The Federal Environmental Protection Authority

Environmental impact Assessment Guideline for Tanneries

NOT FOR CITATION

This guidelines is still under development and shall be binding after consensus is reached between the Environmental Protection Authority and the Environmental Units of Competent Sectoral Agencies

April 2005
Addis Ababa

Acronyms

AOX-Adsorbable Orgainc Halogen

APE-Alkyl Phenol Ethoxylates

EDDS –Ethylene-diamine-Di-Succinate

EDTA- Ethylene-Diamine –Tetra-Acetate

EIA- Environnemental Impact Assessment

EPA-Environmental Protection Authority

EPE-Environmental Policy of Ethiopia

FAO-Food Agricultural Organization

GDP- Gross Domestic Product

HVLP-High Volume Low Pressure

ISO- International Standards Organization

MGDA-Methyl-Glycine-Di-Acetate

NPE-Nonytphenolethoxylaties

NTA-Nitrilo-Tri-Acetate

BAT-Best Available Techniques

EU-European Union

EA-Environmental Assessment

ETP-Effluent Treatment Plant

Glossary

Aerobic: process involving areas of oxygen.

Anaerobic: process without oxygen.

Asphyxia: is the eventual result of prolonged exposure to an atmosphere containing too little oxygen to sustain life; many such situations involve the displacement of oxygen-containing air with an asphyxiant gas.

Assimilative capacity: is the capacity of the natural environment to absorb waste materials without being affected.

Bating: is the manufacturing step which follows liming and precedes pickling. The purpose of bating is to declime the hides, reduce swelling, peptize fibres, and remove protein degradation products.

Beam house: is that portion of the tannery where the hides are washed, limed, fleshed and unhaired, when necessary, prior to the tanning process.

Biochemical Oxygen Demand (BOD): is a measure of the quantity of oxygen which may be consumed while biologically degrading the organic constituents. The test is carried out over five days and the result expressed as BOD_5.

Chemical Oxygen Demand (COD): is a measure of the quantity of oxygen consumed during chemical oxidation of the constituents of an effluent with potassium dichromate.

Deliming: is the process which removes the lime from hides coming from the beamhouse.

Disposal: is the act of discharging a waste or effluent into the environment.

Environmental standard: is a legal level of a pollutant set by regulation.

Eutrophication: is the nutrient enrichment of natural waterbodies leading to excessive growth of algae and weeds so as to ultimately choke the normal aquatic life processes.

Finishing: is the final set of processing steps performed on a tanned hide. These operations follow the retain-colour-fatliquor processes, and include the many dry processes involved in converting the hide into the final tannery product.

Full chrome: is used to refer to a tannery process. "Full" is sometimes added to the term "chrome tanned" to emphasize that the leather has not been tanned by the semi-chrome or combination chrome processes.

Grain: can mean:

a) the outer, or hair side, of a hide or skin that has been split into layers; or

b) the pattern visible on the outer surface of a hide or skin after the hair or wool has been removed.

Leather: is a general term for hide or skin which still retains its original fibrous structure more or less intact, and which has been treated so as to be non-putrescible even after treatment with water.

Pickling: is the process that follows bating, whereby the skin or hide is immersed in a brine and acid solution to bring it to an acid condition. It prevents precipitation of chromium salts on the hide.

Pollution: is a state that occurs when assimilative capacity of the environment is exceeded, resulting in illness or death of organisms, and undesirable ecological changes.

Retaining: is the process of subjecting a skin, which has been first more or less completely tanned by one process or one kind or blend of tanning materials, to a second tanning process involving similar or, more usually, different tanning materials.

1 Introduction and Background

1.1. The Ethiopian economy is dominated by agriculture, which accounts for about 50% of the total, and 90% of the export and 85% of the total employment. Similarly, the industrial sector is basically dominated by agro industries that contribute about 12% to the GDP. This sector supplies important consumer's goods both to domestic and external markets.

1.2 Leather and leather products are among the main manufacturing export products. Within the manufacturing sectors, the leather industry comes as the leading exporter and accounting for up to 67% of the total manufactured exports. The leather industry is one of the many economic sectors, which the government has given due consideration for the development. The country was able to generate above US$60million.in the year 2004 from its leather industry.

1.3. Ethiopia possesses 12, 15 and 22 percent of the world cattle, sheep and goats population respectively. This showed that, the country is one of the most promising leather producing country in Africa. The report issued by the Ministry of Agriculture and Rural Development indicated that from its cattle resources Ethiopia is able to produce about 2.4 million of hides 8.3 million ship skins, 7 million goat skins annually.

1.4 Currently there are 20 tanneries, which are operational in this sector employing about 6000 workers. The current production capacity based on 15 tanneries is estimated at 6,000,000 to 8,000 000 kilograms of hides and 20, 000, 000 to 25,000,000 skins. The hides are processed up to wet blues, crust and finished leather. The wet blues and crust hides are produced for export and the remaining low quality are finished for local market in the form of garments uppers and linings.

1.5. However, the industrial establishments huge potential of for sustained economic development of the country has been constrained for they were not designed and operated in sustainable manner for some time now. In Ethiopia, the annual volume of liquid waste discharge from the 15 tanneries based on their annual production capacities is estimated to vary between 2,000,000 and 2,500,000 cubic meters.

The major features of Ethiopian Industries thus include among other things that, they:

- are based on obsolete technologies;
- were operating in the absence of appropriate environmental laws and standards as well as low level of environmental awareness,
- did not subject to impact assessment process;
- are not located in well defined industrial zones and concentrated in urban centres along multipurpose rivers and streams;
- Most of tanneries do not have treatment facilities and environmental management systems, as a result simply discharging their wastes into the environment; etc.

1.6. Thus, are causing serious environmental and public health problems in particular in urban centres. It is obvious that the effect will further extend to rural areas as well. Besides, the loss of economic benefits that could have been derived from this sector, cannot survive a growing challenge of environmentally sound competitive business unless appropriate environmental management system is introduced.

1.7. It is therefore essential to change this situation by introducing a system that helps improve the environmental performance and consequently the productivity of our tanneries. The objectives of this guideline are therefore:

(i) Major Objective (Over all objective??)

- To ensure the sustainability of Tanneries development in Ethiopia.

(ii) Specific Objectives

- to provide guidance for undertaking environmental impact assessment of tannery developments,
- guide people on safe production, use, handling of tanneries products; and managing adverse impacts and enhancing positive ones in a manner that add competitive value to tanneries business.
- help enforce Environmental Policy of Ethiopia and applicable environmental legislations and standards,

1.8. This, guidelines is prepared mainly to assist EA practitioners, proponents and, regulators. In addition individual researchers and other interested persons can be made use of it.

2 Legal, Institutional and policy Frameworks

2.1 Legal frame work

2.1.1 The Constitution of the Federal Democratic Republic of Ethiopia

The constitution stipulates that the government shall endeavour to ensure a clean and healthy environment as an objective and recognizes the right to a clean and healthy environment as a basic right of the Ethiopian people (Art 92.1 and 44.1, respectively).

It also stipulates that the design and implementation of development programs and projects should not damage or destroy the environment (Art 92.2).

Tanneries development thus has to be guided by these constitutional orders.

2.1.2 Environmental proclamations

To enforce the aforementioned constitutional provisions and give guidance as to positively influence the design and implementation of various developments, a number of environmental proclamations have been proclaimed. Accordingly, development initiatives in the tanneries sub sector are required to review these and other applicable proclamations and environmental standards so as to abide and take the appropriate measures. Major features of some of them are highlighted in brief below.

- ***Environnemental impact Assessment proclamation (Proclamation No 299/2002)***

  This proclamation requires that major development programme; plans and projects of the private and public sectors are subject to EIA before their approval. This proclamation also provides a legal base to harmonize and integrate environmental economic, cultural and social considerations into the planning and decision making process and there by promotes sustainable development. It also states a number of obligations, including that specifies the contents of the report and factors for the determination of impacts, among other things.

- ***Environnemental Pollution Control Proclamation (No 300/2002)***

  This proclamation provides framework or general rules to control environmental pollution from all kinds of sources. As a general principle the proclamation prohibits pollution of the environment from any source by any person violating the relevant environmental standard. It is guided by the precautionary and the polluters pay principles as well as the use of" sound technology "in controlling pollution.

  In addition any person who wish to engage in tannery development is required to review relevant sectors legislation, namely labour proclamation (No 377/2002), public health proclamation (No 200/2002) water resources proclamation (No, 197/ 2000) etc in conjunction with federal and regional environmental legal requirements, procedures, guidelines, etc.

- **Industrial Pollution Prevention and Control Regulation(Draft)**

  The draft industrial pollution regulation, which is excepted to be issued recently provides general obligations to be observed by industries .It also provides the authority and competent environmental agencies with the issuance condition and suspension or pursuant grants to these regulations

- **Provisional standards for industrial pollution control in Ethiopia (2003)**

  This standard among other things provides guidance on effluent and emission standards. Annex 3) emission and effluents standards for tannery).

