Checklist based on best available techniques in the leather industry

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Content

1 INTRODUCTION

The checklist presented here has the objective to support the identification of improvement potential regarding the environmental impact in the leather industry. It is based on a comprehensive technical analysis of the European leather industry and refers to currently available technologies.

Management based on environmental awareness and improved environmental standards results not alone in a positive impact on environment, health and working place conditions but also on operational costs, product quality and company image.

For the implementation of improvement measures, however, a good knowledge on the state of technology in a given industry sector is crucial. On this basis improvement potential and best available techniques (BAT) need to be identified and set into relation to technical, environmental and economical implications.

In Europe, this knowledge is compiled and regularly updated for several industry sectors in comprehensive documents (**B**est available techniques **ref**erence documents so called BREFs[1]). They derive from a stakeholder dialogue organised by the European Commission involving European industries, environmental non-government organisations and Member States.[2, 3] For the leather industries a BREF has been developed in 2003.[4]

In the BREFs, examples for benchmarks and concrete savings in different process steps are given. Stakeholders in the chain of custody are invited to make use of the knowledge compiled in the BREF documents for their own purpose. These BREF documents are detailed and industry specific sources for ideas on how to improve the production processes in regard of its environmental impact. The measures e.g. aim at

- reducing losses and increasing efficiency in the use of raw materials, chemicals etc.
- increasing product quality and reliability
- reducing the amount of energy need
- reducing the amount of water need
- avoiding or reducing pollution of air and water
- avoiding or reducing the amount of hazardous substances in the products

It has to be mentioned that the described BATs depend on the type of aggregates, products, and processing. Detailed information is given in the BREF chapter 4, section applicability.

[1] BREF - Reference Document on Best available techniques

[2] The primary objective of the process was the analysis of best available techniques in industry sectors listed in the IPPC Directive (2008/01/EU). The Directive has been replaced by Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast). Official Journal of the European Union 17.12.2010 L 334/17ff.)

[3] Additional information see http://eippcb.jrc.es/reference/

[4] European Commission, February 2003: „Integrated pollution prevention and control (IPPC): Reference document on best available techniques for the textiles industry“.„Reference document on best available techniques for the tanning of hides and skins“

The motivations for improving the environmental performance of the production process are site specific and may be

- reducing production costs (e.g. via energy/water savings or reduction of operating resources (auxiliaries, chemicals, dyes etc.)
- improving health and working place conditions
- fulfilling national and international legal requirements
- fulfilling requirements within the chain of custody (e.g. brands, trade companies)
- avoiding conflicts with the factory's neighbourhood and/or environmental organisations
- enhancing reputation as „green" company

In a guideline document[5] it is illustrated how BREF documents may contribute to successful environmental management. The now developed checklist's objective is to transfer the knowledge and experiences accumulated in the BREF document for textile industries to an easy applicable instrument in the involved factories. It therefore extracts the suggested best available techniques from the BREF document and translates them into easy-to-answer questions. It is designed to be applied in the textile industries processing steps pretreatment, dying, printing and finishing. Within the companies the checklist targets those individuals responsible for managing daily operations or steering improvement processes. It furthermore addresses consultants and trainers active in the targeted industry.

It is expected that the checklist will not be the only instrument used by the company and staff but be a component in a company specific toolbox. Within this toolbox the checklist can play the role of supporting the analysis of improvement potential. On this basis and with the help of complementary instruments the company should develop specific action plans.

[5] Umweltbundesamt 2011: Environmental standards in the textile and shoe sector: A guideline on the basis of the BREFs – Best Available Techniques Reference Documents of the EU. www.umweltbundesamt.de/uba-info-medien/4128.html

2 CONTENT OF THE CHECKLISTS

The checklist is based on the 2003 version of the BREF for the tanning of skins and hides (leather industries). The BREF is structured in the following chapters:

- Chapters 1 and 2 provide general information on the textile industry and on the industrial processes used within this sector.
- Chapter 3 provides data and information concerning current emission and consumption levels reflecting the situation in existing installations in operation at the time of writing.
- Chapter 4 describes in more detail the emission reduction and other techniques that are considered to be most relevant for determining BAT and BAT-based permit conditions. This information includes the consumption and emission levels considered achievable by using the technique, some idea of the costs and the cross-media issues associated with the technique.
- Chapter 5 presents the best available techniques and the BAT associated emission and consumption levels. The purpose is thus to provide general indications regarding the emission and consumption levels that can be considered as an appropriate reference point to assist in the determination of BAT for the permission of installations. It should be stressed, however, that this chapter does not propose emission limit values.

In the checklist presented here all best available techniques compiled in chapter 5 of the BREF are taken into account and dealt with in individual tables.

Since a company may only cover parts of the chain of custody and may be specialised on specific processes and/or products not all of the BATs apply to them. Furthermore, the environmental impact addressed by BATs differs. Whereas some are quite general (e.g. BATs on good house keeping), others are very specific. Table 1 helps to identify relevant BATs and sorts the BATs in regard of the impact categories waste water, energy consumption, use of resources (including fresh water), waste and air pollution.[6]

Priorities need to be set site specific, taking into account the particular situation of the factory under consideration. The impact achieved by implementing a particular measure obviously varies depending e.g. on the baseline or the quantities processed. Good housekeeping measures, nevertheless, are again considered as a basis and help implementing continuous and long-lasting improvements.

[6] Very often measures have influence on more than one impact category. Only the major impacts are indicated in the table.

Table 1: Topics covered in the checklist in chronological order with indication of process covered and impact categories addressed.

number	measure	process covered				impact categories				
		general	beamhouse	tannyard-operations	post tannyard operations	waste water	energy consumption	use of resources	waste	air pollution
										
1	**Management/Good housekeeping**									
1.1	Input/output streams evaluation/inventory	x								
1.2	Implementation of environmental awareness and training programmes	x								
1.3	Good practices for maintenance and cleaning	x								
1.4	Storage and handling of chemicals/accident prevention	x								
2	**Substitution of chemicals**									
2.1	Measures to substitute biocides in curing, soaking, pickling, tanning and post-tanning processes		x	x	x					
2.2	Measures to substitute halogenated organic compounds		x		x					
2.3	Measures to substitute organic solvents		x		x					
2.4	Measures to substitute surfactants		x	x	x					
2.5	Measures to substitute complexing agents			x	x					
2.6	Measures to substitute ammonium deliming agents			x						
2.7a/b	Measures to substitute tanning agents			x						

number	measure	process covered				impact categories				
		general	beamhouse	tannyard-operations	post tannyard operations	waste water	energy consumption	use of resources	waste	air pollution
										
2.8	**Measures to substitute dyestuffs**				x					
2.9	**Measures to substitute fatliquoring agents**				x					
2.10	**Measures to substitute finishing agents**				x					
2.11	**Measures to substitute water repellent agents**				x					
2.12	**Measures to substitute brominated and antimony containing flame retardant**				x					
3	**Process integrated BAT measures**									
3.1	**Measures in the beamhouse (Curing and Soaking)**		x							
3.1.1	Measures to use fresh hides		x							
3.1.2	Measures to reduce salt		x							
3.2	**Measures in the beamhouse (Unhairing and Liming)**		x							
3.2.1	Measures to reduce the load of COD, BOD suspended solids		x							
3.2.2	Measures to reduce sulphide consumption		x							
3.2.3	Measures to recycle spent liquors		x							
3.2.4	Measures to use lime splitting		x							

number	measure	process covered				impact categories				
		general	beamhouse	tannyard-operations	post tannyard operations	waste water	energy consumption	use of resources	waste	air pollution
										
3.3	**Measures in the tanyard operations (Deliming and Bathing)**			x						
3.3.1	Measures to use CO_2 and/or weak organic acids			x						
3.4	**Measures in the tanyard operations (Pickling)**			x						
3.4.1	Measures to recycle pickle liquor and short pickle float			x						
3.5	**Measures in the tanyard operations (Sheepskin degreasing)**			x						
3.5.1	Measures to use closed machines for degreasing			x						
3.6	**Measures in the tanyard operations (tanning)**			x						
3.6.1	Measures to increase the efficiency of the chromium tanning process			x						
3.7	**Measures in the post-tanning operations (retanning, chromium fixation and neutralisation)**				x					
3.7.1	Measures to reduce the discharge of chromium				x					
3.8.	**Measures in the post-tanning operations (dyeing)**				x					
3.8.1	Measures to reduce the impact on the environment of dyestuff and of the dyeing process				x					

number	measure	process covered				impact categories				
		general	beamhouse	tannyard-operations	post tannyard operations	waste water	energy consumption	use of resources	waste	air pollution
										
3.9	**Measures in the post-tanning operations (fatliquoring)**				x					
3.9.1	Measures to reduce COD and AOX levels in waste water				x					
3.10	**Measures in the post-tanning operations (Drying)**				x					
3.10.1	Measures to safe energy				x					
3.11	**Measures in the post-tanning operations (finishing)**				x					
3.11.1	Measures to improve surface coating				x					
4	**Water management and treatment**									
4.1	**Reduction of water consumption and process-integrated measures**	x								
4.2	**Waste water treatment plant**	x								
5	**Waste management and treatment**									
5.1.	**Organic waste and other residues**	x								
6	**Air abatement**									
6.1	**Measures to prevent air abatement**	x								
7	**Energy**									
7.1	**Measures to prevent energy abatement**	x								

3 HOW TO USE THE CHECKLIST

Table 2 gives an overview over the BATs addressed in the checklist and refers to the detailed tables (in the electronic version with a hyperlink). These tables guide the user via questions (see explanation and illustration below).

