بسم الله الرحمن الرحيم

Sudan University of Science & Technology

Total Quality & Excellence Center

A Study on Occupational Health and Safety for Tannery workers at Khartoum State

دراسة عن الصحة المهنية والسلامة لعمال المدبغة بولاية الخرطوم

By

Fadwa Ali Ibrahim Ali

BSc. (Hon) in Leather Engineering (2005) University of Sudan

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Supervisor:

Dr. FakI Elamen FakI

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DEDICATION

In the name of Allah, Most Gracious, Most Merciful.

Thanks are first due to Allah almighty for his great gift of knowledge and for making this degree possible.

The author dedicates this dissertation to her supportive father, sisters and brothers who's instilled in their drive and determination to follow her dreams and pursue her goals.

I offer my sincere thanks to kind, supportive, intelligent and lovely mother for her support, prayers, understanding and patience, and my husband, who is a source moral and guidance support and to my grandmother, a source of love,

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ABSTRACT

This study aimed to evaluate occupational health and safety in Khartoum tanneries and to assess employee‘s level of understanding of health and safety policies and evaluate the commitment of the top management towards the health and safety of employees. A survey questionnaire was distributed to collect data from four tanneries. A sample of 100 workers from both production staff as well as management staff was selected. 82 questionnaires were collected for statistical analysis. The study findings revealed that occupational health and safety practices at Khartoum tanneries is not in conformity with what has been described as “best practices” compared to the standard occupational safety and health requirements . It was therefore recommended that organizations should put in place active health and safety committees which should be given full mandate to implement their recommendations. Moreover, copies of tannery safety and health procedures should be given to employees so that they may be aware of the laid down policies, rules and safety precautions to reduce accidents in the tannery as well as health and safety measures should be in place and employees should be trained on how to use the emergency facilities in case of a problem.

المستخلص

هدفت هذه الدراسة إلى تقييم الصحة والسلامة المهنية في مدابغ الخرطوم، وتحديد مستوى فهم الموظفين لسياسات الصحة والسلامة ،وتقييم التزام الإدارة العليا بصحة وسلامة الموظفين . تم إعداد الاستبيان وتوزيعه لجمع البيانات من أربع مدابغ . تم اختيار 100 عينة مكونة من موظفي الإنتاج والإداريين .تم جمع 82 استبانه للتحليل الإحصائي .وكشفت نتائج الدراسة أن ممارسات الصحة والسلامة المهنية في مدابغ الخرطوم غير مطابقة مقارنة بالمتطلبات القياسية للسلامة والصحة المهنية .أوصت الدراسة بضرورة إنشاء المدابغ للجان نشطة للصحة والسلامة وينبغي أن تمنح تفويض كامل لتنفيذ توصياتها .علاوة على ذلك، ينبغي إعطاء نسخ من إجراءات السلامة والصحة للموظفين حتى يكونوا على بينة بالسياسات والقواعد واحتياطات السلامة للحد من الحوادث في المدابغ, فضلا عن توفر تدابير الصحة والسلامة ويجب على الموظفين التدرب على كيفية استخدام مرافق الطوارئ في حالة وجود مشكلة.

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CHAPTER ONE INTRODUCTION

1.1. Back ground

Occupational health and safety is a process of ensuring that people stay safe and healthy in the workplace to increase workers capacity to perform, the workplace has become an integral part to the viability of business for employers.

Occupational Health and Safety (OHAS) is a specialized field that promotes and maintains physical, mental and social well-being of workers, and it prevents the adverse health effects on social well-being of workers, and it prevents the adverse health effects on employees caused by hazardous work process and work environment. (Asia, 1999)

Occupational health and safety issues associated with the operation of tanning and leather finishing facilities primarily include exposure to chemicals, biological hazards and Physical hazard. (Asia, 1999)

1.1.1. Chemical Hazards

More than 250 different chemicals are used in the production of leather. Workers in the tannery are exposed to these chemicals in various ways, Though each chemical is not necessarily hazardous to human health, 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. vapors, fumes, effluent) or the containers used for storage and transport of these chemicals. (Asia, 1999)