2.2 Institutional framework

- **Environmental Protection Organ Establishment No. 295 of 2002**

The cardinal factor that stipulates the issuance of the proclamation is to provide an effective and differentiated but collaborated institutional arrangement that is required to ensure environmental development and protection on sustainable basis.

According to this proclamation the Environmental Protection Authority is established with the objective to formulate policies, strategies, laws and standards, which can foster sustainable development, and spearheads as well as monitor their proper implementation.

The Proclamation has also provided for the establishment of Regional Environmental Agencies and Sectoral Environmental Units.

The main implication regarding institutional issues is to put in place appropriate environmental unit (EU) at industry level. This unit should establish functional linkage with appropriate bodies, oversee the companies environmental performance, adherence to various environmental requirements and work with all stakeholders with spirit of collaboration, and responsibility for environmental good governance.

2.3 Frame Work Policies

- **Environmental Policy of Ethiopia**

The country has approved an environmental policy in 1997. Overall policy goal is to promote sustainable development through the sound management and use of resources. So as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs

Environmental Policy Ethiopia (EPE) contains several pertinent policy elements related to industrial pollution prevention and control. The policy radiates the two basic principles applicable to pollution control, namely, the "polluter pays principle" and the "precautionary principle". It also provides for the

adoption of cost effective environmental standards and the establishment of a system for monitoring compliance of the standards. The policy further stipulates for the promotion of waste minimization processes, including the efficient recycling of materials.

- **Other policies**

The Health (Sep.1993) and Water Resources policies have also required prevention of wastes, proper management, and protection of aquatic bodies from pollution. Effort should be exerted to closely study these and other policies in the course of assessment, design and implementation of tannery development.

3 Tanning Process

3.1 What is Tanning?

Tanning is a process of converting putrescible animal hides and skins to a stable commercial product called *Leather.* Before the tanning process, curd hides and skins arriving at a tannery are trimmed to remove long shanks and unwanted materials for leather making. Then the soaking, liming, fleshing, de-liming, bating degreasing and pickling processes are carried out to create a conductive situation for tanning process.

3.2 Major operations

The production processes in a tannery can be split into four main categories.

3.2.1 Hide and skin storage and beam house operations

Hides are prepared for tanning by cleaning and conditioning and by ensuring the correct moisture. The following processes are typically carried out in the beam house of a tannery.

a) Soaking

The main purpose of soaking is to re-hydrate the hides/ skins ready for subsequent processing, and to remove the salt.

- Soaking may be carried out in pit, paddle or drum (or a combination of these) or re-hydrate the skin and reverse the cure process.
- Dirt, blood and dung of may also be removed.
- Chemicals that can be used for this process include sodium-hypochlorite and /or wetting agent, emulsifiers, surfactants and enzyme preparations.

b) Liming and unhearing

- This stages removes:-
  - ✓ Hair and epidermis, and
  - ✓ further reduces the content of non-collagenous proteins,

A significant proportion of organic pollution is derived from the degraded keratin comprising the hair and epidermis.

Lime blended with sodium Sulphide as traditionally used to loosen wool and hair or dissolved these into pulp. The duration of the process may vary from 18 hours (drums) 7 days (pit). This process is responsible for the major part of COD Load form tannery. Chemicals include calcium hydroxide (2-10%), (lime), sodium sulphide (1-4%), sodium and sulphydriate, caustic soda, Dimenthylamine sulphate is too toxic to be recommended.

c) Fleshing and/or splitting

The flesh side of hides /skins still can have excess fat, flesh and connective tissue attached, which must be removed prior to further processing .The hides/skins are individually fed through a fleshing machine

consisting of a set of revolving cylinders designated to cut and scrape away the unwanted material .As the fleshed hides exit the rear of the machine, some of the rough edges are cut off, producing further waste in the form limed trimmings. (See UNEP-guide Page 17)

3.2.2 Tan yard process

Typically, the following processes are carried out in the Tanyard:-

a) Deliming and Bating

The lime in the pelts is no longer required and must be removed to avoid interference with subsequent tanning and stage, which occurs in acide solution such process is called Deliming. Deliming using ammonium salts carries out-reduction in the pH of the pelts first. Bathing is performed in the same delime float and uses enzymes to break down the unwanted protein.

b) Pickling

After bating, pelts are pre-treated by “pickling “in salt and Sulphuric acid to prevent precipitation of chrome salts prior to their addition.

c) Tanning

Tanning processes mainly used for hides or sheep/goat skins include:

- ***Chrome Tanning***

The majority of leathers today are chrome tanned in drums from 4 to 24 hours.

chemicals include: 8-12% pelt weight of chrome tanning salt, and as little as 5-6% for low chrome processes (basic tri-valiant chromium sulphate hydrated complexes) (22-25% Cr_2O_3) I.0% sodium bicarbonate (basifying agent to adjust pH), o.I-o.5% masking agent-sodium formate, phthalate or salts of dicarboxylic acids, o.I fungicide if product is to be stored/transported in wet blue condition.

- ***Vegetable Tanning***

While vegetable tannage has been eclipsed by chromium as the major tanning process, it is still employed for sole saddlery and some specialty leathers. It may also be used as part of a combination process. duration of the process is from I day (drum) to 6 weeks (pit).

Substances used are typically 15-30% of commercial tanning extract (bark or wood of tree, aqueously extracted), often sulphitated, then spray dried or concentrated.

3.2.3 Post-tanning Wet Work

This involves further processing of the stabilized collagen network and may comprise a further tannage (e.g. with combinations of chrome, vegetable, glutaraldehyde or syntan agent) when special characteristics such as perspiration resistance are required. Conditioning softening, dyeing or bleaching may also be carried out.

Few solid wastes are produced, and the aqueous effluents do not generally contribute significantly to the overall load of pollutants from the tannery.

3.2.4 Drying and Finishing

The leathers are sammied to remove moisture, and then dried. The final finishing process includes mechanical treatment of grain and flesh, followed by application of surface finish.

The surface coatings consist of dyes or pigments dispersed in a binder, typically casein or an acrylic or polyurethane polymer, and are applied by padding, spraying or rolling. Nitrocellulose lacquer or urethane lacquer may be applied with organic solvents as top coats. Non-solvent based finishing process are rapidly increasing in use, either through the substitution of aqueous solvents or elimination use of Benzedine dyes, if still occur rings, should be discontinued due to the toxicity of these substances. .

The major environmental problem in finishing is undoubtedly air emission of solvents. Some aqueous waters may be generated. Solid wastes may arise from trimmings and buffing dust.

Finishing

Wetblue:

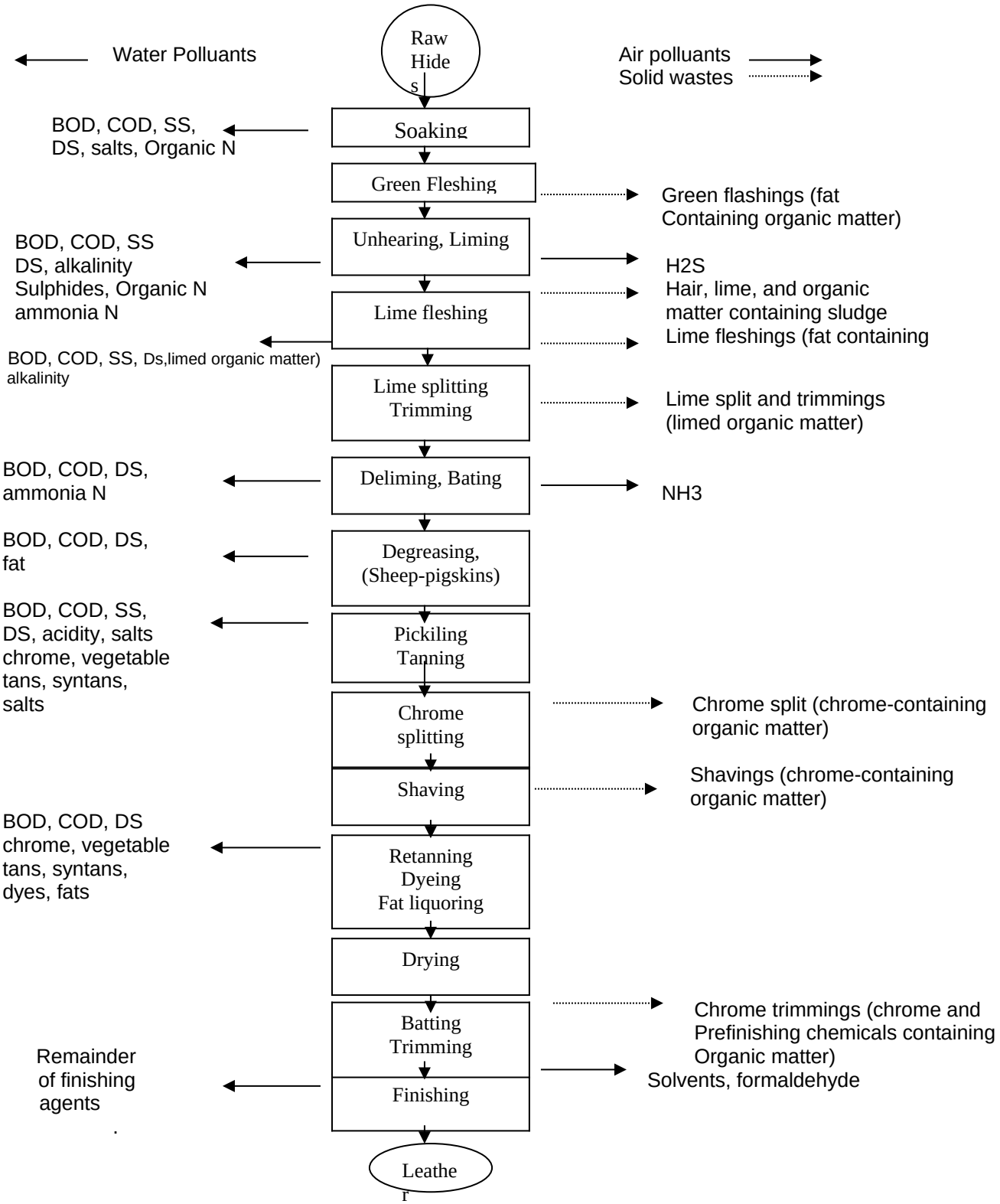
Chromium tanned hides are often retanned - during which process the desirable properties of more than one tanning agent are combined and treated with dye and fat to obtain the proper filling, smoothness and colour. Before actual drying is allowed to take place, the surplus water is removed to make the hides suitable for splitting and shaving. Splitting and shaving is done to obtain the desired thickness of the hide. The most common way of drying is vacuum drying. Cooling water used in this process is usually circulated and is not contaminated.