(**1**) Headers are directly related to the structure of the BREF.

(**2**) A clear reference helps to follow directly to the BREF.

(**3**) Symbols indicate the impact category addressed by the measure

(**4**) A literal copy of the measure is given.

(**5**) A justification for the BAT explains the purpose and the benefits of applying the BAT.

(**6**) In the core table for each BAT the user is guided by questions on 2-3 levels. The higher level question enters into the topic.

(**7**) and (**8**) They are amended with lower level questions giving more details. Consequently lower level questions only need to be answered in case the answer to the higher level question indicates the necessity. In the example below, the question on raw materials/substrates only is relevant, if the user positively answered the higher level question on having listings of input streams.

(**9**) In footnotes additional and important information is given.

(**10**) For all questions the user may answer by yes/no/partly or not applicable.

(**11**) He furthermore finds a field for own remarks.

(**12**) In the last columns the user may indicate whether he deems a follow-up appropriate.

(**13**) For the entire BAT he may indicate whether a follow-up seems appropriate by ticking a box besides the title of the BAT on top of the page. These tick-boxes are included in order to help identifying potential fields of activity and setting up a site and situation specific action plan.

If units are given, these only are of indicative nature. The user may of course deviate by applying the units commonly used in his individual context.

(1)

1 Management/Good housekeeping

1.1 Input/output streams evaluation/inventory

Follow (13)

(2) See BREF chapters 4. and 5.1.

(3) 

(4) BAT is to implement a monitoring system for process inputs and outputs (both on-site and on-process level), including inputs of raw material, chemicals, heat, power and water, and outputs of product, waste water, air emissions, sludge, solid wastes and by-products.

(5) **BENEFITS: A good knowledge of the process inputs and outputs is a prerequisite for identifying priority areas and options for improving environmental performance.**

Details	Status (10)				Remarks (11)	Follow (12)	
	yes	no	partly	not appl.		yes	no
(6) **Do you have listings of input streams?**							
(7) Are the raw materials – different hides/skins/furs - listed?							
(8) *Kind and quantity [t/a]?*							
Make-ups [%]?							

Details	Status (10)				Remarks (11)	Follow (12)	
	yes	no	partly	not appl.		yes	no
(8) *Pretreatment agents?*							
Basic chemicals[1]*?*							
Dyestuffs and pigments?							
(8) Do you have all up-to-date safety data sheets?							
*If **not** ask your supplier.*							
Do you have forms for the listing of characteristics of auxiliaries etc.?							
Do you have forms for the listing of their potential environmental impact?							
Do you list the energy sources?							
Oil [t/a]?							
Coal [t/a]?							
Gas [m³/a]?							
Electricity [kWh/a]?							
Steam generation [t/a]?							

(9) [1] all inorganic compounds, all aliphatic organic acids, all organic reducing and oxidising agents, urea

4 GET AN OVERVIEW OF YOUR SYSTEM

A good knowledge of the process inputs and outputs is a prerequisite for identifying priority areas and options for improving environmental performance. Therefore it is beneficial to implement a monitoring system for process inputs and outputs, including inputs of raw material, operational resources (auxiliaries, chemicals, dyes etc.), energy and water, and outputs of product, waste water, air emissions, sludge, solid wastes and by-products. Ideally, this input/output analysis is done on the level of the entire factory (on-site) as well as for individual processes.

All environmental impacts are directly related to mass flows. For controlling and better performance quality and quantity of the streams should be known as exactly as possible. High energy consuming aggregates or processes, high water consuming processes, processes with high impacts on waste water or off-gas can be detected directly. When analysing the production process, the checklist can be a potential help to solve the difficulties. For example: exceeding values of the COD load of the waste water are observed. If you have an input/output- mass flow sheet, the source can be localized directly (e.g. halogenated organic compounds). In this case solutions can be found in chapter 2.2. of the leather checklist.

In case such a monitoring system has not yet been implemented, the scheme in Figure 1 and the checklist on Management/Good housekeeping are a first step of structuring the process. Within the factory, processes with particular high in- or output can be identified. The results may indicate hot spots and savings potential e.g. that a particular process consumes by far more energy than another one. Focusing on measures to reduce energy consumption in this particular process may be a conclusion.

Understanding input/output streams may, however, be seen as a set of different elements. The entire picture results from many details. Where it is best to start compiling information depends on the individual situation. Besides trying to get an overview over the entire system it may thus also make sense to analyse

- individual processes
- individual machines/production lines
- processes per individual product
- processes per batch
- processes for smaller time scales than a year
- the process using other units and indicators (e.g. weight/time)

Another approach than comparing processes within the own factory is to set the results obtained into relation with the ones compiled in similar sites. A question may be e.g. how high the COD load in waste water is in comparison to other factories. For such orientation benchmarks for environmental indicators for particular technical processes are compiled. Sources for such benchmarks may be

- chapter 3 „Emission and consumption levels" in the respective BREF
- specifications of brands, eco-labels etc.
- requirements of public authorities

· Environmental Health & Safety Guidelines (EHSG)[7]

Based on the described first analysis priorities for action may already become obvious and focus areas for additional analysis can be identified.

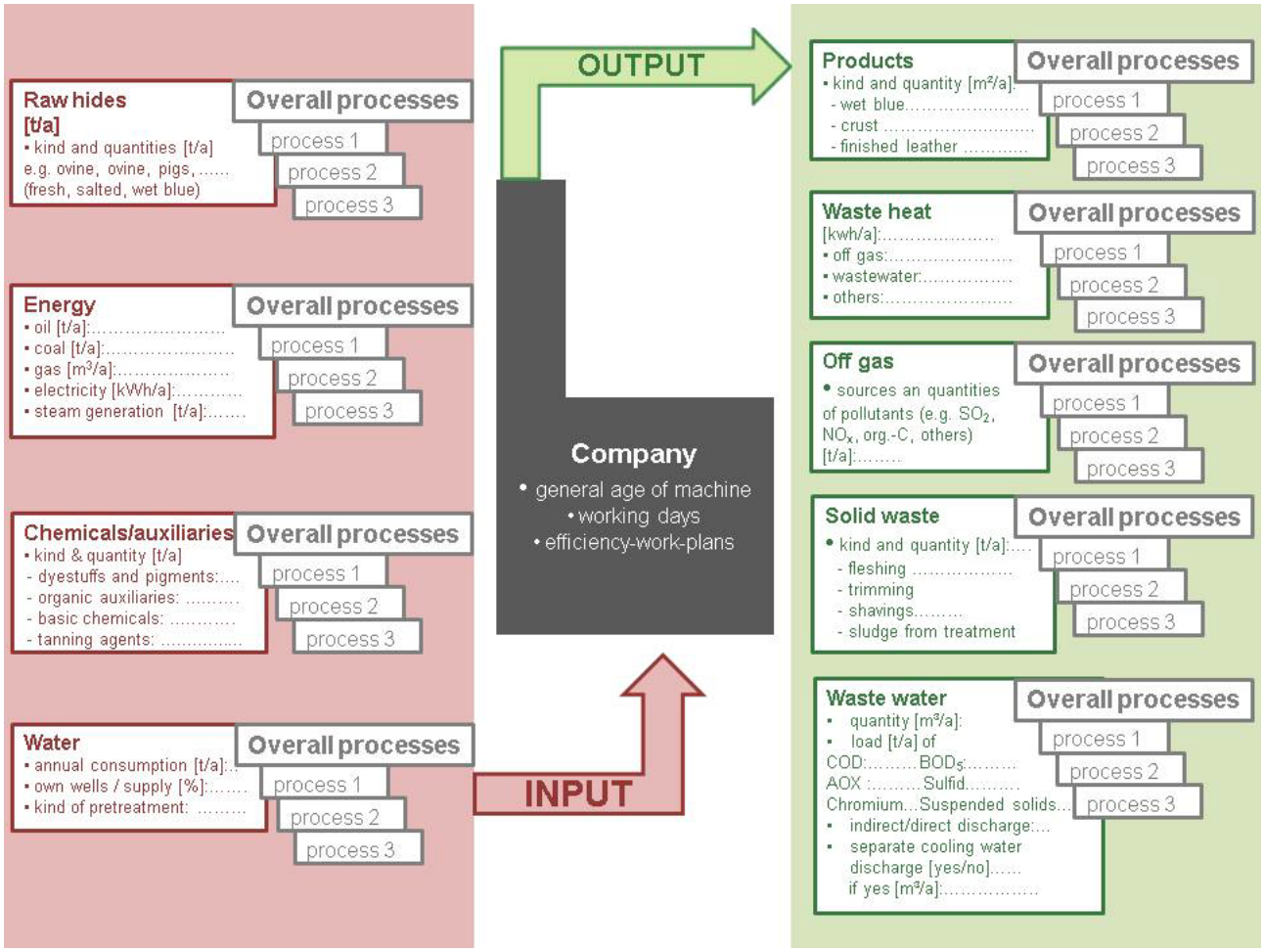


Figure 1: Overview of input and output

[7] Source: http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines respective http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_TextilesMfg/$FILE/Final+-+Textiles+Manufacturing.pdf

5 TABLE OF MEASURES FOR FOLLOW-UP

While applying the checklist the user may find the template given in Table 2 helpful to list the measures he deems appropriate for follow up.