To avoid the negative consequences of chemical hazards include the following:

- Implement management procedures for discharge of floats from paddles and drums

- Use air extraction systems and ventilation in areas / machines for dry shaving, buffing, spraying, and weighing (e.g. chemicals
- Use of personal protection equipment (e.g. gloves, glasses boots, aprons, masks, hoods, respirators)should be used when handling powder and liquid chemicals (Asia, 1999)

1.1.2. Biological Hazards:

Workers may be exposed to disease-agents such as bacteria, fungi, mites which may be present in the hides or as part of the manufacturing process management measures that can be taken to avoid the negative consequences of worker exposure to biological hazards include the following:

- Inform workers of potential risks of exposure to biological agents and provide training in recognizing and mitigating those risks
- Provide personal protective equipment to reduce contact with materials potentially containing pathogens (Dwomoh, 2013)

1.1.3 Physical hazard:

Workers may be exposed to physical problems such as injury, slips and falls which may be present in the manufacturing process.
management role that can be taken to avoid the negative consequences of worker exposure to physical hazards include the following:

- fallow the safety instructions& HSE department order.
- use of personal protection equipment (e.g. gloves, glasses boots, aprons, masks, hoods, respirators) (Dwomoh, 2013)

1.2. The Environmental hazard:

Environmental issues associated with tanning and leather finishing include the Waste water, Air emissions, and Solid waste, Hazardous ma-

terials. The tanning industry poses many dangers to both the environment and those that work within it. the primary environmental threat involves the dumping of solid and liquid waste that contains chromium and other hazardous compounds even in fully modernized and carefully managed facilities, it is nearly impossible to reclaim all of the pollutants generated by the tanning process (Anon., 2007)

1.3.The Tanning impact on Worker (human):

Each year people are killed at work and many are injured or suffer ill health .The most common causes of serious injury at work are slips and trips and falls from height. There are health conditions that can be caused or made worse by work and working environments, including cancer, asthma and skin complaints, work within the tannery itself is fraught with dangers often the result of inadequate or non-existent worker protections. These include:

Slips and falls on improperly drained floors, injury from heavy machinery or flaying knives, buried in lime and the most dangerous part of modern tanneries are handling chromium. In humans, chromium causes a myriad of ailments depending on how it is absorbed. (Anon., 2007)

1.4. Managing health and safety:

Health and safety management should be a straight forward part of managing your workplace as a whole. It involves practical steps that protect people from harm and at the same time protect the future success and the growth of your business. Good practice in health and safety makes sound business sense.

Managing health and safety is an integral part of managing your business. You need to do a risk assessment to find out about the risks in your workplace, put sensible measures in place to control them, and make sure

they stay controlled, You need to consider when managing health and safety and assessing the risks in your workplace to provide information which shows how you can follow a '**Plan, Do, Check, Act'** approach:

Plan: Describe how you manage health and safety in your business (your legally required policy) and plan to make it happen in practice.

Do: Priorities and control your risks – consult your employees and provide training and information.

Check: Measure how you are doing.

Act: Learn from your experience. (Dwomoh, 2013)

