	30 - 70

Source: IFC-EHS Guidelines „Textile Manufacturing“

Benchmarks for textile production

Air emissions

Parameter	Emission value in mg/Nm³
VOC	2 / 20 / 50 / 75 / 100 / 150 a) b)
Formaldehyde	20
Ammonia	30
Total dust	50

a) Calculated as total carbon
b) As the 30 minute mean for stack emissions:
- 2 mg/Nm³ for VOC classified as carcinogenic or mutagenic with mass flows higher than or equal to 10 g/h.
- 20 mg/Nm³ for discharges of halogenated VOC with a mass flow equal or higher than 100 g/h.
- 50 mg/Nm³ for waste gases from drying for large installations (solvent consumption › 15 t/a).
- 75 mg/Nm³ for coating application processes for large installations (solvent consumption › 15 t/a).
- 100 mg/Nm³ for small installations (solvent consumption ‹ 15 t/a).
- If solvent is recovered from emissions and reused, the limit value is 150 mg/Nm³.

Source: IFC-EHS Guidelines „Textile Manufacturing“

„Environmental protection and the rational use of energy have a high value for the German textile and clothing industry. The central task is to establish production processes in an ecologically and economically responsible manner on the basis of statutory requirements, i.e. to use resources efficiently.“

Michael Engelhardt, Confederation of the German Textile and Fashion Industry

Benchmarks for textile production

Waste water and waste

Waste water origin	Benchmark
Wool scouring	2 - 6 l/kg [a]
Yarn finishing (wool)	35 - 45 l/kg [a]
Yarn finishing (cotton)	70 - 120 l/kg [a]
Yarn finishing (synthetic fibres)	65 - 85 l/kg [a]
Finishing of knitted fabrics (wool)	60 - 70 l/kg [a]
Finishing of knitted fabrics (cotton)	60 - 135 l/kg [a]
Finishing of knitted fabrics (synthetic fibres)	35 - 80 l/kg [a]
Finishing of woven fabric (wool)	70 - 140 l/kg [a]
Finishing of woven fabric (cotton)	50 - 70 l/kg [a]
Finishing, including printing, of woven fabric (wool)	150 - 180 l/kg [a]
Finishing of woven fabric (synthetic fibres)	100 - 180 l/kg [a]
Sludge from waste water treatment	1 - 5 kg/m³

a) textile substrate

Source: IFC-EHS Guidelines „Textile Manufacturing" and
BAT Reference Document "Textiles", adapted by the Federal Environment Agency.

Waste water emissions in case of discharge to water bodies

Parameter	Emission value
pH value	6 - 9
BOD_5	30 mg/l
COD	160 mg/l
AOX	1 mg/l
Suspended solids	50 mg/l
Oil and grease	10 mg/l
Pesticides	0.05 - 0.10 mg/l [a]
Cadmium	0.02 mg/l
Chromium, total	0.5 mg/l
Chromium VI	0.1 mg/l
Cobalt	0.5 mg/l
Copper	0.5 mg/l
Nickel	0.5 mg/l
Zinc	2 mg/l
Phenol	0.5 mg/l
Sulphide	1 mg/l
Phosphorous, total	2 mg/l
Ammonium nitrogen	10 mg/l
Total nitrogen	10 mg/l
Colour	7 m^{-1} (436 nm, Yellow) 5 m^{-1} (525 nm, Red) 3 m^{-1} (620 nm, Blue)
Toxicity to fish eggs G_{EI}	2
Temperature increase	< 3 °C

a) 0.05 mg/l for total pesticides (organophosphorus pesticides excluded), 0.10 mg/l for organophosphorus pesticides.

Source: IFC-EHS Guidelines „Textile Manufacturing"

Benchmarks for leather and shoe production

Resources and energy consumption

Consumption per unit produced	Benchmark
Energy/fuel	< 3 - < 14 GJ/t raw hide
Chemicals	~500 kg/t raw hide
Water consumption	19 - 28 m³/t raw hide (salted bovine hide)
	16 - 25 m³/t raw hide (unsalted bovine hide)
	110 - 180 l/raw hide (salted sheepskin)
	360 l/raw hide (wool-on sheepskin)

Source: IFC-EHS Guidelines „Tanning and Leather Finishing" and
BAT Conclusions leather industry, adapted by the Federal Environmental Agency

VOC emissions from leather coating

Parameter	Type of production		g/m² *
Solvent use levels	Water borne coatings are used in combination with an efficient application system	Upholstery and automotive leather	10 - 25
		Footwear, garments, leathergoods leather	40 - 85
		Coated leathers (> 0.15mm)	115 - 150
VOC emissions	Where an extraction ventilation and abatement system is used		9 - 23 (1)

* annual average values per unit of finished leather
(1) BAT associated emission level: range expressed as total carbon
Source: BAT Conclusions leather industry

Emissions of particulate matter from leather coating

Measurement period	Emission value
30 minute mean	3 - 6 mg/m³

Source: BAT Conclusions leather industry

VOC emissions from shoe production

Solvent consumption threshold	Emission value
> 5 t/a	25 g VOC per pair

Source: BAT Conclusions leather industry

Waste water emissions from leather industry in case of discharge to a water body

Parameter	Emission value
pH value	6 - 9
BOD_5	< 15 - 25 mg/l
COD	< 200 - 500 mg/l (1)
Suspended solids	< 35 mg/l
Sulphide in partial flow [a]	2 mg/l
Chromium VI	0.1 mg/l
Chromium, total in partial flow containing chromium [b]	< 0.3 - 1 mg/l
Sulphate [c]	300 mg/l
Ammonium nitrogen [d]	< 10 mg/l
Total Kjeldahl Nitrogen [d]	10 mg/l
Phosphorous, total	2 mg/l
Phenol	0.5 mg/l
Toxicity to fish eggs G_{EI} [e]	2
AOX	0.5 mg/l

(1) The upper level is associated with COD inlet concentrations of ≥ 8000 mg/l
a) Waste water from soaking, liming and deliming, each including rinsing
b) Waste water from tanning, including dewatering and from wet finishing, each including rinsing
c) for areas where the sewer systems do not tolerate sulphate
d) for nitrification a water temperature of at least 12 °C is necessary
e) A salt correction value can be subtracted from the GEI value, if the sum of the sulphate and chloride ions is ≥ 3 g/l. The correction value = sum of these ions in g/l rounded to the nearest dilution step (1-2-3-4-6-8-12-16-24ff) divided by 3 g/l (the organism-specific threshold).

Source: IFC-EHS Guidelines „Tanning and Leather Finishing" and BAT Conclusions leather industry, adapted by the Federal Environment Agency

Environmental management – First steps and associated effects

„The working and environmental conditions of our international supply chain are very important to IKEA. Worldwide, we employ a large staff team verifying our requirements in this area. Our main procurement codex is called IWAY - it is based on the statutes of the International Labour Organization (ILO), also considering environmental issues. Our IWAY auditors regularly review all of our about 1 000 direct suppliers, whereby two thirds of the audits are announced. With this we were able to implement more than 100 000 improvements for people and the environment in our partner companies in the last years.“

Ulf Wenzig,
IKEA Deutschland GmbH & Co. KG

Environmental management is not limited to textile, leather and shoe industries, but it is recognized as one of the best available techniques in all industrial sectors. Therefore, this brochure provides an initial incentive for your corporate environmental protection. Strategic environmental management begins with a flow chart regarding materials and energy used in the process. This allows you to know exactly where you can optimise. At the same time you will identify options for organisational improvement or detect unproductive costs. Dispensing with that can significantly increase the cost efficiency and quality of your products. Trust of your customers and partners in you as a supplier will grow because of your transparent documentation of consumption and environmental relevant substances used and disposed of.

Environmental management task comprise key areas of the company as:

- **Analysis of input and output mass flows in your production.**
- **Well-documented procedures for plant maintenance and for storage, dosing and preparation of the chemicals used.**
- **Education/training of your employees.**
- **Effective structure of information and communication throughout your entire value chain.**

Processes in the textile industry are highly complex. Therefore, the BAT reference document recommends you to work closely with your suppliers. Do not only strive to achieve this at your location, also implement step-by-step the co-operation with production partners beyond your direct suppliers. In doing so you will establish a chain of environmental responsibility that will be increasingly decisive for your marketing success.