Table 2: Template for a table of measures that the user deems appropriate for follow-up.

number	measure	priority	who	when

6 GLOSSARY

The following chapter explains technical terms and abbreviations used in the checklist. It is based on the BREF document for the leather industry and to a limited extent[8] to the BREF document for the textile industry.

Abbreviations and chemical formulae used in the document

AOX	Adsorbable Organic Halogen (X): The total concentration in milligrams per liter, expressed as chlorine, of all halogen compounds (except fluorine) present in a sample of water that are capable of being adsorbed on activated carbon
APEO	Alkylphenol ethoxylates
BAT	Best Available Techniques
BOD	Biological Oxygen Demand: a measure of the oxygen consumed by bacteria to biochemically oxidise organic substances present in water to carbon dioxide and water. The higher the organic load, the larger the amount of oxygen consumed. As a result, with high organic concentrations in the effluent, the amount of oxygen in water may be reduced below acceptable levels for aquatic life. BOD tests are carried out at 20 °C in dilute solution and the amount of oxygen consumed is determined after 5, 7, 20 or, less commonly, 30 days. The corresponding parameters are called BOD5, BOD7, BOD20 and BOD30. The unit of measurement is mg O2/l
BREF	BAT Reference Document
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand: The amount of potassium dichromate, expressed as oxygen, required to chemically oxidize at approximately 150 °C substances contained in waste water. The unit of measurement is mg O2/l or mg O2/g of substance
Cr	Chromium
Cu	Copper
EDDS	Ethylene-diamine-di-succinate
EDTA	Ethylene-diamine-tetra-acetate
H_2S	Hydrogen sulphide
HVLP	High Volume Low Pressure
IPPC	Integrated Pollution Prevention and Control
MGDA	Methyl-glycine-di-acetate
Ni	Nickel
NOx	Nitrogen oxides
NTA	Nitrilo-tri-acetate
Org. C	Organic carbon
pH	The measure of acidity or alkalinity of a chemical solution, from 0 to 14. Anything neutral has a pH of 7. Acids have a pH less than 7, bases (alkaline) greater than 7
SO_2	Sulfure dioxide
SS	Suspended solids
Total-N	Total nitrogen
Total-P	Total phosphorous
TWG	Technical Working Group
VOC	Volatile Organic Carbon

[8] only the explanations on “Biodegradation”, “ Bioeliminability” and “Hazardous Substances”.

Technical terms commonly used in the tanning industry

Aniline leather	A leather that has been coloured with aniline dyestuffs only, with little or no finishing' to obtain a 'natural' leather look
Bating	The manufacturing step which follows liming and precedes pickling. The purpose of bating is to clear the grain, reduce swelling, peptize fibres and remove protein degradation products
Beamhouse/Limeyard	That portion of the tannery where the hides are washed, limed, fleshed and unhaired, when necessary, prior to the tanning process
Biodegradability	A measure of the ability of an organic substance to be biologically oxidised by bacteria. It is measured by BOD tests (OECD tests 301 A to F) and relates to the biodegradation mechanisms taking place in biological waste water treatment works. It is usually expressed in % (of the substance).
Bioeliminability	A measure of the ability of an organic substance to be removed from the effluent as a consequence of all elimination mechanisms that can take place in a biological plant (including biodegradation). It is measured by the bio-elimination test OECD 302 B, which determines the total effect of all elimination mechanisms in a biological treatment plant: - biodegradation (measured over a long period - up to 28 days - in order to account for the biodegradation of substances that necessitate the development of specially acclimatised bacteria capable of digesting them) - adsorption on activated sludge - stripping of volatile substances - hydrolysis and precipitation processes It is usually expressed in % (of the substance).
Bovine	Of or from ox, cow, calf and buffalo
Brining	Curing hides by washing and soaking in a concentrated salt solution
Buffing	Abrasive treatment of the leather surface. If it is carried out on the flesh side, a "suede" leather is obtained. If it is carried out on the grain side, a corrected grain or a nubuck leather is obtained
Calf skin	The skin of a young immature bovine animal not exceeding a certain weight
Collagen	The principal fibrous protein in the corium of a hide or skin that, on tanning, gives leather
Conditioning	Introduces controlled amounts of moisture to the dried leather, giving it a varying degree of softness
Crust leather	Leather which has simply been dried after tanning, retanning and dyeing, without a further finishing process
Curing	Preventing the degradation of hides and skins from the time they are flayed in the abattoir until the processes in the beamhouse are started
Degreasing	Eliminating, as far as possible, the natural grease in the skin
Deliming	Removing the lime from hides coming from the beamhouse before tanning, by the action of inorganic or organic acids or salts of these acids
Dewooling	Separating the wool from the sheepskins
Drum	A cylindrical closed container rotating on an axis
Dyeing	Giving the desired colour by treatment with natural or synthetic dyestuff
Fatliquoring	Incorporating fat into the leather in order to give it flexibility and impermeability
Fellmongeries	Tanneries working on goatskins and sheepskins
Finishing	a) Mechanical finishing operations to improve the appearance and the feel of the leather e.g.: conditioning, staking, buffing, dry milling, polishing, plating/embossing b) Applying a pigmented or a fixing surface coat to the leather
Fleshing	Eliminating sub-cutaneous tissue, fat and flesh adhering to the hide, by the mechanical action of a cylinder equipped with cutting blades
Fleshings	Pieces of sub-cutaneous tissue, fat and flesh separated from the hide during fleshing
Float (liquor)	A solution containing reagents required for a specific action, in which the skins, hides and leathers are immersed

Grain	Can mean: a) the outer, or hair side, of a hide or skin that has been split into layers or b) the pattern visible on the outer surface of a hide or skin after the hair or wool has been removed
Green fleshing	Fleshing done prior to liming and unhairing
Hazardous substances	Substances or groups of substances that have one or several dangerous properties such as toxicity, persistence and bioaccumulability, or are classified as dangerous to humans or environment according to REACH Ordinance (former EU - Directive 67/548 (Dangerous Substances Directive)); e.g. CMR substances
Hide	The pelt of a large animal, such as cow and horse
Leather	Is a general term for hide or skin which still retains its original fibrous structure more or less intact, and which has been treated so as to be non-putrescible
Length of (liquor) float	Volume of a float expressed as a percentage relative to the weight of the skins, hides or leathers
Limed hide or skin	Hide or skin obtained after elimination of hair, epidermis and subcutaenous tissue. This is the name given to hides and skins after liming
Lime fleshing	Fleshing done after the liming and unhairing
Liming	Is the process which causes a controlled alkaline hydrolysis of the collagen in order to remove the hair or wool, epidermis and subcutaenous tissue and thus to give a certain flexibility to the leather
Mineral tanning	The tanning process where the tanning agents are mineral salts such as those of aluminium, chromium or zirconium
Neutralisation	Bringing the tanned hides to a pH suitable for the process of retanning, dyeing and fatliquoring
Ovine	Of or from sheep
Painting	Unhairing the skin by the action of a paste (the painting lime) applied on the flesh side. The painting lime is made of water, lime, sodium sulphide and a thickening agent
Pickled pelt	The hide or skin after pickling and able to be sold at this stage
Pickling	The process that follows bating, whereby the skin or hide is immersed in a brine and acid solution to bring it to an acid condition
Plating/embossing	Flattening or printing a pattern into the leather
Retanning	Subjecting a skin or hide, which has been first more or less completely tanned by one process or one kind or blend of tanning materials, to a second tanning process involving similar or, more usually, different tanning materials
Rinsing	Is the process carried out after each particular treatment and effected by continuous inflow and outflow of water in a treatment apparatus. Usually it is not carried out because of the high water consumption
Shavings	Leather particles obtained during thickness levelling on leather with the help of a cylinder equipped with cutting blades
Soaking	First process in the manufacture of leather, to rehydrate and wash the hides
Skin	The pelt of a small animal, such as calf (calf skin), pig (pigskin), sheep (sheepskin) etc.
Split	Part obtained by splitting the hides and skins horizontally
Splitting	The horizontal splitting of hides and skins into a grain layer and, if the hide is thick enough, a flesh layer. Splitting is carried out on splitting machines, fitted with a band knife. Splitting can be done in the limed condition or in the tanned condition
Staking	Softening and stretching of leather
Tanning	In this process the collagen fibre is stabilised by the tanning agents so that the hide or skin is no longer susceptible to putrefaction or rotting
Trimming	Cutting off some of the edges of the hides and skins, such as legs, tails, face, udders etc. This process is generally carried out during the sorting process, but is also done in other stages in the tanning process
Trimmings	The residues arising from trimming the hides and skins
Upholstery leather	This is a general term for leather processed for use for furniture, aircrafts, buses and cars
Vat	A tank