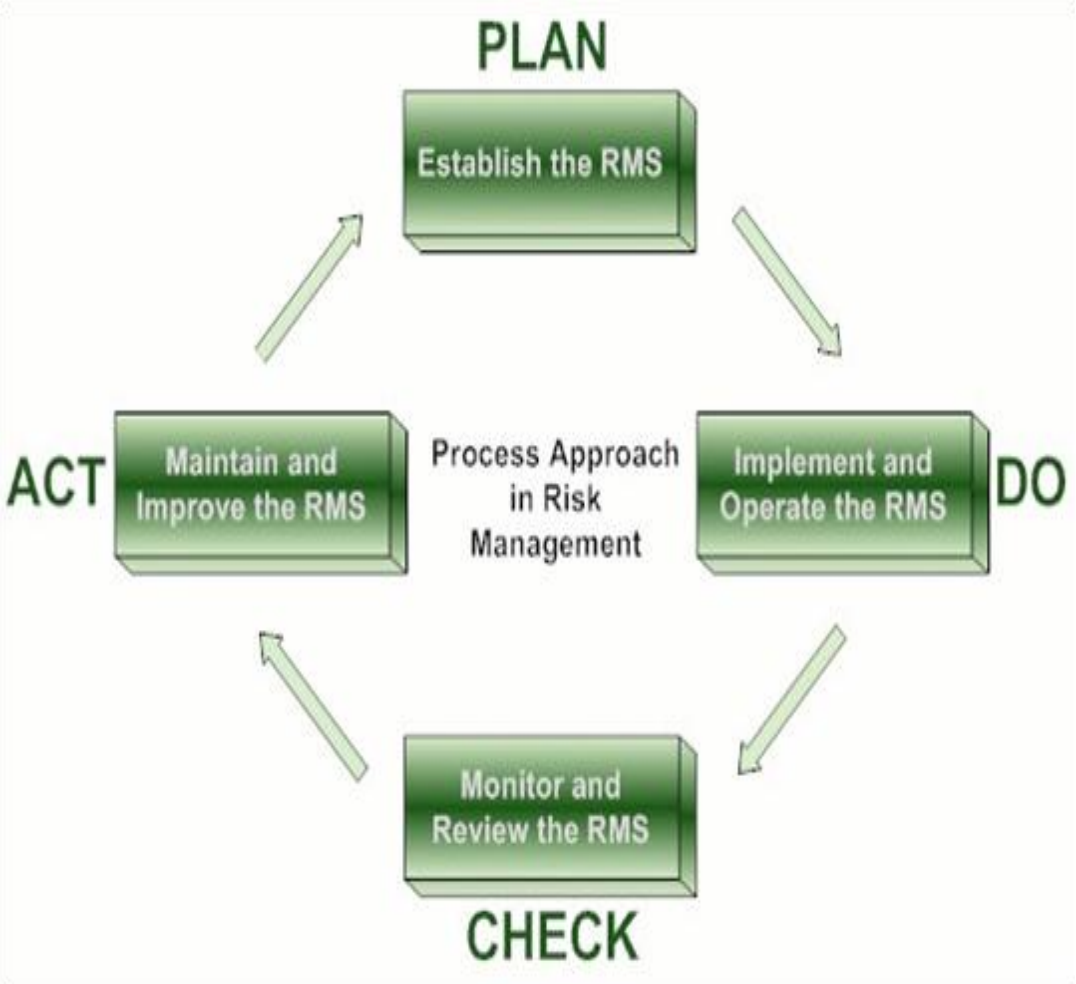

Figure 1.1 integrating risk management by (PDCA)

1.5. Research Objectives:

1.5.1. Main objectives:

The main objective is to assess the level of (OSH) precautions and standards in Khartoum tanneries.

1.5.2 Specific objectives:

The specific objectives of the study include:

1. Identify health and safety standards in Khartoum tanneries.
2. Examine the awareness of employees toward the health and safety policies of the organization.
3. Assess the attitude and attention of management towards the health and safety of employees.

1.6 Problem Statement:

1- Poor health and practices in the tanneries

2- organization ignorance and negligence to safety measures and regulations

3- from extensive web search, conducted by the researcher its appear that there is no similar studies conducted in this field in Sudan.

1.7. Research Questions:

1) What are the safety standards put in place in the tannery?
2) What is the level of employees understanding of health and safety policies of the tannery?
3) What is the attitude of management towards health and safety of employees

1.8. Organization of the Study chapters:

This dissertation is organized into five chapters. Chapter one presents the background to the study, problem statement, objectives (both general and specific). It also outlines the research questions.

The second chapter reviews relevant literature on the concepts and core issues of the study while

chapter three explains how the study was conducted, Methodological issues considered here include the study design, study population, sample size and sampling procedure and instrumentation, sources of data and procedure for data analysis and presentation.

Chapter four discusses and analyzes the results of the study while chapter five summarizes, offers recommendations and conclusion for the study.