Identification and control of input and output mass flows

All environmental impacts of a company can be directly linked to mass flows. The better you identify the quality and quantity of these flows, the better you can control them. These mass flows include the input of textile raw materials, chemicals, energy and water on the one hand, and on the other hand, the output of products, waste water, air emissions, sludge, waste and by-products.

The simplest way to begin is by drawing-up an overview of input and output mass flows per production site and year. Following this, a more precise analysis of individual production stages can be undertaken.

GOOD PRACTICE EXAMPLE

Cotonea – healthy cotton leads to quality, ecology and fairness in all production steps

Cotonea, a trademark of Gebr. Elmer & Zweifel GmbH & Co. KG based in Southern Germany intends to differentiate from conventional cotton by sustainable cultivation and processing. Organic cotton from two fix project partners is used as raw material. It is certified according to GOTS and as well to Fairtrade Standard. The production incorporates best available techniques. Chemical use is restricted and monitored by IVN BEST, the most stringent standard worldwide. This leads to final products characterized by fair and environmentally sound production processes and a long durability. All production lines are certified by Fair for Life.

www.cotonea.co.uk
www.global-standard.org
www.naturtextil.de
www.fairtrade.net
www.fairforlife.org

Documentation and monitoring

Document how your company fulfils the requirements of corporate environmental management. In an information system suitable for documentation, your environmental management staff can effectively record and present the proper operation, compliance with legal requirements, and your already achieved environmental objectives. This is particularly important in communication with business partners, authorities, employees and the public. For example, in this way it is also possible to provide seamless records of all relevant data and measures in cases of liability.

Starting with environmental management in your own company is one thing – regularly checking the environmental management yourself is another. These audits should cover all environmentally-relevant procedures. Appoint a responsible audit manager for this task. Many companies, for example, have their environmental management system audited and certified by external auditors. Such a certificate is an external indication that your company applies the right tools and measures for environmental protection.

Training employees is an active way of environmental protection

To ensure that your environmental management approach, and ultimately your improved production processes bear fruit, you should pay attention to the thorough training and further education of your staff. They should all understand and remember their tasks in the field of environmental protection. Periodic training sessions for your staff are especially effective – for example in the use of chemicals, they will know the risks associated with improper storage, handling in production, and how to protect themselves against hazardous substances. Further training topics could be, for example, dealing with machinery, the right approach in separating and collecting waste, or measures for energy saving.

GOOD PRACTICE EXAMPLE

Checklists on best available techniques in the textiles and leather industry

The UBA (Federal Environment Agency of Germany) has published a checklist tool on best available techniques (BAT) in the textiles and leather industry. Brands manufacturers and retailers can use the checklists to disseminate European environmental standards among their suppliers and initiate improvements. The software is based on Excel, it is easy to use and the download is available free of charge in English and German language versions.

Users can select either the entire production process or single stages when comparing their production with the best available techniques of the European Union. Questions guide the user through different topics providing proposals for improvement for energy savings, resource efficiency, substitution of hazardous substances and perfection of the production flow. The checklists comprise many references to additional information such as chapters of the EU BAT Reference documents and additional literature.

When checking their processes, users can fill in the checklist their ideas for improvement as well as priorities, persons in charge and time frames. At the end of the revision process, these ideas and determinations are available as a comprehensive action plan that can be saved electronically, exported in PDF format or printed on paper.

Advantages of the checklists at a glance:

- **Comprises all best available techniques (BAT) mandatory to apply in Europe.**
- **Enables comparison with own processes.**
- **Individual selection of core topics.**
- **Ideas for improvement measures.**
- **Action plan for further use.**

www.umweltbundesamt.de/en/publikationen/umweltstandards-in-textil-schuhbranche

The job of your environmental manager: analysis, action, monitoring

For being successful with the integration of environmental innovations in your company, someone must take responsibility for this. Appoint a staff member for environmental management, with responsibility for co-ordinating this field and acting as a contact person for all environmentally-relevant matters. Depending on the size of your company, this task can also be undertaken by a team for environmental protection. It should represent the key departments of your company, such as research and development, production, purchasing, sales, marketing and communication.

Tasks of your environmental management:

- **Identification and prioritization of acute environmental risks in the company, so that these can be addressed quickly. This also includes obtaining support from specialists and environmental partners on site.**
- **Precise description of process stages with increased potential for environmental risk at your company. Precisely-defined procedures are an important basis for environmental management system measures with regard to environmental protection issues.**
- **Integration of the measures described in this brochure into your corporate processes in a manner that ensures that no inefficient isolated solutions arise.**

As a company, you should have a vision which includes an environmental commitment. The goals of environmental management should also be anchored in your corporate strategy. As a consistent top-down approach it is advisable, for example, to prescribe environmental management topics as fixed agenda items in meetings whenever relevant.

Setting objectives should be an integrative approach. It should incorporate environmental protection throughout your company, not leaving it as a concern of a specific environmental department. The management level of your company should assume an exemplary role in this.

Ready to use: BAT for good housekeeping

At first glance it may look difficult for you to take environmental aspects into account in your company. You may be afraid of a costly restructuring of your production processes. However, switching to environmentally sound production is often very simple. Many suggestions in the following pages can be implemented without significant human resources. Also some techniques do not acquire high costs. On the contrary: you will save money by using less resources, energy and water.

General measures for environmental management and good housekeeping for the textiles and leather industries are described in Chapters 5.1 of the respective BAT reference documents. These measures form the basis of your resource efficient production. They are presented hereafter and can be read more in-depth in each of the BAT reference documents. You will find the chapter numbers of the BAT reference documents to simplify finding the techniques in the original document.

„Worldwide production of shoes or textiles needs to focus more strongly on the areas of sustainability and environmental protection in future. Transparency, staff training and the regular recording of environmental data are important pre-requisites for sparing the environment and achieving financial success at the same time.“

Stefan Seidel, PUMA SE

Process	BAT	Water	Energy	Resource	Waste	Air
Education/ training of employees	Employees learn preventive environmental and work safety measures, as well as measures for saving resources at the company. The training should be tailored to the resources (chemicals, raw materials, energy, water), processes and the equipment/machinery.	●	●	●	●	●
Equipment maintenance and operations audit	Maintain machinery, pumps and piping thoroughly and check for leaks. It is not only the water system that should be considered here, but also systems for heat transfer liquids and chemicals dispensing systems. Schedule maintenance plans that foresee regular maintenance and document all work activities.	●	●	●	○	○
	Include the most important components of the machinery such as pumps, valves, level sensors, and pressure and flow control instruments in the maintenance plan.	●	●	●	○	○
	Check and clean filters regularly.					●

● High potential for reduction of environmental impact and reduction of costs in related sector ○ Potential for reduction of environmental impact and reduction of costs in related sector

Most relevant improvements in each production stage and related environmental impacts

Process	BAT	Water	Energy	Resource	Waste	Air
Equipment maintenance and operations audit	Calibrate measuring devices, for example measuring and dosing systems for chemicals and thermometers.			●		
	Clean and maintain thermal treatment equipment (such as stenters) regularly (at least once a year). Remove residues from the exhaust air ducts and from the burner air intake pipes.		●			●
Storage and handling of chemicals	Store all chemicals in accordance with instructions (as stated in the safety data sheet of the manufacturer).	●		●	●	●
	Ensure that all safety data sheets for all chemicals used and stored are available up-to-date and easily accessible.	●				●
	Check the leak tightness of all areas in which chemicals are stored or where a leak is likely, so that leaking chemicals cannot enter the groundwater or the sewer. Keep storage areas well ventilated, in particular where halogenated and halogen-free organic solvents or waste containing these substances are stored.	●		●	●	●
	Take preventive technical measures for the safety and protection of individuals: - Keep first-aid facilities on hand, - Conduct regular drills of evacuation and emergency situations on site, - Document accidents and incidents.					
	Regularly inspect pumps and piping systems used for chemicals for leaks.	●		●		
	In the case of manual work take precautions for the safe handling of chemicals (including regular employee training).	●		●		●
	To avoid loss in manual handling weigh, dose and mix chemicals carefully.			●		
Lower costs up to **30 %**	Use automatic preparation and dispensing equipment. BREF TXT 4.1.3	●		●	●	
Improved knowledge of the raw materials and chemicals used	Monitor the input and output flows of the individual processes continuously. Determine the input and output mass flows for the entire facility, as well as for each individual production process. Implement a product input check that takes account of raw materials, chemicals, dyes and auxiliary materials etc.	●	●	●	●	●

BREF TXT refers to BAT Reference Document "Textiles" **BREF TAN** to BAT Reference Document „Tanning of hides and skins"

● High potential for reduction of environmental impact and reduction of costs in related sector ● Potential for reduction of environmental impact and reduction of costs in related sector

„Companies do not only practise an effective risk management when using exclusively chemicals examined and approved by independend bodies regarding their toxicity and biological degradability. These companies can obtain a certificate, also, acknowledging the pollution reduction which can be used for advertising this benefit to their customers."