Crust:

The crust that results after retanning and drying, is subjected to a number of finishing operations. The purpose of these operations is to make the hide softer and to mask small mistakes. The hide is treated with an organic solvent or water based dye and varnish. The finished end product has between 66 and 85 weight percent of dry matter.

A more detailed description of the tanning process is found in the publication “Animal by-product processing” by Ockerman and Hansen, 1988.

Figure 1 schematic of tanning process, indicating waste stream.---



3.3 Impacts of Tanning Industry on the Environment

There are some positive and negative impacts from the tanning industry.

Positive impact:-

- ✓ Generation of employment opportunity:
- ✓ Economic gain through export market and
- ✓ Local market opportunity from the sell of hides and skins

Negative impact:-

The main sources off negative impacts are chemicals used for tanning processes**.**The tanning industry gives rise to two types of hazard involving chemicals. These are, firstly, those concerning particular chemicals used in the various tanning processes, and secondly, chemical substances produced as by-products by the chemical reactions occurring when a hide undergoes the tanning process.

- ✓ The first type of hazard includes the vast majority of chemicals to be found in tanning. It is possible to divide these materials into groups based either on the particular degree of hazard they present, or on their chemical nature (e.g. acids, alkalis, etc.).
- ✓ A chemical hazard to workers e.g hydrogen supplied

In terms of toxicity and potential to cause a hazard it is a relatively straight forward task to divide a typical list of chemicals used in tanning into three groups representing major, moderate, and minor potential hazards. **See annex 1**

Also tanning produces hazardous chemical by-products which can be categorized into three general areas**. See annex 2**

Tanning and its associated operation while using the different chemicals pointed out in the previous paragraphs can be source of considerable negative environmental impacts. The impacts include-:

- ✓ Air , water and land pollution,
- ✓ Human health and occupational safety,
- ✓ Loss of economic benefits
- ✓ Damages the ecological processes

3.3.1 Impact on Air, Water and Land

Tanning generated wastes can cause environmental pollution in different environmental mediums. The following table presents some pollutants that would cause negative impacts on air, water and land.

Table 1 POLLUTANTS AND ITS NEGATIVE EFFECT

Pollutants	Symbol	Main Negative Effects	Impact medium
Ammonia	NH_3	Pungent odour and adverse effects on aquatic life like fish	Water& Air
Total Kjeldahl Nitrogen	TKN	Causes excessive plant growth and formulation of algae cause eutrophication and reduction of oxygen	Water
Trivalent Chrome	CR III	Toxic to human, aquatic life and crops At high temperature oxidizes to chrome VI, which is highly toxic	Water & Land
Chloride	Cl	Harmful to plants and agriculture, corrodes metal and piping in civil construction	Water & Land
Biochemical Oxygen Demand (Winkler)	BOD_5	BODs indicates the quantity of oxygen may be consumed while biologically degrading the organic constitute.	Water
Chemical Oxygen demand (Dichromate)	COD	CODs- is measure of oxygen consumed during chemical oxidation of the constituents of effluents.	Water
Total Dissolved Solids, Sulphates & Chlorides	TDS CL- SO_4	Harmful to plants and civil structures Unfit for human, industrial and agricultural use High salinity cause osmotic pressure (reduced water availability and retarded plant growth High concentrations of sodium ions in irrigation water affect the soil structure and properties by causing dispersion of clay	Water & Land
Oil & Grease	O&G	Forms surface films on water and shoreline deposits which lead to environmental degradation and interfere with biological processes	Water & Land
PH	PH	Acidic conditions cause concreter and metal corrosion and are toxic to aquatic life High alkaline conditions are toxic	Water & Land
Suspended Solids	Suspended Solids	Can form deposits and create anaerobic condition (odour) which pose a danger to aquatic life	Water
Sulphide	S^{2-}	Odour nuisance at low levels and fatal in high concentrations Poisonous to aquatic life, depletes dissolved oxygen damages sewerage systems	Water & Air
Sulphate	SO_4	May cause corrosion of concrete and piping and limits the use of the water bodies for both human and agriculture In anaerobic conditions, can be converted sulphides.	Water & Land

Note: One tone of raw hide converted into about 200 kgs of finished leather the remaining 800 kgs is waste or pollution.

3.3.2 Impact on human health and occupational safety due to exposure to hazardous chemical

- The impact of exposure to hazardous material and waste, which emanates from tanning process include: such as:
  - ✓ dizziness,
  - ✓ headache,
  - ✓ Irritation eyes, skins
  - ✓ Allergic
  - ✓ Collapse due to lack of oxygen
  - ✓ Bronchitis
  - ✓ In some rare case even cause death

4 Hazards related to tannery workers

The leather industry and in particular tanning processes are notorious for their deleterious environmental impacts and occupational health hazards. Working at tanneries involve a series of hazardous processes is presented in Table-2.

Table-2 Hazards related to tannery workers

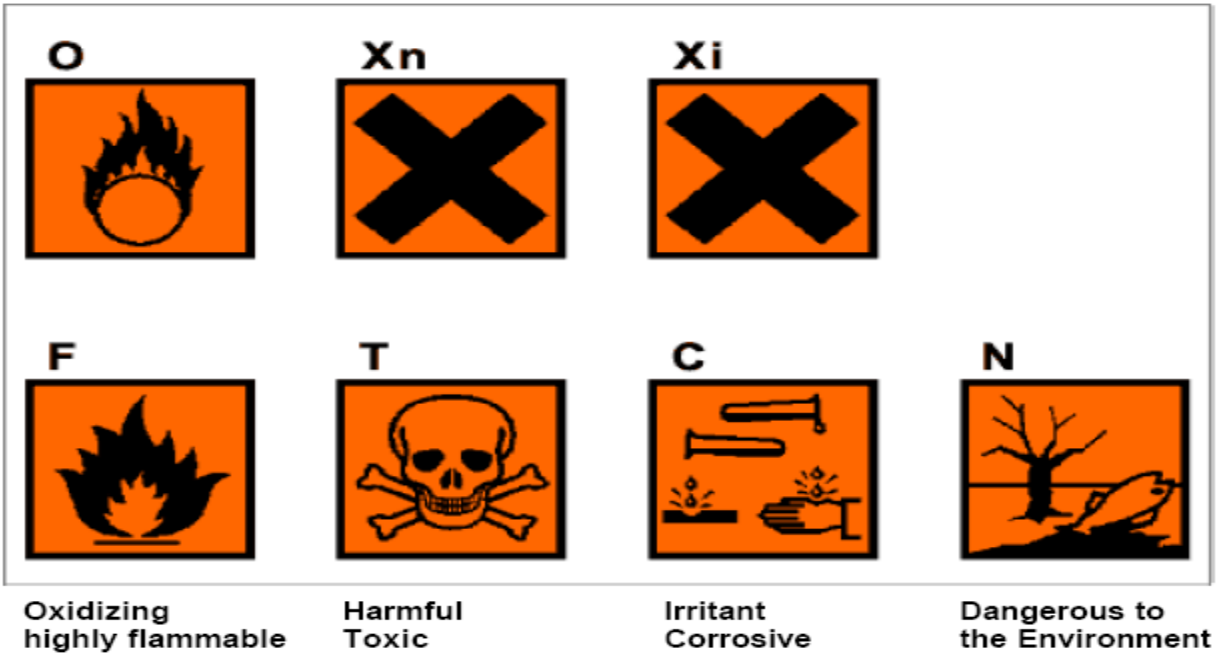
Physical Hazards	Exposure to high noise levels from mechanical equipment.
	Callosities on hands caused by continuous work with hand tools
	Eye stain due to poor illumination in the tannery.
Chemical Hazards	Skin rashes and dermatoses as a result of exposure to cleaners, solvents, disinfectants, pesticides, leather-processing chemicals etc.
	Allergies-contact and systemic-caused by many of the chemicals used in tanneries.
Biological hazards	Raw hides and skins may be contaminated with a variety of bacteria, molds, yeasts, etc and various diseases (e.g., anthrax, leptospirosis, tetanus, Q-fever, brucellosis, etc.) also the large quantities of dust produced in buffing operations would normally be contaminated with disease-bearing microorganisms, etc.
Ergonomic, psychosocial and organizational factors	Acute musculoskeletal injuries caused by physical overexertion and awkward posture while moving heavy or bulky loads, in particular bundles of hides, skins and leather.
	Low back pain due to prolonged working in a standing or semi-bending posture
	Heat stress, in particular when working on warm days in premises lacking good ventilation or air conditioning.
Accident hazards	Slippery floors, while moving heavy loads such as containers of chemicals, bundles or hides, skin, leather, etc.