Chapter two LITERATURE REVIEW

2.1. General:

Leather industry is considered to be a major source of pollution and tannery waste water in particular is potential environmental concern. (Anon., 2007)

There are hazards and risks in all work places. Safety and health are possibly ensured only by knowing these risks and hazards and by properly guarding ourselves until the risks and hazards have been eliminated. Technological progress and change are constantly taking place and while they often bring improvements in both efficiency and safety at work. (Lecturer, 2014)

The chapter providing useful information to the reader in understanding the core issues of occupational safety and health in the leather manufacturing industry, starting with an overview of health hazards and safety risks usually prevalent in different sections of a tannery. The structure follows the flow of production of leather, comprising raw material handling, beam house, tan yard, wet- and dry-finishing operations

2.2. Leather Industries:

The process of converting hides and skins into leather is termed as tanning process. In tanning process the animal hides and skins, are treated, becomes more permanently resistant to decomposition when they are wet, and supple when dry. The process of tanning requires consumption of vast quantities of water and chemicals, which in turn constitute pollutants to the surrounding environment if not treated to a certain degree (Impact of occupational health and safety on worker productivity, 2010).

The pollution resulted from tanning process is being looked at as an emerging problem. Improper and uncontrolled discharge of tannery waste lead to a serious environmental problem, as it increases the pollutants load and causes contamination of surface and ground water. Inadequate provision for solid wastes and sludge disposal, accidents involves chemical substance, general nuisance of odor arid noise are taken into account (Khwaja, 2000).

The discharge of residues is a waste of scarce resources. Whether chemicals, energy or raw material. The eventual clean-up of polluted environment requires expenditure of trends that could have been used to promote positive displacement development. Tanning process is considered as pollution generator due to the presence of organic and inorganic dissolved, suspended solids and odour. (Lecturer, 2014)

Figure2: Leather Industries

2.3 Description of tanning processes:

Tanning and leather finishing facilities generally convert raw hides and skins into leather, which is then finished and used to manufacture a wide range of products. In general,

The production processes in a tannery can be split into four main categories. Pre- tanning (hide and skin storage and beam house operations), tanning (tan yard operation), Wet Finishing (post- tanning operations), and finishing Operations . (M, 1998.)

2.3.1. Pre-tanning (Beam.house Operations):

Cleaning and conditioning hides and skins produce the biggest part of the effluent load. This beam house operation include Soaking, Fleshing and Trimming, De-liming and Bating, Pickling, and Degreasing

In soaking the preserved raw hides regain their normal water contents. Dirt, manure, blood, preservatives (sodium chloride, bactericides), etc. are removed (Organization, 2011). Soaking is usually carried out in processing vessels (e. g. Mixers, drums, pits, or raceways) in two steps, namely a dirt soak for salt and dirt removal, and a main soak. The soak bath is often changed every 8 hours to prevent bacterial growth. Soaking additives include surfactants, enzyme preparations, bactericides, and alkali products.

In fleshing and trimming extraneous tissue is removed. unhairing is done by chemical dissolution of the hair and epidermis with an alkaline medium of sulfide and lime. When after skinning at the slaughterhouse the hide appears to contain excessive meat, fleshing usually precedes unhairing and liming. (Organization, 2011)

The fleshing machine consists of rollers and rotating spiral blades that the pelts. Fleshing of green hides after soaking is called ‘green fleshing’. Fleshing performed after the liming and unhairing is known as ‘lime- fleshing’. (M, 1998.)

In de-liming and bating the unhaired, fleshed and alkaline hide are neutralized with acid ammonium salts and treated with enzymes, similar to those found in the digestive system, to remove hair remnants and to degrade proteins. During this process hair roots and pigments are removed. This results in the major parts of the ammonium load in the effluents (M, 1998.).Pickling increases the acidity of the hide to a pH value of 3 by addition of acid liquor and salts, enabling chromium tannins to enter the hide. Salts are added to prevent the hide from swelling. For preservation purposes, 0.03- 2% by weight of fungicides and bactericides are usually applied.

In degreasing normally performed together with soaking, pickling or after tanning, degreasing is performed by organic solvents or surfactants, leading to a higher COD value in the effluent. (M, 1998.)