Claudia Kersten,
Global Organic Textile Standard GOTS

GOOD PRACTICE EXAMPLE

TEGEWA placards safety guidelines in tanneries

Proper handling of chemicals cannot be taken for granted everywhere outside Europe. In order to have the most elementary protective measures for all handicraft activities present at all times, the manufacturers of leather processing chemicals represented by TEGEWA Association provide their tanning industry customers with a poster addressing protective measures. The poster shows the pictograms presented here. It is signed by the company management as a declaration of self-commitment. The poster is available in English, Chinese, Hindi, Bengali and Tamil.

www.tegewa.de/en

GOOD PRACTICE EXAMPLE

ZDHC finalizes the discharge of hazardous chemicals into water bodies

„We support ZDHC objectives, and provide our specific knowledge of textile and leather chemicals to the ZDHC as well as our longstanding experience with the comprehensively regulated legal framework. Our member companies have developed chemicals corresponding to the criteria of ZDHC-MRSL – without losses regarding technical requirements. Chemicals are offered worldwide and can be found not only on the websites of our members but also on the ZDHC gateway for MRSL-compliant chemical auxiliaries.“

Dr. Volker Schröder, TEGEWA Association

In 2011, renowned brand manufacturers and retailers of the textile industry founded the initiative ZDHC (Zero Discharge of Hazardous Chemicals) to take care jointly for improved production conditions and higher transparency along the value chain and externally. Until 2020, hazardous substances shall be eliminated from the textile and leather value chains. This is intended to ensure that the substances are no longer discharged into water bodies and are no longer relevant neither for the work place safety nor for consumers. ZDHC – since 2016 a foundation according to Dutch law – intends to interlink all relevant stakeholders by involving the chemical industry, certification bodies, textile finishing industry in Far East, science and authorities. The ambitious goal shall be achieved by comprehensive local training and capacity building, audits, and training material in many languages. The focus is on a list of substances (“Manufacturing Restricted Substance List –MRSL“) that must not be used in chemicals for textile and leather manufacturing.

www.roadmaptozero.com

Containers for yarn dying

Most relevant improvements in each production stage and related environmental impacts

Process	BAT	Water	Energy	Resource	Waste	Air
Minimisation/ optimisation of the chemical input	Refrain from using chemicals in processes in which the desired process result can also be achieved without the use of chemicals.	●		●	●	●
	Check recipes regularly in order to identify and avoid excess chemical volumes.	●		●		●
	Employ chemicals and auxiliary materials with good biodegradability/bioeliminability, low human and eco toxicity, low volatility and odour intensity.	●				●
	Employ improved measurement and control equipment, for example for temperature, chemical addition, retention time, moisture (in dryers).		○	○		
	Apply minimum application procedures.	●	○	●		
	Avoid/minimise all excess chemicals and auxiliary materials (e.g. through automatic dosing points for chemicals).	●		●		●
	Optimise process sequences in production. For example, water and chemicals for machine cleaning can be reduced where dark dyeing follows light dyeing.	●		●		
	Use vapour recovery systems (vapour return) when filling volatile compounds.			●		●
	Re-use process liquors.	●		●		
	Pay attention to high fresh water quality to avoid/reduce the use of chemicals to treat process water.				●	
Use of water and energy	Describe production processes in a detailed and comprehensive way, so that resources are not wasted through unsuitable work processes.	●	●	●		
	Monitor consumption of water and energy.	●	●			
50 - 75 % *less water consumption*	Employ efficient washing processes, for example: - Replacement of overflow rinsing with interval rinsing, - Counter current principle. BREF TXT 4.9.1, 4.9.2, BREF TAN 4.6.1.2	●	○			

BREF TXT refers to BAT Reference Document “Textiles” **BREF TAN** to BAT Reference Document „Tanning of hides and skins“

● High potential for reduction of environmental impact and reduction of costs in related sector ○ Potential for reduction of environmental impact and reduction of costs in related sector

Most relevant improvements in each production stage and related environmental impacts

Process	BAT	Water	Energy	Resource	Waste	Air
Use of water and energy *Savings potential for total energy consumption up to* **9 %**	Insulate pipes, valves, containers and machinery. BREF TXT 4.1.5, 4.8.1 *Increased insulation on the stenters alone from 120 mm to 150 mm saves* **20 %** *of energy*		●			
	Optimise process sequences in production.	●	●	●		
	Combination of different aqueous procedures in one single-stage process step (e.g. combined scouring and desizing, combined scouring/ desizing and bleaching). BREF TXT 4.5.3	●	●			
Reduces specific water consumption from **60** l/kg *to* **25** l/kg	Reuse water, for example: - Reuse the last rinsing baths. - Reuse dye baths. - Use the water from the pre-wash for the re-washing (carpet finishing). - Use counter current for continuous wash. - Use cooling water as process water. BREF TXT 4.6.22, 4.1.1, 4.5.8, BREF TAN 4.6.1.5	●	●	●		
Savings potential for water, chemicals and heating energy of up to **50 %**	Use machines with low liquor ratio (short bath). Use airflow-jet dyeing machines instead of conventional jet dyeing. Modern tanning tanks save water. BREF TXT 4.1.4, BREF TAN 4.6.1.3, 4.6.1.4	●	●	●		
	Separation of residual liquor - no discharge as waste water.	●		●	●	
	For batch processes: install automatic control devices that enable the precise setting of filling volumes and bath temperature. BREF TXT 4.6.19	●	●	●		
	For continuous processes: install flow meters and automatic shut-off valves that link the water flow with the main drive of the machine. BREF TXT 4.9.2	●	●	●		
	Closed design of machines to reduce steam losses. BREF TXT 4.1.1, 4.6.19		●			
	Separate the hot and cold waste water streams before the heat exchanger and recover the heat in hot stream. BREF TXT 4.9.2	●	●	●	●	●

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GOOD PRACTICE EXAMPLE

Effective know-how transfer for companies – CPI2 online tool

Production sites have a high demand for practice-oriented assistance. On this background, the online tool of the CPI2 initiative provides useful knowledge and support for textile producers. Textile brands and retailers can use the tool as well to implement environmental standards in their global supply chains.

The CPI2 tool comprises three modules: energy, water and waste water, chemicals. Through a self-assessment, production sites identify relevant fields of action and obtain a detailed list of recommended measures. The list of measures is sorted by simple measures without investments to most challenging top measures. In total, more than 400 improvement measures are stored in the tool, all including information about costs and benefits. The implementation is supported by additional elements like practical guidelines, informative sheets and case studies. The tool is available in six languages. The development was technically assisted by the Umweltbundesamt.

Example of a multistage textile production (dying, washing, finishing) in Bangladesh:
With help of the CPI2 tool, the producer identified 13 improvement measures and implemented those subsequently. Heat recovery was installed at the stenter frame, saving about 100 000 m³ natural gas. Improved maintenance of the boiler and the steam pipe network lead to 1.5 % heat savings. The installation of speed controls for pumps reduced their electricity demand by 35 % on an average. Additionally, meters were installed to improve the monitoring of water consumption. All employees working with chemicals were specifically trained. Energy savings alone summed-up to 38 000 euros per year. Investment costs of 60 000 euros were paid off in less than two years.

www.cpi2.org

„Capacity building plays a central role in our sustainability management. CPI2 supports us and our suppliers to put theory into practice."

Felix Rauer, Otto GmbH & Co. KG

GOOD PRACTICE EXAMPLE

Heat recovery from waste water at TVU Group

TVU Group, based in Leutershausen in southwest Germany exists for 40 years and is one of the biggest yarn finishing companies in Europe. 150 employees dye an average of 4 500 tons of yarn per year.

The dying process generates a high amount of warm or hot waste water. Originally, waste water was discharged directly to the sewage plant. Discharged waste water temperature sometimes exceeded 40°C. The system described hereafter was installed in particular to exploit the energy saving potential: If waste water temperatures exceeds 50°C, a partial flow is separated and collected in a 250 m³ buffer tank. The waste water passes through a very efficient plate heat exchanger with cold fresh water in counter flow. Cold fresh water is heated and hot waste water is cooled. The heat exchange recovers 60 % of the heat input and can be used where hot fresh water is needed.

