UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Occupational Safety and Health Aspects of Leather Manufacturing

2nd edition

THE SECOND EDITION OF OCCUPATIONAL SAFETY AND HEALTH ASPECT OF LEATHER MANUFACTURING

This Second Edition prepared by I. Král' and N. Niedźwiedź is a thoroughly revised and expanded version of UNIDO paper The Occupational Safety and Health Aspects of Leather Manufacture from 1999 prepared by J. Buljan, J. Hannak, A. Sahasranaman.

It is primarily prepared to reflect recent developments that took place in safety requirements and standards, measures, new developments in machinery and technology.

Acknowledgements:

The information and views as well as tables, drawings, photos, etc. in this paper are primarily intended to serve as background material for UNIDO workshops in developing countries; it is also hoped that they will be used for developing a practical eLearning programme on Occupational Safety and Health.

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1 Introduction

Leather manufacturing is an important part of the meat industry. By upcycling hides and skins instead of disposing them in open landfills, the leather industry generates additional income for farmers, creates jobs and produces a sustainable, durable and useful material of established prestige.

Tanning hides and skins of animals into leather has been a widely practised industrial activity. Over the years, the tanning industry has declined in industrialised countries for a variety of reasons. At the same time, the characteristics of the tanning industry have been well suited to the needs in emerging economies: high labour intensity, availability of raw material and high added value. By tanning hides and skins, leather manufacturing also contributes to reducing waste generated by the meat industry as well as lowering the price and increasing the availability of meat, which helps tackle malnourishment.

Anyhow, there are some challenges to fully reap the benefits of the industry. One of them is Occupational Safety and Health (OSH).

The leather sector is often leveraged in growing economies to create thousands of jobs and earn foreign currency, but OSH standards are poor due to the lack of structures, organisation and experience. To protect workers and the jobs created by tanneries, special care must be put in raising awareness of the risks and hazards of the leather making process as well as constantly improving working conditions and safety standards. The main reason for this is, of course, to protect human health and life, which is the highest priority and importance in any human activity, and in this case in a well-managed sustainable business. On top of that, any accident or irregularity in tanneries can spoil the perception of leather businesses in the public eye by creating an image of poor conditions of an undeveloped industry. Therefore, to protect lives, the jobs created, the industry's image and its drive to be the source of solutions not problems, it is in best interest of the entire leather sector to keep the standards of health and safety in tanneries as high as possible.

The wide range of chemicals, machinery, equipment and processes used in the tanning industry can pose

many occupational hazards and high risks to workers, especially in countries with weak law enforcement. In such countries there is often poor safety managment, lack of know-how, no training and little awarness of the dangers that may occur during leather manufacturing. Many tanneries fail to adopt proper preventive and protective measures to improve OSH standards, consequentlly putting their employees at risk. It has been demonstrated that overall safety standards can improve at little or no cost – all it takes is a little effort and good will.

On the whole, the general intention of UNIDO is to present and promote the concept of leather as a sustainable (as long as there is livestock to produce meat and milk) and safe material. To be classified as safe, it has to be:

I. *Safe for operators* and a safe working environment (OSH)
II. *Safe for communities* and ultimate users (all emissions treated and considered safe)
III. *Safe for consumers* - finally, a tanner (producer) also has to design the leathers in a way that will facilitate its handling and disposal at the end of life. This includes avoiding the use of restricted substances and chemicals which may be harmful to a user and/or to anyone else.

Therefore, occupational safety and health aspects should be understood as an integral part of leather manufacturing.

The UNIDO-promoted “Leather Safety” approach is visualised in Figure 1 below:

Figure 1: Leather Safety concept – safe leather for workers; community and users

1.1 REASONS FOR OSH

Attending to workplace safety and health is important for legal, economic and moral reasons. By providing a solid base for good standards, proposing a structure for safety management, giving some practical insight into OSH and indicating room for improvements, this OSH guideline will contribute to the following aspects:

✓ Economic Savings

Poor OSH costs money, therefore taking care of health and safety makes good business sense. Effective safety programmes reduce absenteeism at work, increase longevity of experienced and skilled workers, contribute to high worker morale and keeps premises in higher standards all of which are linked to higher productivity, better quality leather and more effective use of resources. Unsatisfactory OSH standards at work are linked to increased costs and reduced profits. Even in traditional tanneries, it is possible to significantly improve OSH standards as many solutions are simple and of low cost. These solutions can be easily adopted by the industry and can significantly contribute to improved productivity, profitability and environmental conditions.

✓ Right Investment

Although the cost of improvements in the area of workplace conditions (including OSH) adds to production costs, a good work place is more profitable in the long run. The studies by the European Agency for Safety and Health at Work have shown that for every euro invested in OSH, there is a return of 2.2 Euro; in some industries the return is much higher (for example in the German butcher sector, every euro invested brought 4.81 Euro in savings from a reduction of costs related to work accidents and injuries (healthy-workplaces.eu, 2017)). The costs of work-related accidents and ill-health are both direct i.e. worker compensations and medical, hospital and rehabilitation expenses as well as indirect i.e. wage and productivity losses; administrative expenses; losses in

REASONS FOR OSH

"Safe and healthy work is a fundamental human right but the new estimates of the costs of poor non-existent OSH measures show that the economic case for OSH has never been stronger"

Dr. Christa Sedlachek,

the director of EU-OSHA

damaged machinery, tools and other property; accident investigations; and perhaps necessary training of a replacement worker.

To add to that, by complying with OSH manufacturers meet the stakeholders' requirements. Well managed OSH is an essential part of a company's Corporate Social Responsibility policy and a foundation of a sustainable business model that enhances the brand value and attracts customers.

✓ Image

It is important to the entire leather industry, as well as to industries that use leather (such as automotive sector, luxury brands and shoes manufacturers) that the general public perceive hides and skins processing as a modern, safe, sustainable and organised process. Accidents in tanneries can lead to media articles suggesting that the worst cases are the norm, and neither governments nor tanners are attending to workers' health and safety. Poor health and safety standards produce a bad image for all leather businesses. Accidents that could be easily limited may affect the industry's reception. With the materials market being so competitive, leather must be associated with modern, safe and sustainable production.

✓ Legal Obligation

According to common-law jurisdiction, neglecting occupational health and safety regulations may lead to prosecution. The OSH legislations around the world require an employer to ensure the safety, welfare and health of their employees. It is an employer's reasonability to assure all work activities are conducted in a safe and controlled manner, according to the required OSH standards. For instance, in the European Community the OSH issue was regulated by the Directive 89/391/EEC and then adopted by Member States' national laws.

✓ People

Last but not least, OSH is about protecting every company's most valuable asset – its people. Reading this practical, one must bear in mind that the most important part of the tanneries activity is to keep its staff safe and sound – after this come profits and other goals. It is the owners' and managers' moral duty and ethical responsibility to make sure workers return to their families from work.

1.2 WHO NEEDS THIS GUIDELINE?

This manual has been primarily prepared to be used by a wide range of stakeholders involved in the leather making process: from owners and tanners through managers and supervisers to tannery workers and technicians. It has been designed to provide self-study material, guidance and ideas on how to improve the occupational safety and health standards at work

in tanneries and effluent treatment plants by presenting the sources of hazards in tanneries and pointing out i) simple solutions, in a practical manner, ready for quick on-site implementation as well as ii) proposing more complex modifications, structural adjustments and implemenation of new policies.

The manual is also a useful tool for all those who are directly or indirectly concerned with occupational safety and health standards in tanneries and all leather realated sectors. It is recommended reading for enforcement agents, safety officers, OSH experts, advisors, specialists, auditors, planners and consultants that provide services to the tanneries.

1.3 Structure

The recommendations compiled in this manual are based on best practices used around the world in well estblished tanneries and companies representing different industries but sharing same or similar work hazards and risks. The document also makes references to official international regulations and standards.

The manual contains 10 health and safety specific chapters, each of which provide useful information to the reader in understanding the core issues of occupational safety and health in the leather manufacturing industry. The manual starts with an overview of health hazards and safety risks usually prevalent in the different sections of a tannery i.e. raw material handling, beam house, tan yard and wet- and dry-finishing operations.

In addition to above, the manual covers the health hazards and safety risks of utilities such as power generators and effluent treatment facility. There is a special chapter dedicated to risk management, transport within the workplace, personal protective clothes, safety and emergency management and a subchapter looking into auditing and monitoring of the workplace in order to quickly find weak points and verify areas for improvement. Auditing and monitoring will help to continuously maintain safe conditions in a workplace.

Each chapter is written in a similar form and contains various subchapters covering a specific field to facilitate finding information. At the end of each chapter, quick shortlists are available to instantly self-assess the situation in a tannery and immediately take required actions for improvement. The chapters are structured in such a way to give you many practical hints, key points and warnings - particularly important points are highlighted.

Additionally, across the manual, there are numerous cross-references (marked by a blue star) to the appendix sections containing extra materials, analysis of hazards and risks, supplement tables and figures, detailed self-auditing tools, graphical explanations, helpful print-outs and additional detailed information around a given subject.

1.4 How to use the manual?

If you are just starting with improving the OSH standards at work in your tannery, start with Chapter 2 on health hazards and safety risks. It will give you a general idea of what you have

to look for when assessing the current situation in the tannery. Reference sheets analyse hazards in detail and assess the risks at each phase of the production chain from raw to finish.

Auto-evaluation checklist in reference sheet 9.1 could be used to self-assess the present situation in the workplace or at any specific section of the tannery. Once potential problem areas are identified, refer to the specific chapters of the manual and get an idea of possible solutions.

Separately, there are machine-specific checklists that are focused on particular tannery machinery and equipment. These are designed to make sure the machines are installed, kept and maintained in the safest known way.

In case you only want to check on a specific issue e.g. proper storage of chemicals or suitability of specific personal protective equipment, then go to the respective chapter or subchapter referring to the descriptive information, drawings, guidelines and checklists.

In view of the great variety of chemicals and different designs of machines used in tanneries around the world as well as the speed of changes and innovations, it is possible that some chemicals, machines or processes may not be covered in this manual. As there is always scope for further improvement, your comments and ideas will be useful to improve the manual.

2 Risk Management

Occupational safety and health is a multidisciplinary field that helps all employers in protecting their workers, co-workers, outside contractors, visitors, customers, the families of the aforementioned and everyone that can be affected by the workplace environment. This can be achieved by an efficient risk management process, whose main goal is to reduce the number of workplace accidents, injuries, work related illnesses and deaths. The process can be described as a continuous improvement cycle (see figure 2) which can be implemented in the management processes of a tannery.

First, risk management aims to identify what could go wrong during work operations then evaluate the likelihood and severity of the occurrence, decide on control measures, implement them so the risks are as low as reasonably practicable, then decide if they are acceptable. According to the **OHSAS 18001,** an acceptable risk is a risk that has been reduced to a level that can be tolerated by the organization in regards to its legal obligations and its own OSH policy.

Before continuing, it is important to understand the concept of risk and hazard:

Hazard: a source, situation, or act with the potential to harm in terms of human injury or ill health, or a combination of these. In other words, it can be anything present in a company with the potential to harm a worker.

Risk: any given hazard, by combining the likelihood of the occurrence of a harm and its severity. The degree of risk can be expressed by a number or verbal expression (see table 1).

The general principles of OSH management system are covered by **ISO 45001** and **OHSAS 18001**. Risk management guidelines, principles and frameworks are covered by **ISO 31000**. Read more in chapter 9.

2.1 Risk Assessment

A crucial part of risk management is the **risk assessment**, which is an essential part of any OSH improvement process. According to the EU law (Directive 89/391/EEC), the risk assessment is the starting point of any OSH management system, therefore implementation of appropriate safety and control measures must be based on the risk assessment outcomes. Risk assessments should be reviewed regularly especially after changes to the process/operation, changes to legislation, following an accident or simply after a predetermined time period. A risk assessment is not only a legal obligation in many countries, but also a dynamic process that allows companies and organizations to stay effective and to put in place a proactive policy for managing occupational risks. As presented in figure 2, the fundamental steps in the risk assessment are:

- Step 1: Identifying hazards and those at risk
- Step 2: Evaluating and prioritising risks
- Step 3: Deciding on preventive actions
- Step 4: Taking actions
- Step 5: Monitoring and reviewing

Risk assessment is the start of any approach to the occupational health and safety in tanneries, and if it is not done properly, the preventive measures taken are likely to be insufficient or inadequate. Please find below a brief description of each risk management step.

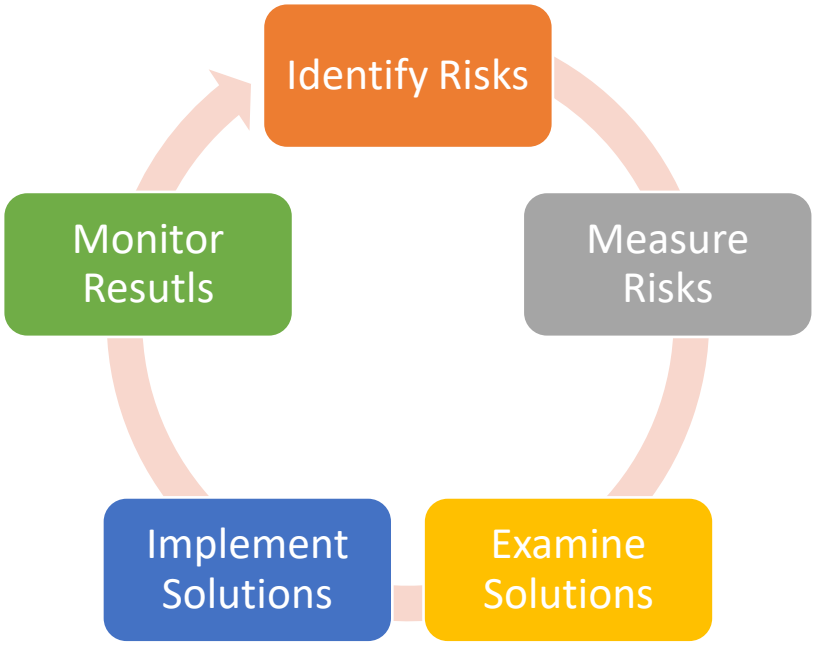


Figure 2: The 5 step risk management cycle

STEP 1: HAZARD IDENTIFICATION

This step of a risk assessment is focused on identifying hazards. The party responsible for hazard identification should target every type of work where hazards can occur and analyse them thoroughly, taking into consideration direct observations of the workplaces (walkthrough), history of past incidents, workers and managers experience/opinions (interviews), machine and equipment safety manual, experts' observations, latest technological and industrial trends, audits, checklists, Safety Data Sheets for chemical substances used, etc. The obtained information should be archived in either physical or digital format and kept in an easily accessible manner.

Consider the below points when conducting a risk assessment:

Check:

What machines are in use?

Which chemicals are being used?

What hazards may arise from the machines and chemicals in use?

What manual handling processes are involved?

What emissions and wastes are likely to be generated during production?

What hazards may occur from generated emissions and wastes?

For any changes in the workplace (new machines, layout, technology, chemicals used etc.)

Accident reports and previous risk and hazard assessments

"Safety doesn't happen by accident"

Anonymous

The easiest way to identify the prevalent hazards in a tannery is by looking at each step of the leather production process. In the appendix section of this guideline you can find a detailed, step-by-step analysis of the leather manufacturing stages (as listed below) with the focus on risks and hazards present throughout the leather making process. The reference sheets in the appendix will help you understand and determine the potential safety risks, health hazards and effects, common bad practices and the causes behind the danger. The provided reference sheets are also a useful tool for monitoring and auditing each step of the leather making process.

Please consult the reference sheets according to the list below:

Raw material	ref. sheet: 2.1	Finishing	ref. sheet: 2.5
Beamhouse	ref. sheet: 2.2	Utilities	ref. sheet: 2.6
Tanyard	ref. sheet: 2.3	Effluent Treatment Plant	ref. sheet: 2.7
Dyehouse	ref. sheet: 2.4	Self-audit checklist	ref. sheet: 9.1

STEP 2: RISK EVALUATION

Once we have identified the hazards, we should evaluate and calculate the risk by looking at the likelihood of the harm and severity of the consequences. Doing so allows the risk to be expressed as a number or as low, medium or high as shown in the table 1. After implementing new control measures, the risks should be re-assessed to verify if it has been lowered. For some risks there are particular control measures that are required by law.

Table 1: Simple Risk Estimator proposed by British Standards 8800 (BSI, 2008)

Likelihood of harm	**Severity of Harm**		
	Slight of Harm	**Moderate Harm**	**Extreme Harm**
Very unlikely	Very low risk	Very low risk	High risk
Unlikely	Very low risk	Medium risk	Very high risk
Likely	Low risk	High risk	Very high risk
Very Likely	Low risk	Very high risk	Very high risk

Examples that carry a recognised risk of harm within tanneries are:

- Working at height
- Working with chemicals and dust
- Machinery and electricity
- Workplace transport, including forklift trucks
- Gas
- Fire
- Noise
- Manual handling
- Slips, trips and falls

Step 3: Risk Control Measures

In this stage the most suitable prevention actions are identified and later (step 4) performed. The risks must be avoided and eliminated or (if not possible) reduced to an acceptable level according to the ALARP principle (as low as reasonably practicable). The order of safety control measures implementation should follow the hierarchy of control shown below (figure 3).

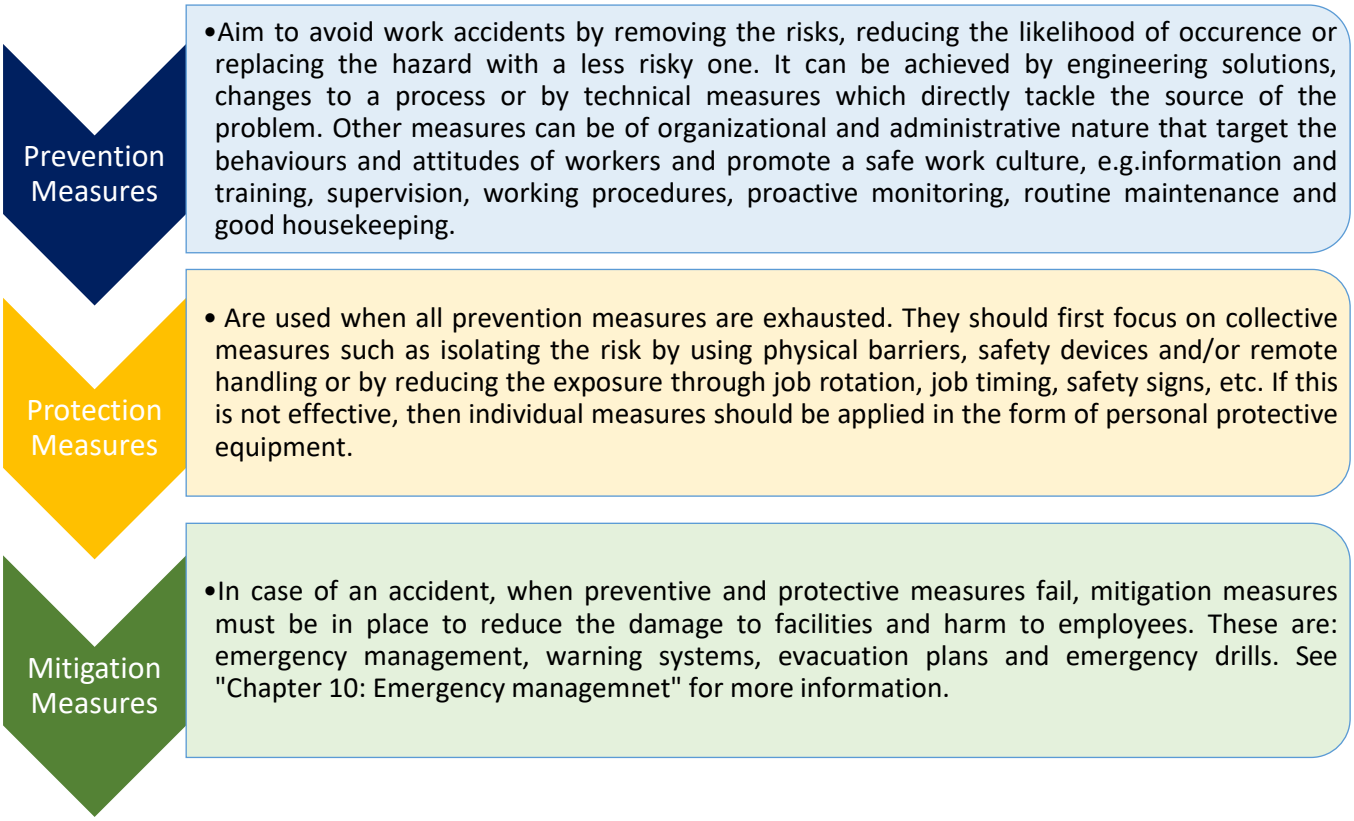


Figure 3: The order of OSH safety control measures

Another known hierarchy of control (figure 4), which has been developed by the US-based NIOSH institute (National Institute for Occupational Health and Safety), is composed of five steps:

1. **Elimination** – Physical removal of the hazard
2. **Substitution** – Replacing the hazard to one less severe or easier to manage
3. **Engineering Control** – Isolating the staff from the hazard
4. **Administrative Control** – Changing the way people work, raising awareness, trainings, warnings
5. **Personal Protective Equipment** – Protection of a worker via PPE

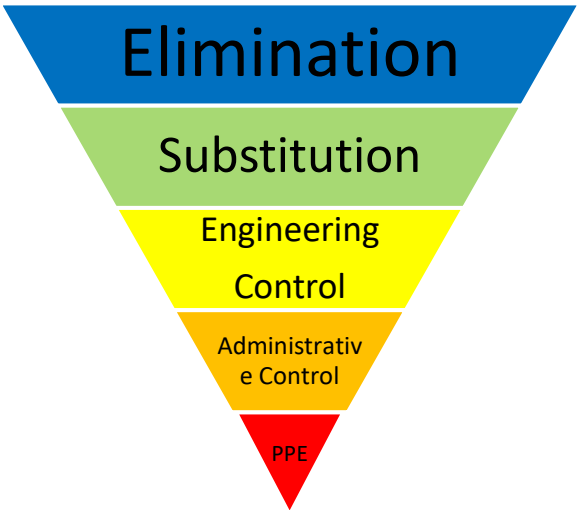


Figure 4: The hierarchy of control by NIOSH

STEP 4: SOLUTION IMPLEMENTATION AND RISK ACCEPTABILITY

After implementing the most suitable solution, risks should be re-assessed to determine if the chosen control measure is suitable at bringing the risk to the acceptable level. To determine if the risk is acceptable, the estimated risk value should be compared with the requirements defined by legislation – although the companies should do more than the legal minimum. If the particular operation/hazard is not covered by legislation, the companies should look for additional references in other knowledgeable sources such as international standards, machines/equipment manuals, verified OSH guidelines, union recommendations (or other relevant body) or practices in similar companies. The British Standard Institution proposed a risk classification baseline for safety action implementation.

Table 2: Risk Categorization (BSI, 2004)

Category of risk	Evaluation of tolerability	Guidance on necessary action and timescale
Very low	Acceptable	These risks are considered acceptable. No further action is necessary other than to ensure that the controls are maintained.
Low	Risks that should be reduced so that they are tolerable or acceptable.	No additional controls are required unless they can be implemented at low cost (in terms of time, money and effort). Actions to further reduce these risks are assigned low priority. Arrangements should be made to ensure that the controls are maintained.
Medium		Consideration should be given as to whether the risks can be lowered, where applicable, to an acceptable level, but the costs of additional risk reduction measures should be taken into account. The risk reduction measures should be implemented within a defined time period. Arrangements should be made to ensure that the controls are maintained, particularly if the risk levels are associated with harmful consequences.
High		Substantial efforts should be made to reduce the risk. Risk reduction measures should be implemented urgently within a defined time period and it might be necessary to consider suspending or restricting the activity, or to apply interim risk control measures, until this has been completed. Considerable resources might have to be allocated to additional control measures. Arrangements should be made to ensure that the controls are maintained, particularly if the risk levels are associated with extremely harmful consequences and very harmful consequences.
Very High	Unacceptable	These risks are unacceptable. Substantial improvements in risks controls are necessary, so that the risk is reduced to a tolerable or acceptable level. The work activity should be halted until risk controls are implemented that reduces the risk so that it is no longer very high. If it is not possible to reduce risk the work should remain prohibited.

Step 5: Monitoring and Reviewing

It is recommended to perform risk assessments on a regular basis (PDAC cycle) in order to keep it relevant and updated, as some new findings regarding a control measure or a risk or hazard can emerge. Additionally, risk assessments should always be reviewed when a change in the workplace occurs. This can be when a new machine/equipment, chemicals, raw material, operation or procedure is introduced into the process.

Documenting

In developed countries the risk assessment must be documented and kept by the employer. In the EU, the directive 89/391/EEC regulates this issue. The appropriate document should be prepared for each workplace within the company and consists of an overview of related hazards, identification of the employees at risk, risk evaluation and estimation, subsequent risk control measures and risk acceptability. Concerned workers should be made familiar with the risk assessment document. Furthermore the documents should be available for work managers, workers, inspectors and other interested parties on request. The document could be used for initial and seasonal training sessions.

Risk Assessment Tools

In the appendix section you will find health hazards and safety risks guides to leather processing. The enclosed reference sheets (2.1 – 2.7) will help in the identification of risks and with effective implementation of control measures. In the reference sheet 9.3, there is a tool and methodology for the assessment and prioritisation of hazards.

Risk assessments can be performed by using specially designed and verified methodologies. Several methods to perform risk assessments are available ranging from expert to participatory methodologies and from simple to complex methods. The risk assessment process can be delegated to an external or internal OSH specialist but the responsibility remains with the employer. There are many online and free tools that can be used, but before applying any, its relevance and suitability should be revised.

2.2 CHECKLIST

Component	Yes	No
1. Are all machines and equipment listed?		
2. Is there a risk assessment for the chemicals used in the tannery?		
3. Is there a risk assessment for every workstation (mechanical operations, manual labour, etc)?		
4. Are hazards that may arrise from the machines and chemicals documented?		
5. Is management aware of the hazards that may occure from generated emissions and wastes?		
6. Are accidents reports and previous risks and hazard assessments recorded and analyzed?		
7. Are control actions (elimnination, prevention and mitigation) implemented in accordance with the risk assessment findings?		
8. Are risk assessments conducted after any change in the workplace (new machine, technology, layout, chemicals, etc)?		

3 Chemicals

Chemicals are widely used across the production of leather, and if not dealt with appropriate care, they can pose hazards to humans. Appropriate handling of chemicals is one of the most crucial points in occupational health and safety in tanneries.

The chemicals used by the leather industry are traded all around the world and a lot of effort is made to control and regulate their use as well as mark the risks and signal the appropriate level of care. The regulations and guidelines particularly worth attention are:

- The Registration, Evaluation, Authorisation and Restriction of Chemicals (**REACH**). This is a complex set of regulations by the EU that oversees chemical production and their use.
- The Globally Harmonized System of Classification and Labelling of Chemicals (**GHS**), created by the United Nations, is a system for standardizing and harmonizing the classification and labelling of chemicals. It is a logical and comprehensive approach to:
    i. Define health, physical and environmental hazards of chemicals;
    ii. Create classification processes that use available data on chemicals for comparison with the defined hazard criteria – categories (ratings) exist from 1 to 5. **The LOWER the number the GREATER severity of the hazard**; and
    iii. Communicate hazard information, as well as protective measures, on labels and Safety Data Sheets (SDS).

For more information regarding the REACH legislation go to its dedicated subchapter 3.8

To consult GHS international labelling danger signs go to reference sheet 3.2

Nowadays, tanners have a wide choice of chemicals they can use and the processes they can follow to minimize the risk of using potentially dangerous chemicals. This means that the safety of the workers starts with managers' and technicians' clever selection of the chemicals and processes that are being used. The chemicals that present harm or pose high risk to someone's health as a result of their use or exposure should be readily replaced by their safer and modern counterparts. For instance, the following chemicals should have no place in modern, safe and sustainable leather production:

- Azo-dyes
- Nonylphenol and nonylphenol ethoxylates based surfactants
- Pentachlorophenols (PCP) based preservatives
- High content formaldehyde chemicals (fillers, syntans)

It is important that all people working with chemicals receive information on their potential health hazards and training on how they should protect themselves.

To find out whether you are using chemicals which are considered hazardous, check the list of risky chemicals in reference sheet 3.1

To protect workers, only chemicals provided by reliable supplier who comply with recent legislation and regulations should be used.

3.1 Communicating Hazards and Risks

Labelling

To determine and effectively manage the inherent hazards of chemicals, the first and most important step is collecting information. Immediate **sources of information** are **labels** on chemical containers, chemical **danger signs** and chemical **Safety Data Sheets (SDS)**.

Figure 5: What chemical is he handling?

Correctly labelling chemicals is crucial for workplace safety; it is required by law and prevents the costly disposal of unknown chemicals. All containers with hazardous chemicals must be adequately labelled for classifying the product at a glance. Proper marking raises the awareness of potential risks and hazards, as well as indicates the right use of the labelled product.

GHS was adopted in 2007 replacing its older European hazard symbols counterpart, which was in force from 1999 to 2007 according to directive 67/548/EEC. Before 1999, the German Hazard Symbols defined by DIN 4844-2 were commonly used. Although the industry quickly adopted the new danger signs, the old symbols can still be found in use. All of the graphical systems are presented, described and explained in the appendix section. They can be printed out and used as training material.