2.3.2. Tanning (Tan yard Operation):

Tanning allows stabilization of the collagen fiber through a cross-linking action. The tanned hides and skins are tradable intermediate products (wet- blue). Tanning agents can be categorized in three main groups namely mineral (chrome) tanning agent; vegetable tanning agents; and alternative tanning agents (e. g. Syntans, aldehydes, and oil tanning agents). (Organization, 2011)

Chrome tanning (CT) is the most common type of tanning in the world. After pickling, when the pH value is low, chromium (III) salts are added. To fixate the chromium, the pH is slowly increased through addition of a base. The process of chromium tanning is based on the cross-linkage of chromium ions with free carboxyl groups in the collagen. It makes the hide resistant to bacteria and high temperature. Chrome tanned leather are characterized by top handling quality, high hydro- thermal stability, user- specific properties and versatile applicability, Waste chrome from leather manufacturing, however, poses a significant disposal problem. (M, 1998.)

Vegetable tanning (VT) produces relatively dense, pale brown leather that tends to darken on exposure to natural light. Vegetable tanning is frequently used to produce sole leather, belts, and other leather goods. Unless specifically treated, however, vegetable tanned leathers have low hydrothermal stability, limited water resistance, and are hydrophilic. (M, 1998.)

Vegetable tannins are polyphenolic compounds of two types - Hydrolysable tannins (i.e. chestnut and myrobalam) which are derivatives of pyrogallols, and- Condensed tannins (i.e. hemlock and wattle) which are derivatives from catechol. (Organization, 2011)

Alternative tanning with organic tanning agents, using polymers or condensed plant polyphenols with aldehydic cross- linkers, can produce mineral free leather with high hydrothermal stability similar to chrome-tanned leather. However, organic- tanned leather usually is more filled (e. g. leather with interstices filled with a filler material) and hydrophilic than chrome- free leather, with equally high hydrothermal stability. This

tanning process is carried out with a combination of metal salts, preferable but not exclusively aluminum, and a plant polyphenol containing pyrogallol groups, often in the form of hydrolysable tannins. (Organization, 2011)

In draining, samming, and setting leather after tanning is drained, rinsed, and either hung up to age or unloaded into boxes and subsequently sammed (e. g. brought to a uniformly semidry state to reduce the moisture content before further mechanical action. Setting (working over the grain surface of wet leather to remove excess water, to eliminate wrinkles and granulations, to give the leather a good pattern and to work out stresses so that the leather lies flat) may be carried out to stretch out the leather.

In splitting is to cut through skins/ hides or leathers at a set thickness. If the hide/ skin are sufficiently thick, splitting can yield a grain split and a flesh split that may both be processed into finished leather. Although splitting can be performed before tanning, after tanning, or after drying, it is usually performed after tanning.

In shaving is undertaken to achieve an even thickness throughout tanned or crusted leather. Shaving is carried out when splitting is not possible or when minor adjustments to the thickness are required. (Organization, 2011)

2.3.3. Post Tanning Process:

Post- tanning operations involve neutralization and bleaching, following by re-tanning, dyeing, and fat-liquoring. These processes are mostly undertaken in a single processing vessel.

Specialized operations may also be performed to add certain properties to the leather product (e. g. Water repellence or resistance, oleophobicity, gas permeability, flame retardancy, abrasion resistance,

Neutralization is the process by which the tanned hides are brought to a ph . suitable for re-tanning, dyeing and fat-liquoring. Neutralization is performed using weak alkalis (e. g. Sodium or ammonium bicarbonate, formiate, or acetate). After neutralization, leather may be dried, generating an intermediate tradable product called white crust. (Organization, 2011)

Vegetable- tanned skins and leathers with wool or hair may need to be bleached to remove stains or to reduce the coloring before re-tanning and dyeing. Making the leather color fade may be achieved using treatment with chemicals (e.g. bleaching agents) or exposure to the sun/ weather elements.

Re-tanning process is performed to improve the leather characteristics and the re- wetting properties (e. g .the introduction of liquid, such as water, into hides, skins or dried leather) of the hides necessary to facilitate and optimize the subsequent dyeing process. A wide variety of chemicals may be used for the re-tanning of leather, including vegetable tanning extracts, syntans, aldehydes, resins and mineral tanning agents.