Process energy (hot water with 175°C and 10 bar) is produced in a biomass plant (fuel: woodchips). The plant is connected with a district heating system providing energy to public buildings like a school, an indoor swimming pool, a sports hall and a kindergarten as well as to several private residences.

Sustainable benefits of the waste water heat recovery system:

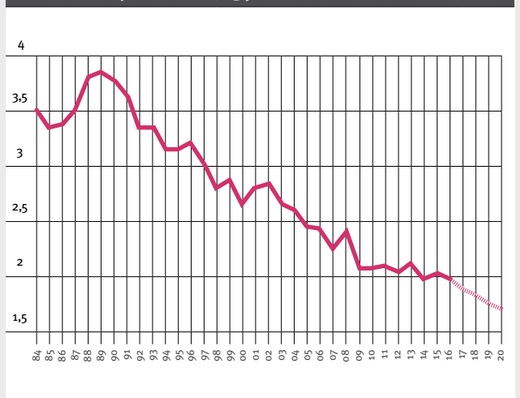
- **Increase of energy efficiency due to 60 % heat recovery.**
- **Saving of limited resources as no fossil fuel is needed.**
- **Minimized emissions as electrostatic filters are used to reduce pollutant release.**
- **Use of wood residues (woodchips), produced exclusively from untreated waste wood.**

www.tvu.de/en

Yarn bobbins before and after the dye bath.

Reduction of heat consumption from 1984 to 2020 *(2017 - 2020 projected)*

Heat consumption in kWh/kg yarn



- **3 000 kW heat recovery in total.**
- **4 000 tons of CO_2 reduction per year.**
- **Energy savings equal 1.4 million litres heating oil consumption per year.**

Most relevant improvements in each production stage and related environmental impacts

Process	BAT	Water	Energy	Resource	Waste	Air
Use of water and energy *Saving potential in energy up to* **70 %**	Install exhaust air heat recovery systems.		●			
	Optimise the boiler house: - Condensate recovery. - Pre-heating of air intake. - Heat recovery from combustion flue gases.		●			
	Install variable speed electric motors. Use electrical motors with efficiency class IE3.		●			
Waste and waste water management	Treat waste water within the company or externally.	●				
	Seperate highly-polluted and mildly-polluted waste water flows separately in order to achieve improved treatment efficiency.	●				
	Collect unavoidable solid waste separately.				○	
	Prevent the contamination of daily waste with hazardous waste via strict waste separation procedures.				●	
	Save material in packaging.			●	●	
	Use returnable containers.			●	●	
	Organise processes in a way that avoids waste or at least reduces the volume of waste.			●	●	
	Recycle waste.			●	●	
Exhaust air treatment	Exhaust air treatment for emission-relevant processes.					●

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● High potential for reduction of environmental impact and reduction of costs in related sector ○ Potential for reduction of environmental impact and reduction of costs in related sector

Process-integrated BAT in the textiles industry

„Production sites of the global textile value chain have a lot of potential to safe resources and costs by more efficient use of energy, water or chemicals. The identification and implementation of appropriate measures and techniques can lead to huge ecologic and economic advantages. In this process, a good adaptation of the necessary know-how to each specific target group is key for success.“

Hubertus Drinkuth, Systain Consulting GmbH

While good housekeeping concerns with measures for the whole production, process-integrated BAT relate to specific production stages. Integrated techniques are used for the selection of raw materials, pretreatment, dyeing, printing and finishing. Supplementary end-of-pipe measures are related to waste management and treatment of emissions to waste water and exhaust air. The latter are covered in a separate chapter (p. 39).

Unless otherwise stated, all chapter numbers refer to the BAT reference document “Textile industry” and therefore to the textile production process. This brochure presents only selected measures of the BAT reference document. Details of all best available techniques, including those not listed here, can be found in the document itself including the deepest technical details.

The content of the REACH Regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals) regarding the use of chemicals is not covered in this brochure. In the annex, you can find additional information on this topic. Ideas to improve your chemical management can be found in the Partnership for Sustainable Textiles (p. 9) and in the initiative ZDHC, aiming at zero discharge of hazardous chemicals into water bodies (p. 22).

BAT for raw materials input

Process	BAT	Water	Energy	Resource	Waste	Air
Use of chemicals	Use of surfactants, complexing agents and anti-foaming agents that are biodegradable or bioeliminable in waste water treatment. BREF TXT 4.3.3–4.3.5	●				
	Use of substances with low human and eco toxicity (replacement of substances of very high concern according to the REACH Regulation (CMR substances, PBT substances and substances with comparable potential as per article 57a-f of the REACH Regulation)).	●				●

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GOOD PRACTICE EXAMPLE

Lower environmental impact by sustainable chemical monitoring at A&E Gütermann

A&E Gütermann have analyzed and optimized all processes for many years. The approval of chemicals, dyestuffs and additives occurs only after a critical check of the data sheets and after we have conducted several application tests in our laboratory. If environmentally compatible and health-friendly substances are available we will always use them. Because of this procedure we have reduced the pollution in the waste water since 2004. The volume was reduced from 1 000 m³/day to about 600 m³/day, although the dyeing capacity has increased by 20 - 30 % in the same time.

www.guetermann.com

Latest high efficient dyeing vessel for a resource-economical dyeing (left) and automatic winding machine with the use of energy-efficient motors (left below).

„By continuous improvements of our manufacturing process during the last years, we have succeeded to reduce the power consumption by approximately 20 % and the water consumption by around 40 % in spite of the increase in our production.“

Clemens Schneider, A&E Gütermann

GOOD PRACTICE EXAMPLE

Josten Top Line – Workwear Made of 100 % Organic Fair Trade Cotton

Consumers appreciate more and more if production standards are ecologically and socially responsible. The demand for textiles made of fair trade cotton is constantly growing. This green conviction is also shared by the manufacturer HUGO JOSTEN AT WORK, based in northwest Germany, therefore offering workwear made of 100 % organic fair trade cotton since 2010, acknowledged by the label "FAIRTRADE – Certified Cotton". The collection JOSTEN TOP LINE offers high quality workwear made of organic cotton and recycled polyester. Comprehensive and functional features go well along with sustainable and high quality tissue. Processing of cotton to yarn and tissue as well as subsequent manufacture of clothing is realized by Hugo Josten in certified companies in Europe (e.g. tissue production in France). Regarding applied materials, this means in detail: 100 % organic fair trade cotton or 65 % organic fair trade cotton with 35 % recycled polyester. Certified fair trade cotton originates from specific regions of Africa.

www.hugo-josten.de / www.fairtrade.net

BAT for pre-treatment

Process	BAT	Water	Energy	Resource	Waste	Air
Desizing	Selection of raw material with size that is biodegradable or bioeliminable. BREF TXT 4.2.4	●	●	●		
	Selection of raw material with minimised size application (via pre-wetting prior to sizing). BREF TXT 4.2.5	●		●		
	Combination of desizing, washing and bleaching in one process stage. BREF TXT 4.5.3	●	●			
Recovery rates for size **80-85 %**	Recovery and reuse of water soluble synthetic sizing agents by ultrafiltration. BREF TXT 4.5.1	●		●		
Bleaching	Use of hydrogen peroxide instead of chlorine-based bleaches. BREF TXT 4.5.5, 4.5.6	●				
Mercerising	Recovery and reuse of caustic soda solution from the mercerising process. BREF TXT 4.5.7	●		●		

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GOOD PRACTICE EXAMPLE

Wool treatment without chlorine emissions by Schoeller Spinning Group

Schoeller Spinning Group is a global vendor of yarn, with a focus on worsted yarn. Production sites are located in Austria, Germany and Czech Republic.

Besides certified bio cotton (GOTS) and reduction of hazardous chemicals (bluesign system partner) Schoeller Spinning Group developed a revolutionary new technique for wool finishing: EXP, standing for "EX-Pollution". It enables the wool to remain machine-washable without chlorine pollution associated with usual finishing techniques. Schoeller has set a benchmark with this innovation and once again proven its commitment to ecological sustainability.