Vegetable tanning	The tanning process with exclusively vegetable tanning agents, which are leached from wood, barks, leaves, roots etc.
Wet-blue	A hide or skin which has been subjected to the usual beamhouse processes, has been chromium-tanned, therefore turned blue, and left wet. It may be stored or exported in this state
Wet-white	Is a term for a hide or skin which has been subject to the usual beamhouse processes and has been (pre-) tanned with non-chromium agents and therefore turned white

7 DETAILED CHECKLIST

1 Management/Good housekeeping

1.1 Input/output streams evaluation/inventory

Follow

See BREF chapters 4. and 5.1.

BAT is to implement a monitoring system for process inputs and outputs (both on-site and on-process level), including inputs of raw material, chemicals, heat, power and water, and outputs of product, waste water, air emissions, sludge, solid wastes and by-products.

BENEFITS: A good knowledge of the process inputs and outputs is a prerequisite for identifying priority areas and options for improving environmental performance.

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you have listings of input streams?							
Are the raw materials – different hides/skins/furs - listed? *Kind and quantity [t/a]?* *Make-ups [%]?*							
Are the chemicals/ auxiliaries listed? *Kind and quantity [kg/a]?* If **yes**, what kinds of listings exist? *Auxiliaries and finishing agents?* *Pretreatment agents?* *Basic chemicals[9]?*							

[9] all inorganic compounds, all aliphatic organic acids, all organic reducing and oxidising agents etc.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Dyestuffs and pigments?							
Do you have all up-to-date safety data sheets? *If **not** ask your supplier.*							
Do you have forms for the listing of characteristics of auxiliaries etc.?							
Do you have forms for the listing of their potential environmental impact?							
Do you list the energy sources? *Oil [t/a]?* *Coal [t/a]?* *Gas [m³/a]?* *Electricity [kWh/a]?* *Steam generation [t/a]?*							
Do you measure the water consumption? *At site level?* *At specific process level/ aggregates?* *Do you have own wells?* *Do you have any kind of water pretreatment?*							
Do you have listings of output streams?							
Are the ready-made products listed? *Kind and quantity [t/a]?* *Make-ups%*							

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you measure the waste water? *Quantity?* *Load*[10]*?* *Indirect/direct discharge?* *Separate cooling water discharge?*							
Do you measure the solid waste? *Kind and quantities [t/a]?* Do you segregate waste streams? Do you recycle certain waste streams?							
Do you measure the off gas? Sources and quantities[11]*?*							
Do you measure the waste heat? *Off gas?* *Waste water?* *Others?*							

[10] E.g.COD, BOD_5, AOX, Cu, Ni, Cr, Total-N, Total-P

[11] E.g. SO_2, NO_x, org. C, others

1.2 Implementation of environmental awareness and training programmes See BREF chapters 4 and 5.1 and 5.2 	**Follow**
BAT is to implement environmental awareness and include it in training programmes.	
BENEFITS: The success of management and good housekeeping measures is largely dependent on information and communication at company level. Staff training is an important element of environmental management. All staff should understand clearly the precautions needed to avoid resource wastage and pollution.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Does the senior management have a clearly expressed commitment to environmental improvement?							
Do you have an environmental policy?							
Do you have a strategy to implement your policy?							
Is it available to all staff?							
Do you train/educate your staff?							
Are the responsibilities for organizing and training established?							
Is the training organized and fixed in the daily routine?							

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Is the training resource-[12] process- and machinery-specific?							
How often do you train your staff?							

[12] chemicals, raw materials, energy, water etc.

1.3 Good practices for maintenance and cleaning See BREF chapters 4 and 5.1 	**Follow**
BAT is to apply good practises for maintenance and cleaning.	
BENEFITS: Machinery, pumps and pipework (including abatement systems) should be well maintained and free from leaks. These measures result not only in savings in the consumption of chemicals, auxiliaries, fresh water and energy but also in production time.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Are regular maintenance schedules established, with all procedures documented?							
Are the most significant components of the machinery[13] included in a maintenance checklist? *Are all aggregates included?*							
Do you conduct audits for broken and leaking pipes, drums, pumps and valves? *In the water/steam system[14]?* *From the oil heat transfer? From chemicals dispensing systems?* *In compressed air systems[15]?*							

[13] pumps, valves, level switches and pressure and flow regulators

[14] Not only visible steam leakages must be corrected but also the invisible parts of the system must be checked.

[15] Compressed air is by far the most expensive form of energy. The use of compressed air is estimated at 5 m3 per m2 leather, corresponding to an energy consumption of 0.35 - 0.40 GJ/tonne raw hide. In practical systems there is normally a waste of 10 – 30 %, mainly due to leakages. An overhaul of the system can often save 0.10 GJ/tonne raw hide.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you check and clean your filters regularly?							
Do you calibrate your measuring equipment[16]?							
Do you clean and maintain your thermal treatment units? *How long is the time period?* [17] *Does it include cleaning deposits from the exhaust gas conducting system and from the intake system of the burner air inlet?*							

[16] chemicals measuring and dispensing devices, thermometers etc.

[17] It should be at least once a year.

1.4 Storage and handling of chemicals accident prevention	**Follow**
See BREF chapters 4 and 5.1.2 	
BAT is to store each chemical according to the instructions given by the manufacturer in the Material Safety Data Sheets and follow the indications given in the horizontal BREF on Storage.	
BENEFITS: Safety aspects and improved working place conditions are the main benefits.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Is each chemical stored according to the instruction given by the manufacturer in the Material Safety Data Sheet?							
Are all areas where chemicals are stored or spillages are likely to occur bunded? Do storage areas provide proper ventilation and soil protection? Is it impossible for spillage to enter surface waters or sewers?							
Are appropriate containers used?							
Are all containers labelled appropriately?							
Are toxic and dangerous chemicals stored separately?[18]							
Do you have appropriate storage areas for waste?							

[18] More detail on these issues will be found in the horizontal BREF on Storage

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you have Material Safety Data Sheets for all chemicals and preparations used and stored on site available and easily accessible?							
Are first aid facilities available?							
Do you have contingency plans? Are evacuation and emergency procedures in place and rehearsed regularly?							
Do you monitor the operation of end-of-pipe abatement measures?							
Do you have clean-up materials readily available for dealing with spillages?							
Do you have efficient capture of waste water from clean-up operations?							
Do you have records of accidents and incidents?							
Do you check the transfer of chemicals from storage to machine which are often prone to leakage or spillage?							
Are the pumps and pipework used for transfer regularly inspected (see “1.1.3 Good practices for maintenance and cleaning” above)?							

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Are there provisions made to ensure the safety of manual transfer?							
Does it include appropriate training of workers, use of buckets with leak-proof lids, etc.?							

2 Substitution of chemicals

2.1 Measures to substitute biocides in curing, soaking, pickling, tanning and post-tanning processes

Follow

See BREF chapters 4.1.5 and 5.2

BAT substitute

• biocidal products with the lowest environmental and toxicological impact, used at the lowest level possible e.g. sodium- or potassium-di-methyl-thiocarbamate

BENEFITS: Handling of hides and skins contaminated with biocides/pesticides and handling of the biocides/pesticides pose a hazard to the work force. They can also have negative effects in biological treatment of waste water.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use biocides? In which process? · curing · Soaking · Pickling · Tanning · post-tanning							
Which biocides do you use? Bactericides · chemical class (e,g, inorganic, halogenated) Fungicides · chemical class (e,g, inorganic, halogenated) *Kind and quantity [kg/a]?* *Make-ups [%]?*							

2.2 Measures to substitute halogenated organic compounds See BREF chapters 4.1.2. and 5.2 	**Follow**
BAT substitute: • They can be substituted completely in almost every case. This includes substitution for soaking, degreasing, fatliquoring, dyeing agents and special post-tanning agents - Exception: the cleaning of Merino sheepskins	
BENEFITS: Emissions of absorbable organic halogens (AOX) are restricted in certain countries for environmental reasons. Chlorinated organic compounds give rise to AOX emissions.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use halogenated organic compounds? In which process? · soaking[19] · degreasing[20] · fatliquoring[21] · dyeing · post-tanning[22] *Kind and quantity [kg/a]?* *Make-ups [%]?*							

[19] In the soaking process halogenated organic compounds may be used as biocides, for substitution see 2.1.1.