> *To consult GHS international labelling danger pictograms as well as European and German danger signs go to reference sheets 3.2, 3.3 and 3.4 respectively.*

Information on chemical container labels:

- Trade name of chemical - Identity of chemical
- Name, address and telephone number of supplier
- Hazard symbols
- Safety precautions
- Identification of the batch
- Statement that a safety data sheet is available with the tanner
- Classification assigned under the system established by the competent authority

Figure 6: Exemplary chemical label

Due to lack of space, the information on the label on each container is often incomplete, additional information sources are:

- Safety Data Sheets
- Supplier and sales representatives
- Trade associations
- Internet databases

Safety Data Sheets

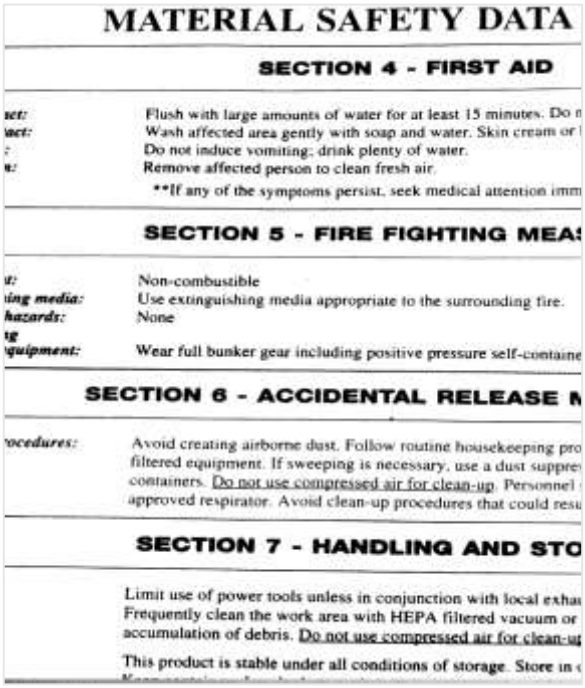
A Safety Data Sheet (SDS), also known as a material/product safety data sheet, is a descriptive document issued by chemical manufacturers to communicate the potential hazards and the safe handling of chemical products to their customers. The SDSs explain the necessary precautions and appropriate use of a chemical product to make its use harmless.

The SDS is mandatory in most countries and its form and structure is now regulated by GHS and the European Community by Annex II of REACH regulations (in force from 1st of June, 2015).

Legal point of view

According to the legal requirements in the EU, it is an employer's obligation to make SDSs openly available for consultation by managers, supervisors, technicians and workers or any concerned party at any time in the local language. Chemical traders and manufacturers are also required to provide every customer with a SDS copy for every first purchase of a product. Moreover, every year the SDSs should be revised and updated to the latest version. The SDSs for most chemicals are also available through various internet databases.

Although there are many countries that approach the issue less strictly, European practices can be applied to improve health and safety level across the leather industry.



MATERIAL SAFETY DATA

SECTION 4 - FIRST AID

Flush with large amounts of water for at least 15 minutes. Do n
Wash affected area gently with soap and water. Skin cream or
Do not induce vomiting; drink plenty of water.
Remove affected person to clean fresh air.
**If any of the symptoms persist, seek medical attention imm

SECTION 5 - FIRE FIGHTING MEA

Non-combustible
Use extinguishing media appropriate to the surrounding fire.
None
Wear full bunker gear including positive pressure self-containe

SECTION 6 - ACCIDENTAL RELEASE M

Avoid creating airborne dust. Follow routine housekeeping pro
filtered equipment. If sweeping is necessary, use a dust suppre
containers. Do not use compressed air for clean-up. Personnel
approved respirator. Avoid clean-up procedures that could resu

SECTION 7 - HANDLING AND STO

Limit use of power tools unless in conjunction with local exha
Frequently clean the work area with HEPA filtered vacuum or
accumulation of debris. Do not use compressed air for clean-u
This product is stable under all conditions of storage. Store in

Figure 7: An example of SDS

If more detailed information is required, please refer directly to EU REACH regulation 2015/830 or GHS (links in the "Find Out More" chapter).

No chemicals should be brought into the tannery if not properly labelled or marked. SDSs for each chemical used in a tannery should be readily available.

Structure of the SDS

1. **Identification of the substance/mixture, producer and intended use.**
   - Informs of the commercial and chemical name of the product. This section includes product application, address of the producer and emergency contacts.
2. **Hazards determination.**
   - A very important section for tanners. This section lists all the risks and hazards related to using and handling the product in question.
3. **Composition and information on ingredients.**
   - It is not necessary to list all of the chemical product's ingredients,but it is mandatory to list hazardous ones as specified in the EU Commission Regulation 2015/830.
4. **First aid measures.**
   1. Life saving information on what to do in case of exposure.
5. **Fire-fighting measures.**
   - This section informs about extinguishing media, reaction of the product with fire and provides advice for firefighters.
6. **Accidental release measures.**
   - Actions to be taken in case of accidental spillage of the chemical.
7. **Handling and storage.**
   - Technical precautions to be exercised during handling and storage.
8. **Exposure controls and personal protection.**
   - Advice on how to minimize exposure, industrial hygiene and suitable types of PPE for handling the given chemical safely.
9. **Physical and chemical properties.**
   - Basic chemical and physical properties such as: active substance, pH, state of matter, smell and colour.
10. **Stability and reactivity.**
    - Evaluation under different storage conditions and exposure to other chemicals.
11. **Toxicological information.**
    - Toxic, carcinogenic, sensitizing and mutagenic effects on mammals.
12. **Ecological information.**
    - Effects on water, air and soil.
13. **Disposal considerations.**
    - Waste treatment, recycle and disposal methods.
14. **Transport information.**
    - Carriage regulations including UN numbers, packing, transport classes, etc.
15. **Regulatory information (labelling).**
    - Signalling the hazards of the product by symbols, warnings, risk and safety phrases to ensure safe handling.

16. Other information.

- Often carry additional OSH remarks as well as further technical reading.

3.2 Chemical Hazards

Every chemical can harm a person's health, but when used properly the chances are reduced to a minimum. Even a substance as simple as flour can be hazardous to health if poorly handled. Ensure the right conditions, safety measures and training in handling chemicals (according to SDS) to protect workers and eliminate the impact of chemicals.

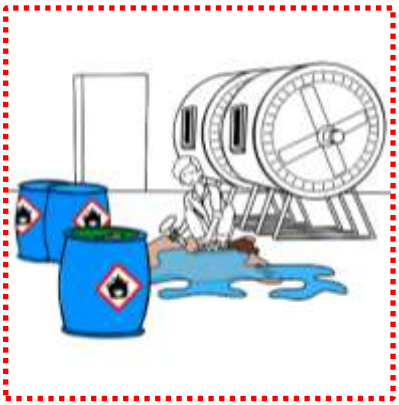


Figure 8: Poor PPE leads to high chemical exposure and risk

Chemical Exposure

From the relevant information on the chemical hazards available to you, it is crucial to check where and to what extent workers in the tannery are exposed to hazardous chemicals.

One must be aware that the inherent source of the hazard can be either the chemical itself, any emission generated during the use or handling of the chemical (e.g. vapours, fumes, effluent) or the containers used for storage and transport of these chemicals.

Who is of concern?

It is not only workers who deal with chemicals that are of direct concern. Chemicals in liquid and gaseous (VOC) form do also affect the immediate neighbourhood when let out into drains or removed from the workplace by exhaust blowers and chimneys. As chemicals emit fumes, mist, vapours or dust during storage and handling, any worker may get exposed to the airborne chemical pollutants in any part of the workplace.

Tannery workers are exposed to chemicals by:

- **Inhalation:** In form of airborne substances such as gases (VOC), dust, mist and fumes. Once breathed in, the chemicals can attack the throat, nose and whole respiratory system – in some cases the chemicals, through lungs, can travel with blood to other organs and damage them (e.g. liver andkidneys).
- **Ingestion:** Through eating, drinking or smoking in the work area, without washing contaminated hands.
- **Skin absorption:** Generally through pores or cuts and wounds of unprotected skin i.e. hands, arms and feet. Some chemicals damage the skin directly while others penetrate and moveinto the body.
- **Contact with the eyes:** Splashes or airborne substances in the form of dust, mist, vapour or fumes irritate the eyes. Acids or some liquids containing certain substances e.g. caustic soda can permanently damage eyesight.

Figure 9: Workers exposure to chemicals

Exposure Symptoms

The impact of such exposures can range from temporary effects such as dizziness, headaches and irritated eyes, skin or lungs to allergic reactions and collapse due to a lack of oxygen or longer-term effects such as poisoning of the liver, kidney or nervous system and, in some cases, even instantaneous death (H_2S poisoning). Long term impairments are: occupational asthma, ulcer, bronchitis, genetic defects.

Figure 10: Exposure to chemicals by draining a retanning drum

Chemicals and the Work Environment

Besides the adverse effects on the human body, chemicals can be the source and the cause of fire, corrosion and damage to structures and electrical installations and may have harmful effects on the surrounding environment when released in an uncontrolled manner.

Workers are exposed during:

- Loading, unloading and handling of chemical containers in a chemical store
- Transferring chemicals between chemical containers
- Mixing chemical recipes in a chemical store or workplace
- Transfering chemicals from a chemical store to the workplace
- Dosing chemicals in workplace.
- Loading and unloading raw material, pelts, limed hides and skins, WB and WW or crust into/from tanning vessels
- Removing chemical wastes and effluent from workplace
- Washing and disposing chemical containers

Occupational Exposure Limits

The basic principle of toxicology is “the dose makes poison”, therefore the American Conference of Governmental Industrial Hygienists (ACHIH) introduced exposure limits expressed by the Threshold Limit Value (TLV) for chemical substances. The value states a worker’s daily safe level of exposure to a given chemical without an adverse effect on safety and health for the entire work lifetime. The TLV for particulates (dust, smoke, mist) is defined in mg/m3, whereas for concentration in air it is expressed in PPM. The ACHIH recommendations have only a guideline status and should not be confused with exposure limits with a regulatory status. Section 8 of SDSs shall indicate the exposure limits. TLVs are defined as:

- Time-Weighted Average (TWA) - referring to a permissible 8 hours (work shift) of continuous exposure
- Short-Term Exposure Limit (STEL) - the maximum permissible continuous exposure for a duration of 10 or 15 minutes. It cannot be repeated more than 4 times a day and abreak of at least 60' should be observed between exposures
- Ceiling Limit (TLV-C) – the maximum exposure limit that must not be exceeded at any time

Chapter 9's "Audit and monitoring" section provides further information on Occupational Exposure Limits and how to determine the actual exposure to chemicals. The reference sheet 3.1 contains a list of risky chemicals that may be found in tanneries with their TLV.

Reducing Chemical Hazards

To reduce the impact and risks of hazardous chemicals apply the following techniques listed below in order of priority:

I. Eliminate whenever possible hazardous chemicals from the workplace by using safer substitutes or by changing a production process.

You can start with:

- Using water-based instead of solvent-based chemicals for degreasing and in the finishing department
- Partially replacing sodium sulphide with enzymes in liming
- Using roller coating instead of spraying for leather finishing

In some cases it might be difficult to find replacements. In such cases it may be useful to look for an alternative process that can be done without using or producing emissions of hazardous substances.

II. Limit the chances of exposure to hazardous chemicals.

For example:

- Use automatic dosing systems to avoid direct contact and exposure to chemicals
- Always putt lids and covers on chemical containers
- Use extraction systems on dry shaving, buffing, dedusting, spraying machines and chemical weighing to reduce the emission of dust, mist, vapours and gases
- Use hand or motor pumps for transferring hazardous chemicals such as acids
- Reduce the concentration of airborne pollutants by using ventilation and natural airflow
- Ensure good housekeeping practices such as regularly cleaning work areas, floors, walls and machines, removing waste and adhering to safe storing and handling practices
- Reduce exposure time e.g. do all product weighing at one time

Limit access to areas where hazardous chemicals are likely to be present

Limiting access to areas where chemicals or chemical hazards are present (e.g. chemical stores, effluent treatment plant) is a simple way of limiting exposure. Clear instructions and displaying suitable sign boards can help achieve this.

Figure 11: Limited access of restricted areas

Reduce the number of workers in areas with hazardous chemicals

Assign designated workers to handle chemicals. At the same time, ensure that the exposure duration of workers is kept as short as possible, according to TLV. Consider introducing a job rotation system to avoid excessive exposure of the same workers over prolonged time.

Chemical releasing and drainage

Pay special attention to releasing chemicals. Control discharge of floats from paddles and drums with a hose or gutter connected to the sewer. Use modified work systems and local exhausts/drains. Simple changes in production process or work systems can reduce the release of chemical fumes, liquors, dust, vapours or gases containing chemicals.

Similarly, local drainage systems for paddles and drums prevent chemical containing effluent to spill over to work areas in the wet process operations.

Figue 12: Uncontrolled float discharge

Figure 13: Modern "banana gutter" with a two-channel system allowing the separation of effluent

Ensure that the extraction or drainage system does not simply shift the pollutant from one work place to another in the factory or outside to the neighbourhood. The drainage system should end at a local effluent treatment plant.

III. Prevent exposure to hazardous chemicals by using PPE

Use personal protective equipment (PPE)

Protecting workers by providing them with PPE is an easy and immediate solution, but should be considered as the last resort only. Keep in mind that the use of PPE often involves discomfort to the worker, particularly in hot and humid regions.

Whenever it is impossible to prevent personal exposure to chemicals and pollutants at levels at which there is no hazard to health - PPE must be used:

Figure 14: Various PPE used

- Gloves, boots and aprons should be available for every worker in the wet parts of the tannery.
- Respiratory-type masks with particulate filters and glasses should be used when handling powder and liquid chemicals.

Personal protective equipment has limitations too. The use of dust masks in buffing areas is ineffective if there are no local dust extraction systems available on the buffing machines. The high dust concentration in the air clogs the dust masks immediately, rendering them useless.

Figure 15: Insufficient exposure reduction

Figure 16: Reducing workers exposure through PPE

3.3 Handling of Chemicals

As a general principle the quantity of chemicals in or at the workplace should be reduced to that required for daily or batch use. The remainder should be kept safely in the chemical store.

Pay special attention to safe handling practices during:

- Transfer of chemicals from large containers to smaller ones
- Preparation of chemical recipes, including dilution of acids
- Transfer of chemicals from the chemical store to the production area
- Dosing of chemicals

Ensure good personal hygiene of workers

Personal protection also means adherence to basic behavioural practices and principles which must be encouraged by managers and supervisors in tanneries at all times:

- Prohibit eating, chewing, drinking and smoking in work areas, particularly where hazardous chemicals are likely to be present
- Inform and train workers on safe work practices in handling chemicals
- Make sure that workers clean and wash exposed parts of body after handling chemicals
- Provide facilities for washing, changing and storage of clothes
- Encourage personal hygiene of workers. Make sure that they always wash hands before eating or smoking

PREPARATION OF CHEMICAL RECIPES

Avoid mixing and preparing chemical recipes in the work area. Ideally, designate a separate area in your tannery. This will eliminate distraction and allow better control over proper mixing and preparation.

Figure 17:Uncontrolled transfer of liquid chemicals without using appropriate PPE

Figure 18: Controlled transfer of liquid chemicals using appropriate PPE

BASIC RULES AND PRINCIPLES IN HANDLING OF CHEMICALS!

- Never mix chemicals randomly or indiscriminately
- Handle chemicals carefully when pouring or measuring to prevent spillage and waste
- Use tools such as scoops, spatulas and measuring cups
- Avoid breathing chemical fumes, dust or vapours. Use appropriate respirators and masks when using chemicals which emit gas, dust or vapours
- Avoid skin contact with chemicals. Use safety goggles and other PPE as required by the applicable safety data sheet
- Do not place fingers into mouth, nose, ears and eyes while handling chemicals
- Wash hands with disinfectant soap after handling chemicals
- Remove chemical spills on skins and eyes immediately
- Any chemical spillage must be cleaned up and reported to the supervisor
- **Always add acid to water, not water to acid**

Figure 19: Uncontrolled mixing of chemicals can be dangerous

Figure 20:

Remember: Add acid to water, not water to acid!

(Western Safety Sign)

TRAINING OF WORKERS

Training and education play important role in the control of chemical hazards. People who work with chemicals should be aware of:

- The possible health risks caused by chemicals
- Safe working procedures
- Care and use of protective equipment
- Label interpretations and meanings of pictograms

Moreover, workers should be trained to identify when control measures fail. Training is essential for new workers, while experienced workers should participate in regular refresher courses.

You will find more information in chapter 7 which is dedicated to personal protective equipment. Reference sheet 7.1 will help you in proper selection of PPE for each step of leather manufacturing

Check in safety data sheet if workers use personal protective equipment as required for dealing with type of the chemical they handle

TRANSFER OF CHEMICALS

Transferring chemicals from containers

Careful handling practices will reduce not only safety risks and health hazards but also waste of chemicals, costly mistakes and contamination of the work place. Take into consideration the following points:

Figure 21: IBC collection basin

- Make sure that the smaller containers used for transferring chemicals from the chemical store to the workplace are clearly labelled and marked (e.g. colour coding, signs, labels)
- After transferring the chemical, make sure that lids and taps are tightly closed
- Proper labelling of main chemical containers prevents mistakes by workers. Colour and shape of chemical containers are neither distinctive nor sufficient indicators
- Clear instructions and training of workers engaged in handling of chemicals are important.

When transferring chemicals, take advantage of simple tools and arrangements such as hand piston pumps (e.g. for transfer of acids) or positioning of barrels on horizontal racks (e.g. for fatliquors).

To avoid contamination, do not use the same spatula or measuring cups for taking different chemicals.

Transferring chemicals within the workplace

Carrying chemicals manually and in open containers should be avoided to prevent spillage, distribution of vapours and chemical accidents.

Carry chemicals in closed containers using trolleys and pallet trucks. Installing ramps and levelling floors will facilitate the use of such trolleys and pallet trucks.

Figure 22: Correct flooring for transporting chemicals around the workplace

DOSING OF CHEMICALS

Nowadays, still in many tanneries, the worker empties the chemical container (bucket, barrel, bag) directly into the pit, paddle or drum. While doing so, chemicals in the form of dust, vapours or mist are released, affecting the workers and the work area. Poor arrangement of dosing chemicals through vent holes or doors on drums result in chemical waste due to spillage, which also contaminates the drum area. Particularly, while lifting the chemical container or carrying it up to the funnel or vent hole, chemicals are spilled as the worker struggles for balance – see picture 22 and 24. To contain such effects, consider dosing chemicals in a closed system – besides saving your workers from risks and hazards, such measures result in significant chemical saving.

Automation and automatic dosing systems

Automatic chemical dosing systems are a very good option to reduce the risks of accidents. However, there are many other important advantages. Nowadays automatic dosing systems are more affordable.

Contrary to the general belief, tannery mechanisation and automation are not just aimed at saving manpower. Similarly, the general belief that automation and mechanisation are not suitable for developing or emerging countries is incorrect. Process automation reduces the human error factor, which is the main reason for leather inconsistency. Process automation and automatic chemical dosing systems contribute to a safer and cleaner working place. Other advantages are:

- Improved uniformity and quality of production
- Reduced exposure to chemicals and risks of accidents
- Reduced risks of spillage and contamination of workplaces during transport of chemicals to the workplace
- Ensured production treacability

Automatic dosing systems and process control are important factors for quality consistency, environment and safety. If for any reasons it is not included in e.g. design of a new tannery, it is recommended that the design takes necessary infrastructure into consideration to avoid extra expenses at a later stage when such equipment will be decided to be installed.

Figure 23: Automatic dosing system (credit Hüni)

Low-cost improvement

In a small tannery the installation of an automated dosing system may not be feasible, however, the use of low-cost appliances or redesigning of an existing device can help:

- Install a fixed funnel or IBC tank with connection to the drum axle
- Install steps to the funnel/IBC tank thatare not higher than 20cm
- Ensure that the upper edge of the funnel/IBC container is not be higher than the hip of the worker when standing on the platform

To avoid carrying chemical containers, use a hand piston pump (see transfer of chemicals) to dose liquid chemicals.

Figure 241: Dangerous and insufficient manner of chemical dosing via front door

Figure 252: Low-cost arrangement to improve chemical dosing via fixed IBC tank connected to the drum axle

DISPOSING OF CHEMICAL WASTE

Empty chemical containers can pose a safety risk and health hazard when not disposed of properly. To avoid potential dangers, you should follow these basic principles:

- Remove empty chemical containers from the store and work area
- Safely store the containers in a separate area of your tannery
- Rinsethe container before disposing, which may allow you to gain more chemicals out of the same container
- Do not pour or mix different waste chemicals in the same waste container or barrel
- Ensure that the rinsing water, if not used in the tannery, is discharged to the effluent treatment plant
- Return the empty chemical containers back to the supplier to refill and reuse if possible
- Collect and dispose of waste chemicals according to local regulations and the SDS

Do not let waste containers be used for storage of drinking water or food! Do not allow workers to take containers from factory. Possibility of chemical residue in disposed containers being absorbed by drinking water or food grain and consequently finding their way into the human body cannot be ruled out

*See ref. sheets: 3.5 for **DO's** and **DON'ts** print-outs in laboratories and effluent treatment plants and reference sheets: 3.6 for **DO's** and **DON'ts** print-outs in general handling of chemicals.*

3.4 Storing of Chemicals

Proper chemical storage is as important to safety as proper chemical handling. The correct storage of chemicals is essential for safety in the workplace, but sometimes it can be confusing and laborious for management due to numerous legislations, rules, recommendations and practices. This section explains how to store chemicals in tanneries safely.

Figure 263: Poor storage discipline

Figure 27: Keep empty containers ready for disposal away from workplace and chemical store

General Recommendations

- Prepare an inventory of all chemicals that are to be kept in the store
- Read SDS's section on appropriate storing conditions of each chemical
- Never store hazardous chemicals in a public area or corridor
- Return chemical containers to their storage location after use
- Make sure the chemicals are strored in well desgined, appropraite areas (see "Storage Layout" section)
- Group chemicals accroding to their hazard category (corrosives, flammables, etc)
- Make sure that incompatible chemicals are kept separatley
- Do not purchase excessive amounts of hazardous chemicals. Limit their amount to the minimum required
- Monitor and revise storage practices by regularly inspecting storage areas
- Do not store chemicals alphabetically except within a grouping of compatible chemicals
- Avoid chemical exposure to heat and direct sunlight
- Good housekeeping is essential!

Figure 284: Proper storage lay-out and structure of a chemical store

If space in the tannery permits, beamhouse chemicals, retanning chemicals, finishing chemicals, and solvents should be stored in a separate chemical store. Chemicals should be stored in such a way that they are positioned in groups referring to their actual use for each production phase, e.g. for soaking and liming, tanning, retanning and finishing. The chemicals that are used in more than one process phase are to be positioned in such a way that they can be easily accessed at any given process. To avoid contamination between the chemicals and to eliminate human error, it is important that there is no mixed or random placing of chemical containers, drums or bags. The storage area should have a ramp outside to facilitate access and use of trolleys for transfer and movement of chemical containers. Liquid chemicals that are distributed automatically need to be organised in such a way that the direct feed container is permanently connected to the dosing and distribution system(s) leaving sufficient space for a refill container on top of the direct feed container.

HAZARDOUS CHEMICALS

Safe storage of chemicals must begin with identification of the chemicals to be stored and their intrinsic hazardous properties. Information on hazardous chemicals (a copy of safety data sheet) and chemical inventory lists should be kept ready on record either in the chemical store itself or in the tannery's administrative office. In case of an emergency, such information provides valuable and often life-saving clues on rescuing personnel and emergency measures.

Chemicals under lock and key

Certain hazardous chemicals (especially highly toxic ones, but also government controlled chemicals) should be stored in separate areas, which can be locked to limit access and prevent theft. At all times, unauthorised personnel must be prevented from entering the chemical store. The main doors should be locked. In addition, a sign board prohibiting unauthorised entry should be displayed at the entrance to the chemical store.

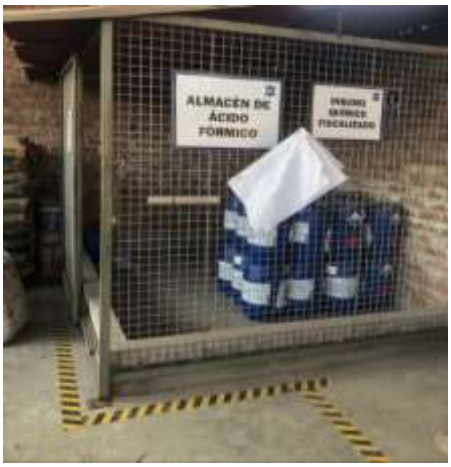


Figure 295: Chemicals under lock

INCOMPATIBLE CHEMICALS

Many chemicals are incompatible with each other. Proper separation avoids undesired reactions between chemicals that could react together (or their vapours/gases) and form hazardous mixtures, which may possibly generate poisonous gas or heat resulting in fire or explosion. The SDSs contain specific guidelines for storage (e.g. temperature, humidity) as well as information on compatibility with other chemicals.

Figure 30: Keep incompatible chemicals separately!

Find the right storage space for chemicals

The organisation of the chemical storage area needs to take into account the separation of corrosive, inflammable and hazardous chemicals from non-corrosive, non-hazardous and non-inflammable chemicals. Powder and liquid chemicals as well as acids and bases should be stored separately. A physical barrier and/or distance is effective for proper segregation.

The most incompatible chemicals in the leather industry:

Keep acids away from sodium sulphide and ammonia sulphate as any accidental mixture of these two results in generation of poisonous hydrogen sulphide gas

STORING CHEMICALS BY HAZARDS CLASS AND INCOMPATIBILITY

Proper storage addresses the compatibility issues of different substances, reactive chemicals and vapours/gases released by toxic chemicals. Grouping chemicals by their basic hazard class will eliminate most accidental adverse reactions that may occur due to breakages, leakages or accumulation (building-up) of chemicals in storage areas. Table 3 introduces the concept of chemical colour coding.

Chemical colour coding

The table below uses internationally recognised colour storage code system introduced by J.T Baker. The idea is that chemicals of the same colour can be stored together safely. **The table has an indicative character –** the most relevant instructions should be retrieved from the SDS documents.

Table 3: Storing chemicals according to their hazard classes

Hazard Class	Group Colour code	Examples	Incompatibilities within the group	Special Instruction
General	G: Green	Syntans, vegetable extracts, fatliquors	Powder chemicals are to be separated from liquids	Moderate hazard. General chemical storage recommended unless SDS advises otherwise. Can be stored on higher shelves.
Flammable	R: Red	Solvent based finishing chemicals. Compressed gasses.	Separate water compatible flammables from water incompatible flammables.	Store in special safety cans or cabinets. Don't store in direct sunlight or near other heat source. Eliminate all sources of ignition. Most flammable vapours will settle low at the ground
Corrosive / Irritating	W: White	Acids and bases (formic, sulphuric acids, caustic soda, ammonia)	Separate acids from bases. Store away from chemicals (sulphides) which could generate flammable and poisonous gases.	May harm skin, eyes and mucous membrane. Store in corrosion proof area.
Reactive / Oxidising	Y: Yellow	Hydrogen peroxide	Highly reactive with most substances and each other.	May react violently with air, water or other substances. Store away from organic material (wood, paper), flammables and combustibles.
Toxic / Health Hazards	B: Blue	Glutaraldehyde, sulphates, biocides, surfactants, TCMTB, Crosslinkers	Many toxic chemicals are also corrosive, reactive or flammable. Comply with SDS directions on storage!	Toxic if inhaled, ingested or absorbed through skins. Store in secure poison area.

The storage area should clearly indicate what chemical group is stored in that location, with each shelf indicating the colour corresponding to the chemical group. Some chemicals may react with other chemicals in the same hazard class – always consult safety data sheets.

Storage Regulations

Rules and regulations regarding chemical storage differ from country to country and from state to state and could be further restricted by individual insurance companies' requirements. Below is a brief summary of specific chemical storage regulations and guidelines sourced from agencies that are involved in health and safety. Links to specific resources are provided for the purpose of reviewing the regulations in more detail. The regulations have been sourced from the Environmental Protection Agency, The Uniform Fire Code, The National Fire Protection Association, and the Occupational Safety and Health Administration.

Occupational Safety and Health Administration (OSHA) Regulations

OSHA 1910.1200 – Hazard communication, OSHA 1910.106 – Flammable Material

Under the OSHA law the hazard of used chemicals must be classified, all chemicals must be labelled and SDSs for each chemical type must be provided to everyone concerned. Workers that deal with hazardous chemicals must be trained on how to handle them. Additionally, chemicals need to be stored by their hazard class and separated from the incompatible chemicals.

Corrosives (acids and bases) and flammable liquids should never be stored together.

OSHA 1910.1450 – Occupational exposure to hazardous chemicals in laboratories

"Bottles of corrosive liquids should be stored in acid containers(...) To ensure that mutually reactive chemicals cannot accidentally contact one another, such substances should be stored in corrosion-resistant secondary containers."

The Uniform Fire Code (UFC)

UFC 80.301 (n):

"Storage of incompatible hazardous materials shall be separated. Separation shall be accomplished by ... Storing hazardous materials in storage cabinets ... Materials which are incompatible shall not be stored within the same cabinet (storing area)"

The National Fire Protection Association (NFPA)

NFPA 400: Hazardous Materials Code

The standard consolidates fundamental safeguards for the storage, use, and handling of hazardous materials.

NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response

Hazard identification system designed for emergency responders. Chemicals are to be stored according to their hazard class to prevent accidents and in case of emergency ensure appropriate response. The standard defines the “safety squares” also known as “fire diamonds” to quickly identified the hazards and assess the risks.

Environmnetal Protection Agency (EPA) Regulations

EPCRA 311

EPA's emergency management activities and regulations help protect the environment and human health from releases or discharges of oil, chemicals, or other hazardous substances. Because each hazardous substance has its own properties and behaviours, the potential for exposure and the nature of the effects vary widely. To minimise the risk of chemical storing the agency set forth guidelines regarding the storage of chemicals.