Wool has a scaly surface, and as its fibres do not sit uniformly, they snag when they contact one another. A warm, humid environment increases this effect and the wool becomes felted. Wool is treated in order to prevent this effect. The conventional process involves smoothing the scales and then coating the chlorinated wool fibres with a wash-resistant polymer film. A substantial amount of chlorine compounds is released during this process ("AOX" emissions). They lead to environmental pollution and can be detected in the wool fibres. The EXP technique completely avoids the use of chlorine and employs natural salts as oxidiser.

www.schoeller-wool.com
www.global-standard.org
www.bluesign.com

The patented chlorene-free EXP technique of Schoeller for the first time achieves a hard-wearing and also environmentally sound wool finishing.

BAT for dyeing

Process	BAT	Water	Energy	Resource	Waste	Air
General BAT for dyeing	Reduction in the number of dyes used.			●		
	Use of automatic dosing and conveying systems for dyes (manual mixing for dyes seldom used). BREF TXT 4.1.3	●		●	●	
	In case of long, continuous conveyor distances (dead volume of the conveyor system comparable to the volume of the dyeing foulard): use of decentralised, automatic dyeing points that do not pre-mix the different chemicals with the dyes prior to the dyeing process.	●		●	●	
General BAT for batch dyeing *Optimisation of machine equipment for winch beck dyeing machines saves up to* **50 %** *fresh water and up to* **30 %** *energy*	Use of dyeing machines with - Automatic controls for filling volume, temperature and other relevant parameters. - Indirectly heated heating and cooling systems. - Hoods and doors to minimise vapour loss in enclosed dyeing machines. BREF TXT 4.6.19–4.6.21	●	●	●		
	Use of suitably-dimensioned dyeing machines.	●	●	●		
General BAT for continuous dyeing processes	Use of adding systems with low flow rates. Minimisation of the volume capacity of the dip trough (for the pad dyeing technique). *The use of a U-trough reduces the bath residue by* **60 - 90 %**	●		●		
	Improved washing efficiency via the counter current principle. Reduction in carry-over (e.g. squeeze rollers). BREF TXT 4.9.2	●	●			
Polyester and polyester blends dyed with disperse dyes	Use of polyester fibres that can be dyed without carriers: 1st priority. BREF TXT 4.6.2	●		●		☁
	Dyeing under high temperature conditions without the use of carriers: 2nd priority.	●		●		☁
	Substituting conventional dye carriers with compounds based on benzyl benzoate and N-alkylphthalimide: 3rd priority.	●				☁
Batch dyeing with reactive dyes *Lowers neutral salt consumption by a third. Important in arid climate zones with negative water balance*	Exhaustion dyeing of cellulose fibres with low salt reactive dyes. BREF TXT 4.6.11	●				

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● High potential for reduction of environmental impact and reduction of costs in related sector ● Potential for reduction of environmental impact and reduction of costs in related sector

GOOD PRACTICE EXAMPLE

Colours at hessnatur - a model for people and the environment worldwide

Fashion is the expression of a lifestyle. Coloring is an integral part of the textile value chain. In many countries of the world water - and thus also the drinking water – is contaminated by the textile industry.

hessnatur therefore relies on colors which are uncritical to humans and the environment. hessnatur excludes dyes containing heavy metals as well as certain turquoise tones or neon colors. In a current jeans project, natural indigo is used from organic cultivation. The dyeing auxiliaries also exclude toxic substances. All used colors are tested for harmful substances. All wet processes are governed by a hessnatur guideline. Tests in contact with perspiration or moisture ensure the color fastness of the dyed fabrics. In addition, hessnatur monitors the manufacturers of the dyes, the composition of the colors as well as the production conditions. hessnatur works only with factories which are proven to have at least a two-stage waste water treatment plant.

With about 3 million items that go to our customers per fiscal year, we think we can make a significant contribution to environmental protection.

www.hessnatur.com/corporate

For the production of jeans, hessnatur has been using organic cotton from sustainable, fair trade cultivation for decades. The current jeans project is about plant coloring processes by means of the indigenous Indian plant. (Indigofera tinctoria).

GOOD PRACTICE EXAMPLE

Step by step Schöffel collection gets PFC-free

Fluorocarbons (PFC) are used to produce outdoor clothing in order to make them water and dirt repellent. As they are not degradable in nature, Schöffel decided consciously to eliminate PFC from their products until 2020. Our goal is to offer high quality alternatives and for that reason we implement this process step by step.

Initially we started to convert our most simple product groups. Already in winter 2017 we are able to offer the entire kids collection PFC-free. Furthermore, all our Schöffel-LOWA stores provide professional PFC-free re-impregnation service to our end users, executed by our experienced partner Meyer & Kuhl.

www.schoeffel.de

„The conversion to PFC-free alternatives should always be accompained by offering professional re-impregnation service to ensure long usability of the products.“

Katrin Klug, Schöffel Sportbekleidung GmbH

BAT for finishing

Process	BAT	Water	Energy	Resource	Waste	Air
General information	Use of low add-on application techniques or reduction volume of padding devices.	●		●		●
	Replacement of halogen organic solvents (e.g. in stain removal and subsequent cleaning).					●
	Use of recipes optimised with regard to lower emissions in air and waste water such as use of fomaldehyde-free or low formaldehyde crosslinking agents. BREF TXT 4.3.1, 4.3.2	●		○		●
Energy savings *of up to* 15 % *of up to* 57 % *of up to* 70 % *of up to* 20 %	Minimisation of energy consumption of stenters: - Use of mechanical dewatering to reduce moisture content of the textile to be dried. - Optimisation of air flow at the stenters. - Installation of heat recovery systems. - Insulation of thermal treatment units. - Regular maintenance of the burners in the case of directly heated thermal treatment units. BREF TXT 4.8.1		●			●

BAT for washing processes

Process	BAT	Water	Energy	Resource	Waste	Air
Washing *Lowers water consumption up to* 50 - 75 %	Replacement of overflow washing with drainage/inflow methods or ”intelligent“ rinsing techniques. BREF TXT 4.3.1	●				
	Installation of washing machines with improved functions - Flow measurement. - Improved washing efficiency through applied counter current principle with water recycling. - Use of heat exchangers. BREF TXT 4.8.1	●	●			

BREF TXT refers to BAT Reference Document “Textiles” **BREF TAN** to BAT Reference Document „Tanning of hides and skins“

● High potential for reduction of environmental impact and reduction of costs in related sector ○ Potential for reduction of environmental impact and reduction of costs in related sector

GOOD PRACTICE EXAMPLE

PFC-free future for JACK WOLFSKIN products

JACK WOLFSKIN decided already in 2008 to protect the environment by starting the first measures to reduce the use of PFC. During an intensive cooperation with suppliers, new PFC-free alternatives were researched, tested and developed to market maturity. All membranes and coatings used by JACK WOLFSKIN are based on polyurethane (PU) and do not use PFC at all. All re-impregnated offers made by JACK WOLFSKIN (household laundry or professional re-impregnation service) are PFC-free as well. Material and waste water is regularly tested by JACK WOLFSKIN regarding PFC (tests are transparently made available to the interested public). This procedure of close cooperation with suppliers allows the identification of PFC even where its use is unknown, yet. The use of water-repellent finishing is avoided wherever possible.

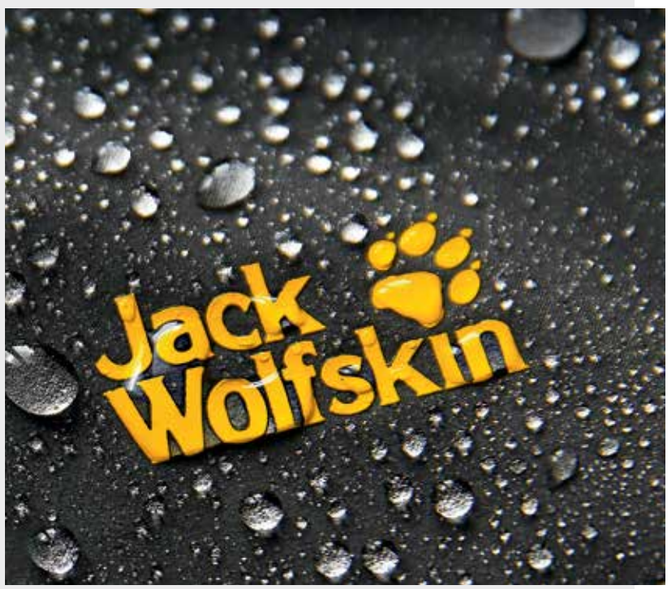
JACK WOLFSKIN fosters basic research of topics related to PFC in surface water in cooperation with the Helmholtz Institute. Equally, JACK WOLFSKIN supports knowledge transfer by providing access to new findings for all suppliers.