Dyeing is performed to produce colors in hides/ skins. Typical dyestuffs include water- based acid dyes. Basic and reactive dyes are less commonly used. (Organization, 2011)

Fat-liquoring is the process by which leathers are lubricated to achieve product- specific characteristics and to reestablish the fat content

lost in the previous procedures. The oils used may be of animal or vegetable origin, or may be synthetic products based on mineral oils. Stuffing is an old technique used mainly for heavier vegetable- tanned leather. Sammed leather is treated in a drum with a mixture of molten fat. The re-tanned dyed, and fat-liquored leathers are then acidified by formic acid for fixation and usually washed before being aged to allow the fat to migrate from the surface to the inside of the pelt.

Drying techniques include samming, setting, centrifuging, hang drying, vacuum drying, toggle drying (leather dried while held under tension on frame using toggles), paste drying (drying method used for upper leather with corrected grain), and over drying. Samming and setting are used to reduce the moisture content mechanically before implementing another drying technique. After drying, the leather may be referred to as 'crust', which is a tradable and storable inter mediate product, the objective of drying is to dry the leather while optimizing leather quality. (Organization, 2011)

2.3.4. Finishing:

The crust that results after re-tanning 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 mistake. The hide is treated with an organic solvent on water based dye and varnish. Environmental aspects are mainly related to the finishing chemicals which can also reach effluent water. (M, 1998.)