STORAGE LAYOUT

Ensure proper structure and layout of the chemical store. Adequate storage facilities are a prerequisite for safe storage. The below rules should be followed to ensure safety in the storage of chemicals in tanneries. Cross-check the numbers from the below drawing (fig. 31) with the corresponding recommendations.

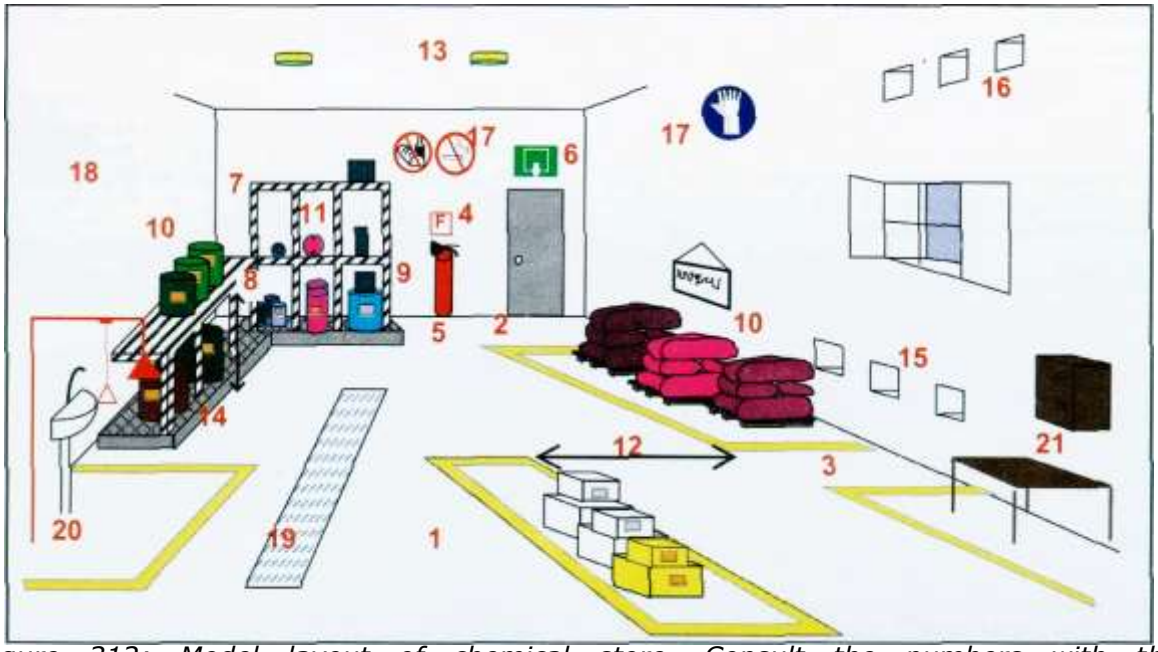


Figure 312: Model layout of chemical store. Consult the numbers with the recommendations listed below (Source: CTC)

- **No. 1:** The floor of the chemical store should be flat to prevent slipping and to allow easy handling of chemical containers. It should be non-permeable to prevent contamination of soil and ground-water from chemical spills.
- **No. 2:** Access to these exits has to be kept free at all times to allow easy escape of personnel trapped inside the store in an emergency.
- **No. 3:** For maintaining better storage discipline, allot the specific storage areas for each group and mark the designated areas with yellow floor markings

- **No. 4, 5:** Fire fighting equipment e.g. ABC type fire extinguisher should be kept ready at easily accessible locations. These locations should be clearly marked. It is recommended to place another fire extinguisher outside the chemical store.
- **No. 6:** The chemical store should have at least two clearly marked emergency exits (e.g. doors, windows).
- **No. 7:** Group and store different chemicals according to their type and compatibility.
- **No. 8:** For easier stock keeping, provide boards indicating name, maximum, minimum and current stock for each group.
- **No. 9:** Avoid storaging chemicals directly on the floor! The humidity from the ground can spoil the quality of powdered chemicals and damage packing.
- **No. 10:** Heavier chemical containers - particularly those containing liquid chemicals (e.g. acids) – should be stored on wooden or plastic pallets at floor level. Lighter chemical containers and powdered chemicals can be stored on upper shelves.
- **No. 11:** Racks and shelves increase the available storage space. Smaller chemical containers (e.g. samples of dyes, fatliquors) can be stored on these.
- **No. 12:** Sufficient width for movement of persons and material should be ensured (about 0.8 meters for persons, more than 1 meter for handling of chemicals, more than 2 meters for movement of pallet or fork lift trucks). The passageways should be marked on the floor.
- **No. 13, 15, 16:** To keep humidity, temperature or any vapour/fume concentration low, natural and artificial ventilation have to be provided. It is important to have exhausts at floor level for removal of heavy vapours and exhausts/vents at a higher wall level for removal of light vapours. The storage area should have at least five air changes per hour.
- **No. 14:** Barrels containing liquid hazardous chemicals have to be stored on catchpits.
- **No. 17:** Affix cautionary and warning signs in the chemical store that prescribe certain precautionary and preventive measures.
- **No. 18:** The chemical store should always be physically separated from production areas, occupied buildings, other storage areas (e.g. raw material, semi-finished and finished leather), workshops or areas with potential sources of ignition such as generators, electrical control panels or transformers.
- **No. 19:** Emergency drains should be available and connected to the effluent treatment plant.
- **No. 20:** A washbasin, eye/face rinsing station or safety shower should be available in or near the chemical store for personal hygiene and emergencies such as acid exposure.
- **No. 21:** Electrical installations in the store such as switches, switch boards, light fittings, cables have to be insulated and "explosion proof". Ideally, switches should be placed outside the chemical store

Emergency Responses

The ideal chemical storage provides for barriers that contain spillage and avoid contamination of ground water in case of massive spillage or accidents. It also provides for smoke detectors.

Proper chemical storage will:

- Enhance effective management of chemicals
- Minimise chemical misuse that can negatively affect leather production process
- Lower the risk of fire
- Prevent accidental mixing in emergencies
- Minimise exposure to corrosive and toxic chemicals
- Comply with relevant legal regualtions

Figure 32: Storing of chemicals on racks and shelves

For more information consult chapter 10: Emergency Management, and reference sheet 10.7: What to do in case of a chemical spill.

3.5 AIRBORNE POLLUTANTS

The main source of airborne pollutants in tanneries are shaving, spraying, milling and buffing operations. These operations produce airborne particulate matter which pose health risks to workers and everyone in the affected area. Exposure to these pollutants over a longer period of time can lead to a serious occupational illness.

Figure 33: Dry shaving machine with exhaustion system

The direct solution to the problem are well designed local exhaust systems. A local exhaust ventilation system consists of i) a hood; ii) ducts or pipes, which are connected to a system to collect and separate the pollutants from the clean air i.e. collecting filter bags or scrubbing devices outside the workplace; And iii) an efficient fan to create enough suction force.

Local exhaust ventilation proves its effectiveness in reducing the emission of mist, vapours, gases and dust in the workplace. Such extraction systems should be in place on dry shaving, buffing, de-dusting, milling and spraying machines.

Reducing the concentration of airborne pollutants using overall ventilation and natural air flows

In addition to local exhaust (extraction) systems, in areas where mist, vapours, gases or dust are likely to be released, or in areas where it is difficult to prevent the contaminants entering the workplace, a satisfactory dilution or overall ventilation system can be installed with sufficient natural air circulation. This practice will further reduce contaminant concentration in the air. At the same time, such overall ventilation helps to bring down the level of humidity and temperature in the workplace.

Before installing overall ventilation and exhaust systems, be aware of the local air circulation around your tannery to avoid entrance of pollutants through windows or other openings or contamination of other work areas. Overall exhaust push-type ventilation (fans and vents) should be provided in chemical store, sub-stores and processing areas such as tan-yard, beam-house, wattle crushing, dry shaving, buffing, de-dusting and spraying. In workplaces adjacent to these areas, adequate pull ventilation should be available to create a positive pressure which prevents contaminants coming from such areas. In other words, it should consist of an inflow of clean air and an outflow of exhaust forced by fans in the right places.

Generally, good housekeeping practices such as regular cleaning of work areas, floors, walls and machines; removal of wastes; and adherence to safe storage and handling practices reduce the number of potential pollutants in the workplace.

Tanneries should aim for 3-6 mg/Nm^3 of particulate matter in exhausted air expressed as a 30-minute mean.

See Reference Sheet 3.7: Selection of dust control equipment in tanneries, to get more information on types of local extraction systems. The summary will help in choosing the correct one.

VOLATILE ORGANIC COMPOUNDS (VOC)

VOC are ubiquitous chemical compounds of synthetic and natural origin that occur in vapour form (gas phase). It is basically every chemical compound that can be smelled.

Keeping a low VOC threshold is crucial for healthy workplace (it directly harms human health) and for environmental-friendly, sustainable production. The LWG environmental audits take into consideration the emission of VOC and this factor contributes to their final evaluation.

There are many interpretations, regulations and definitions regarding the issue depending on country and industry. The directive 1999/13/EC applies to leather, which limits the use of organic solvents in the entire leather production process to 75g/m^2. The limitation is to protect the environment, workers and population from excessive emissions of problematic and toxic VOCs into atmosphere.

Please consult the reference sheet 3.8 for leather VOC guide based on the guiding tool prepared by Lanxess and FILK. The database will help you determine the source, emission and toxicity of every relevant VOC.

Source

The finishing part of the leather industry contributes the most to VOC emission. The main source are solvents that are used as carriers in finishing formulas. The VOCs are released during coating as well as after finishing operations when leather is in its finished state causing a “fogging” effect, which is a serious problem in the automotive sector. However, the source of VOC can also be found in other chemicals used across the leather making process, especially in chemicals used in retanning (to a lesser extent in beamhouse and tanning). Please refer to the VOC guide in appendix section for details.

Figure 34: Spraying booth with and extraction system

Emission

The VOC can be generated to the atmosphere:

- Directly – due to a product's nature
- As a result of the chemical's impurity
- Due to reaction with other chemicals
- Due to conditions such as temperature, pressure, pH,etc.

The most common cause of VOC emission is the simple nature of a chemical product therefore emission occurs directly and naturally. Chemical products containing impurities as well as VOC generated by a reaction of products in the use of chemicals are other VOC emission stimulants.

Toxicity

VOC pose a significant hazard to workers' health. Dangers of inhaling VOC can be classified as the following:

- GHS 06 Toxic: Acute toxicity
- GHS 07 Harmful: Respiratory tract irritation, narcotic effects, acute toxicity
- GHS 08 Health Hazard: CMR (Carcinogenic, Mutagenic, Reprotoxic), chronic, sensitizer

Reducing VOC content in your workplace

The problem of VOC was noticed by the leather industry and since 1999 a lot was done to reduce the use of solvent-based chemicals by shifting to water-based chemicals. Tanneries should retain their effort in reducing the consumption of chemicals linked to high VOC emissions and chemical suppliers should continue their work in finding alternative options and solutions for tanners. Ultimately tanners should aim for a VOC-free finishing process. Reduction of VOC to air and water can be achieved also by roller coating (avoidance of over-spraying and bounce-back effect of spraying) and HVLP spraying guns.

ASBESTOS

Although the problem of asbestos does not affect the leather industry directly, managers, workers and everyone concerned should be aware of this immenesly dangerous construction material that was once widely used.

What is it?

Asbestos is a naturally occurring, fibrous silicate mineral well known for its resistance to heat, fire and electricity. Due to its extreme durability and affordability, it was very popular and used in many industries, especially by the construction sector. The peak use of asbestos started in the 1920s and lasted until the 1990s. Because of many documented and proven cases of premature deaths linked to exposure to asbestos, it was banned from use by mostcountries and nowadays its use is highly restricted.

Risks and Hazards

Asbestos fibers, when inhaled, convert into deadly slow killers – asbestos is linked to fatal sicknesses such as mesothelioma, asbestosis and lung cancer. The illness takes 15-30 years to develop and is the number one cause of occupational cancer in the USA. In the UK every week 20 people die due to past exposure (HSE, n.d.).

Due to its friable nature, asbestos-based materials are considered high risk. Once the fibers are fixed and undisturbed they pose no harm. The danger arises when the microscopic asbestos fibrils are released to the air due to damage or mechanical action (abrasion, rubbing). They cannot be seen nor smelt but readily enter the respiration system of a living organism.

Asbestos and the Leather Industry

Although the use of asbestos has diminished, there are still many common products that contain it, especially in older buildings. Take into consideration the issue of asbestos when planning demolition, refurbishment or renovation within the tannery. If there is a possibility that asbestos materials were used when constructing your tannery, make sure you contract highly skilled and approved companies that are trained and well prepared in dealing with asbestos.

In some developing countries the use of asbestos can still occur. If you plan to make any new construction or renovate/modify the existing one, make sure you use asbestos-free materials.

Go to "Find Out More" section if you want to look for more information about asbestos.

3.6 CHROME VI

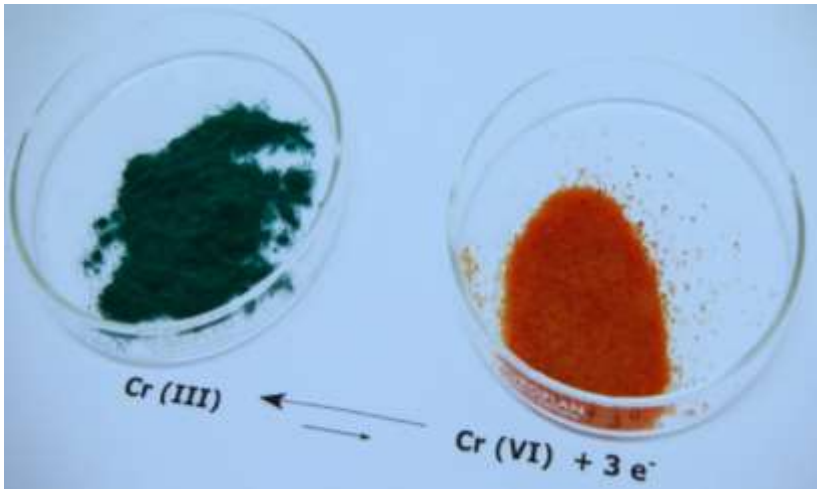


Figure 35: Chrome III vs Chrome VI (Smit&Zoon)

Chrome VI remains a buzz-word in the leather industry, therefore it was decided to dedicate a separate subchapter to the problem. It is estimated that around 85% of the leather made in the 21st century is tanned by chromium salts; this method is considered non-hazardous to health nor to the wider environment.

Chrome salts used in leather industry (in the trivalent state) are safe, non-sensitising and proven to be harmless. The chrome tanning process has been established more than 100 years ago and up to this day proves its effectiveness.

However, there is a possibility of forming Chromium VI – a strong oxidising, toxic and carcinogenic chemical. Nevertheless, this hexavalent form of chromium is not natural and can be prevented by keeping the right process discipline and following good practice. Chrome VI becomes highly dangerous when it enters into the system of a living organism, therefore the realistic way of harmful exposure is via inhalation.

The conversion from chromium trivalent to hexavalent state occurs under extreme temperature and oxidative conditions (UV exposure, oxidative agents). If tanning is operated correctly, the presence of Cr(VI) can be avoided, therefore tanners and leather chemical manufacturers must pay attention to the issue.

Rules and principles to prevent Cr(VI) formation:

- Always use high-quality, well sourced and trusted chrome tanning salts
- Do not bleach leather with oxidation agents after the tanning process
- Wash the leather after tanning
- Limit the use of ammonia in the dye-house
- At the end of retanning, fix the skins at pH level of 3.5/4.0
- The use of low quality, unsaturated fat liquors was linked to Cr(VI) formation. Avoid them
- Avoid chromate pigments
- Provide antioxidants in the form of vegetable tanning extract or synthetic agents

Tanners must make sure that the chrome tanned wastes are stored and disposed of safely. Incineration of chrome tanned trimmings and scraps can have serious implications on worker health as well as the people and animals living in the tannery's surrounding. The ash from combustion comprises high levels of Cr(VI) that can be carried by air and be inhaled by humans and animals.

Avoiding Cr(VI) in a workplace not only makes a process risk-free, but also makes the business sustainable, the leather produced valuable, and the work trouble-free. It is a good example how OSH helps tanners to improve safety and at the same time improves the quality of leather and eliminates further complaints and a potentially serious problem: as Cr(VI) content in final leather is strictly limited by international standards and exceeding the "safe content" limits leads to elimination of the contaminated leather from the market and may also have legal implications.

3.7 Hydrogen Sulphide Formation

Hydrogen sulphide (H_2S), also known as sulfane, sulphur hydride, sour gas or sewer gas, is one of the main threats to health or even to life in tanneries and effluent treatment plants. Every year there are documented cases all around the world of accidents related to hydrogen sulphide, which is a strongly toxic gas that can cause instant death. It is the most frequent killer in tannery accidents.

Characteristics:

It is a colourless, flammable, heavier-than-air and highly toxic gas. It is invisible and while it smells of rotten eggs in low concentration, it is odourless in high concentration.

Evolvement:

The main sources of H_2S are chemicals such as sodium sulphide and sodium hydrosulphide used in the liming process in beamhouse. When pH levels drops below 9.5, the sulphide content effluent starts to release H_2S gas. The lower the pH, the higher the rate of release. The vapour tends to settle and accumulate in depressions and on the ground, therefore special care should be taken in confined spaces.

Dangers:

Any person who is present in the risk location is in danger of being poisoned. These areas are:

- Drainage and sewage pits that carry effluent from liming, deliming and pickling
- In drums, paddles and pits, especially if hides or skins still contain sulphide and the pH is driven down (uncontrolled deliming or pickling)
- Chemical stores (especially poorly managed ones) due to spillage, accidents or careless storing that leads to mixing sulphide flakes and a chemical product with low pH (acids, etc.)
- Mixing of liming liquors or consequent washes with acidic streams such as:pickle, tanning
- Water treatment installations (tanks, chambers, pits, manholes, sumps, etc.)

Figure 363: Use personal H_2S gas detector

Symptoms:

The effects on a human being depends on the time of exposure and H_2S concentration. In low concentration symptoms range from eye irritation, headaches, nausea, leg pain to irritation of nose and throat, blur red vision, nerve problems and loss of consciousness in high concentration. In very high concentration exposure causes convulsion, coma (with

irreversible brain changes upon recovery) and instant death. Hydrogen sulphide in certain concentration is explosive. Check table 3 on the next page to see the impact on humans in correlation with time and H_2S concentration.

It is strongly recommended to get familiar with specially prepared series of materials by UNIDO dedicated to the issue. In the "Find Out More" section, there are links to UNIDO H_2S guideline, eLearning platform and a video on how to deal with the issue.

The characteristic smell of hydrogen sulphide can be only sensed in its low concentration, which poses no adverse effect on health. The poison occurs from higher concentrations when a human loses their ability to smell it.

Table 4: Effects of Hydrogen Sulphide Gas on humans

Exposure (ppm)	Time	Impact on an unprotected person
0.03	No time limit	No effect
0.08 – 2.0	No time limit	(Mal)odour threshold
10	Up to 8 hours	No effect. TWA threshold
15	Up to 15 minutes	STEL threshold limit value
15 – 200	Up to 15 minutes	Headache, nausea, general weakness, leg pain
200 – 500	1 minute	Irritation of nose & throat, vertigo, blurred vision, loss of consciousness lasting a few minutes
500 – 900	1 minute	Profound coma, convulsions, disorientation after recovery
> 900	1 minute	Instant coma and death

Confined spaces:

These locations in tanneries are normally narrow and cramped, difficult to access or exit, have limited illumination and little or no ventilation. Many accidents related to H_2S poisoning happen in these parts of effluent treatment plants or around tanneries, therefore they are very often identified as permit-required and need special preparations and training before personnel can enter and rt work.

Refer to chapter 6 "Working Environments: Confined Spaces"" to find out more about, characteristic, hazard prevention and work organisation in confined spaces

Many deaths caused by H_2S are results of poorly planned rescue attempts. The rescue team should be trained and use appropriate respiratory protection

Preventive Measures:

Some measures to reduce the release of hydrogen sulphide are:

- Use low sulphide or sulphide free liming methods
- Detect risk areas and monitor hydrogen sulfide levels
- Check storage practices (sulphades flakes away from acids)
- Separate liming and deliming floats from pickling and tanning floats (see layout below)
- Perform catalytic oxidation using manganese sulphate (See figure below)
- Use sodium bisulphite in deliming to buffer and oxidize H_2S
- Highly ventilate risk areas to reduce H_2S content
- Segregate effluent streams – do not allow mixing of sulphide containing effluent (alkaline) with acid streams. It is the pH (below 9.5) that boosts the liberation process.
- Do not smoke in risk areas

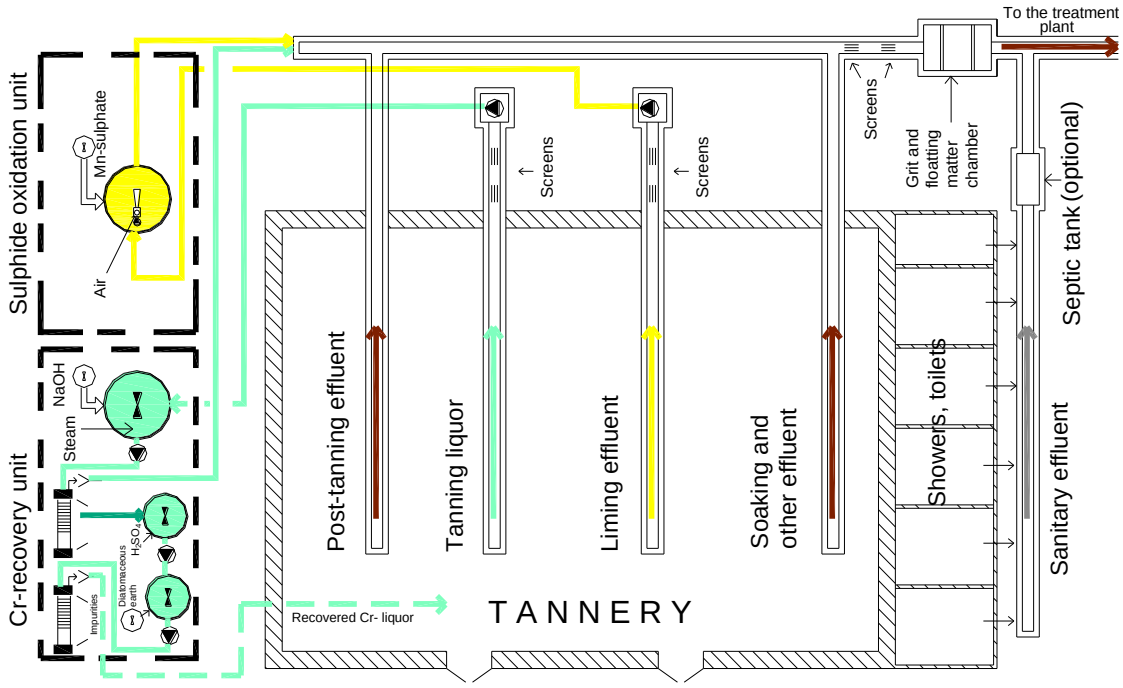


Figure 374: The main tannery stream segregation

Additionally, to protect workers:

- Raise awareness among concerned workers
- Train and equipp concerned workers accordingly
- Install ventilation and exhaust devices
- Check and monitor H_2S content by special portable and personal detectors
- Wear protective masks
- Affix warning signs

3.8 REACH

The European Union is leading the world in making the use of chemicals safer by issuing the 2006 EC regulation: Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). The regulation improves the protection of human health as it obligates producers to put effort into constantly improving chemical safety and searching for better, more user- and environmentally-friendly substitutes.

REACH covers all aspects of chemical products and motivates the industry to look for solutions and improvement of chemical products that will indirectly protect workers dealing with chemicals as well as end users and the environment.

The new proactive approach makes chemical suppliers identify and understand the risks posed by their products and then demonstrate how the given product can be used harmlessly and impart the risk management measures to users.

All substances manufactured in or imported to the EU – in order to be registered – have to go through a detailed verification procedure. Failing the registration process will prevent the chemical's distribution within the EU market.

The chemicals of high concern have to be granted authorisation for use. In order to authorise a certain chemical, the manufacturer must demonstrate that the risks are under control or the social and economic benefits justify the use. Moreover, the manufacturer is obliged to continue seeking safer alternatives or technologies.

With such a complex system, we can be sure that any chemicals purchased in accordance with REACH are the best available choices. If you based your chemical products on ones complying with REACH you improve the OSH of your tannery and also make sure the products will not be rejected by the European Union. This is because within the EU, REACH also restricts the sale or manufacture of consumer goods with higher than regulated presence of certain substances of high concern such as chromium VI, formaldehyde, etc. Although REACH is valid only within the EU, it will certainly have implications on other markets as all products imported to the EU will have to comply with the requirements.

Ultimately, the use of correct chemicals improves OSH, reduces hazards and risks, minimizes impact on the environment and helps meet leather chemical requirements making your products more competitive.

Complying with REACH protects workers, the environment and the reputation of leather!

3.9 CHECKLIST

COMPONENT	Yes	No
LABELING		
9. Are all containers correctly labelled?		
10. Do workers understand pictograms?		
SAFETY DATA SHEETS		
11. Are the SDSs of all chemicals used in the tannery readily available in one designated place?		
12. Do the work-floor supervisors and sub-store supervisors know the basic contents of the SDSs pertaining to chemicals used in their respective areas?		
13. Are SDSs available in a locally used language or in a language that is understood by the concerned workers?		
14. Are workers instructed on how to safely handle chemicals according to the SDSs? Are they aware of the dangers and are they supervised?		
CHEMICAL EXPOSURE / HANDLING		
15. Are workers trained in handling and using chemicals? 16.		
17. Are workers instructed on how to safely handle the chemicals according to the SDSs?		
18. Are workers aware of dangers and are they supervised?		
19. Are Staff familiar with the meaning of signs and symbols, risks and first aid, especially concerning hydrogen sulphide (H_2S), acids and other dangerous chemicals and substances?		
20. Are transfer and dosing of the most hazardous chemicals done in fully closed systems?		
21. Is contact with chemicals during transfer and dosing reduced to minimum?		
22. Are trolley/pallet trucks used for moving heavy materials(Barrels, containers, etc.)?		
23. Are hand pumps used to transfer liquid chemicals?		
24. Are spatulas and scoops readilly available to transfer powder chemicals?		

COMPONENT	Yes	No
25. Is the concentration of chemicals below the required TLV level in terms of both TWA and STEL?		
26. Are vulnarable goups (e.g. pregnant women, youth, etc.) protected from risks related to the use of dangerous products?		
27. Is the use ofse PPE (gloves, goggles, aprons, boots, respiratory masks etc.) when required, in accordance with SDSs instructions?		
28. Do you control discharge of floats from paddles and drums by using hose pipes instead of simply opening the drum doors or paddle faucets?		
29. Are you continouosly taking steps to eliminate or reduce the use of hazardous chemicals?		
30. Is the handling of inflammable substances carried out within a closed installation?		
31. Do workers with a chromium allergy take spacial precautions?		
32. Are residues disposed of in a prescribed manner?		
33. Are small empty containers returned or disposed in the prescribed manner?		
CHEMICAL STORE		
34. Are all chemicals stored in an orderly manner in accordance with MSDS?		
35. Are chemicalsstored by their hazard class?		
36. Is there a list of chemicals that are used in the tannery?		
37. Is there an inventory of dangerous substances available?		
38. Is there limited access to areas with hazardous chemicals?		
39. Are hazardous/inflammable chemicals stored in the proper, prescribed manner?		
40. Are lids and covers always put on chemical containers?		
41. Are there drains inside the chemical store?		
42. Are hydrogen sulphide mitigation actions in place?		
43. Are the possible risks of leaks/spillages of hazardous substnaces addressed? Is there an emergency plan in place?		
44. Are incompatible chemicals seperrated?		

COMPONENT	Yes	No
45. Are appropraite storing conditions ensured? Are extreme tempretures avoided and are chemicals stored away from direct sunlight?		
46. Are unused chemiclas regularly removed from the store and disposed of to avoid building up of unwanted chemicals?		
47. Are shelves uncrowdedand appropriately loaded (not exceeding the weight limit)?		
DISPOSING OF CHEMICAL WASTES		
48. Before disposing, are the containers always rinsed to retrieve as much chemicals as possible for economical and environemntal reasons?		
49. Are residues disposed of in the prescribed manner?		
50. Are empty containers returned to the producer for refilling whenever possible?		
51. Are empty containers kept to ensure they are never given away to workers or local communnities?		
52. Are empty containers disposed of only in the prescribed manner?		

4 Machines and Electrical Installations

Machines and mechanical equipment play an important role in modern tanneries. Though these result in increased productivity, their use has also introduced new hazards to the tanneries. This chapter will provide guidance on how to ensure safe conditions of various machines used in tanneries, their proper maintenance and safe work practices in using and operating these machines.

Although machines are supplied with certain safety devices to control hazards, workers often remove them for their own convenience or forget to reinstall these upon completions of repair or maintenance work.

Figure 38:6 Finishing department of a tannery

Machine-specific safety overviews and checklists are to be found in the appendices. The reference sheets contain specific guidelines for typical tannery machines used by the industry. Though there may be differences in features of the same machine according to model and country of origin, the basic inner design and operations remain similar.