In 2017, 89 % of the summer apparel collection was offered PFC-free. We sensitize the public to PFC, and customers receive information on PFC-free articles on product labels. Until 2020, JACK WOLFSKIN will abandon the use of PFC completely.

www.jack-wolfskin.co.uk/pfc/
www.subsport.eu

„Suppliers appreciate an intensive and open exchange about resource productivity and BAT. A clear communication about opportunities and assistance is often the first incentive to reflect about solutions and techniques as well as for investments into profitable improvements.“

Melanie Kuntnawitz, JACK WOLFSKIN
Ausrüstung für Draussen GmbH & Co. KGaA



GOOD PRACTICE EXAMPLE

VAUDE announces Greenpeace Detox Commitment

In its Greenpeace Detox Commitment of July 2016, the outdoor outfitter VAUDE made a voluntary commitment to eliminate all hazardous substances in the entire supply chain by 2020.

For VAUDE, the Detox Commitment involves major challenges going far beyond the company's current high degree of dedication. The biggest challenge is the commitment to the Manufacturing Restricted Substance List (MRSL), regulating strict limits and banning the use of many chemical substances both in the production process and in the final product. The crucial issue in this regard is the fact that the MRSL does not only refer to chemicals in the final product but also to all chemicals used in the production process.

Specific action plan of our Commitment:

- Full transparency regarding our supply chain (material providers and manufacturers).
- Binding Manufacturing Restricted Substance List (MRSL), providing strict limit values and bans for many chemical substances in the production process and in the final product.
- Complete ban for hazardous chemicals following the precautionary principle and a risk-based approach (PFC included).
- Waste water test regarding pollutants according to MRSL and publication of all test results.
- Close cooperation with suppliers and leading experts of the sector, together with know-how transfer, training and audits along our supply chain.

www.vaude.com/en-GB

„A very effective example of cleaner production is retention and re-use of storage-stable residual liquors from finishing, coating and dying. Residual liquors can be separated and stored with a simple change of the chassis installing a two way valve. Instead of discharging, liquors are ready for use in the next batch - eventually after adjustment. If chemicals are very expensive or persistant, it is worth separating also the first rinsing water. In the case of frequent batch changes, a residual liquor of 100 liters will lead to several milligrams of pollutant contamination in 500 000 liters waste water. “

Dr. Monika Kohla, Association of the textile and clothing industry in Northwest Germany

BAT for printing

Process	BAT	Water	Energy	Resource	Waste	Air
General information *Achievable recycling rates of between* **50 - 75 %**	Recycling of residual printing paste. BREF TXT 4.7.6			●	●	
Lowers water consumption up to **55 %**	Reduction in water consumption in cleaning processes: - Start/stop control of cleaning of the printing belt. - Reuse of the cleanest part of the rinsing water from the cleaning of the squeegees and screens. - Reuse of the rinsing water from the cleaning of the printing belt . BREF TXT 4.7.7	●				
Reactive printing	Substitution or reduction of urea volumes: - Single-stage process with controlled humidifying. BREF TXT 4.7.1	●		●		●
Pigment printing	Use of optimised, low-emission printing pastes: - Low-emission thickener. - APEO-free and with a high degree of bioeliminability. - Reduced ammonia content. BREF TXT 4.7.3	●		●		●

„Companies should use materials and techniques with the lowest environmental impact and approved as toxicologically harmless to humans.“

Kristin Heckmann, Hess Natur-Textilien GmbH

Optimized transfer of chemicals from storage to the batching tanks. The tanks are directly connected with the chassis.

Environmentally sound techniques in the making-up of textiles

Making-up of textiles describes the process of clothing production. The process chain from the tissue to the final product consists of:

- **Cutting/separating.**
- **Joining (sewing, welding, gluing).**
- **Shaping.**
- **Finishing.**
- **Packing.**

In these production stages, the highest environmental impact originates from energy consumption, use of chemicals and associated air emissions, as well as waste generation.

Energy

New energy saving machines for ironing or pressing can significantly reduce your energy consumption. High-frequency fixing techniques of modern presses act only on the adhesive, similar to a micro-wave. Therefore, a working temperature of just around 120 °C is required, which not only protects the textile surface, but also reduces energy costs. Additional measures for environmentally sound making-up can be found in the chapter ”Ready to use: BAT for good housekeeping“ (p. 19).

Chemicals emissions

During making-up, sewing and ironing work places should be equipped with an air extraction system as harmful emissions may occur. On the one hand, halogenated and non-halogenated organic solvents may be emitted from solvents used for stain removal. Furthermore, formaldehyde emissions may occur during ironing from formaldehyde used for easy care and non-iron finishing.

Formaldehyde is classified as carcinogenic and can also cause allergic reactions. The maximum work place concentration should not exceed 0.3 ml/m³ (ppm) or 0.37 mg/m³ (DFG). You can strongly reduce or even avoid formaldehyde emissions by using formaldehyde-free or low-formaldehyde curing agents in your processes.

Waste

The best waste is the one you can avoid. When cutting out textiles, for example, make sure all pieces are best arranged with optimal nesting. Specialized nesting software can be applied to achieve automatic arrangements - for example on CNC cutting machines. Unavoidable waste is best collected separately, so that it can be recycled.

„Health-endangering VOC emissions in textile, leather and shoe production need to be reduced. Whether by good housekeeping measures or altered production processes – the techniques to achieve this are known and well documented as BAT.“

Jonty Wilson, C&A Mode GmbH & Co. KG

„All production is associated with environmental effects. The consumer expects these to be minimised, for example by using the BAT and where possible avoiding chemicals with properties that are hazardous to health and the environment.“

Dr. Rolf Buschmann,
BUND - Friends of the Earth Germany

GOOD PRACTICE EXAMPLE

HELLER-LEATHER goes new ways in leather tanning

In Europe, Germany is currently the third largest leather producer. Here, mainly leather is produced for the premium segment of the car and furniture industry, as well as for high-quality shoes, bags and saddlery. Approximately 35 industrial companies process the animal skins in Germany and tan approximately 25 million square meters of leather annually. About 80 % of this is tanned industrially using chromium salts.

In Europe alone, 16 million tons of olives are harvested annually. So far the leaves of the trees are burned on the plantations after the harvest. The idea of producing organic leather by olive tanning was developed in 2006 by a collaboration of experts from the Darmstadt-based biotech company N-ZymeBioTec with experts from the leather institute Gerberschule Reutlingen. The researchers had knowledge of the use of olive leaf extracts from food and cosmetics industries.

The olive tree protects its leaves and fruits from pests with natural bitter substances. It is precisely this bitter substance, called Oleuropein, that creates firm bonds with the skin protein collagen, and in doing so is almost as efficient as conventional tanning agents, but without being labeled as a hazardous substance.

The advantages of tanning agent from olive leaves:

- **Oleuropein is obtained from a renewable raw material which otherwise ends up as waste.**
- **Oleuropein is not a hazardous substance under European law.**
- **The process of pickling is omitted so that salts and acids used for this process are not required.**
- **Residues generated during production can be recycled to 100 %.**

www.heller-leder.com/blattwerk-169.html

It is an innovation to use tannin of olive leafs in conventional tanning barrels. Among its advantages is the possibility to use it efficiently in existing installations and thereby on large scale.

Process-integrated BAT in the leather industry

Same as for textile production, many environmentally sound techniques have proved their effectiveness in the manufacturing of leather. Good housekeeping – as described at the beginning of this brochure for both industries – also plays an important role in implementation of measures for environment and health protection (p. 19). Additionally, best available techniques are described for the monitoring of relevant parameters and for specific production stages. In the following tables, all references relate to the BAT reference document (2013), except information about shoe manufacturing (p. 46). In this area, the PFI Institute located in Pirmasens in Germany has conducted some research projects since 2003 addressing VOC emission reduction in shoe production, and has drawn-up a basis for its implementation into practice, as addressed in this brochure.

This brochure presents only some selected measures of the BAT reference document for tanning of skins and hides. More detailed information related to best available techniques can be found in the BAT reference document, including those techniques not mentioned here.

Process-integrated techniques are used for example in the beamhouse, in tanning and leather finishing. End-of-pipe techniques are employed for waste management as well as for treatment of waste water and exhaust gas. The latter are presented in a separate chapter (p. 48).