	Electric shocks caused by contact with defective electric machinery
	Blows and crushing injuries caused by rotating or moving parts of machinery
	Acute poising and/or chemical burns by inhalation, ingestion or skin contact with constituents of tanning process liquors, or poisonous gases released during the tanning process (e.g., hydrogen sulfide)
	Burns caused by contact with hot surfaces or splashed of hot solutions
	Cuts and stabs caused by manual or mechanized working tools
	Eye injuries caused by flying particles from rotary buffing machines
	Asphyxiation or poising in confined spaces, in particular during the cleaning of vats or tanning baths

The employer or the tannery manager is responsible for his workers' safety. The employer has the obligation to communicate potential hazard information to the workers in such a way that they can understand and are able to avoid the hazards in question. The employer also has the obligation to provide safety equipments to works so that they can be protected from the likely impact in the tanning process.

It is necessary that all workers in the tanning operation have adequate awareness and knowledge about the different kinds of chemicals, their hazardous status etc. One-way of providing a safety and precautionary measures is to use the most common labels for chemicals in a tannery. These are:

Fig. 2 Categories of Dangerous Chemicals



The classification is normally presented in the form of an abbreviation representing the category of danger together with the appropriate risk phrase or phrases. However, in some cases (i.e. substances classified as flammable, sensitizing and some substances classified as dangerous for the environment) the risk phrase alone is used. The abbreviation for each of the categories of danger is shown below:
Explosive:

- Oxidizing: O
- Extremely flammable: F+
- Highly flammable: F
- Flammable: R 10 (without symbol)
- Very toxic: T+
- Toxic: T
- Harmful: Xn
- Corrosive: C
- Irritant: Xi
- Dangerous for the Environment: N

➢ Prevention of chemical hazards to workers

To handle these hazardous chemicals it is necessary to have / to follow the following procedures:-

- ➢ Material safety data sheets
- ➢ Labels on chemicals containers that show chemical danger
- ➢ Store chemical safely

Material Safety Data Sheets (MSDS)
MSDS are designed to communicate hazard information to the user and public and avoiding any risk to the worker and the environment. EU Commission Directive 93/112/EC of 10 December 1993 defines and lays down detailed arrangements for the system of specific information relating to dangerous substances. The MSDS is divided into 16 sections as follows:

- ✓ Chemical product & company information
- ✓ Composition/information on ingredients
- ✓ Hazards identification
- ✓ First aid measures

- ✓ Fire fighting measures
- ✓ Accidental release measures
- ✓ Handling and storage
- ✓ Exposure controls/personal protection
- ✓ Physical and chemical properties
- ✓ Stability and reactivity
- ✓ Toxicological information
- ✓ Ecological information
- ✓ Disposal considerations
- ✓ Transport information
- ✓ Regulatory information
- ✓ Other information like transport requirements

The information in the MSDS is the summary of facts from many sources

Labelling procedure

- ***Labels should specifically indicates:***
  - ✓ Trade or brand Name,
  - ✓ Ingredient statement,
  - ✓ Common or chemical name,
  - ✓ Type of formulation,
  - ✓ Net content of the package,
  - ✓ Name and address of manufacturer, distributor,
  - ✓ Registration or license number,
  - ✓ Warning or signal words,
  - ✓ Hazards to humans and domestic animals,
  - ✓ Environmental hazards,
  - ✓ Physical and chemical hazards,
  - ✓ Statement of practical first aid treatment,
  - ✓ Re-entry statement,
  - ✓ Storage and disposal directions,
  - ✓ Warranty statement,

Note must be attached to or printed on the side of the container in both English and the official local languages

Store chemical safely

- ✓ Ensure proper lay out of chemical store,
- ✓ Fire extinguishers should be placed outside store,
- ✓ Smoking and use of open fire is prohibited,
- ✓ Shower should be available in or near chemical store,

The following basic rules and principles should be used to store chemical safely

Storage requirements

- ✓ All chemical storage areas must be securely fenced to prevent unauthorized access,
- ✓ All doors and gates should be efficiently locked or padlocked,
- ✓ In case of fire, the address of the person(s) holding the keys should be fixed to the gate or door, etc.

- ***The building:***
  - ✓ Should be constructed of fire-resistant materials such as concrete block or metal,
  - ✓ Should be well ventilated preferably by natural wind flow to minimize temperature increases and keep fumes from accumulating,
  - ✓ Should be surrounded by a ditch to keep any liquid spills from draining away,
  - ✓ Should be constructed to allow tight security. (Locking doors, barred windows),
  - ✓ Should be well lit by sunlight or electric lights,
  - ✓ Have a water supply for spill decontamination, etc.
- ***Managing chemical stores:***
  - ✓ **"**First in first out" procedure should be followed to minimize the deterioration of chemicals and containers,
  - ✓ Different types of chemicals should be stored separately to prevent possible cross-contamination.,
  - ✓ No food, drink or animal feed should be stored in chemical store,
  - ✓ Protective clothing should not be stored in the same room with chemicals
  - ✓ All chemicals should be labelled, etc.

Health and Safety Measures

After understanding the label directions, make certain you have taken the following precautions:

- ✓ Have detergent or soap and an adequate supply of water available,
- ✓ Know the early symptoms of poisoning for the chemicals you are using,
- ✓ Know the first aid procedures and make certain that materials and supplies are available,
- ✓ Be certain that materials are available to handle spills,
- ✓ Make certain that all equipment is functioning properly,
- ✓ Do not work alone; be sure help is available if you get into trouble,
- ✓ Have all the recommended protective clothing and equipment.
- ✓ Double-check that the respirator fits properly and has the correct canister cartridge,
- ✓ Never eat, drink, smoke, or go the bathroom while working with chemicals without first washing your hands,
- ✓ ***Improve working environment***
  - ▪ During the production of leather the process on machines and the chemicals reactions involve emission of heat, dust, gases vapors, noise

vibration to which workers are exposed daily. It is therefore necessary to:

- ✓ Control temperature and humidity through natural and artificial ventilation.
- ✓ Insulate against heat and cold
- ✓ Ensure quality of light
- ✓ Reduces the overall noise level

Personal protective equipment

- ➢ The most commonly needed personal protective equipment in tanneries and effluent treatment plants are ;-
  - ✓ Protective clothing (gloves, safety shoes/boots ,aprons)
  - ✓ Hearing protection
  - ✓ Protective goggles and shields and
  - ✓ Respirators

Disposal

Products that cannot be used for their intended purpose (s) or permitted alternatives, and that cannot be reformulated to become useable again, should be considered for disposal.

The basic procedure for the disposal are the following;-

- ✓ Remove empty chemical containers from the store and work areas.
- ✓ Don't pour or mix different waste chemicals in the same waste container or barrel
- ✓ Disposal should be made based on study, in approved place and acceptable conditions.