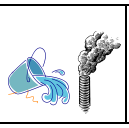
[20] Possibilities for substituting halogenated organic compounds are either using non-halogenated solvents or changing over to an aqueous degreasing system.

[21] There are fatliquors available that do not require stabilisation by organic solvents.

[22] There are water repellent agents available which contain no organic solvents and which require no metal salts for fixing. They result in a decrease of the COD and the elimination of AOX in the waste water.

2.3 Measures to substitute organic solvents

Follow



See BREF chapters 4.1.4 and 5.2

The finishing process and the degreasing of sheepskins are the major areas of relevance.
BAT substitute:
Finishing:
• aqueous-based finishing systems
- Exception: if very high standards of topcoat resistance to wet-rubbing, wet-flexing and perspiration are required
• low-organic solvent-based finishing systems
• low aromatic contents
Sheepskin degreasing:
• The use of one organic solvent and not mixtures, to facilitate possible re-use after distillation.

BENEFITS: In the finishing process, water-based systems are increasingly favoured because of environmental concerns about organic solvents and in order to comply with regulations.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use organic solvents? In which processes? Which solvents do you use? Which solvents are contained in finishing chemicals? *Kind and quantity [kg/a]?* *Make-ups [%]?*							
Have you checked if you can substitute a used organic solvent? If **yes** where? In which process? Which solvents? Which substitutes have you chosen?							

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
In cases where you have checked possible substitutes but could not find any - have you compared different organic solvents? In terms of their toxicity? In terms of their environmental impact? In terms of the possibility to recycle the organic solvent? In which process?							
Have you evaluated the efficiency of abatement in all processes where organic solvents can be released consequently, i.e. also in drying and storage?							
Have you assessed the ratio of recycling or re-use of the organic solvents?							
Do you record the solvent consumption?[23]							
Do you calculate VOC emissions?[24]							

[23] Include not only the solvents bought as solvents, but also the solvents contained in the finishing chemicals.

[24] This is the only acceptable way to calculate the overall emissions of VOC, because it is not possible in practice to monitor fugitive emissions. (VOC releases from leather during storage are estimated as 10 % of the applied organic solvents that remain in the leather and about 60 % of the amount emitted in the drying tunnel. The rest is emitted during storage).

2.4 Measures to substitute surfactants See BREF chapters 4.1.1 and 5.2 	Follow
BAT substitute: • e.g. alcohol ethoxylates, where possible	
BENEFITS: Environmental concern about surfactants is mainly related to their low biodegradability, the toxicity of metabolites of the parent products and the potential to act as endocrine disrupters.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use surfactants? *Kind and quantity [kg/a]?* *Make-ups [%]?*							
Do you use APEOs?							
Do you use Nonylphenol ethoxylates?							
Do you already use less toxic and biodegradable surfactants like e.g. alcohol ethoxylates?							

2.5 Measures to substitute complexing agents See BREF chapters 4.1.6 and 5.2 	**Follow**
BAT substitute: • e.g. EDDS and MGDA, where possible	
BENEFITS: Apart from impeding the waste water treatment, complexing agents have an adverse impact on the environment.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use complexing agents? *Kind and quantity [kg/a]?* *Make-ups [%]?*							
Do you use EDTA?							
Do you use NTA?							
Do you use EDDS and/or MGDA?							

2.6 Measures to substitute ammonium deliming agents[25] 	Follow
See BREF chapters 4.3.1.1, 4.3.1.2 and 5.2	
BAT is to make a partial substitution of ammonium salts with CO_2 and/or weak organic acids[26]	
BENEFITS: CO_2 deliming can eliminate nitrogenous discharges and reduce the BOD load.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use CO_2 for deliming?							
Do you use organic acids for deliming? Which acids do you use?[27]							
Do you take measures to prevent the release of H_2S?							

[25] This question is also incorporated in the process based BAT form.

[26] A complete substitution of ammonium deliming agents is possible for bovine hides, but the process can be very slow with thicker hides.

[27] Boric acid, magnesium lactate, organic acids such as lactic acid, formic acid and acetic acids, or esters of organic acids can be used to substitute ammonium agents.

2.7a Measures to substitute tanning agents See BREF chapters 4.3.4.2, and 5.2 	**Follow**
BAT substitute 20-35% of the fresh chromium input can be substituted by recovered chromium.	
BENEFITS: Savings in chromium can easily offset higher unit costs of the tanning chemicals involved compared to a conventional tanning process with an efficiency of 70 %.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use recovered chromium?							

2.7b Measures to substitute tanning agents See BREF chapters 4.3.4.7 and 5.2 	**Follow**
BAT substitute Products (syntans and resins) with low formaldehyde, low phenol and low acrylic acid monomer content	
BENEFITS: Alternatives are available for syntans with low phenol and low formaldehyde, for resins with low formaldehyde and for acrylic acid condensates with low acrylic acid monomer content. There are not enough data available on the (eco-)toxicity of syntans to give a comprehensive assessment.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use products other than chromium for tanning procedure? Which ones do you use? % of total tanning agents?							

2.8 Measures to substitute dyestuffs See BREF chapters 4.4.2 and 5.2 	Follow
BAT substitute • de-dusted or liquid dyestuffs • high-exhausting dyes containing low amounts of salt • substitution of ammonia by auxiliaries such as dye penetrators • substitution of halogenic dyes by vinyl sulphone reactive dyes	
BENEFITS: Dyes can have a negative impact on the environment. Liquid dyes and low-dust-producing dyes were developed to prevent health impacts by dust emissions on the workforce while handling the products.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Which dyes do you use? *Kind and quantity [kg/a]?* *Make-ups [%]?*							
Do you use metal-complex dyes??							
Do you use powder dyestuffs? **Do you use liquid dyestuffs?** **% of liquid and powder?**							
Do the dyes used in your factory contribute to the AOX? To which extend in the worst case?							

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use ammonia as penetrating agent? Do you use neutralising syntans? Do you use anionic retanning agents prior to dyeing? Do you use a short and cold dyeing bath? Do you control pH during the dyeing process? Have you checked to increase the penetration time?							

2.9 Measures to substitute fatliquoring agents

Follow

See BREF chapters 4.4.3 and 5.2

BAT substitute
• free of agents building up AOX
- exception: waterproof leathers
• applied in organic solvent-free mixtures or, when not possible, low organic solvent mixtures
• high-exhausting to reduce the COD as much as possible

BENEFITS: Fatliquors can be a significant cause of waste water contamination. Emissions to waste water from the fatliquoring agents and the impregnating agents contribute to the COD and BOD in the effluent. Most significantly, the discharge of fatliquors is a principal source of oil and grease in the effluent. Furthermore, when chlorinated fatliquors have been used, the effluent may contain AOX. Applying solvent-free or low-solvent content mixtures will result in less solvent emissions. An exhaustion of fatliquor equivalent to 90 % of the original offer can be considered achievable. Applying solvent-free or low-solvent content mixtures will result in less solvent emissions.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Which fatliquors do you use? *Kind and quantity [kg/a]?* *Make-ups [%]?*							

2.10 Measures to substitute finishing agents for topcoats, binders (resins) and cross-linking agents See BREF chapters 4.1.3 and 5.2 	**Follow**
BAT substitute • binders based on polymeric emulsions with low monomer content • and finishing systems	
BENEFITS: Isocyanates and aziridines are extremely toxic and for this reason they are not used in their monomer form in the leather industry. Commercial products may have used high molecular weight chemicals with isocyanates or aziridines groups, thus considerably reducing the volatility and toxicity of these compounds compared to the monomer, but strict safety precautions are generally required.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Which binders and cross-linking agents do you use? *Kind and quantity [kg/a]?* *Make-ups [%]?*							
Which is the monomer content of the binders and cross-linking agents you use?							
Do you use self-cross-linking reactive polymers?							