BAT for the monitoring

Process	BAT	Water	Energy	Resource	Waste	Air
Monitoring and recording BREF TAN 5.2.	Measurement of water consumption in the two process steps: up to tanning and post-tanning, and recording of production in the same period.	●		●		
	Documantation of the chemicals consumption in each process step and recording of production in the same period.			●		
	Monitoring of relevant parameters in waste water (e.g. sulphide, chromium, COD, BOD).	●				
	Monitoring of volatile organic substances.					●
	Documentation of the quantities of process waste that are recovered, reused, recycled and disposed.				●	
	Documentation of all forms of energy consumption and of production in the same period.		●			

BREF TXT refers to BAT Reference Document "Textiles" **BREF TAN** to BAT Reference Document „Tanning of hides and skins"

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BAT for the beamhouse

Process	BAT	Water	Energy	Resource	Waste	Air
Curing and soaking	Processing of fresh hides, where available. BREF TAN 4.4.11, 5.4.1					
	Reduction of salt consumption as far as possible.					
Liming and unhairing *Reduces COD and sulphide content in each process by* **40 - 70 %**	Reduction of sulphide consumption via the use of enzyme preparations (not for sheepskins). BREF TAN 4.5.3.2, 5.4.1					
Reduces the sludge volumes in waste water treatment by **15 - 30 %**, *the COD content of waste water by* **30 - 65 %**, *and BOD content by* **60 %**	Use of hair-save technique.					
Splitting	Use as much of the split as possible.					
Deliming and bating *Reduces overall nitrogen by* **20 - 30 %**, *in* CO_2 *deliming the BOD is reduced by* **30 - 50 %**	Partial substitution of ammonium salts with CO_2 and/or weak organic acids. BREF TAN 4.5.5.1, 5.4.1					

BAT for tanning

Process	BAT	Water	Energy	Resource	Waste	Air
Pickling	Use of a short float (50-60 % float, related to the fleshed weight). BREF TAN 4.3.2, 4.6.3.1, 4.12.1, 5.4.2					
Reduces specific water consumption up to **50 %**	Recycling of pickling bath or reuse of pickling bath in the tanning process. BREF TAN 4.3.2.					
Tanning *Reduces chromium content in waste water by* **70 - 80 %**	Increasing efficiency of chromium tanning via careful control of the pH value, the float, the temperature, the time, the chromium supply and the drum speed. BREF TAN 4.6.3.3					
Saves up to **35 %** *of fresh chrome tanning salt. Chromium emissions are reduced dramatically.*	Chromium recovery. BREF TAN4.6.3.3					
	Use of high-exhausting tanning methods where chromium recovery is not possible. BREF TAN 4.6.3.2					

GOOD PRACTICE EXAMPLE

Raising awareness for more sustainability in the value chain

The "Tannery of the Future Initiative" was established in 2016. Manufacturers of leather chemicals represented by TEGEWA Association support the initiative ideationally and recently also financially. The initiative is run by the Dutch foundation CSR Netherlands, which is committed to sustainability in various value chains (not only in the leather sector).

The "Tannery of the Future Initiative" provides a self-assessment tool allowing tanneries to assess their sustainability status – it is very simple and meant as guidance for discussion. The tool is designed to help tanneries understand what consumers expect from the leather manufacturers. It is also intended to prepare the tanneries for increasing sustainability requirements requested by the international brands of the textile and clothing industry. The tool has been presented at the largest leather exhibition in China at the end of August 2016 and in India in January 2017.

www.tanneryofthefuture.org

GOOD PRACTICE EXAMPLE

Saving primary energy by cogeneration of heat and power

Conventional thermal power plants have a degree of efficiency of less than 50 %. Everything else is heat, which is unused in most cases because of a lack of adjacent need for it and therefore is released to the environment. To reduce the use of primary energy, Heinen Tannery uses cogeneration of heat and power since 2013 to cover 50 % of the factory's need for electrical energy and, depending on the season, 50 - 85 % of the need for heat. This is achieved by burning natural gas in an internal combustion engine which powers an electrical generator. But instead of releasing its waste heat to the environment, it is used for heating water and buildings, and drying leather. The overall degree of efficiency based on the input of natural gas is more than 95 %.

www.heinen-leather.de

„Leather production must not be reduced to tanning alone. Other process steps, like assessment and selection of process chemicals, waste water treatment and the use of by-products, have a significant environmental impact as well. For instance are heat recovery units in effluent gas streams a good way to save primary energy, automatic dosing and metering systems save process chemicals and the multiple use of process floats reduces the need for fresh water.“

Dr. Christian Matzen,
Lederfabrik Josef Heinen GmbH & Co. KG

Two cogeneration plants cover 50 % of the factory's need for power. The inevitable heat produced is used for heating water and buildings, and for drying leather.

BAT for use of chemicals

Process	BAT	Water	Energy	Resource	Waste	Air
Use of chemicals	Selection of complexing agents and surfactants that are capable of bio degradation or bio elimination. BREF TAN 4.2.1, 4.2.5	●				
	Halogenated organic compounds: these can be completely replaced in most of the cases. This includes substitutes for soaking, degreasing, fat liquors, dyes, flame-retardants and special post-tanning agents. Exception: the cleaning of Merino sheepskins BREF TAN 4.2.2	○				○

BAT for finishing

Process	BAT	Water	Energy	Resource	Waste	Air
Retanning, chromium fixation and neutralisation	Improving the exhaustion of retanning agents and the fixation of tanning agents in leather. BREF TAN 4.7.2	○		○		
Dyeing	Selection of dyes with low environmental impact: - Dust-free or liquid dyes. - Dyes with high exhaustion and low salt content. - Substitution of dyes containing halogen. BREF TAN 4.7.3, 4.7.6	○				○
Fat liquors	Improving the exhaustion of fat liquors. BREF TAN 4.7.4	○		○		
	Selection of fat liquors with low environmental impact: Free from substances that form AOX. Exception: waterproof leather. BREF TAN 4.7.4	○				
Drying	Optimisation of mechanical dewatering prior to drying. BREF TAN 4.12.3, 5.8		○			
	Insulation of the drying unit and reduction of heat losses. BREF TAN 4.12.3		●			

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● High potential for reduction of environmental impact and reduction of costs in related sector ○ Potential for reduction of environmental impact and reduction of costs in related sector

Environmentally sound techniques in shoe manufacturing

„For our company group exclusively producing in Europe, an environmental management system certified according to ISO 14001 is a fix element of our daily work since 1999. For us, environmental management is a very important tool to guarantee planning, controlling, monitoring and improving all company-related measures for environmental protection.“

Jörg Ertl, RICOSTA Schuhfabriken GmbH

„Resources could be saved by making use of heat that is generated from biogas and is currently not used. Process-integrated measures such as hair filtration in the liming and alternative tanning methods with renewable raw materials are part of current production system. Thereby, a successful commercial value was created.“

Ekkehard Werner,
HELLER-LEDER GmbH & Co. KG

„Sustainability is a self-evident aspiration for German companies."

Manfred Junkert, HDS/L – German Federal Association of the Footwear and Leather Goods Industry

The manufacture of shoes involves more environmental protection aspects than only concerning the production of leather. You should take advantage of the following recommendations by PFI Institute describing technical improvements of the process comprising gluing, shoe construction and final surface treatment.

Water-based adhesives and hot melts are more and more used for the production of shoe uppers. They serve as assembly aids to avoid slippage during stitching. Water-based adhesives are a standard for gluing of city shoe soles. Hot melts are employed in lasting machines and for sealing of membranes.

Upper manufacturing

- **Reduction of VOC emissions by using solvent-free pressure systems.**

Surface treatment

- **Use of water-based finish (polishes, creams, waxes, dressings, varnishes) or finish with reduced VOC content.**

Gluing

- **Use of VOC-free halogenated substances.**
- **Plasma treatment.**
- **UV treatment.**

Shoe assembly

- **Reduction of VOC emissions by using hot melt adhesives or water-based adhesives.**
- **Direct injection of soles or sole components using thermo-plastic elastomers.**

GOOD PRACTICE EXAMPLE

Heel counters of adidas – a tiny piece with huge impact

The heel counter is a little insert in the heel area of the shoe. It is rigid so that it supports and stabilises the wearer's heel inside the shoe. The heel counter is not visible as it is located in the inner part of the shoe, and covered with material on both sides.