5 THE NEED FOR POLLUTION CONTROL

Defining Pollution Prevention

Pollution prevention (P2) is the reduction or elimination of wastes and pollutants at their sources. For all the pollution that is avoided in the first place, there is that much less pollution to manage, treats, disposes of, or cleanup. P2 can encompass activities such as:

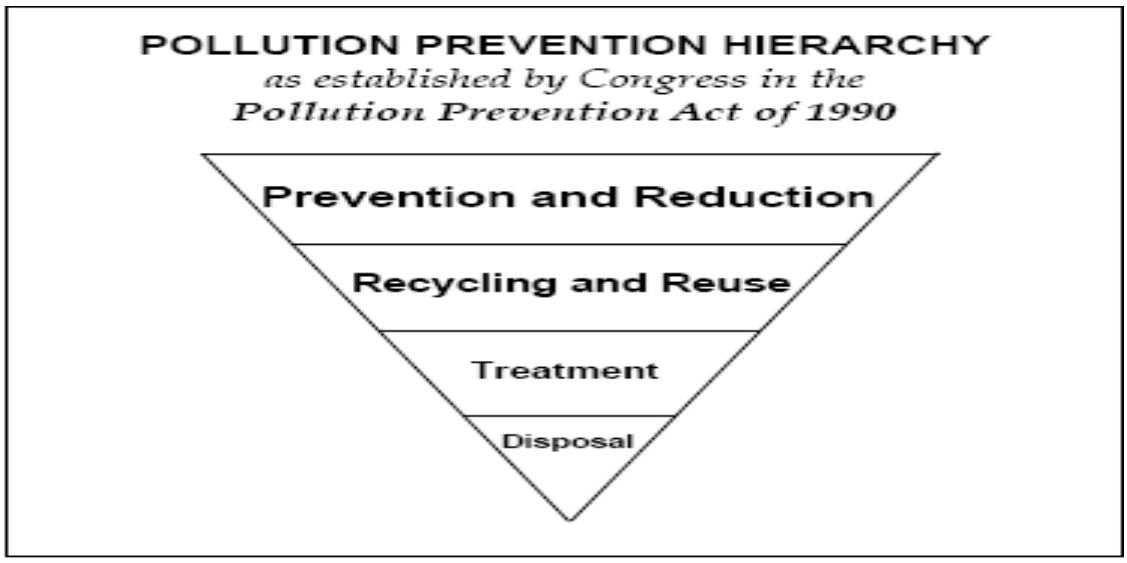
- ✓ redesigning products to cause less waste or pollution during manufacture, use, or disposal
- ✓ altering production processes to minimize the use of toxic chemicals
- ✓ implementing better housekeeping practices to minimize leaks and fugitive releases from manufacturing processes taking steps to reduce energy consumption

5.1 Basic waste management hierarchy

In order to minimize the negative impacts emanates from tanning industry ,fundamental pollution control practices have to be implemented .The generally accepted waste management hierarchy include waste:-

- ✓ Prevention and Reduction
- ✓ Recycling and Reuse
- ✓ Treatment and
- ✓ Disposal

Fig 3- Pollution Prevention HIERARCHY



One of the main principles mentioned in our Environmental policy is pollution prevention.
The main reasons for exercising pollution prevention are to:

- Protect the environment;
- Safeguard human health;
- Create sustainable development and economic benefits of the tanning industry.
- Normalize the opposition of peoples who are living nearby against the released waste.
- To produce ecologically sounding product and to get acceptance in the market.
- For the ease of certification of environmental management system.

✓ ***Waste reduction at source***

Example

- Timely repair/sealing of water and steam leakages from pipes, valves, flanges, etc
  - -keep taps close when not in use
  - -control of leakages and spillages in the handling and preparation of chemicals and additives
  - -Avoid Spillage
  - -segregate the line of alkaline from acidic
  - -Reduce material handling losses,
  - -proper maintenance and operations of equipment
  - -By changing process

- **Recycling, Reuse, Recovery and uses of unnecessary discharges water stream**
  - ✓ **Recovery and reuse onsite**

    Example:
    - Recycle back used water.
    - Lime sulphide recovery from waste sulphide liquor.
    - Chrome recovery from waste tanning liquor.
    - condensate recovery and reuse in boiler houses

  - ✓ ***Creation useful by products***

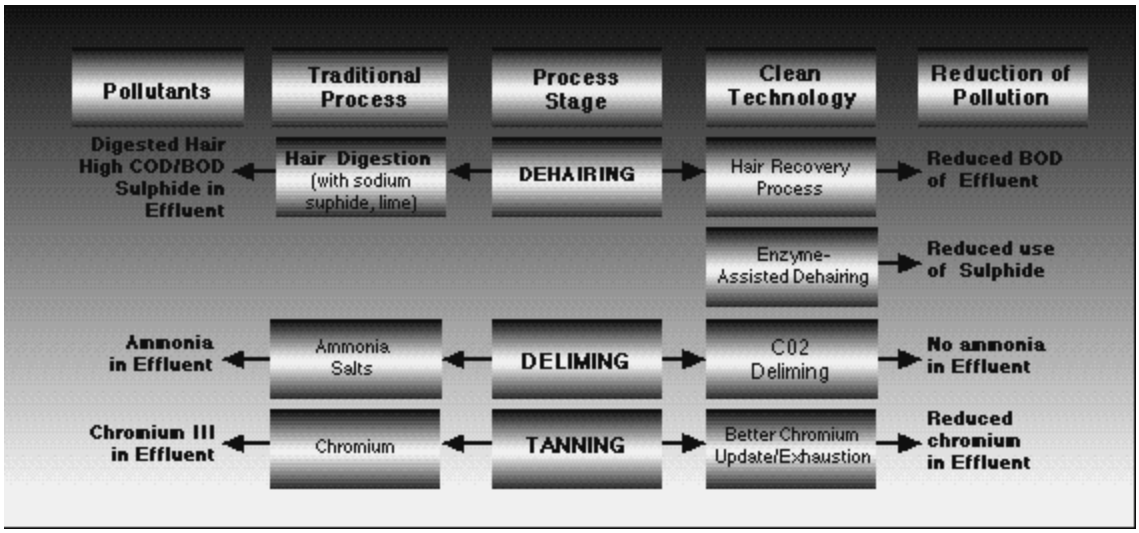
    Example:
    - manufacturing of glue from lime trimmings
    - Manufacturing of leather board from shaving dusts.
    - Conversion of splits to high valuable product etc.

- ✓ ***By changing in put raw material***

  Example:
  - o Using fresh hides and skin than salted hides and skins to avoid salt for preservations etc.
  - o use non-toxic materials
  - o equipment modifications
  - o install efficient equipment
- ✓ ***Technology change***

  Example:
  - o CO_2 deliming
  - o using short float for the reduction of water consumption
  - o improve chemical uptake by the leather
  - o use alternative technology for waste minimization
  - o avoidance toxic and Hazardous Chemicals
  - o Using of water base degreaser, liquor etc.

Fig 4. Pollutant and their management flow chart



- ✓ ***By product modification***

  Example
  - o production of chrome free leather
  - o produce ecologically sustainable leather

In addition to those mentioned above the following are to be considered. See annex 3

6 Treatment

GENERAL PRINCIPLES

Some basic data must be investigated and defined for designing and ETP.

- o **Tannery production and capacity:**

  - Raw material, processing system (with particular attention to the unhearing and tanning phases), and final product.
  - Quantity of the processed material (present and future) as kg or number of hides or skins processed pre day.
    - Eventual (possible) internal recycles or recovery.

- Water consumption.

- **Factory location:**

  - Industrial rural or residential zone.
  - Area available for the ETP.

- **Discharge standards**

  - Limits to discharge, or (in absence) type of recipient and its characteristics (e.g., surface waters or sewer). In the future the current limits could be subject to change for magnitude or new parameters under control. Therefore the plant must be flexible and expandable for complying with new stricter impositions. To respect this condition is not always easy, but, as a principle, extra space for future extension should be considered in the ETP layout.

- **Some common errors done in the project data collection and ETP design are:-**

  - Incorrect estimate of the water consumption

The water consumption expressed in L/kg of raw material (green or wet salted weight) should not differ too much from the following values:

Raw material	**water consumption (*)**
Hides (chrome tanning)	25-40
Hides(vegetable tanning)	20-30
Skins (mixed tanning)	30-60
Skins (fur)	50-100

- **Criteria for selecting the effluent treatment**

The tannery effluents are characterized by:-

- Intermittent flow,
- Wide fluctuation in pH (from 3 to 12)
- Big variations in the type and load of pollution (both organic and inorganic).

For achieving the common standards for the discharge into surface waters tannery effluents must undergo a two steps treatment: primary and secondary. By the term “primary” those physical –chemical treatment are meant which precede the biological (secondary) treatment. Only in case of discharge into municipal sewer sometimes the installation of the primary treatment alone may be sufficient.

- **The primary treatment has the following main aims:**

  - Eliminate the coarse materials as well as abrasives (sand) that can cause clogging or damage to the pipes and pumps;
  - Transform the tannery wastes (which are extremely variable in quantity and quality) into a uniform effluent that can be treated in a constant /uniform manner;
  - Neutralize too high or low pH values, and eliminate potentially toxic substances (especially sulphide) that may affect the proper functioning of the biological treatment;
  - Reduce the organic load (BOD and COD) and eliminate most of the inorganic suspended solids in order to reduce the treatment costs and simplify the biological process.