2.11 Measures to substitute water repellent agents See BREF chapters 4.1.2.3 and 5.2 	Follow
BAT substitute • free of agents building up AOX - exception: waterproof leathers • applied in organic solvent-free mixtures or, when not possible, low organic solvent mixtures • free of metal salts - exception: waterproof leathers	
BENEFITS: Water repellent agents can contain organic solvents and organic halogenated compounds. Some water repellents contain emulsifiers and need fixing, which is most efficiently done with metal salts of aluminium, zirconium, calcium or chromium.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Which water repellent agents do you use? *Kind and quantity [kg/a]?* *Make-ups [%]?*							
Are these water repellent agents building AOX? Do they contain organic solvents?							
Do the water repellents need fixing? Do these agents contain metal salts?							

2.12 Measures to substitute brominated and antimony containing flame retardants See BREF chapters 4.4.3 and 5.3 	**Follow**
BAT substitute • Phosphate-based flame retardants	
BENEFITS: These flame retardants are persistent and toxic for humans and for the environment.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use flame retardants? *Kind and quantity [kg/a]?* *Make-ups [%]?*							

3. Process-integrated BAT measures

3.1 Measures in the beamhouse (Curing and Soaking)

3.1.1 Measures to use fresh hides See BREF chapters 4.2.1.1 and 5.3 	Follow
BAT is to process fresh hides as far as they are available. Exceptions: - when long transport time is necessary (max 8 - 12 hours for fresh, unchilled hides; 5 - 8 days if a cooling chain of 2 °C is maintained) - for certain types of end-products - sheepskins, calfskins	
BENEFITS: The processing of fresh (unsalted) hides will result in a significant reduction of the level of salt in the effluent.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you process fresh hides?							
If **yes**, do you - use dried hides - cooled hides							

3.1.2 Measures to reduce salt See BREF chapters 4.2.1.2, 4.2.1.3 and 5.3 	**Follow**
BAT is to reduce the amount of salt used as far as possible.	
BENEFITS: The main contamination in the beamhouse is the high COD and salt content in the waste water effluent.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Are the hides delivered after washing, trimming, fleshing and curing in the abattoir?							
Do you recover salt?							

3.2 Measures in the beamhouse (Unhairing and Liming)

3.2.1 Measures to reduce the load of COD, BOD and suspended solids See BREF chapters 4.2.3.1 and 5.3	Follow
BAT is to use hair-save technology, but economics can be an issue for existing plants when re-use of the saved hair is not possible.	
BENEFITS: About 75 % of the BOD and COD load is produced in the beamhouse, with the main load coming from unhairing that does not use a hair saving technique. Liming/unhairing are also the main generator of suspended solids (about 60 %). In total the beamhouse emissions rise to about 90 % of total suspended solids.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use hair saving technologies?							

3.2.2 Measures to reduce sulphide consumption See BREF chapters 4.2.3.2 and 5.3 	**Follow**
BAT is to reduce sulphide consumption by the use of enzyme preparations; not for sheepskins.	
BENEFITS: Sulphide can be transformed to highly toxic hydrogen sulphide gas. Typical effects are headache, nausea, and eye irritation. One of the problems with the gas is that although the odour can be detected at low levels, these are often higher than levels acceptable for extended exposure. At concentrations above 100 ppm hydrogen sulphide cannot be detected by smell and can be lethal. COD and sulphide levels can be reduced by 40 – 70 %.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use enzyme preparations for unhairing operations?							

3.2.3 Measures to recycle spent liquors See BREF chapters 4.2.3.3 and 5.3 	Follow
BAT is to recycle spent liquors only when processing sheepskins, which are dewoolled by painting.	
BENEFITS: In the waste water treatment, input chemicals are saved and the amount of sludge produced is reduced. Between 50 and 70 % of the float (and of the chemicals) can be recovered and recycled.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you recycle the floats after unhairing processes?							
If **yes,** do you follow the process with laboratory analysis?							

3.2.4 Measures to use lime splitting See BREF chapters 4.2.4 and 5.3 	**Follow**
BAT is to use lime splitting (Exceptions: - when the starting material is wet blue - when a firmer leather has to be produced (e.g. shoe-leather) - when a more uniform and accurate thickness is needed in the final product) and to maximise the use of split	
BENEFITS: The consumption of all chemicals and water in the subsequent process is reduced, the area yield is improved, and processing time is reduced.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you split limed hides?							

3.3 Measures in the tanyard operations (Deliming and Bathing)

3.3.1 Measures to use CO_2 and/or weak organic acids See BREF chapters 4.3.1.1, 4.3.1.2 and 5.3	Follow
BAT is to make a partial substitution of ammonium salts with CO_2 and/or weak organic acids.[28]	
BENEFITS: CO_2 deliming can eliminate nitrogenous discharges and reduce the BOD load.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use CO_2 for deliming?							
Do you use organic acids for deliming? Which acids do you use?[29]							
Do you take measures to prevent the release of H_2S?							

[28] A complete substitution of ammonium deliming agents is possible for bovine hides, but the process can be very slow with thicker hides.

[29] Boric acid, magnesium lactate, organic acids such as lactic acid, formic acid and acetic acids, or esters of organic acids can be used to substitute ammonium agents.

3.4 Measures in the tanyard operations (Pickling)

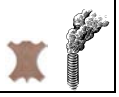
3.4.1 Measures to recycle pickle liquor and short pickle float See BREF chapters 4.3.2.1, 4.3.2.2 and 5.3 	Follow
BAT is to use partial recycling or re-use of pickle liquors.[30] BAT is to use a volume of floats in the range of 50 – 60 % (based on fleshed weight) for ovine skins and bovine hides in order to reduce salt consumption.	
BENEFITS: Pickle liquor recycling reduces the amount of salt and effluent discharged to sewer. A short pickle float will reduce the salt consumption for the pickling, and reduce the water consumption and subsequently the volume of effluent generated.	

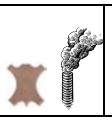
Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you recycle pickle liquor? Do you control this process analytically? Do you train your personnel especially for this process?							
Do you recycle spent liquors from chromium tanning process to pickling step?							
Have you optimised the pickle float?[31]							

[30] split view on Pickling (see p. 170 Reference Document on Best Available Techniques for the Tanning of Hides and Skins February 2003): The majority in the TWG agreed that partial recycling or re-use of pickle liquors is BAT. Experts representing one Member State and some experts representing industry in the TWG did not fully agree because in their view an exception has to be made. In their view BAT is: • To use partial recycling or re-use of pickle liquors with an exception for high quality leathers.

[31] The float can be reduced to 50 – 60 %, which means that 0.5 - 0.6 m³ water per tonne fleshed pelts is used.

3.5 Measures in the tanyard operations (Sheepskin degreasing)



3.5.1 Measures to use closed machines for degreasing See BREF chapters 4.3.3.3 and 5.3 	Follow
BAT is to use • Closed machines with abatement for air and waste water releases when organic solvents are used to degrease skins in dry state.	
BENEFITS: Over 80 % of organic solvent can be recovered with closed loop systems.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use closed machines in the degreasing process? If **yes** Have you installed abatement measures for air and waste water releases? Which measures have you installed (e.g. activated carbon filters)? Is the used solvent automatically distilled and reused?							
Do you collect degreasing baths separately from other liquors?[32]							

[32] The grease can be re-used in the production of technical fat. Separate treatment can also be advantageous for the waste water treatment, because grease, organic solvents, and detergents increase the COD-level.

3.6 Measures in the tanyard operations (tanning)

3.6.1 Measures to increase the efficiency of the chromium tanning process See BREF chapters 4.3.4.1; 4.3.4.2; 4.3.4.3; 4.3.4.4. and 5.3 	Follow
BAT is • to increase the efficiency of the chromium tanning process through careful control of pH, float, temperature, time and drumspeed, all in combination with chromium recovery through precipitation for waste water streams containing Cr_{total} > 1 g/l [33] • to use high-exhaustion tanning methods where chromium recovery is not possible • to maximise exhaustion of the vegetable tanning liquor with counter-current (pit system) or recycling (drum tanning)	
BENEFITS: "The potential hazards and benefits of chromium are complex and are highly related to chemical speciation. The toxic mechanism of action differs for hexavalent versus trivalent chromium. It can be assumed in practice that chromium tanned leather, which is produced according to the 'Best Available Techniques', with the most modern processes, including all the environmentally-friendly technical measures available, may carry the designation 'environmentally beneficial'.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Which tanning agents do you use? *Kind and quantity [t/a]?* *Make-ups [%]?*							
Is your liming and splitting procedure well performed?[34]							

[33] Split view on tanning (see p. 170 Reference Document on Best Available Techniques for the Tanning of Hides and Skins February 2003)

[34] With thorough liming more chrome can be bound and splitting after liming which facilitates chrome penetration and reduces chemical input.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Have you optimised relevant parameters in the tanning procedure?[35] Chromium input? Float length? pH? Temperature? Time?							
Have you installed (automatic) process regulation equipment?							
Do you use high-exhaustion chromium tanning recipes/methods? With modified tanning agents? - Which ones do you use? With special chromium agents? - Which ones do you use?							