Figure 39:7 Buffing machines tend to produce excessive noise. In the picture, we can see a model with active safety device and emergency switch off button

4.1 TANNERY MACHINES

Each machine listed below has its own safety overview in the appendices that describes the safe use of the machine, points out the necessary safety measures and highlights the aspects that are particularly worth attention. Bear in mind that the descriptions are not exhaustive and they rather have the purpose of drawing attention to the most important hazards and safety requirements. The provided reference sheets contain a self-auditing tool for quick verification of the safety condition of a machine and determine room for improvement.

Figure 40: Well maintained beamhouse m/c improves safety and productivity

To consult the safety overview and carefully, one by one, self-check the machines , see the following reference sheets in the appendix section:

Drums	ref. sheet: 4.1	Spraying M/c	ref. sheet: 4.11
Fleshing M/c	ref. sheet: 4.2	Vacuum dryer	ref. sheet: 4.12
Splitting M/c	ref. sheet: 4.3	Embossing M/c	ref. sheet: 4.13
Sammying M/c	ref. sheet: 4.4	Through-feed M/c	ref. sheet: 4.14
Shaving M/c	ref. sheet: 4.5	Glazing M/c	ref. sheet: 4.15
Setting out M/c	ref. sheet: 4.6	Roller coating M/c	ref. sheet: 4.16
Slocomb M/c	ref. sheet: 4.7	Stacker M/c	ref. sheet: 4.17
Vibration staking M/c	ref. sheet: 4.8	Electrical supply	ref. sheet: 4.18
Buffing M/c	ref. sheet: 4.9	Power generating plant	ref. sheet: 4.19
Manual spraying	ref. sheet: 4.10		

In the appendices, a European Norm standard reference is provided where detailed, updated and complex information can be found for each machine. Though some countries may have regulations that are stricter (or less strict), European standards still serve as a solid and reliable guide. The norms include general safety requirements regarding the design,

construction, operation, maintenance and the general work system as well as prescribe the function of safety devices to eliminate or minimize risk of work to as low as possible. Machines that conform to the health, safety and environmental protection standards established by the CEN are granted a CE mark.

There may be other requirements (specific for a given country) or EU directives applicable to machines. Complying with EN standards does not exempt manufacturers or users from their legal obligation to other regulations.

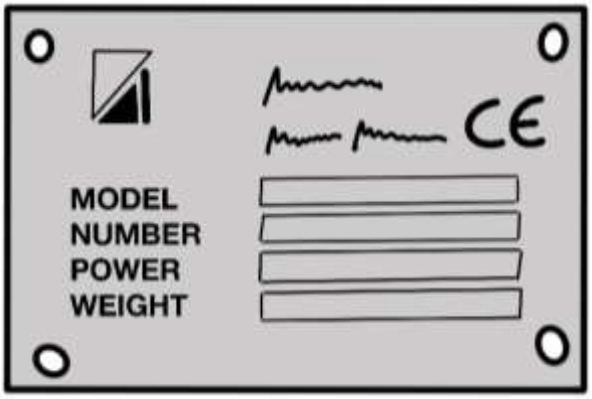


Figure 415 To ensure the traceability of machinery, the information placed on machinery must be visible, legible and indelible

IDENTIFYING POTENTIAL MACHINE HAZARDS

Dangers from machines exist in several specific locations such as at the point of operation, where the power is transmitted to machines and around any moving parts of the machine.

Operation of machines causes emissions (e.g. noise, dust, heat, vapours) and/or the floor to become slippery around the machine. These conditions pose hazards if not contained at their source with appropriate engineering devices or proper maintenance.

Figure 42 Identify m/c hazards and make sure they are contained. Here the contact with band knife

Common accidents related to machinery in tanneries:

- Trapping of fingers/forearms between rollers and bladed cylinders of shaving, fleshing and setting m/c.
- Trapping of fingers/forearms between belts and pulleys of drive of drums, padddles and other machines.
- Trapping of fingers between glass roll and bed of glazing machines.
- Being hit by moving protruding parts of machines such as drum door handle, moving link/glazing arm of glazing jack
- Entanglement between roller and blades of a slocomb staking machine.
- Trapping of fingers/arms between plates of a hydraulic press.
- Contact with the grinding wheel of a shaving machine.
- Contact with the band knife of a splitting machine.
- Contact with the rotating fleshing cylinder.
- Contact with the live parts of electrical installations on a machine.
- Contact with the hot plates of a plating machine, vacuum dryer or boiler system.
- Being hit by parts of disintegrating grinding stones.

Figure 43: Mechanical fleshing

Adherence to good safety and maintenance practices when using machines and mechanical equipment contributes to:

- The reduction of the number and severity of accidents
- The redection of machines down-time
- The reduction of energy consumption
- The improvement of workflow due to a higher rate of machine productivity
- The improvement of leather quality due to correct machine function

PURCHASING OF MACHINERY

Figure 44: Reconditioned platen embossing machine to meet the present safety requirements

Tanners use various sources when obtaining a tannery's machinery, very often it is a second hand machine from another tannery or a second hand reconditioned/rebuilt model from an agent. Bigger tanneries prefer buying brand new machines, straight from the manufacturer. Regardless of the source, while purchasing a machine the safety aspect should always be taken into account as a priority. The supplier is obliged to provide safe and risk-free machines that pose no danger to health if used correctly and according to supplier's instruction. Nevertheless, once the machine is transported and installed in the tannery, the safe use of the machine becomes the tanner's responsibility. Machines produced before the European Norm introduction were not necessarily fitted with the safety systems that are adequate with the current safety practices introduced by the European Committee. In the reference sheets, the date of the introduction of European safety standards is specified for each machine. You can compare it with the year of manufacture of the machine in question.

The next time a new machine is ordered, cross check with the respective checklist available in the appendix section and specify a machine that is safe by construction and has guards and protection for dangerous machine. Before importing and installing the machine in the tannery, make sure that all safety aspects and issues are managed and the machine complies with the required safety standards. Once the machine is paid for and located in the tannery, the supplier (other tannery, agent, manufacturer) may leave all the responsibility of adjusting the machine to the required safety norms in your hands.

Go to the "Find Out More" section for additional, recommended reading around the topic

Machines manufactured before the introduction of EN Standards can often be rebuilt or reconditioned in a way to meet the latest safety practices and requirements

4.2 Safety Measures

Proper sitting of a machine

A good machine foundation contributes to its lifespanParticular care needs to be paid to levelling when installing multi-roller machines. This reduces the accelerated wear of cylinders and bearings as well as keeps maintenance costs low. It ensures good product quality (e.g. no chatter marks on shaved leather).

When installing the machine, take care that at least one meter (three feet) is available around the machine. This allows space for maintenance, easy handling of material in process and daily cleaning and removal of waste.

Figure 45: Fleshing m/c sitting to facilitate work, maintenance and waste removal

Active safety devices

Cylinder, multi-roller and splitting machines as well as presses should be provided with active safety devices (e.g. dynamic guards operated by pneumatic, ultrasonic, optical or electrical means).

Active guards are designed and installed in such a way that they immediately stop or reverse the process when actuated, which prevents workers' hands/fingers and other body parts from getting drawn into and trapped in the machine.

Figure 46: Active safety device on splitting machine with affixed warning signes and emergency of buttons

Fully mechanical machines of older designs do not usually have active guards. It is possible to upgrade the design of these models to basic mechanic-electrical types of safety devices, as shown in picture .

- Clearly mark the active safety device by painting it in a signalling colour (e.g. yellow)
- **Check** the functioning of the active safety device on a daily basis, **before** starting **work**
- Consider phasing out outdated, unupdatable and high risk machines, as they not only pose safety risks to workers but in many cases also limit production quality and quantity.

PASSIVE GUARDS

Passive protection are guards, fences or covers which serve as a barrier to prevent workers coming into contact with moving machine parts such as prime movers, belts, open gears, transmission parts and other moving parts of a machine (e.g. rotating drum or paddle).

- Ensure that these are properly fixed on the floor or on the machine itself
- Increase the effectiveness of the passive safety guard by painting it in a signalling colour (e.g. yellow)
- Make sure that passive guards are put back in place after removal for maintenance and cleaning

Figure 476: Danger! Unguarded gear mechanisms

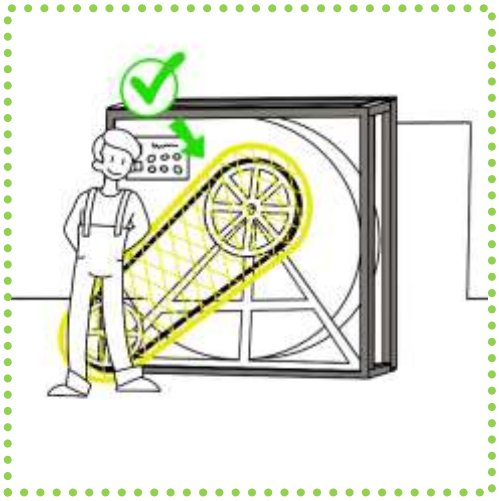


Figure48: Passive safety guards

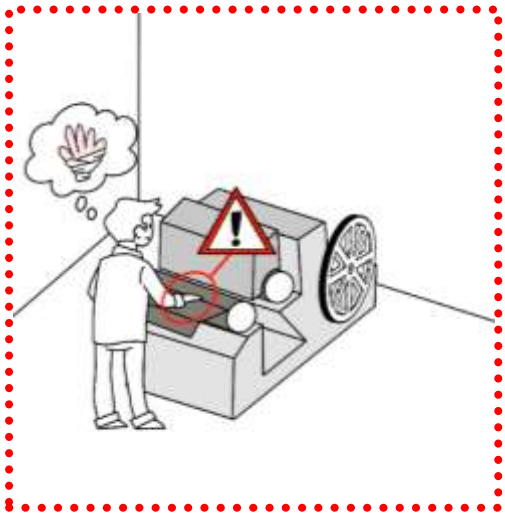


Figure 497: m/c with missing active safety device and emergency switch OFF buttons

Figure 50: m/c with active safety device and easily available emergency switch OFF buttons

Drums are often installed along a mezzanine floor to facilitate loading, which can be done from the top. Special care must be taken to prevent workers from falling inside the drum. The company's responsibility is to design and maintain the drum access area in a way so as to minimize the possibility of stumbling or slipping and consequently falling inside the drum. Write a safe procedure and train workers on how operations such as dosing, mixing, inspecting and loading should be performed.

Figure 51: Tanning drums without emergency off switches nor active or passive safety guards. Manual chemical feeding and open float discharge

Figure 52: Tanning drums protected with active and passive safety devices, with automatic dosing (liquids) system, emergency off switches and gutters for closed discharge system

OPERATION CONTROLS

All switches and buttons on a machine should be clearly marked with colours and labels in the local language. Imported machines often have labels in the language of country of origin and an operator may know the meaning of each button due to long work experience on a particular machine. However, in an emergency, other workers may not be able to take adequate action. Therefore:

- Remember to request the machine supplier to translate lables intothe local language
- If not possible, label all control buttons and switches on the machine in the local language
- Make sure that an emergency OFF button is within the reach of the operator(s)
- Ensure that operators and assitants have a correct work position on the machine (e.g. provide platform of adequate height and proper material)

Figure 53: Label control buttons in local language

Figure 54: Ensure proper position of workers

ELECTRICAL INSTALLATIONS

Electricity is one of the notorious reasons for accidents in workplaces. Every year people are killed by electric shocks and many hundreds are injured; electricity faults are a frequent cause of fires.

Tanneries and effluent treatment plants have highly corrosive conditions (e.g. high levels of humidity, presence of corrosive chemicals in liquid and gaseous form). These affect electrical installations all over a tannery but particularly on and around machines.

Earthing wires corrode quickly and snap. Water from paddles, drums, fleshing and sammying machines splash on switch boxes and starters which can cause **short-circuits**. Inadequate electrical cabling and wiring can cause a fire and it is a high safety risk to workers (e.g. electrical shocks, burns, injuries from falls triggered by a minor electrical shocks). Additionally, it can result in a waste of electricity and damage machines.

Colour coding of cables and wires

Check whether the electrical wires and cables are colour coded. This will allow easy identification of the electrical wires and cables in case of repair or maintenance work. If the colour coding used in your tannery does not conform to standard, mark the respective electrical wires by other means after testing or consider adjusting the colour codes to the locally used standards.

There are many local rules and exceptions in wire colour coding per country or origin. The standards can also change due to new directives/regulations. Make sure you are updated on the standards in force!

Figure 55: Poor safety standard of an electrical installation

Figure 56: High safety standard of an electrical installation of a machine

To avoid accidents:

- Ensure protective devices such as fuse and circuit breakers immediately disconnect power supply whensustained overloads or short circuits occur.
- Insulate, enclose and protect all live parts (exposed/unconnected wires, open fittings) using barriers or keeping the installation out of reach (e.g. overhead transmission line)
- Use earth leakage protective switches as another protection measure that disconnects electrical supply before a lethal current can be drawn from the main lines (e.g. in case a person gets a shock from earthing a live wire);
- Keep cables and equipment effectively disconnected and locked-out when carrying out maintenance or repair work (e.g. remove fuses in the supply line).
- Make sure metal casings of electrical equipment (motor, starter boxes) are earthed. The earthing cables must be connected to an earthing conductor placed in an earthing pit
- Use standard colour coding for clear identification of the type of wire and connection

Figure 57: Check condition of electrical installations

Check electrical motors located in wet-processing and dusty areas for the following:

- Check the index of protection (IP) of the motors used (usually mentioned on a small label) and verify its adequacy for the location. Remember: electric motors in wet-processing areas must be IP 55
- Ensure that the motors terminal boxes are covered
- Insulate all wires (no bare conductors or blank wires) and, preferably, place in cable ducts
- Check that the earthing wires are in place (e.g. on motor, metal starter boxes and transformers) and not corroded

Figure 58: Don't allow open terminal boxes and missing cable glands

Check the reference sheet 4.20 for index of protection explanation.

When carrying out electric maintenance work, rely on skilled and trained personnel or specialized contractors only!

4.3 Emission Control

Figure 59: Outdoor part of the LEV. Dust extraction system cyclone + filter (air cleaner)

Figure 60: Indoor part of the LEV from the previous picture, installed on a shaving machine

During the many stages of leather production, mechanical processing of hides and skins, often in combination with chemicals, may result in emissions that affect the operator and other workers in the work place. Such emissions include noise, vibration, heat and various airborne contaminants such as dust, gas, vapours and mist.

Airborne Contamination

Machines that are known to emit airborne contaminants (e.g. dry shaving, buffing, dedusting, spraying machines) have to be equipped with local extraction and exhaust facilities (local exhaust ventilation - LEV). Their adequacy and proper functioning can be verified during work place auditing and monitoring (see chapter 9). In fig 59 you can see the external part of the LEV system that is placed outside for noise control. The fan, cyclone and air cleaner are connected via ducts with hoods fixed to a shaving machine in fig. 60.

For further information on controlling airborne contaminants, please refer to its dedicated section in chapter 3 – "Airborne Pollutants". In ref. sheet 3.7 you will find guidance on adequete selection of dust control equipment

VIBRATIONS

Excessive vibrations can affect a machine and workers. A simple solution is to place the machine on vibration absorbing mounts or feet.

Figure 61: Vibrating staking m/c with multiple noise and vibration-dampening feet

NOISE

Effective noise control should start at the source itself. First, try to identify the source and cause of the noise. In many cases, better lubrication of noisy machine parts may solve the problem. Alternatively, consider replacement of the noisy part with a less noisy one, for example in the case of drums:

- Machine-cut drum gears emit less noise and vibration than roughcast ones.
- Consider switching to teflon/plastic pinions, which are considerably less noisy than iron-cast pinions

Figure 62: Low noise nylon pinion on drum drive

Noise emission on some machines such as older models of through feed staking machines or reverse setting machines cannot be controlled this way. In such cases, encasing the machine (e.g. installation of noise baffle, construction of noise absorbing walls around the machine) or relocating the noisy machine to a separate location may be more viable options. In latter cases, you have to make sure that operators and workers are provided with hearing protection.

Excessive noise emitted by a machine may indicate a waste of energy as noise is energy in a different form

4.4 CHECKLIST

COMPONENT	Yes	No
GENERAL		
53. Is the proper functioning of the machine checked before starting work?		
54. Are machines certified for safety? (E.g. CE certificate)		
55. Is safety taken into account when purchasing a new machine?		
56. Are machine-specific safety checklists regularly conducted for each machine? (See ref. sheets 4.1 - 4.19)		
SAFETY DEVICES		
57. Is the machine provided with passive safety device (e.g. guard, cover, fence) preventing contact with prime mover, belts, open gears and transmission parts?		
58. Is the machine provided with active safety devices (e.g. dynamic guards operated on pneumatic, ultrasonic, optical or electrical basis) immediately stopping or reversing the process when actuated?		
59. Are they checked everyday before starting work?		
SITTING OF THE MACHINE		
60. Is the machine properly seated in relation to the adequacy of machine foundation?		
61. Is there at least one meter (i.e. three feet) of free space around the machine?		
62. Does the available space around the machine facilitate maintenance and waste removal?		
63. Is the space in front of the machine sufficient to ensure proper work flow?		
64. Do workers collide with each other when loading and unloading material?		
65. Are exclusions zones around machines clearly marked?		
66. Is there anti-slipping flooring around machines where trips, slips and falls pose a high risk?		
OPERATING CONTROLS		
67. Do operators recevie initial and periodical trainings of the machinery they use?		

COMPONENT	Yes	No
68. Are the control switch labelsand operating instructions in the local language?		
69. Is the emergency OFF button in reach of each operator and helper?		
70. Are operatros and helpers taking safe work positions?		
71. Do workers wear approprate clothes when using the machine? (PPE, no loose clothes?)		
ELECTRICAL INSTALLATIONS		
72. Are the electrical installations (e.g. motor, switch gears, terminal boxes, electrical connectors and starters) on the machine of an adequate degree of protection? (e.g. IP 55 for machine in wet and corrosive conditions)		
73. Does the electrical starter of the motor not restart when the supply is restored after a power failure?		
74. Is the location of the control panel consistent with safety regulations?		
75. Are the electric motor body and base frame earthed?		
76. Are all switch gear electrical enclosures of connected with corrosion protected earth wires; if insulated are they marked as per the international color code?		
77. Are electrical rubber safety mats placed in places with high electric shock risk?		
78. Are electric wires protected by conduits (armoured)?		
79. Are cable glands used (connectors or fittings)?		
80. Are junction/terminal boxes used?		
81. Are electrical installations unobstructed and safely and immediately accessible?		
82. Is electrical equipment regularly serviced by a competent person?		
EMISSION CONTROL		
83. Are emissions levels monitored and controlled?		
84. Does the machine generate excessive noise (above 85dbA), vibration, dust, gas or mist?		

COMPONENT	Yes	No
85. Are the emissions (noise, vibration, dust, gas, mist, etc) managed in a such way that they do not affect the health and safety of the operator nor other workers?		
86. Is there an extraction (LEV) or control facility available on the machines generating airborne emissions?		
87. Is the extraction or control facility adequate and functioning well (dust and VOC content in air in norm)?		

5 Maintenance

Regular maintenance is essential to keep equipment, machines and the work environment safe and reliable. Lack of maintenance or inadequate maintenance can lead to dangerous situations, accidents and health problems. Maintenance is a high-risk activity with some of the hazards resulting from the nature of the work. Maintenance workers are more likely than other employees to be exposed to various hazards. Maintenance is a generic term for variety of tasks in very different types of sectors and all kinds of working environments.

Maintenance is a high-risk activity with specific hazards and risks and these include working alongside a running process and in close contact with machinery. During normal operation, automation typically diminishes the likelihood of human error that can lead to accidents. In maintenance activities, contrary to normal operation, direct contact between the worker and machine cannot be reduced substantially - maintenance is an activity where workers need to be in close contact with processes.

Maintenance often involves unusual work, non-routine tasks and it is often performed in exceptional conditions, such as working in confined spaces.

Maintenance operations typically include both disassembly and reassembly, often involving complicated machinery. This can be associated with a greater risk of human error, increasing the accident risk.

Maintenance involves changing tasks and working environment. This is especially true in case of contract workers. Subcontracting is an aggravating factor in terms of safety and health - numerous accidents and incidents relate to subcontracting maintenance.

Working under time-pressure is also typical for maintenance operations, especially when shutdowns or high-priority repairs are involved.

Carry out preventive maintenance

Regular and systematic maintenance of machinery and installations is a prerequisite for cost-effective and safe production in a tannery.

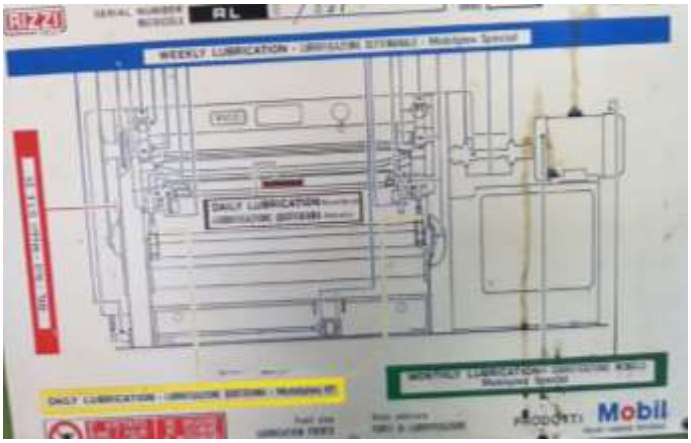


Figure 63: Lubricating scheme and schedule of a shaving m/c

Prepare and keep a maintenance schedule

Maintenance is more than simply repairing after breakdown. The emphasis should be on preventive maintenance to avoid breakdowns and stoppages of machines. On a daily basis, the operator should carry out pre- and post-operation maintenance work Amongst others, the following actions are advised:

- Check for proper functioning of the m/c before start of operation
- Test active safety devices before start of operation
- Check proper placing of passive safety devices
- Lubricate moving machine parts
- Clean the machine after completion of work

Figure 64: Poor maintenance and housekeeping!

Figure 65: Regular maintenance and machinery review is crucial for safety

The machine's manual and other technical information used to repair or order spare parts must be catalogued. It is also important to work out a specific maintenance schedule. The

below instructions will help you exploit cost saving potential by reducing the variety of lubricant and hydraulic oil, reducing unnecessary stocks of easily available spare parts, avoiding machine down time due to non-availability of spare parts or rescheduling major maintenance work to lean periods:

- Retrieve the information from the operating manuals of the machines
- If not available, request the manual from the machine manufacturer or supplier
- Based on this information, organise an annual maintenance plan
- List the maintenance and spare parts required for all machines in your tannery
- Keep separate maintenance records for each machine in the tannery
- The machine manufacturers/suppliers can additionally advise you on scheduling, organising and outlining the maintenance work

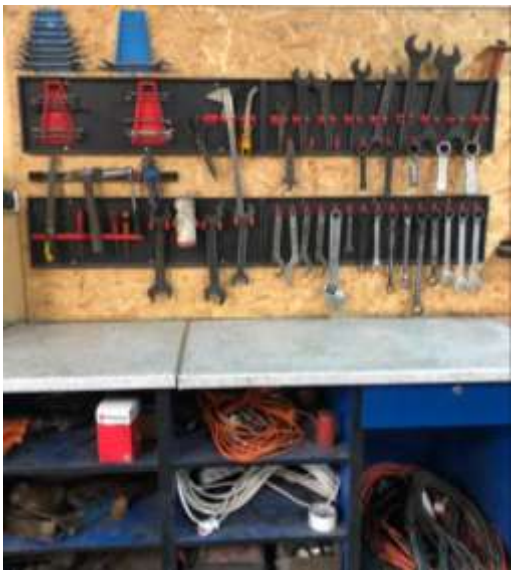


Figure 66: Tools ready and mobile

Make sure that your tannery has personnel with the requisite knowledge and experience in maintaining the plant machinery and equipment. They should know about:

- Rationalisation as well as correct application of lubricants and hydraulic oil
- Material and tolerances to be typically used for bush bearings
- Correct application of electrical motors and switch gears in each area of the tannery and ETP

Allocate space and provide tools for maintenance

A separate area in the tannery premises should be allocated for maintenance work by internal or external personnel and storage of tools and spare parts. It is important to:

- Stock and properly store general mechanical and electrical engineering hand tools and service equipment
- Stock critical spares, particularly those that cannot easily be procured at short notice
- Stock lubricants and other consumable maintenance material in sufficient amounts

Figure 67: Tannery area dedicated to maintenanace

Apart from general engineering tools, tanneries should have the following special equipment and instruments:

- Vernier calliper 300mm x 0.02mm
- Precision spirit level 200mm length, sensitivity 0.05mm/m
- Digital clamp meter instrument - electrical, digital, autoranging, digital 0-1000V, 0-600 A, with ohm meter
- Multi-meter autoranging, digital 0–1000 VAC, 0-300 Vdc, 0-10A

Balancing machine:

For maintenance of shaving and fleshing cylinders, tanneries should also have access to a dynamic balancing facility. Recommended specification:

- 300kg hard bearing
- 1500mm diameter
- 3000mm long
- max. rotor size, variable rpm 20-2000
- 5-micron accuracy.

5.1 WORKING SAFETY AT HEIGHTS

This section aims to help employees and managers to prevent falls and accidents while working at heights. Working at heights is a common cause of injuries and deaths in the workplace: often personnel do not identify the risks associated to heights, and therefore, they do not take the necessary measures to work safely.

GENERAL CONSIDERATION

A workplace is considered "at height" when i) a person (not taking the proper measures) may fall a considerable distance, which leads to body injuries or damage (for example, working on a ladder, a roof or on a fragile surface); and ii) there is a probability of falling into a hole or opening in the ground. It is good practice to avoid working at height when not strictly essential. However, if working at heights cannot be avoided, it is vital to consider the following:

Figure 68: Badly prepared work at height using inadecuate equipent with insufficent safety means

- Determine whether the task will require staying up on the ladder for more than 30 minutes? If yes consider alternative means
- Work as much as possible from the floor
- Plan, organize and supervise work at height. Introduce a work permit system for tasks at height
- Assess the length of the task and the frequency it needs to be done, likewise the condition of the surface being worked on
- Provide the precise type of gear and a safe space to work
- Preselect the personnel involved in the task who must be trained, competent and in good health
- Reduce the distance and chance of a fall by using the type of equipment needed (e.g. podium steps, cherry pickers, tower scaffolds, platforms, etc.)
- Ensure that the equipment used for the task is properly selected, inspected and maintained. Damaged equipment must either be fixed or removed
- Make an emergency evacuation plan and study the rescue measures. Think about probable situations and make sure employees know the emergency procedures

AGREE ON THE METHOD OF WORK

The method for working at height should be written (unless the task is simple, low risk and of short duration). A good method of work is clear and concise. A risk assessment process should

identify potential hazards and minimize risks. It is important to identify how the work will be supervised and carried out. Furthermore, it should include the specification of the types of access and equipment needed; the measures for delivery, moving and erecting products safely; how the safety of the access equipment will be monitored; the procedure to ensure the safety of the people nearby and the order in which it should be carried out, especially if it is not obvious.

USING LADDERS AND STEPLADDERS

Ladders and stepladders can be used when a risk assessment has shown that using equipment offering a high level of fall protection is not justified as the task is of short-duration and of low risk. Following the below instructions will minimise the risk of an accident when using ladders:

Before working at heights

- Assess the specific hazards, e.g. wet/dirty/greasy floors, fragile materials, location of asbestos materials, live electrics, vehicle movements, heat, fumes, etc.
- Consider external conditions that could compromise worker safety, e.g. wind, rain, ice.
- Ensure the ladder can be level and stable. Do not use on pallets, bricks, fork lifts, etc.
- Stock objects and materials securely to prevent injuries if they collapse or fall
- Check equipment before use e.g. examine the condition of feet, stiles, step, rungs, etc
- Make sure the length is enough for the task
- Guarantee that personnel can safely get up to and down from where they are working. Make sure the ladder will not be hit or pushed by windows or doors
- Protect the working area with barriers, tape or cones to prevent ladders from being struck or pushed by a passer by

While working at heights

- Do not overload – only carry light materials and tools
- Do not overreach
- If the ladder dropped, check it again to see that there are no defects or cracks
- Maintain three points of contact
- The ladder's leaning angle should be 75 degrees (The 1 in 4 rule – 1 unit out for every 4 units up)
- Do not try to move the ladder while standing on it, don't slide down the stiles
- Always grip the ladder when climbing up or descending
- Do not stand or work on the top 3 steps
- Always face the ladder rungs
- Use a tool belt to avoid holding items when climbing or descending
- Make sure the upper resting point is solid; you should also consider securing the ladder by tying it
- When using a stepladder, make sure the locking device is engaged.

MONITORING

The type of monitoring will depend on the difficulty and risk of the tasks and the extent to which it might endanger the employees. **Before** work starts, check if the people on site are trained; if not, take corrective measures. Make sure the equipment is appropriate for the task. **During** the work, use the agreed method of work indicated by the risk assessment. Assess if the workers are using the correct PPE. **After** the work ends, check their performance to see if the task went as planned.