- **Treatment options**

The choice therefore is on a technical nature but costs are also involved: on the one hand the primary treatment must guarantee an effluent suitable for secondary one, on the other the same secondary treatment may be designed for greater or lesser efficiency. High efficient primary treatments greatly increase the volume of generated sludge and associated disposal costs. For this reason the present trend is to simplify to the maximum the primary phase, confiding in the secondary one for the main treatment of the tannery effluent.

In some cases a totally biological process could be designed, possibly proceeded by chrome segregation and precipitation, and sulphides oxidation. In general the implementation of a two-phases [1]ETP (physical-chemical and biological), allowing adaptation of the primary to the secondary, and vice-versa, is preferable.

- **Other factors are important for selecting the most appropriate treatment method.**

  - Area availability that allows extended treatment or forces to more compact systems.
  - Factory location. Because of the risk of bad-smell and unpleasant sight, certain systems (e.g., ponding/ lagooning of water or sludge, sludge drying beds, etc.) are viable only in areas located far from residential zones.
  - The local climate plays an important role in the choice of treatment. Temperature affects the efficiency and performances of the biological process and rain fall the performance and feasibility of natural drying system for sludge, e.g., sand-bed
  - The tannery production, type of raw material (haired hide, wet-blue or crust), processing method (mainly chrome or vegetable tanning, and pulp or save hair removal) influence the type of the necessary treatment. The same effluent volume may affect the type of treatment: the scale of the tannery could recommend more sophisticated and mechanized solution or justify simpler and manual alternative

- **The characteristics of the final recipient body:**

  - Rivers and other surface waters usually require the highest quality discharge standards, but sometimes the high dilution capacity of the recipient could permit more tolerant standards. Similar standards are usually required for rivers and lakes, but because of the eutrophuy risk in the second case stricter standards are imposed for phosphorus and Nitrogen.
  - Municipal sewer: the discharge into sewers combined to a treatment plant must respect the limits imposed by the local municipality. The limits refer to some parameters: pH, coarse and settle able solid, sulphide, and trivalent Chrome. Sometimes also BOD and COD are indicated, but usually these parameters only affect the tariff charged by the municipality for the treatment service.
    Draft effluent and emission limits value for discharge to water from tannery See **annex 5**

6.1 ALTERNATIVE TECHNIQUES

In order to minimize the effect of pollution from tanning process different alternative techniques could be used. These include measures such as, Cleaner Production (CP), Best Available Techniques (BAT) and Environmental Audit etc.

➢ Cleaner Production Definition

"Cleaner production is the continuous improvement of industrial processes, products and services to reduce the use of natural resources, to prevent-at the source-the pollution of air, water and land and to reduce waste generation-at the source – in order to minimize risks to human population and the environment" (UNEP 1994). (See Annex 3&4)

[1]

Best Available Techniques

Best Available Techniques(BAT)- is defined as "the most effective and advanced stage in the development activities and their methods of operation which indicates the practical suitability of particular techniques for providing in principle the basis for emission limit value designed to ,prevent and ,where it is not practicable ,generally reduce emissions and the impact on the environment as whole."(See annexes 6-9)

Environmental audit

Environmental management system audit –a systematic and documented verification process objectively obtaining and evaluating evidence to determine weather an organization's environmental management system conforms to the environment management system audit criteria set by the organization, and for communication of the result of this process to management. For environmental management system requirement see annex 10

ANNEXES

Annex 1

- **CHEMICALS USED IN TANNING PROCESSES(Annex 1)**

  - **High Potential Hazard Group**

Under this heading the following chemicals can be listed:

- ✓ acetic acid hydrogen peroxide
- ✓ ammonia oxalic acid
- ✓ (slaked lime, lime) sodium chlorite
- ✓ calcium hydroxide sodium hydroxide (caustic soda)
- ✓ formaldehyde sulphuric acid
- ✓ formic acid sulphides and hydrosulphides
- ✓ glutaraldehyde hydrochloric acid (e.g. sodium sulphide, sodium
- ✓ (muriatic acid, spirits of salts) hydrosulphide, calcium hydrosulphide)

  - **Moderate Potential Hazard Group**

The chemicals listed under this heading include:

- ✓ aluminium sulphate
- ✓ amyl acetate (as lacquer constituents)
- ✓ amyl alcohol (as lacquer constituents)
- ✓ benzyl alcohol (lacquer solvent) carbon black
- ✓ chromium salts (trivalent) enzymes
- ✓ isopropyl alcohol perchloroethylene toluene
- ✓ white spirit

  - **Low Potential Hazard Group**

A third hazard category includes those or negligible hazards:

- ✓ alums oils
- ✓ acetone paraffin
- ✓ albumen pigment dispersions
- ✓ ammonium chloride sequestering agents
- ✓ ammonium sulphate silicones
- ✓ borax, boric acid sodium acetate
- ✓ casein sodium bicarbonate
- ✓ calcium chloride sodium citrate
- ✓ castor oil china clay sodium carbonate
- ✓ ethanol (ethyl alcohol) sodium formate
- ✓ fat liquors sodium metabisulphite
- ✓ fats sodium nitrite
- ✓ ferrous acetate sodium phthalate
- ✓ ferrous sulphate sodium sulphite
- ✓ gelatine sodium thiosulphate
- ✓ glues (for some glues, solvent synthetic tannins
- ✓ may contribute to toxicity) tragacanth
- ✓ lactic acid titanium salts
- ✓ lanoline vegetable tanning extracts
- ✓ lecithin waxes
- ✓ wetting agents

  - **Miscellaneous Hazards Group**

Because of wide variations in potential toxic hazard it is not possible to categorise dyestuffs or fungicides into any one hazard group.

✓ **Dyestuffs**

These may vary widely in toxicity from potentially quite serious if inhaled or ingested, to non-toxic.

✓ **Fungicides**

Tanneries use several biologically active chemicals to control the growth of various forms of fungal life on the leather (e.g. “TriNap 40”). These should all be handled with caution to prevent contact with the skin, inhalation or ingestion by workers

Annex 2

- **HAZARDS RESULTING FROM BY-PRODUCTS OF TANNING PROCESSES**

  - ✓ ***Gaseous emissions within the tannery***- during processing; the most important in-plant pollutant is hydrogen sulphide, and ammonia may also present problems.
  - ✓ ***Effluent outside the Tannery***- The other two areas are those of liquid and solid effluent which are removed by normal drainage systems, and the release of gaseous wastes into the atmosphere. Each of these results in a problem outside the confines of the factory itself and in terms of legislative responsibility the onus rests with agencies other than the Department of Labour, which under the Factories Act can deal directly only with in-plant problems. The Department of Health has the legislative responsibility for dealing with solid and gaseous environmental pollutants such as those arising from tanning processes, while the various Regional Water Boards have authority over liquid waste discharge.
  - ✓ ***Generation of Hydrogen Sulphide in Effluent Streams***
    A major hazard which could arise from improperly handled tanning effluent is the generation of highly toxic hydrogen sulphide gas. If acidic liquid effluent is not neutralised before being admitted into the general effluent sewer then its reaction with added sulphide solutions will generate hydrogen sulphide Effluent treatment and disposal systems must be designed so as to ensure neutralisation of acids before disposal to the general sewer

Annex 3:

Cleaner Production (CP) issues through Tanning Process

Cleaner Production Issues to Consider:

- ✓ Process fresh hides or skins to reduce the quantity of salt in wastewater, where feasible.
- ✓ Reduce the quantities of salt used for preservation. When salted skins are used as raw material, preterit the skins with salt elimination methods.
- ✓ Use salt or chilling methods to preserve hides, instead of persistent insecticides and fungicides.
- ✓ When antiseptics or biocides are necessary, avoid toxic and less degradable ones, especially those containing arsenic, mercury, lindane, or pentachlorophenol or other chlorinated substances.
- ✓ Flesh green hides instead of limed hides.
- ✓ Use sulphide and lime as a 20–50% solution to reduce sulphide levels in wastewater.
- ✓ Split limed hides to reduce the amount of chrome needed for tanning.
- ✓ Consider the use of carbon dioxide in deliming to reduce ammonia in wastewater.
- ✓ Use only trivalent chrome when required for tanning.
- ✓ Inject tanning solution in the skin using high-pressure nozzles; recover chrome from chrome-containing wastewaters, which should be kept segregated from other wastewaters.
- ✓ Recycle chrome after precipitation and acidification. Improve fixation of chrome by addition of dicarboxylic acids.
- ✓ Recycle spent chrome liquor to the tanning process or to the pickling vat.