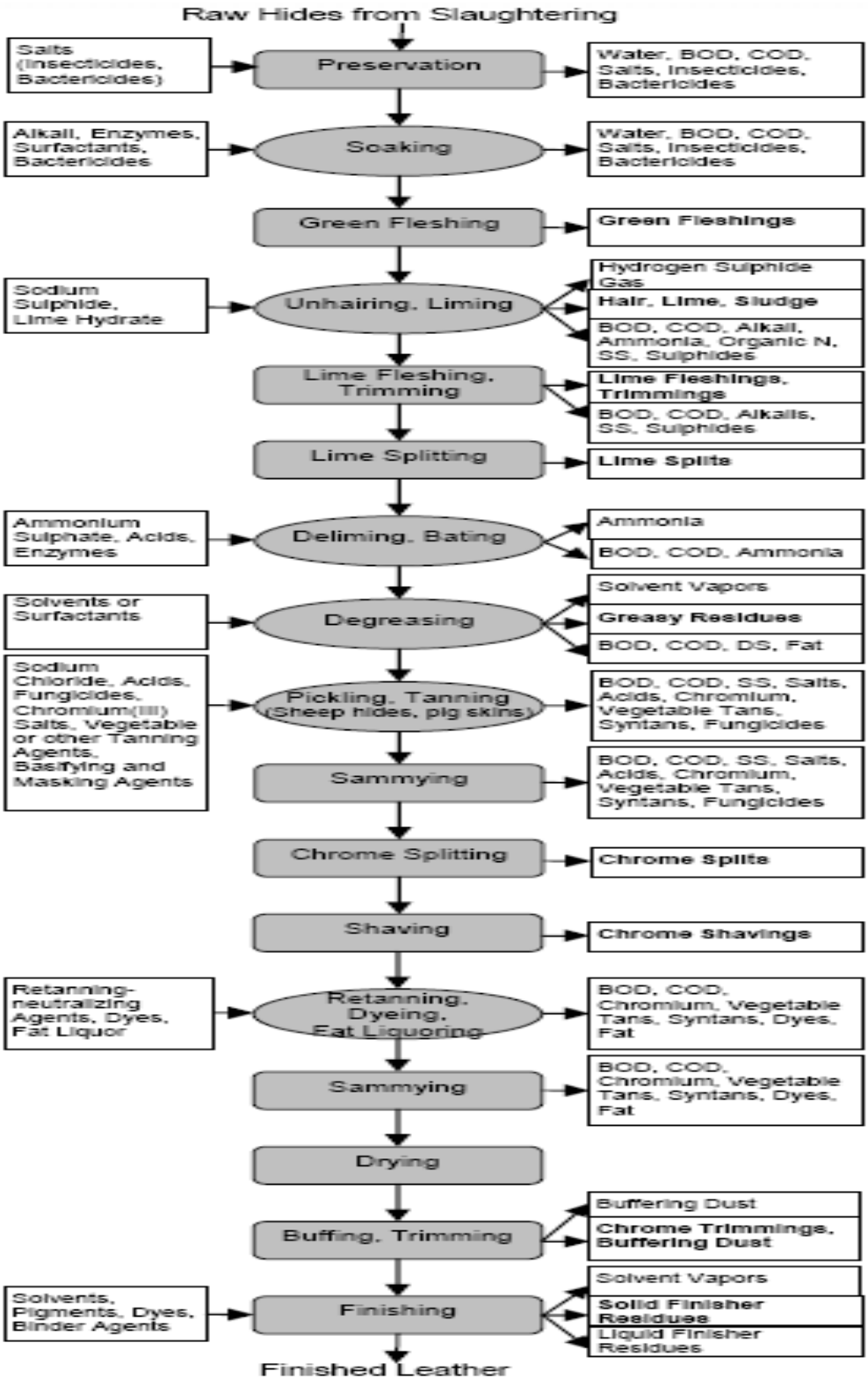

Figure 3: An overview on the steps of leather processing

2.4 Safety in use of chemicals in leather tanneries:

The level of knowledge about proper storage and handling of particularly hazardous chemicals is very low. Measuring and mixing of chemicals is done manually in the small-scale tanneries. Process control is generally absent. (Sahasranaman, 13-15 December 2000)

More than 250 different chemicals are used in the production of leather. workers in the tannery are exposed to these chemicals in various ways , though each chemical is not necessarily hazardous to human health, 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, the impact of such exposure can range from temporary effects such as dizziness, headache, irritation of eyes, skin or lungs, allergic reactions, collapse due to lack of oxygen, poisoning of liver, kidney, nerval system to long term impairments such as cancer, bronchitis, genetic defects and, in some rare cases death (Anon., 1991)

Workplace in every sector uses chemicals, and thus a broad range of workers are potentially exposed. Therefore chemicals are potentially a concern in every type of work performed. While the amount of effort needed to address the specific situation will vary with the degree of exposure and quantity handled, there is no sector that can simply be exempted. From having an approach to prevention and control of hazardous substances. Increased concerns in recent years about the chemicals used in tanning many of them are quite hazardous, because they are used without preventive and protective equipment, or workers' training. While consumers are also exposed in these facilities, those exposures are infrequent and for short duration, this is unlike the exposures of the workers

Who use the chemicals all day, every day. Chemical exposures may be incalculable. Certainly, the victims of such diseases often lose the ability to work, and support themselves and their families. (Anon., 1995)

2.4.1. Basic rules and principles in handling of chemicals:

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

2.4.2. Dispose Chemical Waste:

Empty chemical containers can pose a safety risk and health hazard, when not disposed of properly.

2.4.2.1. Basic rules and principles:

- Do not let the waste containers be used for storage of drinking water or food grains!
- Remove empty chemical containers from the store and work areas as you will need the space.
- Safely store the containers in a separate area of your tannery.
- Do not pour or mix different waste chemicals in the same waste container or barrel.
- Make sure that the rinsing water, if not used in the tannery, is discharged to the effluent treatment plant. (Anon., 1991)