Conventional heel counters are usually made of 100 % virgin material containing thermoplastic rubber and polystyrene. Virgin materials are resources extracted from nature in their raw form. Our supplier "framas" has developed a sustainable material to be used in the heel counters of adidas footwear.

To save resources and reduce costs, the virgin polystyrene is replaced by recycled polystyrene from used food packaging material. The new heel counter, called Framaprene® ECO, contains more than 50 % recycled material made of old food packaging. Overall, since 2014, "framas" produces 110 million pairs of heel counters a year for adidas. This means that 1 500 tons of polystyrene waste is diverted from landfill each year. Currently, "framas" is working on a new generation of heel counters, aiming at producing heels that are based on 100 % recycled material to avoid another 1 500 tons of waste per year.

www.adidas-group.com/en/sustainability/products/materials

„Reducing our chemical footprint has high priority in our sustainability strategy. We follow a holistic approach that is aligned with best practice standards for the selection of chemicals, monitoring their implementation during production and the final product.“

Frank Henke, adidas AG

Annually, 1,600 tons of polystyrene waste is prevented by producing 110 million heel counters for adidas shoes with 50 % recycled polystyrene from used food packaging material.

End-of-pipe: BAT for waste water and exhaust gas treatment

„During the last years, the shoe industry has consistently implemented environmental standards in the production process. This includes the use of waste gas abatement as a standard when applying solvent-based adhesives as well as the shift towards water-based adhesives. Another important element of successfull environmental protection is the implementation of a hazardous substances management for processed shoe materials. For this purpuse, companies can benefit from activities like those of CADS cooperation.“

Dr. Kerstin Schulte, PFI - Test and Research Institute for Footwear Production

Avoiding waste water emissions and exhaust gas is better and cheaper than treatment. Before installing waste water and exhaust gas treatment facilities in your company, you should study all viable options for avoiding and reducing these wastes streams. Thus, you will save the costs of waste water and exhaust gas treatment facilities.

Waste water treatment

The following general principles should be considered for waste water treatment:

- **Characterisation of all waste water streams in the production regarding their properties.**
- **Separation of waste water at the source with regard to type of contamination and load before mixing with other streams:**
  - **to enable internal recycling of low polluted streams,**
  - **to enable efficient treatment of heavily polluted streams or dispose them as waste.**
- **Direct each waste water stream to the most suitable type of treatment.**
- **Do not direct any waste water stream into the biological treatment unit that could cause malfunctions.**
- **Employ alternative cleaning techniques other than biological treatment for waste water streams with relevant volumes of non-biodegradable substances.**
- **If waste water with non-biodegradable compounds is not treated separately, then additional physical-chemical treatment of the entire waste water is necessary.**
- **Specific process residues (e.g. printing paste residue, padding liquor residue) should not enter the waste water but be disposed of in a more appropriate manner.**

Treatment of waste waterstreams from the textile industry

- **In general:**
  - **Biological treatment of waste water with activated sludge ensuring that partial streams containing non-biodegradable substances are treated separately.**
- **For selected highly-polluted partial streams containing non-biodegradable substances (e.g. desizing baths):**
  - **Chemical oxidation**
- **For partial streams containing heavy metals:**
  - **Precipitation and flocculation.**
- **For heavily coloured waste water partial streams and waste water with a high volume of dissolved substances:**
  - **Membrane process.**

Treatment of waste water from the leather industry

- **Sulphide-containing waste water partial streams from the beamhouse:**
  - **Maintain a high pH value before sulphide treatment.**
  - **Sulphide treatment by oxidation with air oxygen or hydrogen peroxide and manganese salt as a catalyst or biological oxidation.**
- **Chromium-containing waste water partial streams (e.g. from tanning and dewatering):**
  - **Precipitation and flocculation or biological treatment.**
- **In the joint treatment of partial streams containing sulphide and chromium care should be taken to ensure that the same level of reduction of the pollutants is achieved as with the separate pretreatment of partial streams.**

GOOD PRACTICE EXAMPLE

The Environmental Protocol of the Leather Working Group

The Leather Working Group (LWG) is a community of interests composed of players from the leather sector. Its goal is to develop and maintain an audit protocol that assesses the environmental performance and effectiveness of leather manufacturers and promotes sustainable, environmentally friendly business practices within the leather industry. The group aims to improve the leather manufacturing industry by creating a clear focus on environmental priorities, visualizing the best available practices in leather production and proposing guidelines for continuous improvement. In doing so, the group is extremely transparent by involving trademarks, suppliers, traders, leading technical experts of the leather industry, NGOs and other organizations. Currently (as of 2016), more than 160 players of 21 countries have joined the Leather Working Group, originating from different production stages along the supply chains of leather articles.

www.leatherworkinggroup.com

„In order to meet ecological requirements, we implement consequently a sustainable leather production. For this purpose, we initiated among others the development of the Blue Angel for leather, which considers consumer protection, environmental protection and occupational safety at a high level. In addition, the German leather industry recognized the need for verification requirements to demonstrate an energy-efficient manufacturing creating the world's only climate protection certificate for tanneries ECO2L (Energy Controlled Leather).“

Dr. Thomas Schröer,
VDL - German Leather Federation

Echaust gas treatment

Treatment of exhaust air from the textile industry

- **Combination of condensation and scrubbers followed by electrostatic precipitators (ESP), or use of combustion with energy recovery in textile processes with relevant quantities of exhaust air emissions (e.g. thermosol processes, finishing, coating, printing).**

Treatment of exhaust air from the leather industry

- **Treatment in wet scrubbers, for example to reduce ammonia and hydrogen sulphide emissions from the process stages of deliming, pickling and dyeing.**
- **Treatment in wet scrubbers, absorbers, biofilters or deposition with low temperature condensation or combustion to reduce VOC emissions from the process stages of degreasing, drying and finishing.**
- **Treatment in wet scrubbers, absorbers or biofilters to reduce emissions of harmful substances from waste water treatment.**

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LWG - Leather Working Group
www.leatherworkinggroup.com

IED - Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions
http://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32010L0075&from=EN

Partnership for Sustainable Textiles
www.textilbuendnis.com/en

Umweltbewusstseinsstudie 2014 (Study on environmental awareness) by the Ministry of Environment and the Federal Environment Agency
www.umweltbundesamt.de/umweltbewusstsein

ZDHC - Zero Discharge of Hazardous Chemicals
www.roadmaptozero.com

Additional Information

Blauer Engel – Germany's Label for the Environment
www.blauer-engel.de/en

BEST Standard
www.naturtextil.de

Bluesign ®
www.bluesign.com

Business Environmental Performance Initiative (BEPI) - Self Assessment
www.bepi-intl.org/resource/bepi-assessment

Chemical Secretariat ChemSec,
Substances of very high concern (SVHC-Liste)
www.sinlist.org

DEG - Germany's development bank, KfW Bank Group
www.deginvest.de/International-financing/DEG

ECO2L - Energy Controlled Leather
www.eco2l-leather.com

European Ecolabel – European Union's Label for the Environment
www.ec.europa.eu/environment/ecolabel

European Chemicals Agency ECHA - information on chemicals
www.echa.europa.eu

Fair Trade Label
www.fairtrade.net

GOTS Standard
www.global-standard.org

International Union of Environment Commission (IUE) - Technical guidance for environment protection in world-wide leather industry
www.iultcs.org/environment-iue.php

Label data base of the Consumers Initiative
(in German language only) www.label-online.de

OEKO-TEX® - Sustainable Textile Production (STeP)
www.oeko-tex.com/step

Orientation on social and environmental label, Federal Ministry for Economic Cooperation and Development (in German language only)
www.siegelklarheit.de

Cleaner Production Germany – Website for Technology Transfer
www.cleaner-production.de/index.php/en

Sustainable Apparel Coalition - Higg Index
http://apparelcoalition.org/the-higg-index

UNIDO - United Nations Industrial Development Organization - Cleaner and Sustainable Production
www.unido.org/cp

UNEP - United Nations Environment Program
A Workbook for Trainers, 1996
Cleaner Production in Leather Tanning
www.unep.fr/shared/publications/pdf/WEBx0031x

UNEP - United Nations Environment Program, Cleaner Production in Textile Wet Processing – A Workbook for Trainers, März 1996
www.unep.fr/shared/publications/pdf/WEBx0033x

Publication available as pdf:
http://www.umweltbundesamt.de/
uba-info-medien/[XXXX].html

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