Employees should:

- Report any identified safety hazard to the employer
- Use the equipment and safety devices given for the task in accordance with the training and instructions
- Report on health matters
- Ask for information and training

Figure 69: Bad example of overreaching and not maintaining 3 points of contact

Figure 70: Good example. Work within reach and maintaining 3 points of contact

Figure 71: Application of 1 in 4 rule, i.e. 1 unit out for every 4 units up

Figure 72: Maintaining 3 points of contact rule, when using both hands for work

5.2 CHECKLIST

Component	Yes	No
MAINTENANCE PROVISIONS		
1. Are machines cleaned after completion of work?		
2. Is there an operating manual for the machine?		
3. Do you follow the operating manual recommendations for machine maintenance?		
4. Is the main power off during maintenance?		
5. Are periodical maintenance works planned?		
6. Are the maintenance details recorded?		
7. Are daily pre- and post-operation procedures (checks, cleaning, maintenance) carried out on the machine?		
8. Are signs “UNDER REPAIR” or “MEN AT WORK” visibly posted during repair and maintenance work?		
WORKING AT HEIGHTS		
9. Is there a work permit system for working at heights?		
10. Are risk assessments done prior to performing any work at heights?		
11. Is the work performed according to the risk assessment recommendations and control measures?		
12. Are emergency and rescue precedures in place?		
13. Is there protection from falling in place?		
14. Are only preselected personnel allowed to perform tasks at height?		
15. Is the equipment to be used before work carefully examined?		
16. Are work conditions and weather taken into consideration when planning the work?		
17. Are ladders or stepladders used as a last resort for light works of short duration?		
18. Are ladders overweighted?		

6 Workplace Environment

Workplace environment and conditions influence workers' performance in a tannery. When neglected, it can decrease employee morale and commitment to work as well as increase absenteeism. Temperature, humidity, noise and quality of light are some key conditions. These can have an effect on workers' safety and health and can be improved by simple means.

Similarly, changes in work organisations and work place layout can have an impact on the tannery's productivity while improving safety and health standards at work.

Accordingly, some aspects that you can check are:

- Adequacy of layout and spacing between production facilities and walk ways (availability of space)
- Adequacy of storage and handling practices (size and layout of storage areas, use of trolleys for transferring material)
- Adequacy of ventilation to control temperature and humidity in the work areas (use of natural and artificial ventilation, insulation)
- Adequacy of lighting in work areas i.e. adequate light intensity, proper use of natural and artificial illumination arrangements, avoidance of glare.

Figure 73: Efficient and safe workplace organization

6.1 WORKFLOW

Organise and improve the workflow

Major modifications of the existing workflow are often not easily possible. Over time, a tannery may have expanded by adding on to the existing production facilities paying little attention to productivity or workflow. Maybe production facilities are based on the methods and technologies of the time. Progressively, the available floor space was distributed among various competing demands, not all necessarily conducive to efficient production. It is imperative to ensure efficient and safe workflow. Studying the workflow on your production floor can be helpful for improving efficiency and safety. Many accidents happen because workflow crosses into zones unnecessarily and increases risk.

WORKSPACE

Increase available work space

Over a period, you may notice spare parts and materials are being placed in the work area for lack of other storage space, incomplete repair of floors and haphazard storage of material leading to a shortage of available pathways and work areas. Such circumstances may result in injuries from fall due to uneven or slippery floor conditions or by falling over items kept in the walkways.

Figure 74: Good work organisation but no access routes nor chemical areas marked

Figure 75: Chemicals are in the clearly marked areas

To increase productivity and facilitate use of time- and labour-saving methods, consider the following:

- Remove all materials from the work area that are not immediately needed for the production
- Provide and clearly indicate separate storage space for material in process, certain operations (sorting, loading, unloading), chemicals and other inputs needed in the immediate production process
- Provide and indicate passageways for walking and material movement. Use floor markings such as coloured, preferably yellow lines to mark passageways and dashed lines for specific work or storage areas
- Remove and collect waste (fleshing, trimmings, shaving) as often as possible from the work area and temporarily store them at a specially assigned place until final removal or disposal.

Figure 76: Piled up shavings not only pose a fire risk but also take up valuble production space

Figure 77: Shavings are readilly removed from the workplace by conveyor belt, compacted and safely stored

FLOORING

Improve flooring

Uneven and broken floors and uncovered drainage facilities prevent the movement of trolleys and require the material and other inputs (e.g. chemicals) to be carried manually from the stores to the work area or from one production stage to the next. You lose valuable time as workers can only carry a limited number of skins/hides or materials at a time. At the same time, solid waste collects in the open and uncovered drains, resulting in clogging and slippery floor conditions, particularly in and around the wet-processing areas.

Figure 78: Using hand pallet trucks facilitate transport and save workers' from carrying heavy loads

The simple action of improving the floor will allow easy and fast transfer of materials and chemicals in your tannery. Cover all drains in the work area with small-holed grates to prevent solid waste from falling into the drains (the grates should be made of concrete, wood or other corrosion-proof material and should be at the same level as the floor).

Cover all other floor openings (e.g. wells, pits at floor level) to prevent falls and accidents. Ensure that floors have a slip-proof surface. A gently sloping floor will help to drain effluent and water.

Figure 79: Open wells/lids lead to an accidents

Figure 80: Cover floor openings and drains

Manual handling and carrying during production should be reduced to the minimum extent possible. Keep in mind that there are specific limits for the maximum weight workers should lift or handle during a workday (usually specified in the labour legislation of your country). There are more efficient ways of moving materials in your tannery!

Figure 81: Bad work organization. Not enough space allowed for passing

Indicative space (in meter) required for passage/aisles:

- 1m free space around machines
- 0.8m for one person walking
- 1m for one person carrying material
- 1.5m for moving a pallet truck or trolley
- 2m for moving a self-driving pallet truck

PREVENTING SLIPS, TRIPS AND FALLS

Paying attention to good workplace conditions at the very beginning will make dealing with slips and fall risks easier. Make sure you choose suitable floor surfaces, have sufficient lighting levels and properly mark pedestrian and traffic routes.

Slips often happen when floors are wet or dirty with oil, elastic bands, dust, etc. as well as when floors are damaged, uneven or because obstacles or objects have been unexpectedly left in the way.

Figure 82: Obstructed access routes

Figure 83: Marked access routes free from obstruction

The following will help avoid accidents:

- Keep work areas tidy and clean
- Do not leave objects that obstruct the way
- Warn people by using barriers and/or signs. Do not leave them when the floor has been already dried or cleaned because people tend to start ignoring them, therefore, they lose their effectiveness
- Spillages must be cleared as soon as possible. Be a good colleague! If you accidentally create a spillage clean it up right away to prevent an accident
- Do all necessary maintenance work at suitable intervals
- Do not joke with colleagues or make silly tricks such as pushing, setting traps, or squirting water. As hilarious as it could seem, it could be the cause of a serious accident
- Do not unnecessarily run or rush when moving around
- Carry objects that you can easily manage and do not obscure your vision. If they are heavy or big objects use trolleys, pallet trucks or wheelbarrows.
- Avoid cables or rubbish crossing pedestrian routes

Figure 84: Dirty work area with insufficient space around the machine can be a cause of an accident

Figure 84: Sufficent space around machinery with even flooring and clearly marked passages

Figure 85: Steps and stairs properly marked to avoid falls

6.2 WORK ENVIRONMENT

During the production of leather, machines and chemicals cause emissions such as heat, dust, gases, vapours, noise and vibration to which workers are exposed on a daily basis.

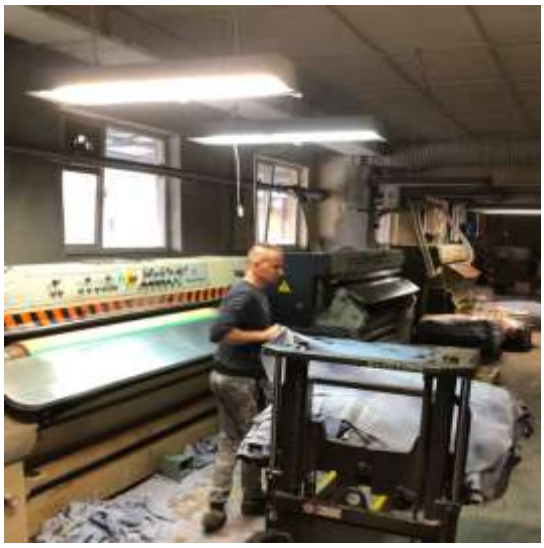


Figure 86: Install appropriate local lightning for better quality and safety

LIGHTNING

Ensure good light quality

Poor lighting leads to low productivity and poor quality, particularly in finishing operations, as workers will start suffering from eye strain, fatigue and headache. Better lighting does not mean that more light bulbs have to be installed. In many cases, rearranging existing lighting and proper maintenance and cleanliness of reflectors/ fittings will result in improvements.

To improve quality of light you should consider the following:

- Make full use of natural daylight by installing skylights or modifying size and location of windows. Keep windows clean all the time. By doing so you also save the electricity cost of artificial lighting
- Paint ceilings and inner walls in lighter colours. This provides better reflection and distribution of existing light sources and results in better visual conditions and a pleasant work environment.
- Avoid direct and indirect glare particularly in areas involving multi-roller machines and finishing machines directly operated by the workers (e.g. staking machine, glazing jack). Glare can distract workers, possibly resulting in poorer product quality or accidents.
- Find the right place for light sources (e.g. do not place a light source above a ceiling fan, which results in a stroboscope effect!) and maintain/clean to ensure high light efficiency.

To verify whether the level of lighting is adequate, you can check with the help of a light (lux) meter

Figure 87: Keep windows clean to make the most of the natural light

Figure 88: Use natural light for good light quality in the work area whenever possible

TEMPRETURE AND HUMIDITY

Control temperature and humidity through natural and artificial ventilation

Good ventilation and air circulation in the work area will contribute to a pleasant temperature and reduction of humidity. At the same time, overall ventilation also reduces the concentration of airborne contaminants.

Ideally, factors such as wind direction and building orientation (north-facing) should be always considered when planning the construction of a tannery.

Use natural ventilation and air circulation to achieve low cost overall ventilation first, taking advantage of horizontal air movement around and through buildings, or the tendency of hot air to rise. Simple modifications such as removing separating walls or increasing wall openings will improve the natural air flow. Install fans if natural air ventilation and circulation are insufficient.

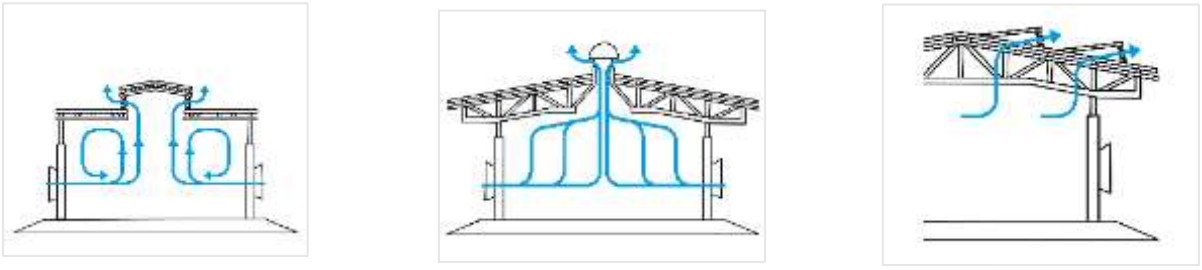


Figure 89 a-c: Ventilation for different building designs

Figure 90: Ventilation and exhaust in required areas

Figure 91: Air ventilation in beamhouse

HEAT AND COLD

Insulate against heat and cold

Temperature and humidity are also affected by heat and cold. Before resorting to expensive equipment to control temperature, be aware that heat and cold are also caused by outside climatic conditions. Heat and cold may permeate the tannery directly through openings such as windows, doors, gaps, skylights or indirectly through conduction through walls and roofs. While ventilation is one way to remove heat from the work place, also consider:

- Improving the heat reflection of walls and roofs by plastering or whitewashing
- Improving roof insulation by using insulating material or installing a double layer roof
- Using radiant heat from machines and processes to warm work places in cold climates
- Using shades for the wall openings to deflect heat from direct sunshine
- Planting trees and shrubs around the premises, which not only provides shade but also become a natural filter for outside dust and gives your tannery a pleasant appearance

Figure 92: Open workspace for good ventilation

NOISE

Reduce the overall noise level at the workplace

Exposure to excessive noise at the work place affects a workers' ability to concentrate, causes mental stress and results in irreversible partial or complete hearing impairment or loss. Noise at the work place can mask what we want to hear. This can cause accidents because a worker may not be able to hear warning shouts or signals. A competent, authorised person should carry out a noise assessment in your workplace.

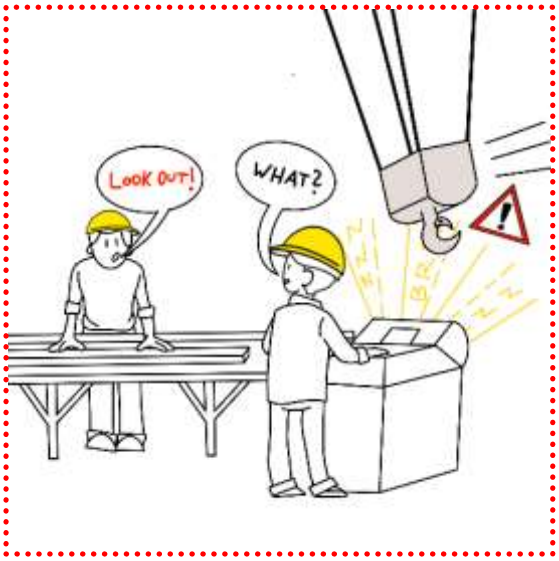


Figure 93: Noise may mask what you want to hear!

Not every type of noise affects human beings. The effect depends on the volume (loudness) measured in decibel (dB) and the pitches (high and low frequency) measured in Hertz (Hz). High pitches irritate more than low ones. Noise that is continuous at levels above 85dB(A) sound measured in dB(A) corresponds closely to the effects on the ear, or more, is injurious to hearing.

Figure 94: Reduce noise pollution by enclosing noisy machines or machine parts

You risk damage to your hearing if you spend more than five hours a day at these levels 85dB(A) or more. Hearing can also be damaged by sudden loud noises such as from an explosion. If you are unable to have conversation in a normal tone voice at an arm's length from your partner, the noise level is too high. Normal conversation takes place at around 60 dB(A)

Try to contain noise levels in your tannery so that they do not exceed 60 - 70 dB(A). Take the following actions to reduce noise levels in your tannery:

- Check the noise level of each machine and, if possible, reduce noise level by repair or maintenance work (e.g. better lubrication)
- Replace noisy machine parts (e.g. metal, iron) with ones made of low noise emitting material (e.g. teflon/plastic pinions on drums)
- Enclose the entire machine or noisy parts of it with mufflers or cases with foam plastic lining
- Shift noisy machines to an isolated location or build a wall covered with sound absorbing material around it

If the noise level cannot be reduced below 85 dB(A) by these methods, the operators have to be provided with hearing protectors (e.g. ear plugs, ear muffs). Table 5 contains the threshold limit values (TLVs) for different time intervals.

Table 5: Selected TLVs for noise according to the American Conference of Industrial Governmental Hygienists

	HOURS						MINUTES		
Duration	24	16	8	4	2	1	30	15	1
Sound level in dBA	80	82	85	88	91	94	97	100	112

For more information on noise go back to chapter 4: Emission Control. For further information on hearing protection consult chapter 7: Personal Protective Equipment.

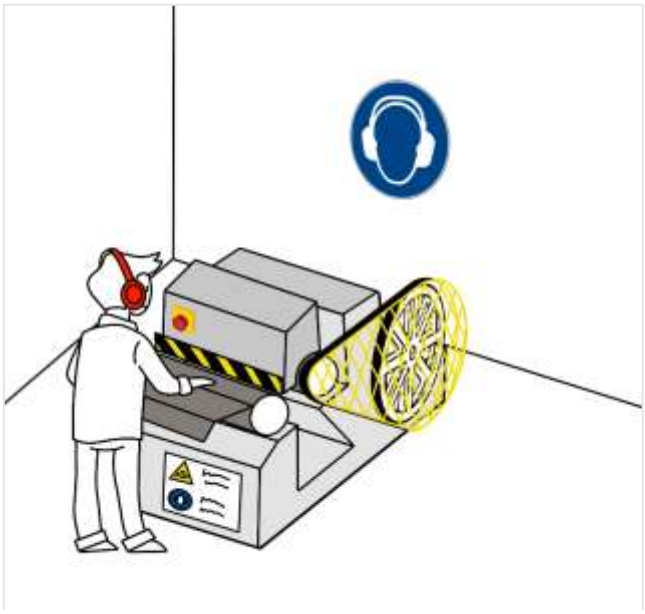


Figure 95: Use hearing protection if you cannot contain noise otherwise

6.3 Confined Spaces

Any place that is not intended for human occupation and has limited means of entry and exit is called a confined space. Due to its enclosed nature, there is a high risk of death or injury from presence of harmful substances or others hazards. In tanneries most of the confined spaces are identified as a permit-required, that means the employer must develop a written work system for confined spaces that complies with local legislation.

In tanneries, the following can be classed as confined space:

- Process vessels (liming drums, paddles)
- Drains (manholes, treatment tanks, effluent pits)
- Sewers (Sumps)
- Boilers (fuel tanks)

Figure 96: Unprotected man performing a task in confined space

Hazards and Risks

Accidents in confined spaces occur regularly, therefore workers must be aware of the following dangers:

- Lack of oxygen
- Poisonous gases, fumes or vapours
- Fire and explosions
- Entrapments
- Drainin

Employer are obliged to perform a risk assessment of work in confined spaces and, based on the outcomes, determine the adequate precautions.

For more information see reference sheet 6.2 for a risk assessment of confined spaces in tanneries.

In the leather industry, a highly common scenario is that a worker enters a confined space to perform a task and is asphyxiated by the presence of deadly gases (e.g. hydrogen sulphide). Then, rescue attempts are poorly prepared by untrained and unaware colleagues who also fall into the deadly of hydrogen sulphide trap.

PREVENTION/FALL PROTECTION

First of all, make sure it is necessary to enter a confined space. Can it be avoided or can work be done from outside by using an alternative approach/means? If the entrance cannot be avoided, make sure you have a safe system for working in confined spaces. Make sure you cover the following points:

- Only trained and well instructed workers should be allowed to enter confined spaces. The designated workers must be fit for the job and meet the job predisposition requirements.
- Preselected workers must be trained, fit for the job requirements and be familiar with the safety work protocol in confined spaces.
- Jobs in conifned spaces should require a job permit granted by management. This allows proper communication and a formal check if everything is in order and accoring to the protocol before the job
- Work place preparation: isolate any form of energy that could interfere with performed work (pipes isolation, mechanical, pneumatic, electircal and hydraulic isolation). Improve ventilation by opening other access points or provide mechanical ventilation. The conifined space opening (e.g. manhole entrence) must be guarded by a temporary rail or barrier during the work to prevent accidental falls into the opening.
- Test the air to check if it is free from toxic and/or flammable gases (hydrogen sulphide, carbon monoxide)
- Make sure workers inside confined spaces have suffiecient means of communication with the people outside.
- PPE and additional equipment i.e. helmet, gloves, suit, safety boots, SCBA, hydrogen sulphide detector (if applicable), full body harness
- Emergency Plan: be preapred for any kind of emergency. The rescue team keeping watch should always be ready for intervention. The workers inside must be using independent lifelines connected to a man-rated winch and tripods in case they lose consciousness

RESCUING

Please refer to chapter 10: Confined Space Emergency

Figure 97: Open channels and confined spaces should be protected and access limited

Figure 98: Restricted access to confined spaces within ETP:

Figure 99: Pits and tanks should be seperated by fences or barriers to prevent from falling inside

Figure 100: proper arangements to protect from failing inside tank

6.4 DERMATITIS AND ITS PREVENTION IN THE WORKPLACE

It is common for workers in the leather industry to be in contact with plenty of materials that are likely to produce a variety of skin illnesses. Touching materials or liquids that contain chemicals such as strong acids, epoxy resins, latex, hexavalent chromium formulations, rubber, enzymes and fat liquors or even soaps and cleaners without any personal protective equipment can possibly cause skin irritation or more serious skin problems.

Figure 101: A moderate case of dermatitis (Wikimedia Commons)

DEFINITION

One common sickness in this sector is dermatitis, which is a general term that describes a skin inflammation. This illness can show in many ways, but generally symptoms are itchiness, skin rash, swelling, redness and cracked skin surface. Dermatitis can be triggered when coming into contact with an irritating chemical material for any length of time (e.g. acids and alkalis) or as a response of the skin to an allergic substance, which signals that the worker had been previously sensitised to the material. Practically, everyone could be allergic to some material.

REDUCTION OF DERMATITIS IN TANNERIES

Pre-employment

As an employer in the leather industry, it is deemed good practice to ask if an applicant has ever experienced any skin complaint, skin diseases or suffered from Dermatitis or Eczema in every application form. If an application form is not used, this inquiry could be also carried out during the job interview or recruitment process. It is desirable that the answer is registered or recorded. For the sake of the employee´s health, candidates who suffer from skin complaints shouldn´t be considered for vacancies that involve handling chemicals or dyestuffs or a job that would be carried out in humid conditions. Instead, this kind of applicant could be considered to work in areas that suit the applicant's medical condition. If there is a bit of uncertainty regarding an applicant's skin sensitivity, medical opinion should be required after consent from the applicant.

Dermatitis can be prevented by:

- Checking for early signs of dermatitis
- Correctly using suitable equipment to avoid contact with exposed areas of the skin on the body and limbs e.g. armlets, protective gloves, aprons, or another PPE where necessary
- Ensure hands are washed and dried regularly, including before and after wearing protective gloves

- Avoiding chemical splashes on any part of the body
- Adequate and regular cleaning of facilities used on a daily basis. These facilities must not be used for substances disposal
- A regular hand inspection made by a competent person

It is important for employees to know that they need to report to their supervisor or manager if a rash or other skin abnormality arises. If the company requires a further examination by a medical advisor, the employee's cooperation is desirable.

Supervision and training

It is good practice to give employees appropriate and sufficient information, instruction and training, which should include:

1. The names of the substances/chemicals that the employees work with or are exposed to
2. The possible risks involved with such contact as well as the access to the substances Safety Data Sheets
3. The precautions needed to protect themselves and people working nearby
4. How to properly use PPE and clothing/uniform
5. Emergency procedures that need to be followed

The completion of these good practices is vital to prevent skin illnesses in the workplace. Employees must comprehend the hazards from the risky substances they could be exposed to. Control measures might not be effective if employees are not aware of their purpose or importance. The employees should be given information that they can understand.

For further reading around the subject go to the "Find Out More" section where you will find a detailed source of information that explains the issue in depth as well as an action plan for prevention and elimination of dermatitis from the workplace.

Figure 102: It is recommended to use appropriate gloves and apron

Figure 103: Workers using gloves and apron

6.5 BULLYING AND HARASSMENT IN THE WORKPLACE

Every person should be treated with dignity and respect and should go to work knowing that he/she will find a healthy environment to work in. Based on that, bullying and harassment must have zero tolerance and a policy that punishes such behaviour should be implemented in all companies.

Everyone has heard at least once about bullying or harassment, but do we really know how to identify the behaviours related to it? Is any employee in your company being bullied or harassed? It is not necessarily apparent or obvious to everyone and it can occur without the employer´s awareness. In this section, we will go over some crucial information about harassment and bullying, how to identify and distinguish the two, some examples of this behaviour and how to prevent it.

What is bullying/harassment?

Bullying is defined as an attitude whose purpose is to humiliate, intimidate, degrade or offend a person. It is often carried out by a person who takes advantage of his/her power or higher position at work. This unwanted behaviour affects the dignity of a person. While it may be persistent or even a single event, the main characteristic is that the comments or actions are unwelcomed or unwarranted and cause distress to the affected person.

Examples of bullying/harassment are:

- Verbal abuse e.g. calling names, spreading rumors or false information, swearing or insulting specially when using age, race, sexual preferences, pregnancy, religion/beliefs or disabilities to mock and humiliate
- Excessive supervision
- Asking for unreasonable deadlines or objectives as well as giving large loads or work
- Ignoring maliciously
- Withholding information on purpose e.g. meetings, schedules, memos, mails, etc.
- Blocking or denying promotion or training
- Making willful comments or threats about job security

BULLYING CONSEQUENCE

If bullying/harassment attitudes at the worplace are not well managed, the result in increased absence due to sickness or depression could lead to reduced productivity, high staff turnover, resignation, litigation, risk to public image damage, loss of respect from the personnel or even client and costumer confidence

- Unwelcome sexual attitudes, such as touching, asking for sexual favors, violation of personal space, displaying offensive materials or content or threatening the recipient by saying he will be fired if he does not comply with the requests of the offender.

Be aware that bullying or harassment do not only occur face to face. These events can happen also by e-mail, phone, letter or other indirect forms of communication.

Despite the excuse of many bullies saying that such behaviour is necessary to motivate an employee in today´s competitive environment, the impact on an organisation can be devastating no matter how "competitive" a person can become. Bullying is a problem not only for the recipients and their families, but also the company or organization as a whole.

Problem Identification

See reference sheet 6.3 on types of harassment and the behaviours related to it for prompt identification/detection of the potential problem in your workplace.

How to prevent bullying/harassment?

- Write a formal policy involving staff when making it. The policy should clearly explain that these behaviors are not to be tolerated in any way
- You might secure the confidentiality of the recipients and expound the responsibilities of managers and supervisors
- Write an administrative statement for all the staff about the expected behaviour; in this way it might be easier for employees to be aware of their approach and responsibilities to others
- A good example needs to be set – it is possible that severe styles of management might generate an environment where these kinds of attitudes thrive
- Set an employee-employer relationship built on trust. Employees should know that complaints of bullying/harassment will be treated confidentially and fairness

Training

As employers are responsible for preventing and detecting bullying and harassment, training is important to develop the skills among managers, supervisors, HR staff, etc. to help them to manage and deal with the work-related problems and that create a healthy and productive work environment. A good training could lead to:

- Creation of an action plan in case an event of such nature occurs
- Raising staff awareness
- Knowledge of how to mediate conflict

- Adoption of policies that encourage employees to speak up if they found themselves being bullied

For further reading around the subject go to the "Find Out More" section where you will find information explaining the issue in depth, a model policy on workplace bullying/harassment as well as the procedure for investigating a claim of bullying/harassment.

6.6 KNIFE SAFETY

In the leather industry, knives and blades or other sharp objects are used on a daily basis. Even if unfortunate events cannot be predicted, some serious accidents (such injuries or cuts in fingers, hands, arms or legs) and other minor accidents can be prevented if management and staff acknowledge the hazard and implement safe working practices to help minimize negative consequences.

Figure 104: Selection of suitable knives and protective equipment for the task is crucial

INJURY PREVENTION

In order to diminish the use of knives for tasks completed on a regular basis, try to find a way to redesign the tooling or cutting process e.g. automatic cutting, eliminating or reducing trimming, using safer tools.

Whenever the use of knives/blades is essential, and the task being done implies that the workers are exposed to sharp machine parts, study the variety of knives available for the task, conduct trials and invite the user's views. Only suitable tools to be used in specific tasks need to be kept; any other knife or blade that does not comply with the above suggested characteristics should be removed from the work area.

To prevent injury from working with knives, look for the following features

- Knives that can be firmly handled and easily gripped
- Knives with round-ended and/or a retractable blade as well as a reduced cutting edge
- Appropriate for left and right-handed workers

GENERAL CONSIDERATIONS

1. Always clean knives and keep them in good condition for accurate cutting
2. Examine if the size of the blade is suitable for the tasks
3. Since the chances of an accident are higher with a blunt knife rather than with a sharp one, keep knives sharp
4. Store sharp tools in drawers, on special shelves, slots or boxes or hang up on racks.
5. Store knives next to or close to the workplace where knives will be used so the workers do not need to walk long distances while carrying knives
6. Make sure workers never carry a knife in their pockets
7. If carrying the knife from one place to another is necessary, workers need to be given suitable belts or sheathes
8. Agree on a specific place for discarding used blades

KNIFE USE AND HANDLING

1. If a cut needs to be made close to the free hand, the right PPE should be worn, e.g. chain mail or mesh gloves (see fig. 104).
2. Make sure worker also wears (PPE) for eyes, hands, arms, torso/legs and feet according to the risk assessment
3. The position of free hand must never be in front of the knife blade
4. One must never turn around, carry objects or walk while holding a knife. A person nearby or the holder himself may become injured
5. Do not use knives with wet or greasy hands
6. Avoid cutting directly toward the body
7. Only skilled, competent employees should use open bladed hand knives if there no other alternatives
8. Do not consent exceptions for duties that take "just a few minutes"

HOW TO SHARPEN A KNIFE?

Grinding

- Before starting, make sure the knife is not greasy or dirty. Wash with hot water if necessary.
- Use a fine wet sandstone grindstone. Do not use a dry one, as it can ruin the knife temper
- The grindstone must be wet (if a dry grindstone is used it can ruin the temper of the blade).
- Present the blade to the stone at a slight angle to get a long-lasting sharp blade
- To obtain more permanent results, you can use an oilstone after grinding to 'set' the sharp edge by smoothing it.

Steeling/rifling

- Carry out this process after grinding if a smooth cutting edge is desired. Good results are obtained when using a fairly smooth steel, a rough steel will provoke the edge to "turn"
- For good control of the knife blade that reduces the chances of injuries, hold the steel firmly in a horizontal way across the chest and away from the body, or the steel pointing vertically downwards, pressing with the tip of the steel against a firm, non-slip surface (e.g. table, bench)
- Firmly draw the blade edge along the steel, then alternate the sides of the blade.
- Make sure there is no one close to the steeling process area
- Make sure that only skilled, competent employees carry out the task of sharpening knives

Reference sheet 6.4 contains a **DO's** and **DONT's** print out which can be posted in the workplace where knives are used. Additionally, in the "Find Out More" section you will find links to additional information on the subject.