- ✓ Examine alternatives to chrome in tanning, such as titanium, aluminium, iron, zirconium, and vegetable tanning agents.
- ✓ Use nonorganic solvents for dyeing and finishing.
- ✓ Recover hair by using hair-saving methods to reduce pollution loads. For example, avoid dissolving hair in chemicals by making a proper choice of chemicals and using screens to remove hair from wastewater.
- ✓ Use photocell-assisted paint-spraying techniques to avoid over-spraying.
- ✓ Precondition hides before vegetable tanning. Through good management, water use can be reduced by 30–50%, to 25 litres per kilograms (l/kg) of raw material. Recommendations for reducing water consumption include the following:
- ✓ Monitor and control process waters; reductions of up to 50% can be achieved.
- ✓ Use batch washing instead of continuous washing, for reductions of up to 50%.
- ✓ Use low-float methods (for example, use 40–80% floats). Recycle liming, pickling, and tanning floats. Recycle sulphide in spent liming liquor after screening to reduce sulphide losses (by, say, 20–50%) and lime loss (by about 40–60%).
- ✓ Use drums instead of pits for immersion of hides.
- ✓ Reuse wastewaters for washing—for example, by recycling lime wash water to the soaking stage. Reuse treated wastewaters in the process to the extent feasible (for example, in soaking and pickling).

Waste reduction measures should include the following:

- ✓ Recover hide trimmings for use in the manufacture of glue, gelatin, and similar products.
- ✓ Recover grease for rendering. Use aqueous degreasing methods.
- ✓ Recycle wastes to the extent feasible in the manufacture of fertilizer, animal feed, and tallow, provided the quality of these products is not compromised.
- ✓ Use tanned shavings in leather board manufacture.
- ✓ Control odour problems by good housekeeping methods such as minimal storage of flesh trimmings and organic material.
- ✓ Recover energy from the drying process to heat process water

Annex 4: Tanning Sector (case study on tannery CP ELICO Awash Tannery November 12, 2002

1) ***Reduction of painting Chemical Consumption***

Problem- High chemical consumption
»168g/lit Na_2S
»52g/lit NaHS
- High BOD level.
- Low efficiency of sulphide oxidation in effluent treatment plant.
Action Taken
- Concentration of chemical reduced.
» Na_2S from 168g/lit to 135g/lit.
» NaHS from 52g /lit to 40g/lit.
Result of the Change
No change in quality
clean sheepskins, no fine hair & no rough skin

Process 1.8 sheepskins (year).			
	Previous	Current annual consumption kg/annum	difference in kg/annum
Na_2S	100,800	81,000	19,800
NaHS	31,200	24,000	7,200
Total	132,000	105,000	27,000

Financial Benefit

Total saving of Birr 201,423.96 Birr, as
Na2S- Birr 143,324.28
NaHS- Birr 58,099.68

Environmental Benefit

- The discharge load has reduced by 27 ton per annum, in terms of total suspended solids (TSS) and alkalinity reduced the volume of water to the effluent treatment plant. More over the new revised process has shown marked improvement with respect to quality

2) ***Reduction of Lime Consumption in Hide Liming Process***

Problem:
- Drawn grain problem.
- Excess chemical consumption as

Undissolved lime in the drum.
- Long processing time.

Action Taken

Soaking time for dry hide reduced from 48 hours to 24 hrs.

Has been reduced.

From 7% to 4% for dry hide.
From 3% to 2% for wet salted hide.

From 2.75% to 2% for fresh hide.

Result of the change:

Several tests and assessment on quality show much better result on drawn grain, loose grain & flatness.
Touch of the pelt after soaking,
Splitting was much better

	Total soaked weight in kg/annum,	Previously consumed lime kg/annum	currently consumed lime kg/annum
Dry hide	888,052	62164.0	35522.1
Wet salted	69,279	2078.4	1385.6
Fresh hide	381,684	10,495.3	7633.7
Total lime powder consumption		74,495.3	44541.4

Financial Benefit
- birr 16,668.90 was saved
- Unquantified production reduction due to

Productivity improvement
quality improvement
reduced effluent treatment cost.

Environmental Benefit
Reduced the environmental load of lime by 30 ton per annum, in terms of total suspended solid (TSS)
Alkalinity

3) Chrome Recovery & Reuse

Recovered Chrome in lit/ month	%Cr_2O_3	Amount of 21 % Cr_2O_3 (kg/month)
1920	12.14	1109.9
2000	7.3	695.2
2000	7.0	666.7
Total in quarter		2471.8

Financial Benefit
Annual saving Birr 61,392 per annum
Environmental Benefit
Reduced chrome load to the environment by 9887 kg per annum.

Financial Benefit

Remedial Step Taken	Savings
- reducing the size of the boiler - feeding water tank and heating it.	409.40 Birr/day
- recovering condensate up to 70^0c 32	20.02
- installing more direct steam lines	Birr/day
considering 330 working day & 16 hrs a day annual saving:- Birr 162,241.20	

4. ***Collection and Reuse of Painting Spillage***

Observation:-
Painting solution
Spillage drained to the waste stream

Measurement:-
Spillage 16 to 17% of the supplied solution.

The estimated loss of chemical for annual production of 1 million pieces of skins

	Annual Loss in kg	Annual Loss in Birr
Na2S (kg)	5136	40060
NaHS	3424	24650
Lime	17200	10660
Total	15760	75370

For complete collection spillage, minimum requirement
Insolate the drainage line for painting solution
collecting tank

Action Taken
- Intermediate spillage collecting tank (before the drainage line)
- pallet arrangement … to reduce water contamination on the floor

Data was colleted for months show, the following saving.

chemical	Na2S(kg)	NaHS	Lime	Total
Saving in kg	194.4	73.3	307.3	575
Saving in Birr	1552.20	527.80	190.50	2270.5

Financial Benefit:-
Birr 18340 per annum
Environmental Benefit:- Environmental load due to the Na2S, NaHS and Lime by
»575 kg in three month or
»4611 kg in a year.

Annex 5: Tannery Effluent Standard

Table 1.1 Emission Limit Values for Discharges to Water

Constituent Group or Parameter	Emission Limit Value (mg/l)
Temperature	40 ˚C
pH	6 – 9 pH units
BOD_5 at 20□C	>90% Removal or 200 mg/l
COD	500
Suspended Solids	50
Total Ammonia (as N)	30
Total Nitrogen (as N)	>80% Removal or 60 mg/l
Total Phosphorus (as P)	>80% Removal or 10 mg/l
Oils, Fats, and Grease	15
Mineral Oil (Interceptor)	20
Chromium (as total Cr)	2
Chromium (as Cr VI)	0.1
Chloride (as Cl)	1000
Sulphide (as S)	1
Phenols	1

TABLE 1.2 EMISSION LIMIT VALUES FOR EMISSIONS TO AIR

Substance	Concentration Limit (mg/Nm^3)
Total Particulates	50
VOCs (degreasing)	50
VOCs (finishing)	75 g/m^2 product produced
Total hydrogen sulphide, sulphides and mercaptans (as S)	5 ppm v/v
Ammonia	40 ppm v/v
Acid vapours (as HCl)	30

Properly implemented CP:

Annex 6: Best Available techniques (BAT) for the substitution of chemicals

Substances to be substituted are listed in the left column. BAT substitutes are listed in the right column.

SUBSTANCE	BAT SUBSTITUTE
Biocides	• Products with the lowest environmental and toxicological impact, used at the lowest level possible e.g. sodium-or potassium-di-methyl-thiocarbamate
Halogenated organic compounds	• They can be substituted completely in almost every case. This includes substitution for soaking, degreasing, fat liquoring, dyeing agents and special post-tanning agents - Exception: the cleaning of Merino sheepskins
Organic solvents (non-halogenated) The finishing process and the degreasing of sheepskins are the major areas of relevance	Finishing: • Aqueous-based finishing systems - Exception: if very high standards of topcoat resistance to wet-rubbing, wet-flexing and perspiration are required • Low-organic solvent-based finishing systems • Low aromatic contents Sheepskin degreasing: • The use of one organic solvent and not mixtures, to facilitate possible re-use after distillation
Surfactants APEs such as NPEs	• e.g. alcohol ethoxylates, where possible
Cmplexing agents EDTA and NTA	• EDDS and MGDA, where possible
Ammonium deliming agents	• Partially with carbon dioxide and/or weak organic acids
Tanning agents - Chromium - Syntans and resins	• 20-35% of the fresh chrome input can be substituted by recovered chrome • Products with low formaldehyde, low phenol and low acrylic acid monomer content
Dyestuffs	• De-dusted or liquid dyestuffs • High-exhausting dyes containing low amounts of salt • Substitution of ammonia by auxilaries such as dye penetrators • Substitution of halogenic dyes by vinyl sulphone reactive dyes
Fatliquoring agents	• Free of agents building up AOX- - Exception: waterproof leathers • Applied in organic solvent-free mixtures or, when not possible, low organic solvent mixtures • High-exhausting to reduce the COD as much as possible
Finishing agents for topcoats, binders (resins) and cross-linking agents	• Binders based on polymeric emulsions with low monomer content • Cadmium-and lead-free pigments and finishing systems
Others: - Water repellent agents -Brominated and antimony-	• Free of agents building up AOX - Exception: waterproof leathers • Applied in organic solvent-free mixtures or, when not possible, low organic solvent mixtures • Free of metal salts - Exception: waterproof leathers • Phosphate-based flame retardants