[35] Without introducing any new chemicals or technologies, tanners can significantly improve the chrome uptake (compared to about 60 % in normal operation).

- 80 % chrome uptake can be achieved by altering the physical parameters (temperature rise from 20 ºC to 50 ºC, pH from 3.5 to 4.5) of the tanning operation.
- Up to 90 % chrome uptake is possible by altering both physical and chemical parameters (float levels, chrome offers).

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you recycle and/or re-use chromium solutions? Do you have a chromium recycling unit? Do you recycle the tanning liquors to pickle process? Do you recycle the tanning liquors to tanning process?							
Do you recover chromium through precipitation? Do you control this procedure analytically?							

3.7 Measures in the post-tanning operations (retanning, chromium fixation and neutralisation)

3.7.1 Measures to reduce the discharge of chromium See BREF chapters 4.4.1 and 5.3		Follow
BAT is • to enhance exhaustion of post-tanning treatment agents and fixation of tanning agents in the leather • to reduce the salt content of spent liquors		
BENEFITS: In the post-tanning operations, considerable amounts of organic substances (COD) and chromium may be released. The release of unfixed chromium can be as high as 1600 mg Cr/l in the combined waste water from a typical post-tanning sequence.		

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you include a neutralisation step to reduce the chromium discharge? Do you use • sodium bicarbonate • sodium formate • sodium acetate • borax • neutralising syntans							

3.8 Measures in the post-tanning operations (Dyeing)

3.8.1 Measures to reduce the impact on the environment of dyestuff and of the dyeing process See BREF chapters 4.4.2 and 5.3 	**Follow**
BAT is • to enhance exhaustion of dyestuffs	
BENEFITS: Emissions during the dyeing operation can occur before, during and after the dyeing process, as dyestuff dust can be released into the air during the weighing out operation, and as the dyes are mixed prior to use. At the end of the dyeing process the spent dye bath can be discharged to the waste water treatment plant.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you use techniques and technologies to reduce the impact of dyestuffs and the dyeing process on the environment? Do you • minimise the input of chemicals • select environmental friendly dyestuffs • substitute dyes which are poorly exhausting • substitute dyes with high levels of salt • avoid the use of ammonia • substitute powder dyestuffs with liquid ones							

3.9 Measures in the post-tanning operations (Fatliquoring)

3.9.1 Measures to reduce COD and AOX levels in waste waters See BREF chapters 4.4.3 and 5.3 	Follow
BAT is • to enhance exhaustion of fatliquor	
BENEFITS: Fatliquors can be a significant cause of waste water contamination (COD, BOD, AOX, oil and grease), especially in the production of soft leathers, which require large amounts of fatliquor.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Which fatliquors do you use? Do they contain • organic solvents • AOX							

3.10 Measures in the post-tanning operations (Drying)

3.10.1 Measures to safe energy See BREF chapters 4.4.4 and 5.3 	Follow
BAT is • to optimise mechanical dewatering prior to drying where possible	
BENEFITS: Forced drying of leather is among the most energy intensive processes (apart from waste water treatment) in the tannery. Natural air-drying does not consume energy but it is not applicable under all circumstances.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
How do you dry leather? Do you use a mechanical dewatering process?							

3.11 Measures in the post-tanning operations (finishing)

3.11.1 Measures to improve surface coating See BREF chapters 4.5 and 5.3 	Follow
BAT is • to use roller coating • to use curtain coating • to use HVLP spray guns • to use airless spray guns exception for all four above-mentioned techniques: - when very thin finishes are applied, e.g. on aniline and aniline-type leather	
BENEFITS: A very low amount of waste (mostly cloths from cleaning) of 3 – 5 % waste of the amount of finish chemicals against up to 70 % by conventional spraying is produced. A considerable reduction of the releases of organic solvents and particulate is achieved.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
What do you use for surface coating?							

4 Water management and treatment

4.1 Reduction of water consumption and process-integrated measures

Follow

See BREF chapters 4.6.1 and 5.4.

BAT is

- to improve the matching of water flow to the requirements of the process
- to use 'batch' versus 'running water' washes
- to modify existing equipment to use short floats
- to use modern equipment for short floats
- to re-use waste water in less critical processes
- to recycle or re-use process liquors where possible

BENEFITS: The first step to efficient waste water treatment involves optimisation of water consumption and lowering the consumption of chemicals used in the process and in the waste water treatment. That will reduce both the necessary size of the waste water treatment plant and the energy consumption.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you measure the water consumption?[36] *At site level?* *At specific process level / aggregates?* *Do you have own wells?* *Do you have any kind of water pretreatment?*							

[36] Question from management/good housekeeping

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you measure the waste water?[37] *Quantity?* *Load?*[38] *Indirect/direct discharge?* *Separate cooling water discharge?*							
Do you have a worker training programme?							
Do you have clearly communicated code of practice for operators? Including: Cleaning cycles Installation of basic technical equipment (e.g. flow-meters)							
How do you wash your goods (running water vs. batch)?[39]							
Do you combine batch washing with short floats?[40] Do you control pH, temperature and chemical dosage in this process? Do you have modern tannery machines?[41]							

[37] question from management/good housekeeping

[38] e.g.COD, BOD_5, AOX, Cu, Ni, Cr, Total-N, Total-P

[39] Savings of up to 50% are possible with batch washes.

[40] Savings of up to 70% are possible with the combination of batch washing and short floats.

[41] Depending on the cost of water the high cost of machines can often be justified by the water and chemical conservation and reduction of chemical input.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you reuse waste water? In which processes? With which savings?							
Is the drainage system for surface water on the site (rain etc.) separated?							

4.2 Waste water treatment plant

Follow

See BREF chapters 4.2.3.4; 4.6.2 and 5.4.

BAT is

· to keep sulphide-containing effluent from the beamhouse separate and at high pH until the sulphide is removed. The associated emission level after treatment is 2 mg S2-/l in a random sample in the separate effluent. After the sulphide is removed (on site or in a jointly used dedicated treatment plant) the effluent can be mixed.

· to collect chromium-containing partial effluent (e.g. from tanning and samming) with a concentration of Cr_{total} > 1 g/l separately and send it for chromium recovery. Chromium recovery can be done on or off site

· to treat (on or off site) chromium-containing effluent with a concentration of Cr_{total} < 1 g/l in combination with other effluent

· to use mechanical treatment (on or off site)

· to use biological treatment (on or off site)

· to use post-purification sedimentation and sludge handling (on or off site)

BENEFITS: Measures aim at the reduction of potentially harmful substances before effluents are released to the environment.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you have an on site waste water treatment plant?[42]							
Do you have mechanical treatment to reduce solid and organic content? On site Off site Do you remove e.g. pieces of skin and leather fibres? Does your mechanical treatment include skimming of fats, grease and oil?							

[42] A preliminary settling operation for the raw waste water can remove up to 30 % COD, thus saving flocculating chemicals and reducing the overall quantity of sludge generated.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you have physico-chemical treatment?[43] On site Off site Do you perform the following treatments and if **yes** how: - Sulphide oxidation - Sulphide precipitation - Chromium precipitation - Flow equalisation - COD removal and balancing (e.g.via coagulation or flocculation)							
Do you have biological treatment?[44] On site Off site Aerobic? Anaerobic? Lagoons?							
Do you have a nitrification/denitrification step?[45] On site Off site							
How and where do you treat sediments and sludge? On site Off site							

[43] to remove substances via e.g. sedimentation or precipitation

[44] Biological treatment in combination with physico-chemical treatment can achieve a COD removal of up to 95 %. Substances can be removed via biodegradation or biosorption.

[45] Ammonium and nitrite will be oxidised to nitrate; nitrate will be reduced to nitrogen.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you have other special treatments? e.g. for halogenated hydrocarbons? biocides other organic compounds salt others Do you have these treatments On site Off site							

5 Waste management and treatment

## 5.1 Organic waste fraction and other residues See BREF chapters 4.7. and 5.5. 	**Follow**
BAT, in order of priority is: • prevention • reduction • re-use • recycling/recovery • thermal treatment for certain types of waste.	
BENEFITS: A large amount of waste, in particular organic waste, is inherent to production in tanneries. For tanneries one focal point is waste reduction within the process in conjunction with the recycling and re-use options. Process-integrated measures are essential for an optimised waste treatment system. These measures are discussed in other chapters, but end-of-pipe treatment is still necessary.	