Figure 105: Leather trimming is a common operation in tanneries. The cut should be performed away from the body

6.7 CHECKLIST

Component	Yes	No
WORK ENVIRONMENT		
1. Is there adequate lighting across all workplaces?		
2. Are danger zones and risks clearly marked?		
3. Is there adequate layout/spacing?		
4. Is noise kept under the threshold limit value?		
5. Is ventilation sufficent to keep airborne pollutants in a safe concentration?		
6. Are safety and health protection signs and instructions visibly displayed?		
7. Is access to danger zones limited (especially to confined spaces)?		
8. Are the electricity, gas and water supplies well kept and maintained?		
9. Is the workplace thoroughly cleaned and tidied up after every workday (waste prodcuts, excess, by product, co-product)?		
10. Are there sufficient, well-kept and nearby sanitary facilities for all the workers?		
BUILDINGS AND FLOORS		
11. Are buildings well maintained and regularly inspected?		
12. Are floors even?		
13. Are there floors with slip-proof surfaces where needed?		
14. Are floor openings covered?		
15. Are drains covered with corrosion-resistant grates?		
16. Do floors facilitate the use of trolleys for safely transferring materials and chemicals?		
17. Is sufficient space provided for materials (e.g. semi processed leather, chemicals etc.) and waste away from work areas and walkways?		
18. Are passages, walkways and exclusion zones clearly marked?		

Component	Yes	No
19. Are walkways and exclusions zones free of objects that can interrupt movement?		
WORKING WITH RAW HIDES AND SKINS		
20. Are disinfection facilities available?		
21. Is there strict prohibition of food or beverages at the raw hides and skins warehouse?		
22. Are raw trimmings and fleshings stored separately in a specially dedicated area that is sign posted?		
ENVIRONMENTAL CONDITIONS		
23. Is the indoor temperature of the workplace acceptable and uniform (in both winter and summer)?		
24. Is the workplace well ventilated with fresh air to control humidity?		
USE OF KNIVES		
25. Are there suitable types of knives for the performed tasks/operations?		
26. Are they in good condition?		
27. Is there a safe storage facility for knives and blades that are not being used?		
28. Are workers aware of the general safety rules for knife use?		
29. Is there a first aid kit available close to the workplace where knives are used?		

7 Personal Protective Equipment

Personal protective equipment, commonly referred to as “PPE”, is equipment worn to minimize exposure to a variety of hazards. Examples of PPE include such items as gloves, foot and eye protection, protective hearing devices (earplugs, muffs) hard hats, respirators and full body suits.

The use of Personal Protective Equipment (PPE) and clothing is an immediate but only short-term solution for dealing with health hazards and safety risks at the work place.

PPE should only be considered as a final and supplementary solution when it is not possible to completely eliminate or prevent exposure to hazards by engineering or administrative control.

The most commonly needed PPE in tanneries and effluent treatment plants are:

- Protective clothing (gloves, boots, coats, helmets)
- Hearing protection
- Protective eye goggles and face shields
- Respirators

It is management's responsibility to provide the appropriate personal protection equipment, to keep it in good and clean condition and to replace it when necessary. It is the worker's duty to use the personal protective equipment provided.

It cannot be emphasized more that the use of PPE should be temporary and as a last line of protection. It is management’s responsibility to keep looking for better engineering or administrative safety measures according to the risk management principles provided in the chapter 2

7.1 CHOOSING THE CORRECT PPE

While numerous types of personal protective equipment are available in the market, selecting the most appropriate and cost-effective one is not an easy task.

While choosing appropriate PPE, take the following into consideration:

- Type of hazard and required degree of protection
- Workers need to be trained on the proper use of PPE
- A PPE maintenance system must be in place
- PPE should be properly stored and easilly accessibile

Before procuring personal protective equipment, check whether it is needed at all in a specific work area. In all cases make sure that the equipment fits the worker. You should always ask your PPE supplier for advice – they have the experience and should be able to help you choose adequate PPE. If you still have doubts you can always seek advice from a specialist safety consultant.

Please see a brief description of each type of PPE below.

RESPIRATORS

Figure 105: Half mask respirator

Respirators, which cover the mouth and nose, prevent the entry of chemicals, dusts, fumes, vapours, gases and other contaminants into the body through inhalation.

They need to be worn whenever the concentration of airborne pollutants (dust, vapours, gases) cannot be reduced to acceptable levels by other means.

WHO IS RESPONSIBLE FOR PPE?

Providing personal protective equipment is an employer's duty!

Using personal protective equipment is an employee's duty!

Important factors to be considered for the correct selection of appropriate respirators are:

- Type of contaminant or contaminants
- Expected and permissible concentration in the workplace (the latter also called threshold limit value)
- Type of activity
- Compatibility with hard hats, goggles and other PPE
- Ability of the worker to communicate and perform required job duties
- Acceptability to the worker (comfort, type of activity)
- Proper respirator fit (careful check is required if the worker has a beard)

Figure 106: Worker is using prescribed PPE

The most common respirators required in tanneries for day-to-day operations are air purifying respirators that clean the air by filtering or absorbing chemicals, gases or airborne particles before they get to respiratory system. The masks either come in the form of half-face masks (covering mouth, nose, chin) or full-face masks. Some reusable respirators filter the air through replaceable cartridges of limited lifecycle – make sure these are not expired and are systematically maintained.

Another type are air-supply respirators. These provide a continuous supply of clean, respirable air from a different source and offer the highest level of respiratory protection. The air is supplied by a pump (air-line system) or a cylinder/tank containing compressed air. This portable, self-contained breathing apparatus (SCBA) is required for entry into any confined space (e.g. man holes, deep pits, underground tanks) where presence of toxic gas (e.g. hydrogen sulphide gas) or lack of oxygen is likely.

Figure 8: Self contianed breathing apparatus

EYE PROTECTION

Safety glasses and safety goggles protect eyes from mechanical impacts, chemical splashes and exposure to debris, dust, vapour, mist and fume or other foreign bodies (e.g. splinters). Workers that use prescription glasses should be using special eye protection PPE designed to be worn over regular lenses.

The options to protect eyes are:

- Safety glasses: Light protection, suitable for tannery/ETP labs.
- Goggles: Better protection than safety glasses. Normally are thicker and more stable (better fit). Choose one with correct air circulation to avoid fogging.
- Face shields: Are worn over a standard eye protection, provide additional protection to the face (chemicals splashes)

Particular areas of eye protection application in tanneries and effluent treatment plants are the handling, dosing and dilution of chemicals, such as lime, acids and alkalis. Adequate eye protection should be also worn in tannery's labs and during repairs/maintenance work according to risk assessment findings.

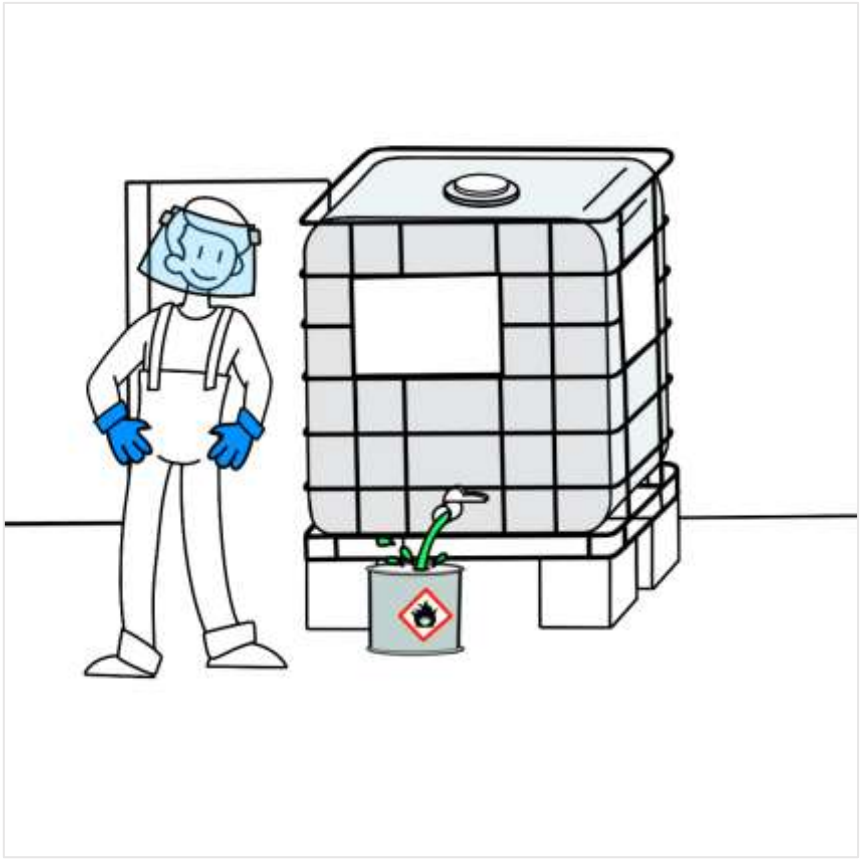


Figure 9: Face shields provide additional protection to the face against chemical splashes

HEARING PROTECTION

Whenever continuous noise levels cannot be contained below 85 dBA (decibel), workers' hearing has to be protected. In such cases workers have to be provided with hearing loss protection such as ear muffs or plugs. Most available hearing protection devices enable reduction of noise by around 15 dB(A).

Figure 109: Ear protection

Hearing protectors must be worn by a worker as long as he is exposed to high level of noise. Even removing them for a short period of time can involve risk of damaging hearing.

Make sure:

- The hearing protection device provides a good sealing effect. Loosely worn ear muffs or earplugs do not protect from noise
- Ear plugs are properly cleaned or replaced to avoid contaminants entering into the ear.
- Workers are trained in the use of hearing protection
- Hearing protection matches the type of noise frequences (high, medium, low)
- Workers do not use music headphones or buds under the hearing protection
- To consider comfort and hygeine when choosing ear defenders

Figure 110: Ear muffs

PERSONAL PROTECTIVE CLOTHING

To prevent workers's skin from contact with contaminants i.e. chemical, biological and physical agents as well as mechanial damages, protective clothing should be provided and worn in various areas of the tannery and effluent treatment plant.

Protective clothing used in a tannery by body parts are:

- Head: Hard hats are used for impact protection. In cold environments thermal insulation is needed
- Hands and arms: Gloves are crucial PPE items in tanneries. They prevent your staff from cuts, heat, abrasions and chemicals and are

Figure 111: Are they comfortable? Does the PPE fit well?

sometimes used with armguards to provide isolation (fleshing)

- Foot and leg protection: There are many safety shoes/boots models available depending on the application and need. The main aim is to protect user's from slipping, injury, (crushing, piercing, cutting, twisted ankle), temperature and electricity. The model used should be adequate to the hazards workers are exposed to.
- Specific body protection:
    - Lab coats, aprons, etc. to prevent from chemical splashes and act as a barrier
    - Special clothes should be provided for protection against the weather
    - High visibility clothing for highly mobile workers i.e. fork lifts operators or in mixed vehicle/pedestrian traffic
    - SCBA suit and safety harness for work in confined spaces

In some instances, e.g. involving electricity, special personal protective clothing is required.

The following aspects should be considered when choosing protective clothing

- Material (durability)
- Thermal comfort (cold weather, sweating, take into account the local climate)
- Cost and practicality of cleaning
- Hygiene control requierd
- Level of personal contamination
- Workers' preferences (seek their approval as in the end they will use it on a daily basis)
- Restriction of movement
- Storage
- Wet or dry conditions (where the protective clothing will be used?)
- Look for certified PPE (for example CE marked)

The specific circumstances and risk assessment outcomes should be kept in mind when selecting and providing personal protective equipment.

Figure 112: Workers performing "traditional" scudding operation. Well selected, adequate and comfortable PPE is key!

Figure 113: Hand, foot and body protection for tannery workers

In the reference sheet 7.1 provides you with an overview of personal protective equipment needed in the different areas of the tannery and effluent treatment plant. Additionally it provides a technical description of PPE needed for the given tannery operation.

7.2 Maintenance of PPE

As with all other equipment used in tanneries and effluent treatment plants, personal protective equipment should be properly maintained to ensure their effectiveness and lifespan. The following are important considerations:

- One designated and competent person should be responsible for maintaining, cleaning, storing, managing, preparing, selecting and purchasing PPE
- Replace worn-out or damaged personal protective equipment
- Clean, dry and store personal protective equipment in a separate place
- Glases should always be clean. Dirty glases can impair vision and lead to an accident
- Employees must be instructed to report loss, destruction or any fault in PPE

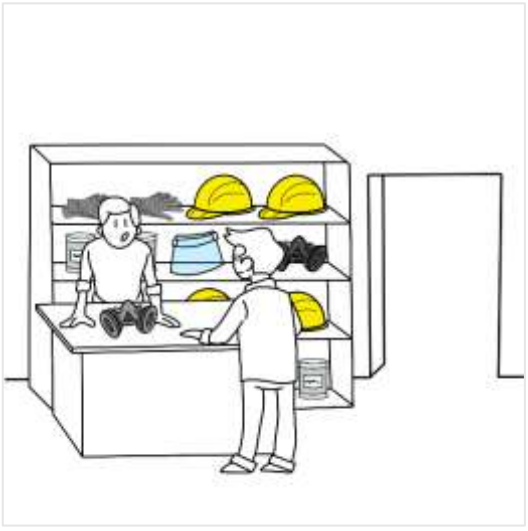


Figure 114: Store and maintan PPE properly

Respirators have to be replaced when workers notice:

- Difficulty in breathing;
- Dizziness or distress;
- Irritation, smell or taste of contaminants;
- A puncture or other mechanical damage

Remember, respirators that use replaceable cartridges must be change according to the manufacturer's instructions to ensure they function correctly.

7.3 Use of PPE

Promote the use of PPE

When introducing personal protective equipment, workers may be reluctant to use it because they are not used to PPE or are worried about its implications. They may feel uncomfortable due to hot and humid and working conditions. Employers often say: "My workers refuse to wear personal protective equipment". The most common excuses are:

- It is too hot to wear it

Figure 115: All personell including visitors should be provided PPE and properly trained

- It does not fit properly (too big, too small, tight, baggy, etc)
- It looks unattractive
- PPE are not easilly accessible

Training and information will help overcome resistance more easily:

- Inform workers about the possible ill-effects of exposure on their health due to not wearing personal protective equipment
- Remove incorrect perceptions about personal protective equipment
- Clearly instruct workers when and where they have to wear personal protective equipment

PPE signs

There is a standardised graphical sign system (ISO 7010) linked to OSH. It is used to indicate mandatory actions and PPE to be worn in certain areas of the workplace. The signs are designed to universally achieve understanding of required PPE (and actions) across the workplaces with the use of as little words as possible.

In the reference sheet 7.2 you will find the graphical representations, official numbers and titles of symbols that may be useful in the leather industry.

Figure 11610: Mandatory PPE signs should be displayed and used by operators

The provided list can be consulted and adequate symbols displayed in work areas where they are needed according to the risk assessments findings.

Monitoring

As the worker's well-being at the workplace is management's responsibility, sometimes exercising supervisory power may be necessary. Regularly check if PPE is properly used. If it is not, why? Investigate the reason and look for a solution. Safety signs in some particular areas of work can be a useful reminder that PPE must be worn.

7.4 CHECKLIST

Component	Yes	No
PERSONAL PROTECTIVE EQUIPMENT		
1. Are PPE requirements signposted throughout workplace?		
2. Is appropriate PPE provided to workers (boots or closed shoes; gloves and googles; respirators; dust masks; ear protectors etc.)?		
3. Is the prescribed PPE worn by personnel in required areas?		
4. Are staff trained on the use of PPE?		
5. Is PPE maintained and managed by a dedicated person who is responsible and competent?		

8 Transport Within the Workplace

Workplace transport involves the use of vehicles and mobile plant/machinery:

- Within a workplace/tannery boundary such as production facilities; stores, loading/unloading goods and chemicals including temporary workplaces construction sites.
- Includes a wide range of vehicles from common vehicles such as cars, delivery vans, large goods vehicles and forklift trucks to less commonly encountered container handlers; rubber tyre gantries and various conveyors.
- Very few places of work do not encounter some form of workplace transport.

Every year people are killed or seriously injured in accidents involving workplace transport. Accidents that do not involve personal injury can result in damage to property, plant and equipment and the vehicle itself.

At the route of these accidents is poor management control, involving a failure to provide or maintain a Safe Workplace, a Safe Vehicle, a Safe Driver and / or safe systems of work. With appropriate and effective safety management practices workplace transport risks can be controlled.

Such a trivial and common activity as transporting goods around the tannery poses a serious threat to the lives and health of the workers. There are nevertheless means to reduce danger to a minimum.

Figure 117: Safe use of forklifts requires skilled, trained driver and well maintained, organized traffic space

8.1 Risk assessment

To identify the risks related to workplace transport, a company should determine activities associated with vehicles such as departures and arrivals, internal transport routes, movement range and loading/unloading operations.

Statistically the most common accidents are:

- People being struck by vehicles or by obejcts falling from them
- Workers falling from vehicles
- Vehicles crushing workers or overturning
- Roof collapse due to collision with pillars

8.2 Preventative measures

To reduce the number of accidents and risks involved in transportation around the workplace the following actions should take place:

Training and instructions

- Workers should be familiar with transport routes
- Workers authorised to use transport vehicles should be trained regularly
- Workers should be informed of particular risks and how to eliminate or reduce them
- Workers should know the location and use of first aid equipment

Create a safe work system

- Driving should require authorisation (tranpsort vehicles can be used only by authorised and trained staff)
- A reporting system should record faults, accidents, observations and hazards
- Ensure special attention is paid to visitors and visiting drivers. They may not be familiar with OSH rules. Before entering the workplace equip them with PPE and brief them on potential risks.
- Safety begins from the top – make sure managers and supervisors are sensitive of the potential risks and hazards.

Provision and maintenance

- vehicles and devices should be checked by a competent person acording to manufacturers' recommendations (daily, weekly, monthly and yearly)
- Establish if there is need for PPE such as high-visibility clothing, head protection, safety belts, boots and equipment to prevent falls
- Maintain the floors, routes and surfaces to prevent from tripping, falling or losing stability of loads being transported
- Inspect pallets before use; damaged ones should immediately be sent for repair or destroyed. Use only good quality, certified pallets. Make sure pallets are loaded correctly and the load is stable. Use banding or stretch wrap foil to improve load stability.

Figure 118: Forklifts are commonly used for transportation in medium and large size tanneries

8.3 VEHICLE SAFETY

Employers must make sure that the vehicles used in their company meet the requirements and standards of safe work and that they are suitable for the purpose. Every vehicle must be used according to the manufacturer's instructions and specifications.

Before allowing any vehicle to be used by your workers answer the questions below:

- Are there safety belts and restraints? Do they work well?
- What warning systems are installed? For example horns, sensors, CCTV and lights when reversing
- Do vehicle lights provide sufficient light for safe work? Do they meet standards? They should be at least as good as required for public roads.
- Is the vehicle well marked and visible?
- Do breaks work well when on, off or in stationary mode?
- How good is the protection against overturns?

- Does the cabin protect the operator from factors such as dirt, dust, fumes, low or high temperature and bad weather?
- Is getting in and out of the vehicle easy and safe?
- Are safeguards fitted to prevent people from coming into contact with dangerous vehicle parts?

Reversing

Special care should be exercised during reversing. Warehouses and traffic areas should be designed to avoid unnecessary reversing. This can be achieved by ensuring enough space for U-turns or a one-way traffic system. When it cannot be avoided, make sure reversing is properly signalled by lights and horns. Vehicles equipped with reversing CCTV and sensors also prove to be useful.

8.4 Designing the Traffic Area

The area and routes that are used to move around goods and commodities should be carefully designed to keep the risk of accidents at the lowest possible level.

Points to take into consideration while designing the traffic area:

- Size, type and features of the vehicles being used
- Avoid sharp turns, and dead-ends
- Minimize the needs for reversing
- Bear in mind load stability. Avoid steep slopes and maintain the surface to avoid potholes from developing
- Separate pedestrain/vehicles access to the buildings
- Create pedestrian-only and vehicles-only zones
- Always keep pedestrian walkways clear
- Define, designate and clearly mark pedestrian routes and crossings

Figure 119: Make sure the traffic area is safely designed and separates pedestrians from vehicles

Figure 120: Storage should facilitate the quick and safe loading and unloading of pallets

Storage

By design, areas such as warehouses should facilitate easy, quick and safe loading and unloading. The designated area should be properly marked, spacious, without tight corners or pillars. The surface should always be even and without obstacles and barriers.

8.5 Transport Safety Management

To verify the current situation in the workplace, it is recommended to perform a self-audit process in the form of a checklist, which can be found in appendices. Each "no" answer indicates room for improvement. Please refer to this guideline or consult other sources to find a solution.

To keep good transport OSH practices in order, the following should be in place:

- A system to report defects and observations to ensure issues are followed up and resolved
- A maintenance plan
- Thorough examination proceedure for each vehicle and/or transport equipment.
- Worker's training record (initial, periodical)
- Driver's authorisation system

Selecting a suitable driver

To designate one of the workers to act as driver in the company may not be an easy task. During recruitment you should ask:

- What are the entry requirements by law to operate a vehicle in question?
- What are the recognised qualifications for driving and operating the given vehicle?
- Do candidates have experience with the same or similar vehicle they will use?
- Are there medical contraindications?
- What is the character of the job the candidate will be doing?
- What type and how long is necessary training?

See reference sheet 8.1 for the self-audit tool regarding transport safety within workplace

As often as possible, it is important to minimize potential contact between pedestrians and vehicles by separating them and marking separate routes. If they must use the same way, adequately divide the route between the two users!

TRAINING

The selected candidate should undergo adequate training to prepare her/him for the job. It should be understood that the company drivers not only need to drive vehicles, but also control attached devices and use skills such as loading, unloading, inclining, etc. Bear in mind that electric pallet trucks also require operator training and certification, however it does not require quite the level of instruction and examination as forklift drivers do.

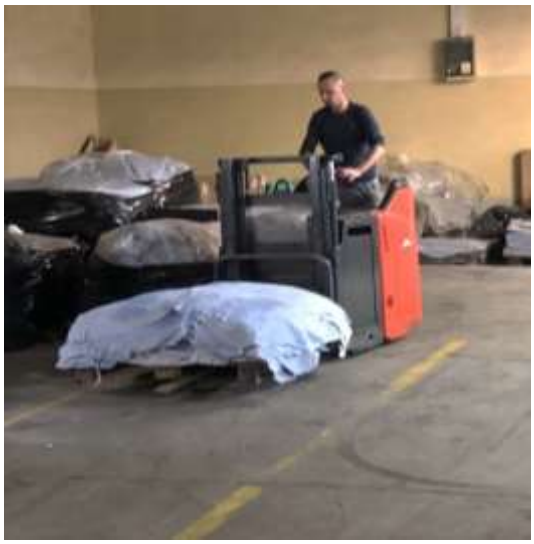


Figure 121: Self driving pallet truck is very convenient

Training should include some explanation of the most common mistakes made by drivers i.e. fast driving, sharp breaking and turning as well as driving on slopes and inappropriate surfaces. Upon training completion, the employer should establish regular, periodical trainings for the drivers so they can:

- Learn new skills if needed
- Maintain good driving habits
- Re-asses their abilities

It is recommended to organise an extra training when:

- Vehicles change
- Sites change
- Work organisation changes

Training courses should be provided by a competent, independent instructor. One can be contracted directly or through specialised training centres. Training records should be kept in the office and include names, vehicle, training history, outline and schedule. By keeping this record, you keep track of training and make sure all the drivers are up to date.

For further reading on the subject go to the "Find Out More" section where you will find detailed information

8.6 Conveyor Transport

This mode of transport is frequently used in factories to enhance efficiency, improve workflow and speed of moving materials around the workplace as well as decrease possibility of human error by automation. Overhead chain conveyors and conveyor belts are the type of conveyor transport often used in tanneries. They improve safety in the workplace by eliminating the need to carry around heavy objects and reduce manual handling of different materials that could be hazardous; nevertheless they also have their own risks. Please examine the below example (fig. 122 and 123) of a conveyor belt installed to transport shavings from a machine to a designated area where shavings can be safely stored.

Figure 122: Removing shavings or other material manually is less effective and imposes direct contact with shavings

Figure 123: Conveyor belts readilly transfer e.g. shavings

Thanks to the conveyor system, shavings do not obstruct walkways, do not have to be handled manually and do not pile up in one place where they can eventually dry up and catch fire. However, if not operated with necessary precautions, the conveyor system's mechanical motion can lead to accidents. Frequent injuries occur from body parts being caught in the conveyor's nip or shear points. This happens during:

- Maintenance and cleaning of an operating conveyor
- Reaching into the nip point to remove debris or jammed material while the machine is on
- Working when the conveyor catches loose clothes or hair and pulls a worker into the conveyor

Constant vigilance, appropriate training and well-designed conveyor systems that have safety features embedded in the design itself are vital to keeping your team and facility safe. In the United States, the Occupational Safety and Health Administration has issued regulations for conveyor safety, as OSHA 1926.555.

SAFEGUARDING CONVEYORS

Each conveyor system should be evaluated to determine specific and most effective safety measures. Certified and reliable providers of the conveyor solutions should train the staff and provide specific safety instruction. Generally, to reduce the safety risk while using conveyor systems, tanneries should apply the following precautions:

Figure 124: Overhead conveyors are often used for hang drying and transporting crust leather around tannery departments

General considerations

- People should never stand, ride, walk, touch or sit on the conveyor belts at any time
- Long hair, loose clothes and jewelry should be kept away from the conveyor belts at all times
- Nip points, shear points and any moving parts of the conveyor belts should be guarded to seperate staff from coming into physical contact with operating machine components. Guards may include barriers, fences, enclosures, etc.
- Only authorized and trained personnel should be allowed to control conveyor systems
- Emergency OFF switches and controls should be placed in clearly visible and easily accessible spots
- Overhead conveyors pose a threat to staff working underneath them. Special care must be taken to make sure that transferred material or parts of the conveyor system will not fall down (e.g. guards, protection plates)
- Workers performing their tasks directly underneath the overhead conveyor chain, for example in automated fleshing operations (see picture x) may need hard hats to protect themselves from being hit by a falling hook or hide

Additional safety measures

- Design the conveyors to be located a safe distance from workers (if possible)
- Use awarness signs and lights
- Visitors should be warned about conveyor transport hazards and risks
- The area surrounding the conveyor chains and belts are to be free from any debris or objects that can interrupt system functionality
- Workers should be encouraged to report potential risks and observations related to working with a conveyor transport for management to take action

Figure 125: An overhead conveyor chain for transport of limed hides to fleshing machine

Maintenance:

Conveyor transport systems should be regularly reviewed: special attention should be paid to the O-rings, bearings, motors and reducers. Regular maintenance should also include lubricating and cleaning debris. Before carrying out maintenance, the conveyor system must be disconnected from all energy sources i.e. electric, hydraulic, air.

8.7 CHECKLIST

Component	Yes	No
MANAGEMENT OF WOKPLACE SAFETY		
1. Have workplace transport risks been assessed?		
2. Are there documented site rules?		
3. Are the rules brought to the attention of all relevant people – employees, drivers, pedestrians, visitors, contractors, customers etc?		
4. Is there a documented traffic plan, including a site map, in place?		
5. Is there a report system in place for workplace transport accidents, incidents and near misses?		
6. Are unsafe behaviours challenged and investigated and is appropriate action taken?		
7. Are employees and other relevant people provided with instruction, information and training in relation to workplace transport hazards?		
8. Is there adequate supervision to ensure that workplace transport safety standards are maintained?		
9. Is the access into the workplace visible and safe?		
10. Are traffic routes marked and signposted where necessary, for example indicating the right of way at road junctions, speed limits, etc?		
11. Are all traffic routes free from obstructions and other hazards?		
12. Are all traffic routes wide enough?		
13. Are all traffic routes well constructed, marked and maintained?		
14. If present, are unavoidable permanent obstructions on traffic routes, clearly highlighted and visible?		
15. Is there a need for features such as: Barriers to keep vehicles and pedestrians apart? Fixed mirrors to provide greater vision for example, at bends? Traffic calming measures such as road humps to reduce vehicle-speeds?		
16. Is the surface of all trafic routes: Clearly marked? Flat? Firm? In good condition?		

Component	Yes	No
The VEHICLES; TRANSPORT EQUIPMENT (Assess each vehicle[transport equipment individually)		
17. Are the vehicles and attachments: Suitable for the task they are carrying out? Compatible with one other?		
18. Are vehicles purchased or leased with all the recommended safety features?		
19. Are drivers protected (as necessary) against: Impact? Rollover? Falling objects? Hazardous environments such as cold, fumes, dust, excessive noise or vibration?		
20. Do drivers carry out basic safety checks before using the vehicle?		
21. Is there a regular preventative maintenance programme in place for each vehicle?		
22. Is there a vehicle defect report system in place?		
23. Are statutory thorough examinations carried out as required, such as the yearly examination requirement for tailboard goods lift and forklift, conveyors etc.?		
24. Are maintenance records and thorough examination reports kept and available for inspection?		
25. Is the manufacturer's instruction book available for all vehicles?		
The DRIVER		
26. Are all drivers trained and qualified to drive the vehicles they operate (including forklifts)?		
27. Are drivers qualifications checked?		
28. Are drivers assessed to ensure their competency?		
29. Is on the job training provided including information about the task, specific hazards and site rules?		
30. Is refresher training provided (especially if there is a lapse in safe vehicle driving standards)?		
31. Is there a driver authorisation system in place?		
32. Is there a vehicle key control system in place?		
33. Is there a driver's handbook (or other suitable equivalent) outlining the relevant policies and procedures?		
34. Do drivers: a. Drive with care?		