containing flame retardant	

Annex 7. Process: Integrated BAT measures

	PROCESS UNIT	BAT is:
BEAMHOUSE	Curing and soaking	• To process fresh hides as far as they are available Exceptions: - When long transport time is necessary (max 8-12 hours for fresh, unchilled hiders; 5-8 days if a cooling chain of 2°C is maintained) - For certain types of end-products - Sheepskins, calf skins • To reduce the amount of salt used as far as possible
	Unhearing & liming	• To use hair-save technology, but economics can be an issue for existing plants when re-use of the saved hair is not possible • To reduce sulphide consumption by the use of enzyme preparations; not for sheepskins • To recycle spent liquors only when processing sheepskins, which are dewoolled by painting
	Splitting	• To use lime splitting Exceptions: - When the starting material is wet blue - When a firmer leather has to be produced (e.g shoe-leather) - When a more uniform and accurate thickness is needed in the final product • To maximise the use of split
TANYAARD OPERATIONS	Deliming and bating	• To make a partial substitution of ammonium salts with CO_2 and/or weak organic acids
	Sheepskin Degreasing	• To optimise wet degreasing using surfactabts, with or without organic solvents • Closed machines with abatement for air and waste water releases when organic solvents are used to degrease skins in dry state
	Pickling	• To use partial recycling or re-use of pickle liquors (*) split view; see below • To use a volume of floats in the range of 50 – 60% (based on fleshed weight) for ovine skins and bovine hides in order to reduce salt consumption
	Tanning	• To increase the efficiency of the chrome tanning process through careful control of PH, float, temperature, time and drum speed, • To use chrome recovery through precipitation Exceptions - When specialised recovery plants are not available -When the recovered chrome cannot be recycled in order to produce high quality leathers. • To use high –exhaustion tanning methods where chrome recovery is not possible (exception;-high quality leather production). • To maximise exhaustion of vegetable tanning liquor with counter-current (pit system) or recycling (drum tanning)

POST-TANNING OPERATIONS	Retaining, chrome fixation and neutralization	• To enhance exhaustion of post-tanning treatment agents and fixation of tanning agents in the leather • To reduce the salt content of spent liquors
	Dyeing	• To enhance exhaustion of dyestuffs
	Fat liquoring	• To enhance exhaustion of fat liquor
	Drying	• To optimize mechanical dewatering prior to drying where possible
	Applying a surface coat	• To use roller coating • To use curtain coating • To use HVLP spray guns • To use airless spray guns Exception for all four above-mentioned techniques: - When very thin finishes are applied, e.g. on aniline and aniline-type leather

Annex 8: BAT for water management and treatment

Within these areas, BAT is:

GOOD HOUSE KEEPING AND PROCESS INTEGRATED MEASURE	To improve the matching of water flow to the requirements of the process
	To use 'batch' versus 'running water' washes
	To modify existing equipment to use short floats
	To use modern equipment for short floats
	To re-use waste water in less critical processes
	To recycle or re-use process liquors where possible
EFFLUENTTREATMENT	To keep sulphide-containing effluent from the beam house separate and at high pH until the sulphide is removed. The associated emission level after treatment is 2 mg S^{2-} /1 in a random sample in the separate effluent. After the sulphide is removed (on site or in a jointly used dedicated treatment plant) the effluent can be mixed.
	To collect chromium-containing partial effluent (e.g. from tanning and samming) with a concentration of Cr_{total}>1 g/1 separately and send it for chrome recovery. Chrome recovery can be done on or off site.
	To use mechanical treatment (on or off site)
	To use biological treatment (on or off site)
	To use post-purification sedimentation and sludge handling (on or off site)

Annex 9: BAT for waste management

Re-use/recycling/recovery and treatment	Type of waste
Leather production	Splits
Leather fibre board production	Tanned wastes in general, e.g., splits, shavings, trimmings
Small leather goods etc.	Splits and tanned trimmings
Filling material, wool	Hair and wool
Gelatine and/or hide glue	Raw trimmings, green and limed fleshings and splits
Sausage casings	Untanned splits
Fat recovery	Raw trimmings, green and limed fleshings
Protein hydrolysate	Hair, raw and limed trimmings, green and limed fleshings, green limed and tanned splits and shavings
Collgen	Limed trimmings and splits
Agriculture and fertilizer	Hair for the nitrogen content, residues from composting and anaerobic digestion, sludges from waste water treatment. The legal requirements for the application of waste to land require sophisticated waste separation and treatment of the various fractions.
Compostion	Hair, green and limed fleshings, green, limed and tanned splits and shavings, fats grease and oil: sludges from waste water treatment
Anaerobic digestion	Hair, raw trimmings, green and limed fleshings, green, limed splits, fats, grease and oil; sludges from waste water treatment
Thermal treatment	Fats, grease, mixtures of non-halogenated organic solvents and oil
Recycling of organic solvents	Organic solvents (no mixtures)
Regeneration of air abatement filters	Activated carbon filters
Re-use and recycling of packaging material by feeding it back to the supplier via an appropriate recycling system	Container, pallets, plastic, cardboard

Annex 10

- ***General requirements***

  The organization shall establish and maintain an environmental management system, the requirements of which are described below;-

  - **Environmental policy**

    - ***Top management shall define the organization's environmental policy***

  - **Planning**

- ***Environmental aspect***

The organization shall establish and maintain (a) procedures to define the environmental aspects of its activity, products or services that it can control over which it can expect to have an influence, in order to determine those which have or can have significant impacts on the environment

- **Legal and other requirements**

The organization shall establish and maintain a procedure to identify and have access to legal and other requirements to which the organization subscribe, that applicable to the environmental aspects of its activities , products or services.

- **Objectives and targets**

The organization shall establish and maintain documented environmental objectives and targets, at each relevant faction and level within the organization.

- **Environmental management programme(s)**

The organization shall establish and maintain (a) programme(s) for achieving the objectives and targets.

o **Implementation and operation**

- ***Stricture and responsibility***

  Roles, responsibility and authorities shall be defined documented communicated in order to facilitate effective environmental management.

- ***Training, awareness and competence.***

  The organization shall identify training needs. It shall require that all personnel whose work may crate a significant impact upon the environment, have received appropriate training.

- ***Communication***

With regard to its environmental aspects and the environmental management system, the organization shall establish and maintain procedure for

a) International communication between the various levels and functions of the organizations
b) Receiving the documenting and responding to relevant communication from external interested parties

- ***Environmental management system documentation***

The origination shall establish and maintain information, in paper or electronic form to :

a) describe the core elements of the management system and their reaction:
b) provide direction to related documentation

- **Checking and corrective action**

  - ***Monitoring and measurement***

    The organization shall establish and maintain documented procedures to monitor and measure, on a regular basis the key characteristics of its operations and activities that can have a significant impact on the environment.

  - ***None conformance and corrective and protective action***

    The organization shall establish and maintain procedures for defining responsibility and authority for handling and investigating non-conformance, taking action to mitigate any impacts caused and for initiating and completing corrective and prevention action.

  - **Records**

    The organization shall establish and maintain procedures and for the identification, maintenance and disposition of environmental records**.**

  - ***Environmental management system audit:-***

    The organization shall establish and maintain (a) programme (s) and procedures for periodic environmental management system audits to be carried out, in order to

    a) Determine weather or not the environmental Management system
    b) Provide information on the results of audits to managements

  - **Management review**

The organization's top management shall, at intervals that is determine, review the environmental management system, to ensure its continuing suitability, adequacy and effectiveness

Annex 11: Checklist for assessing Environmental Impact

- Water pollution from uncontrolled storm derange
- Water pollution from effluent and waste waters
- Water pollution from spills and accidents
- Groundwater pollution from ponds ,pits,, lagoons, holding thanks.
- Ground water pollution from waste dumps
- Impact on sewage treatment systems
- Impact on sewers and drains
- Soil pollution from effluent and waste water.
- Soil pollution from sledges and residues
- Contamination of land from spills
- Odors and nuisance toxic from decomposing wastes and chemical
- Toxic gas emission from chemicals , wastes and effluents
- Industrial hazard form chemicals, contact, fumes
- Hazards from treated hides (handling, effluent)
- Public hazards of waste dumps-chemicals , wastes, containers
- Noise , smoke, dust
- Water consumption
- Storage safety of chemicals
- Energy consumption
- Transport of chemicals, wastes and general materials
- Use of land which ecologically valuable

Annex 12: Environmental Criteria for locating the project in any area of the country

The following Environmental criteria for locating tanning industry project in any area of the country should be given due consideration.

- Environmental Sensitivity value and availability based on the uniqueness, sensitivity and inventory of natural resources in the specific section of the identified areas;
- Importance social importance and priority based on heritage and archaeological sites and level of attractiveness to the public for purposes of leisure, tourism and recreation;
- Land use zone whether the selected area is in compatible with the national or local land use plans or not;
- Alternative technologies Introduction and promotion of environmental sound alternative technologies, which are suitable to the local situation;
- Carrying capacity of the natural resources; etc.

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