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you consider process steps at rendering plants or other separation processes for organic waste fractions? *For* *Gelatine and glue from untanned wastes* *Production of sausage casings* *Tallow recovery from raw trimmings, fleshings and splits* *Separation and recycling of fat* *Recovery of protein e.g. from spits* *Recovery from collagen from e.g. lime trimmings and splits* *Use of tanned wastes in leather fibreboard production* *Use of tanned wastes for fertiliser* *Others*							

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you have other procedures for organic waste? *Composting* *Recycling in agriculture* *Anaerobic digestion* *Landfill* *Thermal treatment* *Treatment to reduce water* *Processing of sludge from waste water treatment* *Re-use of sludge*[46]							
Do you use hair saving technologies?[47]							
Do you have further measures or processes for other residues? *salt*[48] *organic solvents*[49] *obsolete chemicals* *finishing and wet scrubber sludges* *residues from air abatement e.g. activated carbon filters* *packaging material* *sewage and rubbish*							

[46] Depending on the contamination and the national regulations and strategies.

[47] Techniques for treatment of hair are: filling material, protein hydrolysate, anaerobic digestion, composting. Hair can also be used as fertiliser.

[48] Salt from curing can be recovered as solid waste. Disposal is difficult, however, not allowed to landfill in many Member States and not favourable from the environmental point of view. The salt is usually released via waste water effluents. This can be a problem in areas where salinity of the effluent is a crucial criterion. Process-integrated measures relevant to liming, soaking and pickling are discussed in other chapters.

[49] Organic solvents that cannot be recovered on-site need to be disposed of to external treatment plants for recycling or thermal treatment.

6 Air abatement

6.1 Measures to prevent air abatement

Follow

See BREF chapters 4.8. and 5.6.

BAT is

to prevent the generation of odours

to prevent releases of e.g. hydrogen sulphides, ammonia, VOCs and dust in particular:

• wet scrubbing, for example, to abate ammonia and hydrogen sulphides from deliming, pickling and dyeing

• wet scrubbing, absorption, bio-filters, cryogenic removal or incineration to abate VOC from degreasing, drying and finishing

• wet scrubbing, absorption or bio-filters to abate various releases from waste water treatment.

BENEFITS: Releases to air can arise from various process steps carrying different substances and particulates. Preventative measures and end-of-pipe techniques are available to prevent or abate emissions from organic solvents, ammonia, hydrogen sulphide, sulphur dioxide, total particulate together with the odour which might arise from those substances.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Have you ever had complaints from neighbours or others concerning the odours of your factory?							
Have you implemented measures to avoid odours? *Proper storage* *Proper curing* *Prevention of odours from waste, beamhouse and waste water treatment with good house keeping methods?* *Others*							

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you record solvent consumption? [50]							
Do you measure the emission of organic solvents regularly? [51]							
Do you use water based systems instead of organic solvents to reduce VOC emissions?							
Do you recover and re-use used organic solvents to reduce VOC emissions?							
Do you use end-of-pipe abatement possibilities to reduce VOC emissions? • *wet scrubbing* • *adsorption* • *bio-filter* • *cryogenic removal* • *incineration.*							

[50] The minimum requirement for organic solvent-based coating is the recording of solvent consumption, to include not only the solvents bought as solvents, but also the solvents contained in the finishing chemicals. This is the only acceptable way to calculate the overall emissions of VOC, because it is not possible in practice to monitor fugitive emissions. (VOC releases from leather during storage are estimated as 10 % of the applied organic solvents that remain in the leather and about 60 % of the amount emitted in the drying tunnel. The rest is emitted during storage.

[51] If organic solvents are used, regular measuring of emission concentrations and loads and the keeping of an organic solvent inventory are important.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you control and prevent dust emissions? • *Do you control dust at source?* • *Do you have efficient dust control equipment?*[52] • *Do you have grouped dust-producing operations and machines?* • *Do you have a centralised dust collection system?*[53] • *Are the used fans stress relieved before dynamic balancing for low power consumption and noise levels?* • *Have you installed adequate room ventilation.*							

[52] Like cyclones, scrubbers, bag filters, combination of collecting systems, extraction fans (for more information see table 4.25 in the BREF document

[53] Centralised collection rather than a number of separate collectors provides lower initial and running costs, particularly in terms of energy

7 Energy	**Follow**

7.1 Measures to prevent energy abatement See BREF chapters 4.9. and 5.7. 	**Follow**
BAT is · to record the energy consumption for electricity, heat (steam and heating) and compressed air, particularly for the units with the highest consumption, such as waste water treatment and drying procedures.	
BENEFITS: A reduction of energy consumption focuses on the minimisation of losses, e.g. the use of heat pumps in drying, reduction of (hot) water consumption, and optimisation of energy use by enhancing efficiency (for example in drying) and in choosing the right size of machinery. Furthermore, the choice of energy source is important, e.g. fuels and renewable energy, as is consideration of energy recovery by aerobic/anaerobic digestion and thermal treatment of wastes produced in the tannery.	

Details	**Status**				**Remarks**	**Follow**	
	yes	no	partly	not appl.		yes	no
Do you list the energy sources?[54] *Oil [t/a]?* *Coal [t/a]?* *Gas [m³/a]?* *Electricity [kWh/a]?* *Steam generation [t/a]?*							
Do you record actual energy usage, split by energy type and major end-uses, on a specified and appropriate regular basis (e.g. hourly, daily, weekly, etc.)							

[54] Question from good house keeping chapter 1.1

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Have you generated energy performance indicators?[55]							
Do you monitor energy performance, including mechanisms to alert the operator to significant variations from predicted energy performance?							
Do you ensure appropriate investigative and corrective action is taken, and recorded, in response to variations?							
Do you delivering concise, appropriate and timely energy performance information to all individuals with identified responsibilities for energy management?							
Do you set, review and revise performance targets?							
Do you recover steam condensate?							

[55] Like historical energy performance or normalised to an indicator of production/external temperature/building occupancy etc.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Have you minimised hot water consumption? **Are all hot water tanks covered?** **Do you re-use the cooling water from the vacuum dryer in the hot water supply?**[56] **Do you use other heat exchangers?**[57]							
Have you installed switching off *hot and cold water valves* *air exhaustion* *finishing lines* *light*							
Have you evaluated the use of heat pumps?							
Do you control the temperature and humidity during the drying?[58]							
Do you run drying installations continuously?							
Do you check the heat capacity and transmission for new installations?[59]							

[56] This water must not be polluted. 10 – 20 % of the energy consumption of the vacuum drying may be recovered in this way.

[57] Energy can be recovered from the waste after-treatment baths, from condensate from vacuum dryers, from evaporated water from high-frequency drying or from exhaust air from drying. Up to 75 % of waste heat from drying may be recovered. Use of the waste heat from the compressor for water heating or for space heating can recover 80 – 90 % of the total energy consumption of the compressors.

[58] Elimination of the greatest possible amount of water in samming may mean energy savings of 0.5 - 1 GJ/t raw hide in drying. Keeping drying temperature low and drying time and amount of exhaust air at the necessary minimum will keep heat losses to a minimum (although, consideration of leather properties will have priority).

[59] The heat capacity and heat transmission of new installations are as low as possible.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you use natural drying of leather? **Do you use infrared heating for finish drying?**							
Do you use an economiser?[60]							
Do you avoid idle running of machines?							
Do you know the capacity of your electromotors?[61]							
Do you use compressor and pumps in adequate units?[62]							
Do you well maintain and keep as tight as possible the walls of spray cabinets?[63]							
Do you digest limed fleshing and waste water sludge? **Do you incinerate fat from the fleshings?**[64]							

[60] The use of an economiser in the boiler house in order to minimise the chimney loss can be recommended when a low-sulphur fuel, especially gas, is used (otherwise corrosion problems occur). Control and maintenance of the boilers can save energy 'at source'. Other energy saving technologies for boilers are e.g: • burners with digital combustion controls/boiler modulation controls • flue gas economisers • condensing economisers • oxygen trim controls • sequence controls • automatic flow valves • heat recovery from boiler blowdown • condensate return systems • flue shut-off dampers.

[61] For many motors, the best economy is obtained by running the motor at 75 % of maximum performance (this must be verified for individual motors).

[62] In the case of compressors or pumps, the use of smaller units (e.g. one unit for basic requirements and a supplementary unit for peak loads) is more economical in energy usage than one big unit, due to the greater flexibility.

[63] The velocity of exhaust air through the open area must be min. 0.5 m/s. Consequently, the loss of warm air and the energy for ventilation are proportional to the area left open (and to the running time).

[64] It is possible to recover around 3 GJ/tonne raw hide through digesting limed fleshings and waste water sludge. Also incineration of fat from the fleshings can cover 50 – 70 % of the total demand for thermal energy. An English sheepskin tannery gets 20 % of its thermal energy consumption from incineration of sheepskin fat.

Details	Status				Remarks	Follow	
	yes	no	partly	not appl.		yes	no
Do you well maintain and keep as tight as possible the walls of spray cabinets?[65]							

[65] The velocity of exhaust air through the open area must be min. 0.5 m/s. Consequently, the loss of warm air and the energy for ventilation are proportional to the area left open (and to the running time).