Component	Yes	No
b. Use the correct routes? c. Drive within the speed limits? d. Follow site rules?		
35. Is information about the workplace provided to visiting drivers?		
36. Do employees and other personnel working in areas where there is vehicular traffic, wear High Visibility clothing?		
37. Do drivers wear seatbelts and other PPE, where provided?		
38. Do drivers wear appropriate slip resistant footwear?		
SAFE SYSTEM OF WORK		
39. Are there documented safe systems of work in place, for example for: a. Loading and unloading? b. Coupling and uncoupling? c. Maintenance? d. Working at height on vehicles? e. Securing of loads?		
40. Are vehicles braked, chocked and/or stabilised as appropriate, to prevent unwanted or unsafe vehicle movement during loading and unloading?		
41. Are systems in place to prevent premature vehicle departure/ unscheduled departure?		
42. Is loading and unloading carried out so far as possible, that the load is spread evenly to avoid the vehicle/forklift becoming unstable?		
43. Are checks in place to ensure that the vehicle: a. Is not overloaded? b. Loads are adequately secured and stable and cannot move if the vehicle brakes or negotiates steep inclines?		
44. Do employees know and follow the safe systems of work?		
FORHLIFTS; CONVEYORS; LIFTS		
45. Are forklifts checked and inspected regularly by authorized personnel? 46.		

Component	Yes	No
47. Are lifts properly installed and in good condition, properly maintained and inspected by authorized personnel?		
48. Are heavy weights moved around by pallet trucks or trolleys?		
49. Are forklifts operated only by authorized personnel?		
50. Are forklifts operated only within their weight capacity?		
51. During load transportation , is sufficient vision ensured for the driver (forklifts, cars, vehicles, cranes etc.)?		
52. Are traffic routes properly marked and laid out in a safe way? Are workers trained in basic emergency procedures?		
53. Are conveyors installed by authorized personnel with all safety devices and requirements?		
54. Are internal roads safe with appropriate access for pedestrians and vehicles?		

9 Safety Management Systems

The objective of a Safety Management System is to provide a structured management approach to control safety risks in operations. Effective safety management must take into account the organisation's specific structures and processes related to safety of operations.

A Safety Management System (SMS) is a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures.

Use of SMS can be generally interpreted as applying a quality management approach to control safety risks. Similar to other management functions, safety management requires planning, organising, communicating and providing direction.

The SMS development begins with setting the organisational safety policy. It defines the generic principles upon which the SMS is built and operated. This first step outlines the strategy for achieving acceptable levels of safety within the organisation.

Safety planning and the implementation of safety management procedures are the next key steps in the processes designed to mitigate and contain risk in operations. Once these controls are ready, quality management techniques can be utilised to ensure that they achieve the intended objectives and, where they fail, to improve them. This is accomplished by deployment of safety assurance and evaluation processes which in turn provide for a continuous monitoring of operations and for identifying areas of safety improvement.

Put simply, effective safety management systems use risk and quality management methods to achieve their safety goals. In addition, SMS also provides the organisational framework to establish and foster the development of a positive corporate safety culture.

The implementation of an SMS gives the organisation's management a structured set of tools to meet their responsibilities for safety defined by the regulator.

9.1 Formal Safety Systems

In March 2018, the International Organisation for Standardisation published standards for the safety management system (SMS) for occupational health and safety - ISO 45001. Its main goal is to reduce occupational injuries and diseases. The standard is based on previously used and widely internationally recognised BS OHSAS 18001, ILO-OSH 2001 by ILO (International Labour Organisation) and other national standards.

Figure 126: Display of safety and health instructions

ISO 45001 is a comprehensive SMS that contains the latest structures to encourage continual OSH improvement. The standard covers areas such as policy, organization, planning, procedures, responsibilities, evaluation, auditing, actions for improvements and their implementation. It is compatible and designed to be easily integrated with other international management standards, such as ISO 9001 and similar.

Though ISO 45001 was already adopted as a national standard by over 30 countries around the world, many different regions, states and countries still define their own local management system standards for occupational health and safety.

9.2 Informal Safety Systems

Apart from the formal management system, some tanneries, especially smaller ones with limited budgets, can also form their own internal safety management system or base their safety management system on formal frameworks without official certification. There are cons and pros to every approach, but each has its place in the leather industry. The safety management system should be chosen in consideration of the business' legal form, business size, organization, other certifications and systems already implemented, number of employees and scope of the activity.

In this chapter you will find the principles and foundations of SMS. Make sure you implement the below aspects in your safety management system.

9.3 Management

Simple managerial measures and responsibility to improve OSH standards in a tannery are:

To Train:

- ✓ On proper use of all machines and equipment
- ✓ On handling and safe application of chemicals
- ✓ Across the entire work hierarchy. From managers, through supervisors to physical workers
- ✓ In a well thought, organised and consistent manner

To Formulate Policies:

- ✓ On mandatory training (initial, overall, periodical, induction and when needed)
- ✓ On regular maintenance of equipment and installations
- ✓ On a strict system of proper housekeeping (cleanliness, well organised storage and work areas)
- ✓ On internal monitoring and performance measures for management to improve performance evaluation of OSH measures
- ✓ On regular self assesments/self-auditing checks
- ✓ On raising OSH awarness among workers

To Control:

- ✓ Work safety by performing regular risk assessments for every work position
- ✓ The quality of chemicals used
- ✓ The quality of raw material being processed
- ✓ Proper chemical handling, mixing and dosing in all production stages
- ✓ Process discipline (doing as instructed, not as it happens)
- ✓ Mechanical operations (fleshing, splitting, trimming, shaving, setting and buffing)

Figure 127: OSH management cicle

To Provide:

- ✓ Basic equipment for process control (e.g. balances, flow meters for fresh and waste water, thermometers, timers, micrometers, pH meters or paper, and densimeters)
- ✓ Operational and reliable work tools, apparatuses and implements
- ✓ Personal Protective Equipment
- ✓ An information system on workplace hazardous materials, risk assessments and practices

- ✓ Any required information regarding workplace health and safety

OSH management is a **continuous process** that should be steadily revised and improved. The OSH management cycle is illustrated in figure 7. It could also be implemented through the **PDCA cycle.**

9.4 PREVENTION AS A KEY

The fundamental concept in OSH management is prevention – all efforts should be put into avoiding work accidents and work diseases. Some general principles when implementing the "prevention is better than cure" policy are:

- Viewing employees not as a cost factor, but as members of the same team, striving for the same goals
- Involving employees in policy formualtion and creating a safe work culture at work (which increases awarness and responsibility assumption)
- Making sure workers' personal skills and predispositions match their job requirements
- Formulating the right policies regarding OSH and their systematic implementation through an appropriate OSH management system
- Regular risk assessments, self-auditing and auto-updating procedures to maintain good working practices and to keep up to date with the latest trends regarding OSH
- Constant monitoring of workplaces to keep safety discipline high

9.5 AWARENESS

Information and training courses are essential to raise awareness about OSH among workers. Any hazardous situations, possible work-related risks and potential occupational diseases (including symptoms) must be clearly communicated to workers; workers should also inform supervisors about risks in the workplace through a reporting system.

PREVENTION

"Treatment without prevention is simply unsustainable"

Bill Gates

Figure 128: Fleshing machine with warning, mandatory and precautionary signs

Training sessions and toolbox talks are good occasions for managers and safety officers/agents to collect insight on the work environment. The workers' participation is an important contribution to safer work environment and successful OSH programme implementation. In this regard, raising awareness of risks and hazards should occur both ways: from managers to workers but also the employers ought to consult workers or workers' representative on work issues and involve them in discussion regarding OSH measures and management. The points that could be discussed with workers are:

- Personal protective equipment in use
- Process methods
- Safeguards
- Safety measures
- Design of workplaces

Collaboration between workers and managers on OSH can be very helpful in finding new solutions and improving existing ones. Involving workers in the decision process make them feel more appreciated, conscious and responsible, which contributes to a better work culture and improves safety at your tannery.

PROMOTING OSH

Information regarding potential safety risks and health hazards, precautionary safety and emergency practices must be provided to all workers (including casual workers), contractors hired for carrying out work in the tannery and effluent treatment plant and any other visitors.

Display safety and health instructions

Visibly displaying a safety policy statement or a written commitment of the management to safety and health of the company's workers has a motivating effect on them.

The contact address and telephone numbers of the nearest medical doctor, hospital, firefighting service and first aiders should be prominently displayed on an information board. In large tanneries, such information may be displayed in all sections.

At the work areas, particularly those involving hazardous operations, specific safety guidelines should be visibly affixed.

Figure 129: First aiders list with emergency contacts

Attaching machine operating checklists for the machine operators at the respective machine contributes to better awareness, not only in terms of safety but also in terms of better machine maintenance and general housekeeping.

Affix warning and precautionary signs

Safety and precautionary signs increase the awareness about specific potential hazards and promote adherence to safe practices.

- Make sure that all workers understand the meaning of the signs (use standard pictograms)
- In case explanatory text is put on the sign board, make sure that it is in the local language

Figure 130: Use safety signs and specific health instructions to warn about hazards and indicate safe work mode

- Drink clean, potable water!
- Never eat, drink or smoke in storage or work areas
- Wash hands and exposed parts of body regularly
- Clean teeth and mouth daily and have periodic dental check-ups
- Wear proper clothing and footwear
- Do not mix working and casual clothes
- Use PPE
- Keep physically healthy

Encourage all employees to follow good personal hygiene

SAFETY TRAININGS AND DRILLS

According to the Occupational Safety and Health Act of 1970 (OSH Act) by OSHA, and equivalent acts in other countries, workers have the "right to know" about all the hazards and risks they are exposed to and precautions that can be taken to control these harmful effects. By providing training courses and drills, employers fulfil their responsibility of informing workers about the risks they are exposed to. On the other hand, managers must know the risks and hazards their workers are exposed to, which are determined by risk assessments (see chapter 2).

Train workers on safe work practices

Each worker in the tannery and effluent treatment plant should undergo a general safety orientation training in the form of induction and refresher trainings. Explain to your workers, and anyone else who needs to know, what the dangers are. It is poor practice just to hand them a page of written information. The training content should be carefully determined by a specialist, should be based on latest risk assessment findings and cover:

- Existing health hazards and safety risks in their location
- Control measures, use of PPE, safe behaviour and work practices
- Basic first aid and what to do in emergencies (practice drills)

Apart from general safety training for all workers, certain jobs require additional, work-specific training. Such training has to be provided to those workers engaged in hazardous operations. Their training should cover the use of special personal protective equipment and safe practices as required for the type of work. The first aiders should undergo refresher training at least once a year.

Conduct emergency drills

Regular training on the use of emergency equipment and on what to do in emergencies should be carried out at least twice a year. Subjects to be covered in the safety training are:

- Location and use of first medical aid kit
- Rescuing and attending to victims of accidents (e.g. rescue from confined space in effluent treatment plants, from electrical installations)
- Checking and use of fire fighting equipment
- Use of specific equipment such as self contained breathing apparatus, safety harness, hydrogen sulphide detectors, etc.

Figure 131: Emergency drills (Wikimedia Commons)

Instruct contractors and visitors on safety procedures

Be aware that people visiting your business (e.g. contractors, visitors) may not be familiar with your tannery or effluent treatment plant.

- Do not permit unauthorised entries to the premises
- Instruct contractors and visitors on precautionary measures and behaviour before entering the work areas
- Accompany outside contractors and visitors when they are in the tannery or effluent treatment plant

If contractors are engaged for certain work in your tannery or effluent treatment plant, an experienced person of your staff should supervise their work.

9.6 WELFARE

Workers tend to bring their problems from home, go home with their problems from work and bring back the same problems to work.

Be aware that a worker who brings problems from home will not be able to concentrate or be fully productive. As an employer, ensure that workers do not go home with problems from work. Besides good work conditions, availability of welfare facilities contribute not only to the welfare of your workers but also improve productivity and relations.

Figure 132: Provide decent resting area

Care for workers welfare

The type and quality of welfare facilities may differ from country to country and company to company. Facilities for workers' welfare during working hours should at least include:

- Facilities for personal sanitation (toilets, washing facilities, change room for drying and storing working clothes) should be provided near work areas
- Access to drinking water and other beverages (e.g. salty drinks in hot climates or hot drinks in cold climates)
- Rest area, dining room (e.g. for taking lunch) away from the work area

Keep in mind that you need to keep toilets and washing facilities separated for women and men.

9.7 Laws and Regulations

Be up to date with legistlation

Not knowing the laws and regulations on labour, workers' rights and OSH of your country does not protect you from the consequences of non-compliance.

These laws and regulations are based on the idea that the improvement of workplace conditions is to be organised and performed by an employer in co-operation with workers. The regulations only relate to the minimum requirements in terms of occupational safety and health at work, leaving you with the freedom of being better than the standards prescribed.

Your country may be a signatory to international agreements, declarations and programmes of United Nations organisations such the World Health Organisation, International Labour Organisation and others.

9.8 Audit and Monitoring

Audit and monitoring is crucial for a systematic approach to improving occupational safety and health standards at work. A simple audit and monitoring system comprising of the following elements should be established in every tannery:

- Basic workplace inspection schedule (e.g. on a monthly basis)
- Accident/incident reporting system
- Systematic health monitoring of all workers

The principal objectives of audit and monitoring are to:

- Identify the risks and hazards that can lead to injury, illness and unsatisfactory conditions at the workplace
- Analyse and determine the nature of risks and hazards (how do they affect the worker and what safety measures have to be taken?)
- Correct bad practices and introduce improvements
- Follow up to ensure that the measures have been properly carried out and have had the intended effect
- Ensure that no new problems have been introduced into the workplace

The systematic and detailed examination and inspection of the workplace is the most important preventive step. It requires contributions from and co-operation between workers and management.

Safety self-assessment checklist

A hazard identified is a hazard solved!

Encourage your workers to report unsafe and hazardous conditions to their supervisors on a regular basis. This cooperation is mutually beneficial: workers feel more in control of their workplace and a safe working culture is built in your tannery. Involving employees in decisions

can help to foster closer working relationships and make employees more receptive to new ideas.

A checklist is a useful guidance tool for carrying out an audit in your tannery or effluent treatment plant. It is impossible to remember everything that has to be checked during each work place inspection therefore you should always make use of a fixed checklist.

Reference sheet 9.1 contains an inspection checklist for an internal tannery self-audit

With the help of the audit you will be able to identify unsafe conditions and the potential sources of health hazards. It is also helpful for follow-ups to verify if the applied safety measures improve the problematic situation. It is pointless making checks if you take no action when something is wrong and if the self-auditing process produces a long list of 'actions needed', you are not managing health and safety properly.

MONITORING

Monitor the workplace on a regular basis

Once you have implemented all planned improvement measures, the same auditing methods allow you to verify the impact and effectiveness of these measures and to decide on further measures. Regular monitoring of the workplace will help maintain the occupational safety and health standards at work. A general workplace inspection should be carried out at least once a year by a competent, authorised person. Chemical stores, chemical preparation area(s) and effluent treatment plants should be inspected more frequently, for example on a monthly basis.

On a daily basis, check with workers in each work area whether they have any problems and suggestions regarding safety, health or working conditions. In addition, special work place inspections are prescribed by law, such as inspection of boilers or pressure vessels.

It is important that the observations made during workplace inspections are noted so that any shortcomings or suggestions can be reported and followed up on. Information gathered from audit checklists, results from monitoring, health records and accident reports are useful inputs for planning and deciding on measures to be taken to improve the occupational safety and health standards at work.

Check with reference sheet 9.3 for a simple method of how to assess and prioritize hazards
Try to obtain experts' advice. Engineers, safety officials, experienced supervisors and outside consultants may be of further help.

Nature and extent of risks and hazards

Analyse and determine the nature and extent of risks and hazards. As the next step, determine the level of exposure.

Figure 111: Use personal gas detector to assess actual exposures at the workplace

Occupational Exposure Limits

Parameters relevant in tanneries and effluent treatment plants are:

- Concentration of dust (total and respirable)
- Concetration of chemical mist/gas/vapours
- Level of noise
- Level of temperature and relative humidity
- Wind speed

The measured values of these parameters will subsequently serve as a comparative basis to assess the impact of improvements made and achieving satisfactory conditions in the work place (determined by local authorities).

> *Check reference sheet 9.2 for detailed information on which parameters should be monitored in which location of the tannery and effluent treatment plant*

These measurements have to be cross-checked with the permissible OEL as laid down in the form of international recommendations or respective national standards in your country.

Occupational Exposure Limits (OEL) are grouped into three categories:

- Time-Weighted Average (TWA) - referring to the permissible continuous exposure for 8 hours (one work shift)
- Short-Term Exposure Limit (STEL) – the maximum permissible continuous exposure for a duration of 10 or 15 minutes. It can not be repeated more than 4 times a day with at least 60’ break between exposures
- Ceiling-Limit (TLV-C) – the maximum exposure limit that must not be exceeded at any time

The basic principle of toxicology is “the dose makes poison”, therefore the American Conference of Governmental Industrial Hygienists (ACHIH) introduced exposure limits expressed by the Threshold Limit Value (TLV) for chemical substances. The value states a worker’s daily safe level of exposure to a given chemical without an adverse effect on safety and health for the entire work lifetime. The TLV for particulates (dust, smoke, mist) is defined in mg/m3 whereas for concentration in air it is expressed in PPM. The ACHIH recommendations have only a guideline status and should not be confused with exposure limits having a regulatory status. Section 8 of SDSs indicates the exposure limits.

The measurement of these environmental parameters usually requires extensive use of special monitoring instruments. In most countries you can avail professional assistance of an outside expert or agency to carry out the monitoring for you.

For detailed information on exposure limits of chemicals commonly used in tanneries, check with reference sheet 3.1

Blood test and other biological samples

In addition to the measurements listed above, there are other methods that help find out to what extent workers in your tannery have been already exposed to certain safety risks and health hazards. To determine the overall exposure of workers through inhalation, skin contact or ingestion, samples of worker's blood and urine can be analysed in a laboratory and checked for extraordinary levels of chemical substances, for example chrome levels, pesticides, etc. These provide complementary information to workplace monitoring.

Health Check-ups

Regular health checks of workers, particularly at the time of recruitment and on a regular (at least annual) basis, is an important method of carrying out effective proactive health services.

These examinations take into account the possible exposure of workers to various factors such as noise, climate and chemicals.

The annual examination should therefore include a:

- General health examination
- Routine blood test
- Lung function test
- Hearing test

Figure 112: Monitor the health of emploees on a regular basis

9.9 SICKNESS ABSENCE MANAGEMENT

It is certain that workers will be sick from time to time, but long-term sickness absence often represents a problematic issue for employers and employees. It involves a cost, productivity decrease and unnecessary recruitment. On the other hand, most employees feel bad about abandoning their jobs that increases the workload for colleagues and reduces their earnings.

Research shows that sicknesses that lasts more than six weeks decreases the person´s capability to return to work. Almost one out of five people that reach this point stay off work, and eventually leave paid employment. However, following some steps, you can avoid the loss of your employees through sick leave. By these means, it will not be necessary for you to constantly recruit and train new workers, and you will safeguard the livelihood of your employees.

Some employers think, it is a better option to leave sickness management to medical persons, but it is not! There are good practices that you can carry out that can help sick employees come back to work.

Getting started on good sickness and absence management implies the following measures:

I. Informing workers about the procedures to be taken in case of sick leave
II. Checking and registering your sickness absences, which includes knowing who is absent, why the worker is off, when they will possibly return and how you will deal with it
III. Keeping in contact with sick personnel, which includes return to work interviews and involving them in scheduling their return to work
IV. Promoting the safety and good health of employees at the workplace
V. Dealing with long-term/short-term absences as well as unauthorized ones for other reasons

Tannery's Policy

It might be helpful to write a clear policy on these elements with the company´s approach. Consider if the written policy should stand alone or form part of the other company or organizational policy documents, e.g. staff handbooks. Some useful information you could include in your policy:

1. Company´s approach and commitment to help workers return to work
2. The time off provided to attend medical appointments
3. Measures for keeping in touch with workers on sick leave and what is expected from employees
4. Assuring that employees will be treated equally, fairly and consistently

Frequent causes of absences due to sickness

Sick leave can be due to a mixture of:

1. Personal health habits e.g. smoking, diet, drugs, exercise, etc.

2. Physical hazards. Check if employees are skilled enough, e.g. if they know how to handle chemicals, machinery, etc.
3. Emotional or psychological stress, e.g. harassment/bullying, too much work, poor working relationships, personal issues such as family or emotional problems

Remember that early action on your part can increase the chances of an earlier return to work.

The minimum suggested information you need to record is:

- Name/ID of the employee and telephone number to be contacted
- Date of the first absence
- Reason for absence
- Whether the injury or sickness is work-related
- The date that the employee last communicated and the outcome
- Working days absent and expected length of absence
- Date when the worker is expected to come back to work

As an employer, you have a responsibility to protect your staff at work. It is crucial to identify how to help sick workers to return safely and maintain positive cooperation between everyone involved to reach effective returns to work of ill, injured and disabled employees, as soon as possible.

9.10 Reporting and Investigating Accidents

Learning lessons from work accidents is at the heart of preventing them from happening again. Carrying out your own investigation of workplace accidents will allow you to deeper understand the nature of the hazards and risks associated with work activities.

This subchapter will help you to adopt a system of accidents reporting and investigation to uncover the reasons behind accidents and find solutions that will prevent them to happen again.

Benefits of an investigation:

- Insights gained: Accounts of the accidents will give you information on how the work/tasks are really performed. Sometimes workers look for short cuts and ignore rules. This would identify deficencies in monitoring and supervising. Of course there may be other reasons to the accidents that investigation will uncover.
- Improvement in employee morale and attitude towards health and safety by giving a good example and showing management's dedication to OSH values.
- Reducing accident rates and therefore preventing business losses (setbacks, legal action, disruptions)
- Legal and formal SMS compliance

How to conduct and investigation?

The goal is to determine the root of the problem that would allow the tannery to learn from the failure. It should be performed with the willingness to improve, not to identify someone to blame. The investigators should think not only how the accident happened, but what it allowed to happen. These rules can help in successful investigation:

- Do not rush into conclusion before completing the investigation
- Follow a structured and thorough investigation method
- The investigation team members should complement each other in their specialisations and be unbiased and objective
- Start the investigation as soon as possible while memory is fresh and motivation high

Four step system

The investigation can be divided into four phases:

1. Gathering information: Preparing a report involving photographs, witness names and accounts, chronology of events and description of what happened, list equipment and people involved, written work instructions (procedures, risk assessment, job guides)
2. Analysing information: All the gathered information must be analysed and conclusions taken (underlying casues, root casues) or further actions identified. It may be necessary to contact an external specialist for help in analysing the gathered information.
3. Identyfing suitable risk control measures: Based on the findings from step 2, identify risk control measures that were missing, inadequete or unused. Also compare work conditions as they were with that required by your company or by law and good industry practice. In this step you should also identify additional measures needed to address the root casue of the accident. This step of the investigation should conclude with recommnedations that are to be implemented.
4. Action plan and its implementation: Provide a specific and realistic action plan with measurable and timely deadlines. The actions should deal with immediate and underlying casues. Communicate the results of the investigation to everyone concerned and make sure it is taken into account in the risk assessments.

Cause of the accident

The nature of the cause can be immediate and/or underlying.

- Immediate cause: This category includes physical condition of the workplace, plant, equipment and substances. It can also be anything about procedure, instruction or information (or lack of it). Human factor should also be investigated – especially suitability for the work, competence and emotional and physical state of the staff involved in the accident.
- Underlying cause: This is about the cause that can not be seen at first glance as it is more about workplace management, supervising, monitoring, auditing, risk assessment, communication, control, co-operation and policy implementation in the workplace.

Reporting the accident to authorities

Note that certain accidents must be reported directly to the enforcing authority. In the UK the system in place is called **RIDDOR** (Reporting of Injuries and Dangerous Occurrences Regulations). The regulation specifies exactly what accidents, incidents and injuries are to be reported officially. Most countries have their own official reporting system in force.

9.11 CHECKLIST

Component	Yes	No
SAFETY MANAGEMENT SYSTEM		
1. Is there any (formal or informal) safety management system in place?		
2. Is there a systematic approach to manage safety and health risks in place?		
3. Is OSH part of the standard operation of the tannery?		
4. Is there an appointed person responsible for issues related to safety and health at work?		
5. Are risk assessments conducted regularly for every workstation within the tannery?		
6. Are risk assessment findings taken seriosuly and control measures implemented accordingly?		
7. Is there a constant effort to keep making the workplace safer (e.g PDCA continuous improvement cycle)?		
8. Are all workplace accidents and incidents reported and recorded?		
9. Is there an accident investigation system in force?		
10. Are follow up actions and corrective actions to avoid future accidents are taken and followed?		
11. Is there a well established accident prevention and monitoring system?		
12. Is occupational health and safety training content established and provided to workers?		
13. Do plant contractors and visitors receive instruction on risks at the workplace?		
14. Are unauthorized personnel allowed to enter the premises?		
15. Are outside visitors accompanied while they are on the premises, tannery or ETP?		
16. Is there an emergency plan?		
17. Is the safety legal compliance of the company ensured and monitored for changes/updates?		

Component	Yes	No
18. Is information on Standard Operating Procedures available and signposted?		
19. Is there a work permit system while identified, highly dangerous task is in force?		
20. Is there an accidents/incidents reporting and investigation system in place?		
SAFETY TRAININGS		
21. Are training courses scheduled advance and registered?		
22. Are training courses conducted regularly according to local law and good industry standards?		
23. Is the training content well designed, approved by specialists and does it cover all important issues?		
24. Are training sessions conducted by competent personnel?		
25. Has each tannery worker (administration, production, stores, effluent treatment etc.) successfully completed an initial general safety orientation training?		
26. Has each employee successfully completed the initial training for specific operations?		
27. Is a new assignment (such as use of a new machine, equipment or chemical) allowed only after appropriate training?		
28. Are regular safety refresher training courses conducted for all staff and workers periodically (According to the local law or good OSH standards – once every 6 months)?		
29. Is a stress prevention policy implemented?		
AUDIT AND MONITORING		
30. Are internal safety self-audits conducted regularly?		
31. Is there regular OSH supervision in place?		
32. Are audits and monitoring part of a larger plan rather than sporadic actions?		
33. Are self-audits conducted by competent staff?		
34. Are external, professional safety audits conducted periodically?		
35. Based on findings, are follow up and corrective actions taken and followed?		

Component	Yes	No
36. Are corrective actions implemented within the indicated date?		
37. Is there a specific audit checklist for every machine readilly available for all interested parties?		
38. Are detailed and customized safety checklists regularly conducted for each machine (these are provided in the reference section of the OSHALM manual)		

10 Emergency Management

Despite all precautions, the occurrence of emergencies in factories cannot be ruled out. An efficient management unit is always prepared to deal with emergencies. This chapter provides you guidance on how to prevent and deal with emergencies.

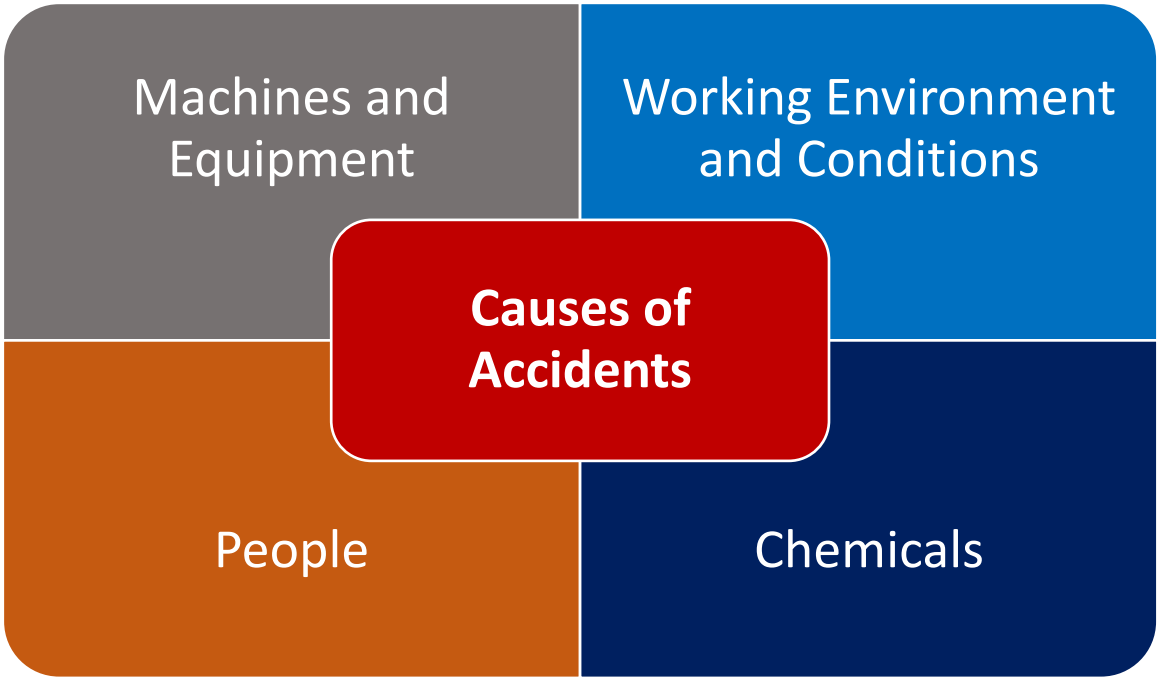
Emergency preparedness is a well-known concept in protecting workers' safety and health.

Putting together a comprehensive emergency action plan involves conducting a hazard assessment to determine what, if any, physical or chemical hazards inside or from outside the workplaces could cause an emergency. The plan should describe how workers will respond to different types of emergencies, taking into account specific worksite layouts, structural features, and emergency systems. If there is more than one worksite, each site should have an emergency action plan.

An emergency action plan is intended to facilitate and organize employer and worker actions during workplace emergencies and is recommended for all employers. Well-developed emergency plans and proper worker training (i.e., so that workers understand their roles and responsibilities within the plan) will result in fewer and less severe worker injuries and less damage to the facility during emergencies. A poorly prepared plan may lead to a disorganized evacuation or emergency response, resulting in confusion, injury, illness (e.g. due to chemical exposure), and/or property damage.

10.1 Main Causes of Accidents

Due to the nature of the work in tanneries, which involves natural raw materials, heavy machines and a wide range of chemicals, work in tanning industry can be quite risky when it comes to health and safety. Statistically speaking, the main contributing factors to accidents in tanneries are:



Machines and Equipment

Faulty design, poor maintenance or incorrect handling of machines can lead to a sequence of events that may result in an accident and severe bodily damage.

Working Environment and Conditions

Appropriate working environment and conditions are crucial to reduce work-related accidents, sick leave, occupational diseases and to keep workers committed and motivated. When assessing your workplace, pay special attention to the following factors:

- Noise
- Disorder at the workplace
- Temperature and humidity
- Lighting
- Ventilation
- Psychosocial issues (bullying, harassment)

People

Managers' and supervisors' performance and behaviour influence workers with regard to good work practices and being able to respond properly in case of an emergency. Important factors to be taken into account are:

- Job experience and training
- Awarness
- Information and instructions on working practices and hazards involved
- Supervision by managers and skilled workers
- Personal predisposition of a worker when assigning a job/task

Chemicals

Chemical substances applied before or during leather production can have an impact on the safety and health of people exposed to them while working. Such workers should be trained on how to properly handle chemicals to avoid potential health hazards. Special attention should be placed on especially harmful chemicals and hydrogen sulphide formation.

STATISTICS AND LESSONS LEARNT:

The European Agency for Safety and Health at work (EU-OSHA) presents the following interesting statistics to consider:

- Men have accidents more often than women
- The most common type of injuries are wounds and superficial injuries
- Accidents that occur at night tend to be more fatal than ones in mornings, afternoons and evenings
- Shift workers have a higher accident rate
- The accident rate among young workers is much higher than among their older colleagues; older workers have more fatal accidents
- Small and medium-sized enterprises have higher accident rates
- Hydrogen sulphide is by far the most frequent killer in tanneries and ETPs

10.2 Fire and Explosion Risk

A careful assessment of your tannery and effluent treatment plant will help you identify the locations with a high risk of fire. To do so, you should keep in mind that fire requires three basic elements:

- Combustible/flammable material
- Oxygen
- An ignition source (heat, spark)

Whenever all three elements are present, a fire may start. If two of the three elements are found together, a high risk of fire must be assumed. See the brief description below to be able to identify fire-causing elements and recognise the risk of fire.

Figure 135: Identify areas with fire and explosion risks

Identify combustible/flammable materials in your tannery

The most common combustible/flammable materials in tanneries are:

- Chemicals in liquid and solid form (check the label)
- Chemical fumes, vapour and mist
- Wastes (dry shaving dust, buffing dust, vegetable extract)
- Fuel and lubricating oil

Figure 136: Mixing of chemicals can lead to spontaneous combustions

The safety data sheet of chemicals usually gives detailed information on the respective risk of fire or explosion. When checking the safety data sheet, keep the following in mind:

- For flammable liquids, the lower the flash point, the higher the fire and explosion risk of the chemical
- A vapour heavier than air (density higher than 1) may travel along the ground and collect in pits or below ground creating fire and explosion risks far away from the chemical's location.

Identify the potential sources of ignition in your tannery

For a chemical/fuel and its gaseous form to pose a fire risk, the flash point temperature has to be exceeded.

Potential sources of heat required to ignite the flammable material are:

- Sparks (poorly made electrical connections, cylinders for grinding knives)
- Static electricity (dry belts rubbing against wooden or plastic parts or cylinder rollers e.g. driving belts, measuring machines)
- Electrical short circuits
- Spontaneous combustion (oily rags in dry open air)
- Chemical reactions (accidental mixing of spilled chemicals in chemical store or work place)
- Friction (loose drive belt rubbing against covers, rubbing of moving machine parts due to poor maintenance or missing lubrication)
- Process and radiant heat (drying chamber/tunnel, steam pipes, boiler, badly ventilated electrical motors e.g. fans, exhaust ventilation)
- Open flames (cigarettes, matches, candles)
- Solar heat

Oxygen

Since oxygen will be present in the air, the focus of preventive action should be kept on flammable material and sources of ignition.

PREVENTIVE MEASURES

- Store chemicals properly and keep chemical containers covered
- Clean chemical spillages immediately as per the instructions of the safety data sheet
- Ventilate chemical stores and work areas to avoid accumulation of vapour, fume, mist, etc.
- Remove waste systematically, particularly from dry shaving and buffing machines
- Store fuel for engines in separate locations away from the work area in conformity with relevant rules for fuel storage
- Keep electrical installations clean and in good order
- Ensure proper maintenance and lubrication of machines
- Prohibit smoking in fire-prone areas such as chemical stores and all work areas

FIRE EMERGENCY

Forewarned is forearmed

While the listed preventive measures above minimise the risk of fire, further measures have to be taken to be able to respond immediately if a fire occurs to avoid or minimize harm to the plant and people.

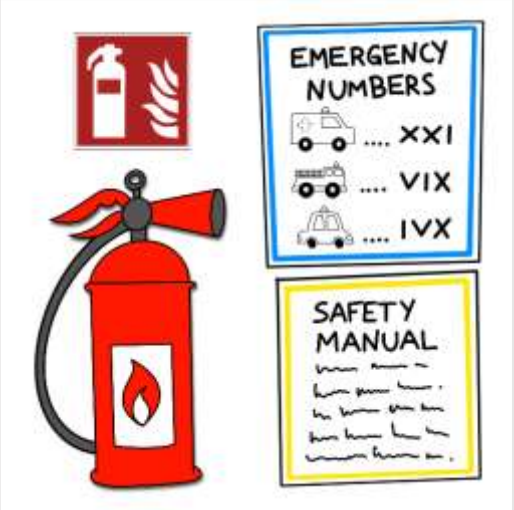


Figure 137: Be prepared for a possible fire!

Prepare for a possible fire! Check if:

- Workers are able to escape rapidly from any part of the tannery in case of a fire
- Fire exits are clearly indicated and marked
- Fire fighting equipment is inspected at least once a year, filled and ready for use
- The location of the fire fighting equipment is clearly marked
- Workers are trained on the use of the provided fire fighting equipment
- Everybody in the tannery knows what needs to be done and how to behave in case of a fire

Figure 138: Keep evacuation routes unobstracted and fire fighting equipment ready in marked locations

Thumb rules in firefighting equipment

- One 6 litre or 6kg fire extinguisher is suitable for 150-200m^3
- Locate fire extinguishers not farther than 15 meters from the nearest fire-prone area
- Fire extinguishers suitable for A B C class fires can be used in chemical stores
- Fire extinguishers for different risk areas are to be kept separately

To find out how to select the correct firefighting equipment please refer to the specially designed guideline in the appendices section. See reference sheet 10.1

10.3 Accidents

Workers, supervisors, managers and even yourself may be exposed to a variety of external safety risks and health hazards at the work place.

Be prepared for medical emergencies

Though the probability of accidents can be reduced by taking preventive and precautionary measures, one should be prepared and equipped to respond to a medical emergency. Immediate and correct (re)action with the facilities available are decisive for the rescue and full recovery of victim(s). First aid is the first step in a medical emergency response. The first moments after accidents are critical for the victim(s) further recovery.

Identify possible medical emergencies in your tannery and effluent treatment plant

The most likely medical emergencies you may come across in tanneries are:

- Bleeding from cuts, bruises, abrasions, open wounds
- Broken limbs, sprains or dislocation
- Injuries from working with chemicals (spills of acids and alkalis on skin or eyes)
- Heart and breathing failure (due to inhalation of gas, lack of oxygen, electrical shock)
- Burns (from acid, fire, hot embossing platens/cylinders or contact with electricity)

In the appendices section you will find emergency instrucions in case of:

- Fire: Ref. sheet 10.2
- Gas poisoning: Ref. sheet 10.3
- Incidents with machines and electricity: Ref. sheet 10.4
- Chemical splashes on eyes and skin: Ref. sheet 10.5
- Accidenal ingestion of chemical: Ref. sheet 10.6
- Chemical spills and leaks: Ref. sheet 10.7

10.4 Confined Space Emergency

Confined spaces (e.g. manholes, storage tanks, underground tanks, pits, wells) in tanneries and effluent treatment plants can be risky to enter due to the likely presence of gas (hydrogen sulphide, methane) or lack of oxygen. There are strict rules pertaining to entry into confined space that apply equally for regular workers and rescue operators.

Figure 139: H_2S can accumulate in drums and make operators fall inside when taking samples. Be prepared for this!

Any worker entering a confined space must be attached to an independent lifeline for fall protection, retrieval and emergency situations. A complete retrieval system should consist of a:

- Man-rated winch attached to workers at all times
- Tripod
- Full body harness
- Separate winch only for materials
- PPE (helmet, gloves, suit)
- Portable hydrogen sulphide detector
- Self-contained breathing apparatus (SCBA)

Emergency

The rescuing team is required to be trained, have the necessary equipment and practice drills before any emergency situation occurs. Provision of rescue equipment should be adequate to potential emergencies identified by the risk assessment. The rescuers must be fit for carrying out the task, ready and capable of using the equipment provided for rescue and retrieval. At least one of the rescuers needs to be a trained first aider. The emergency should also be communicated to management who should comply with their part of rescue procedure and notify relevant local emergency services about the accident.

Figure 140: There are numerous confined spaces within ETPs. You need to take special care in guarding them and while cleaning and maintaining

10.5 First Aid

In the tannery, staff should be prepared and trained to rescue and provide first medical aid to accident victims. Remember to:

- Display the phone number or contact address of the nearest medical doctor and the fire fighting service in a clearly visible location
- Keep at least one first medical aid box in the tannery and inform all workers about its location
- For first medical aid in case of accidents involving chemicals, check with the respective safety data sheet

Keep rescuing and emergency equipment ready

Before first medical aid can be administered to the victim(s), the victim(s) needs to be rescued, removed from the accident location and moved to a safe area. Rescuers may have to enter the danger zone and require special items such as rescuing equipment and personal protective equipment.

Keep a first medical aid box ready in a central location with easy access. In small tanneries, one box kept in the tannery office may be sufficient. In larger tanneries, additional boxes should be kept in each department and areas with high or special safety risks and health hazards.

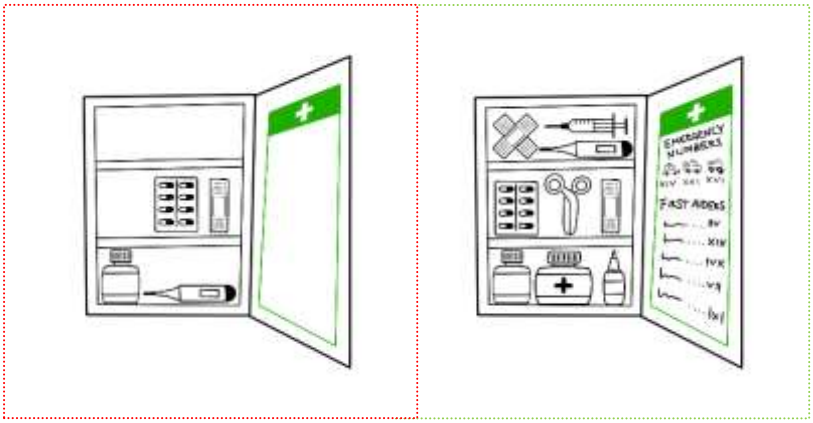


Figure 141: Well equipped first medical aid kit with emergency conctacts and first aiders listed is required

Though the content needs to meet the regulatory requirements, the essential items are:

- Antiseptic lotion, powder or cream
- Sterile dressing in dust proof packets

MEDICAL KITS

Thinking of refilling the fire extinguisher at the time of fire or replenishing the first aid medical box when accident has happened is too late!

- Adhesive plasters
- Triangular bandages
- Scissors
- Burn cream

The content of the first medical aid box should be regularly checked to replenish used items or to replace items past their expiry date.

Eye rinsing/safety shower/washing facilities

In cases such as spills/splashing of chemicals into the eyes or on the , immediate facilities to clean the affected part of the body have to be available. Emergency washing facilities should be available in or nearby the chemical store.

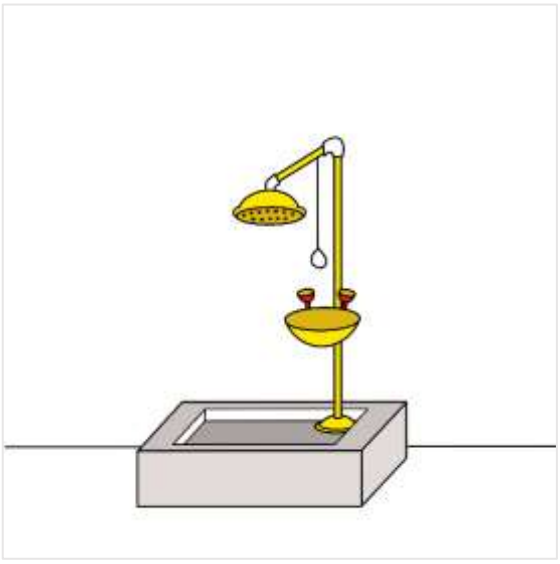


Figure 142: Emergency shower and eye rinsing station

First aid training

Though everybody in the tannery should be trained on basic rescuing procedures and application of basic first medical aid, at least two staff members should be trained as certified first medical aiders. Make it a rule that one first medical aider should be present on each shift. Particularly, as noted in the statistics earlier, night shifts can be critical.

10.6 Emergency Plan

Plan for emergencies

Based on the initial safety audit, which identifies the potential safety risks and health hazards, you should not only plan for the improvement measures but also prepare plans on how to deal with the possible emergencies in the tannery and effluent treatment plant.

Put the emergency plan into writing and inform your staff and outside emergency services. Key elements of your plan should be training and emergency drills. The emergency plan should include clear explanations on:

- How to alarm and evacuate
- How to rescue accident victims and to give first medical aid
- Procedures to adopt during and after an emergency

Finally, does your medical doctor or nearest hospital know about the safety risks and health hazards in your tannery and effluent treatment plant? Brief your doctor or hospital so that they are prepared as well!

Learn From Emegencies

Once the immediate emergency control steps have been taken, the accident should be investigated as quickly as possible to establish the cause, not to lay blame. You can draw useful lessons from a careful investigation of accidents. Please see the accidents reporting and investigation section in chapter 9.

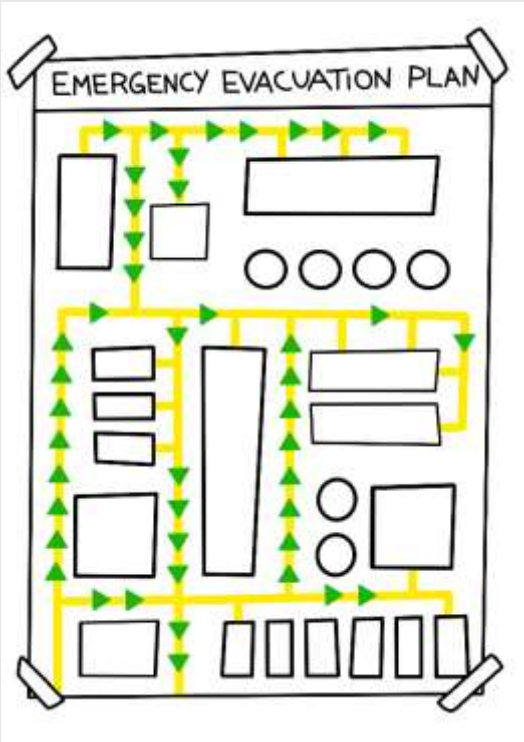


Figure 143: Example of a tannery evacuation plan

Figure 144: Train your staff on how to deal with emergency situations

EMERGENCY PLAN

An emergency plan without emergency training and drill is useless!

10.7 CHECKLIST

➢

Component	Yes	No
EMERGENCIES AND FIRST AID		
1. Is emergency action plan prepared		
2. Do you have a written, well-outlined plan in case of each possible accident/emergency?		
3. Are emergency drills practiced (at least once a year)?		
4. Have all employees attended emergency drills?		
5. Have all employees attended a first aid workshop?		
6. Are first aid personnel available in your tannery on each shift?		
7. Are the responsible persons informed of the nearest medical facility (doctors, hospital)?		
8. Are the nearby medical facilities aware of common safety risks and health hazards in your tannery and ETP?		
9. Is transport to the nearest medical facility available?		
10. Are means to obtain outside help established and communicated to the workers?		
11. Is the rescue and emergency equipment inside the tannery/ETP sufficient to react adequately to the potential accidents?		
12. Are workers trained in basic emergency procedures?		
13. Are there sufficient emergency exits?		
14. Are emergency escapes and exits clearly marked and kept unlocked, unblocked and unobstructed at all times?		
15. Are there emergency maps within the workplace?		
16. Are employees familiar with the emergency procedures; escape routes and locations of exits and first aid kits?		
17. Are certain groups of workers identified and trained for the proper reaction in case of an accident/emergency/fire?		
18. Are safety showers available?		
19. Is there an eye/face rinse station on site?		
20. Are properly equipped first aid kits available?		

Component	Yes	No
FIRE RISK		
21. Are fire safety instructions clearly signposted and available for everyone present in the company premises?		
22. Are combustible materials stored safely?		
23. Is adequate and appropriate firefighting equipment readily available?		
24. Is firefighting equipment regularly checked and certified?		
25. Is firefighting equipment clearly signed and easily accessible?		
26. Are fire alarm points clearly signed and accessible?		
27. Are fire assembly points with safe distance from the tannery and tannery facilities clearly marked?		
28. Is smoking is banned in vulnerable working areas of the tannery and tannery facilities?		

11 Others

11.1 Acronyms and Abbreviations

A	Ampere
BOD	Biochemical Oxygen Demand
BS	British Standard
BSI	British Standard Institution
°C	Degree Celcius
COD	Chemical Oxygen Demand
CSDS	Chemical Safety Data Sheet
CTC	Centre Technique Cuir Chaussure Maroquinerie
CEN	Comite Europeen de Normalisation
EC	European Commission
EN	European Norm
EU	European Union
EU-OSHA	European Agency for Safety and Health at Work
ETP	Effluent Treatment Plant
dB	Decibel
dB(A)	Decibel within usual frequency range of human ear
FILK	Forschungsinstitute Fur Leder und Kunststofbahnen (Research Institute for Leather and Plastic)
FMA	First Medical Aid

GHS	Global Harmonized System
HEPA	High Efficiency Particulate Air
Hz	Hertz
IBC	Intermediate bulk container
IDLH	Immediate Danger to Life and Health
ILO	International Labour Organisation
IP	Index of Protection
LEL	Lower Flammable/Explosion Limit
LWG	Leather Working Group
m	Meter
m^2	Squate Meter
M/c	Machine
mm	Millimeter
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
OEL	Occupational Exposure Limit
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration (USA)
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RePO	Regional Programme Office
RIDDOR	Reporting of Injuries and Dangerous Occurences Regulation

SCBA	Self Contained Breathing Apparatus
SDS	Safety Data Sheet
SIDA	Swedish International Development Agency
SMS	Safety Management System
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	Time Weighted Average
UFL	Upper Flammable Limit
UNIDO	United Nations Industrial Development Organization
V	Volt
VOC	Volatile Organic Compound
WB	Wet Blue
WW	Wet White
WHO	World Health Organization

11.2 GLOSSARY

Acid: Any of a class of substances that liberate hydrogen ions in water and have a pH of less than 7. Acids are corrosive and may cause severe burns.

Acute effect: The effect caused by a single short-term exposure to a high amount or concentration of a substance.

Aerosols: Liquid droplets or solid particles dispersed in air that are of fine enough particle size (0.01 to 100 microns) to remain dispersed for a period of time.

Alkali: Any of a class of substances that liberate hydroxide ions in water and have a pH of more than 7. Strong alkalis in solution are corrosive to the skin and mucous membranes. They are also called bases, and may cause severe burns to the skins.

Allergen: An **allergen** is a usually harmless substance capable of triggering a response that starts in the immune system and results in an **allergic** reaction.

Anhydrous: Does not contain water (e.g. anhydrous lime!).

Assphyxiant:

Asphyxiation: A condition whereby oxygen in the air is replaced by an inert gas such as nitrogen, carbon dioxide, ethane, hydrogen or helium to a level where it cannot sustain life. Normal air contains 21 percent oxygen. If this concentration falls below about 17 percent, the human body tissue will be deprived of their supply of oxygen, causing dizziness, nausea and loss of co-ordination. This type of situation may occur in confined workplaces.

Auto-ignition temperature: The minimum temperature at which a material ignites without application of a spark or flame.

Boiling point: The temperature at which liquid changes to a vapour state at a given pressure (usually 760 mmHg or one atmosphere).

Carcinogen: A substance or agent that causes cancer.

Caustic: The ability of an alkali to cause bums.

Chronic (health) effect: An adverse effect on a human body, with symptoms developing slowly over a long period of time.

Chronic toxicity: A chronic effect resulting from repeated doses of or exposure to a substance over a relatively prolonged period of time.

Combustible: A term used to describe and classify substances that burn.

Confined space: Any area that has limited openings for entry or exit that would make escape difficult in an emergency, has a lack of ventilation, contains known and potential hazards and

is not normally intended or designed for continued human occupancy (e.g. a storage tank, manhole of collection conveyance system in effluent treatment plants).

Corrosive: A corrosive material is a highly reactive substance that causes obvious damage to living tissue. Acids and bases are common corrosive materials. Corrosives such as these are also sometimes referred to as caustics. Typical examples of acidic corrosives are hydrochloric (muriatic) acid and sulfuric acid

Dust, airborne: Refers to the suspension of solid particles in the air. Invisible dust will remain airborne for a long period of time and is dangerous because of its ability to penetrate deeply into the lungs.

Explosion-proof equipment: Apparatus or device enclosed in a case capable of withstanding an explosion of specified gas or vapour and preventing the ignition of specified gas or vapour surrounding the enclosure by sparks, flash or explosion, and operating at an external temperature so that the surrounding flammable atmosphere cannot ignite.

Exposure:

Flammable: A flammable liquid is defined as a liquid with a flash point between 21 and 55 degrees Celsius. It may catch fire upon contact with a source of ignition.

Flammable/explosion limits: Flammable/explosion limits produce a minimum and a maximum concentration of gases/vapours/fumes in air that will support combustion. The lowest concentration is known as lower flammable/explosion limit (LEL), the highest concentration is known as upper flammable/explosion limit (UFL).

Flash point: Minimum temperature at which, under specific conditions, a liquid gives off sufficient flammable gas/vapour/mist to produce a flash on contact with a source of ignition.

Fume: Solid particles formed from condensation of substances from the vapour state. Fumes are normally associated with molten metals where vapours from the metal are condensed into solid particles in the space above the molten metal. The particles are in the visible range to the naked eye.

Hazard: A potential to cause danger to life, health, property or the environment.

Health: State of a humang being or organism that does not have any sickness or injury and practises all its functions in a normal way.

General exhaust/ventilation: A system for exhausting or replacing air containing contaminants from a general work area.

IDLH, Immediate danger to life and health: The maximum concentration from which one could escape within 30 minutes without any escape-impairing symptoms or irreversible health effects. Usually used to describe a condition where self-contained breathing apparatus (SCBA) must be used.

Incompatible: Condition of materials that could cause dangerous reactions from direct contact with one another. Particularly relevant when storing different substances in the same place.

Local exhaust: A system or device for capturing and exhausting contaminants from the air at the point where the contaminants are produced (e.g. dust in shaving and buffing).

Lockout: The placement of a device on an energy isolating device, in accordance with an established procedure, to ensure that the energy isolating device cannot be operated until the lockout device is removed.

SDS, Safety Data Sheet: consolidated information on specific identity of hazardous chemical substances, also including information on health effects, first medical aid, chemical and physical properties and emergency measures.

Mutagen: Is a physical or chemical agent that changes the genetic material. DNA changes caused by mutagens may harm cells and cause certain diseases, such as cancer.

Mist: The dispersion of liquid particles in the air. Mists are normally generated by processes where liquids are sprayed, splashed or foamed.

Noise: Unwanted sound, which may cause harmful effects on the human body at a certain density and frequency.

Occupational disease: Sickness caused by labor or due to the exposure to chemical or physical agents present in the workplace.

OEL, Occupational exposure limit: An exposure level established by a regulatory authority (e.g. OSHA, NIOSH).

Poisoning: Normally the human body is able to cope with a variety of substances within certain limits. Poisoning occurs when these limits are exceeded and the body is unable to deal with a substance (by digestion, absorption or excretion).

Prevention: Measure or decision made in advance with the aim to stop an event that is considered to be negative.

Risk: The measured probability of an event to cause danger to life, health, property or the environment.

Risk assessment: The process of examining the dangers involved in a planned activity.

Safety: Total absence of danger or risk.

TLV, threshold limit values: A concentration threshold in the atmosphere that is set specifically for each pollutant. It refers to the limit accepted in the atmosphere of a working area.

TLV-STEL, TLV short term exposure limit: Concentration threshold in an atmosphere contaminated with a specific type of pollutant for a 15-minute exposure (if not otherwise specified).

TLV-TWA, TLV time weighted average: Concentration threshold in an atmosphere contaminated with a specific type of pollutant, usually for a continuous eight-hour exposure.

Toxicity: The inherent potential of a chemical substance to cause poisoning.

Vapour weight: Weight of the chemical (in gaseous form) as compared with the relative weight of air. Vapours of chemicals that are heavier than air may travel long distances and concentrate in low areas.

Work accident: Any negative event causing an injury or damage to an employee at the workplace or while doing a work-related activity

11.3 Find Out More

Chemicals

- Asbestos
  - There is a special section on the british "Health and Safety Executive" website that provides detailed information exclusively on asbestos. You can find there how to deal with asbestos, precatuions, managing, trainings, disposing, risks, hazards and etc. See: www.hse.gov.uk/asbestos/
- GHS
  - Globally Harmonized System of Clasification and Labelling of Chemicals (GHS) by United Nation Economic Commission for Europe (UNECE). The offical website has access to the original, complete document. Access it via: www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html
- Hydrogen Sulphide Series
  - Safety handbook: How to deal with hydrogen sulphide gas in tanneries and effluent treatment plants by UNIDO, 2015. Available at: www.leatherpanel.org
  - eLearning course on the UNIDO Leather Panel, an interactive, self-learning platform. Available at: www.leatherpanel.org (you have to register first to access the eLearning module)
  - Video presenting accident clichés that may be used as a training material. Published by UNIDO's Leather Panel. Available at: https://www.youtube.com/watch?v=xQkXMyetLfM&t=4s
- REACH EU 2015/830
  - European Chemicals Agency (ECHA) – Offical party responisble for REACH execution and implementation. The official law and up-to-date amendments can be found on the official website.
  - Publication: "REACH, A guidance note for the footwear and leather industry by Footwear and leather Industry Health & Safety Committee". November 2008. Avaliable at: https://leatheruk.org/wp-content/uploads/2019/04/REACH.pdf
  - Publication: "Reviev of some EU normative documents and legistlation and their relevance for the tannig industry in develpoping countries". REACH by Jakov Buljan. January 2010

Emergency Management

- First aid
  - Interactive on-line module "First Aid in the Workplace" produced by UNIDO as a part of the eLearning course on health and safety in tanneries and ETPs. You can register and train your workers on the UNIDO Leather Panel website. The module is available here: https://leatherpanel.org/content/first-aid-workplace-english-version

Machinery

- General knowledge

- The Machines in the Tannery: A review of leather producing machinery and equipment in current use by Walter Landmann. June 2003.

Maintenance

- Working safely at heights
  - *Working at height safely: A brief guide.* Leaflet INDG401(rev2) HSE Books 2014 www.hse.gov.uk/pubns/indg401.htm
  - Work at height web pages on the HSE website: www.hse.gov.uk/work-at-height/index.htm
  - *Using ladders and stepladders safely: A brief guide.* Leaflet INDG455 HSE Books 2014 www.hse.gov.uk/pubns/indg455.htm
  - *Health and safety in roof work* HSG33 (Fourth edition) HSE Books 2012 ISBN 978 0 7176 6527 3 www.hse.gov.uk/pubns/books/hsg33.htm

Safety Management System

- Formal Safety Management Systems
  - ISO 45001 (https://www.iso.org/iso-45001-occupational-health-and-safety.html)

Transport within the workplace

- Workplace transport safety
  - "Workplace transport safety: A guidance note for the footwear and leather industries" by footwear and leather industries health and safety committee. September, 2008. Available at: https://leatheruk.org/wp-content/uploads/2019/04/WORKPLACE-TRANSPORT.pdf

Work Environment

- Bullying/Harassment
  - "Bullying and harassment in the workplace: A preventative guide for the footwear and leather undustries" by footwear and leather industries health and safety committee. September, 2007. Available at: https://leatheruk.org/wp-content/uploads/2019/04/BULLYINGHARASSMENTGUIDANCENOTE.pdf
- Dermatitis
  - "Prevention of Dermatitis in the workplac: A guidance note for the footwear and leather industry" by footwear and leather industries health and safety committee. November, 2008. Available at: https://leatheruk.org/wp-content/uploads/2019/04/DERMATITIS1.pdf
- Knife safety
  - Available at: https://leatheruk.org/wp-content/uploads/2019/04/KNIFE-GUIDANCE.pdf

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INDUSTRIAL DEVELOPMENT ORGANIZATION

Vienna International Centre · P.O. Box 300 · 1400 Vienna · Austria
Tel.: (+43-1) 26026-o · unido@unido.org
www.unido.org