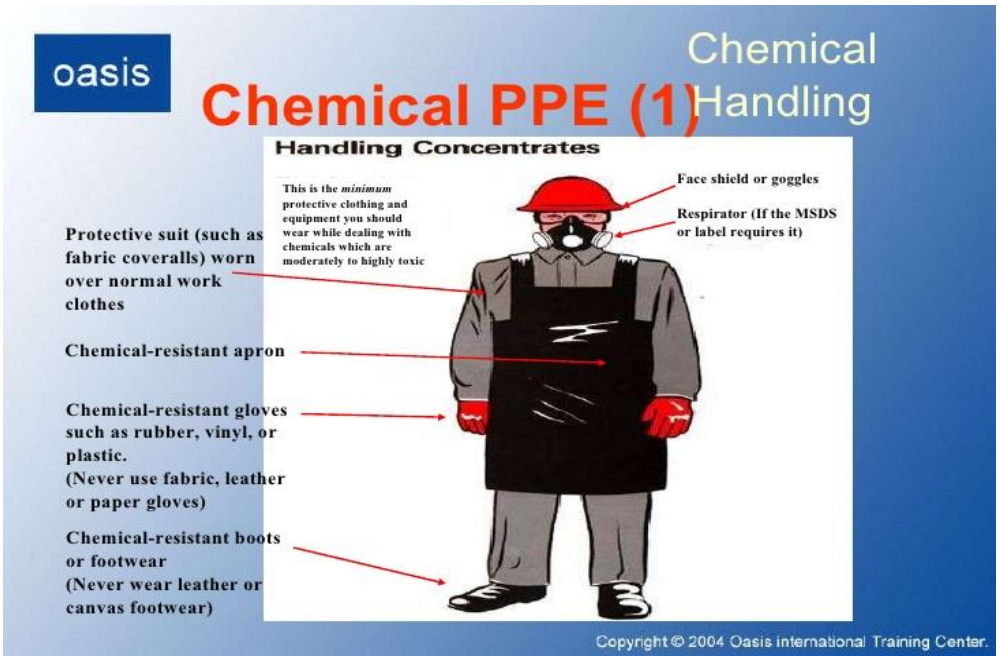

Figure 4: chemical PPE

2.5 Tanning impact on Environment:

The major environmental issues of tanneries are solid wastes and wastewater. In the course of processing of hides into leather about 20% of the material results as solid wastes, consisting of leather scraps, hair, soluble proteins, curing salts and fleshing .(animal fats, collagen fibers, meat etc.). The effluents discharged from tanneries are large in volume, are highly colored and contain heavy sediment load, toxic metallic compounds, chemicals, biologically oxidizable materials and large quantities of putrefying suspended matter Solid wastes of tanneries are usually dumped improperly inside and around the factory area The highly colored effluents not only give an unaesthic appearance but by cutting off sun light also affect the purification capacity of a water body like Kabul river, into which these are being discharged. Low pH of tannery effluents cause corrosion of water-carrying system. Large pH fluctuation and high BOD value caused by tannery effluents, can kill all natural life in an effected water. (Williams CJ, 2000)

Reported millions of people suffer from gastrointestinal, dermatological and other diseases and 90% of them die before the age of 50, Most of the tanneries do not have treatment facilities and environment management Systems, as a result simply discharging their wastes into the environment. thus, are causing serious environmental and public health problems in particular areas.

Also explained tanning process includes both solid and liquid wastes. The solid wastes are predominantly from the initial and final stages of processing while the effluents are produced mostly during tanning and dying. The effluents contain dissolved lime, hydrogen sulfide, acids, chromium dyes, oils, organic matter and suspended solids and the waste water which

is discharged into open drains and ultimately find its way onto land surfaces and into waters in the vicinity. As it is difficult to flush-out the waste water, so it causing a great environmental hazard in the neighborhood of the tannery

On the other hand, dumping of solid waste is seriously affecting the soil and plants, vitiating the air, groundwater and human health (al, 2016)

2.6. Impact of safety management to productivity & employees performance:

The employees' productivity is influence by management safety practices and safety programmers', management attitude towards health and safety, investigation of accidents, supervisor's safety, and training of employees on safety standards held in the organization. It also revealed that health and safety standards if managed effectively have a positive impact on productivity. Therefore it is recommended that organizations should put in place active health and safety committees which should be given full mandate to implement their recommendations, Moreover, there should be

Awareness among employees and they should be trained on how to use the emergency facilities in case of a problem. (al, 2016)

Pointed to the study found out that OHS related problems negatively affect workers' productive capacity resulting in reduced worker output. Workers develop a negative attitude and low morale towards work. High incidents of accidents at work also occur. The study recommends that companies should upgrade their OHS through training programmers' and use up-to-date equipment. (safety practices and the productivity of employees in manufacturing firms , 2013)

Revealed the positive and significant relationship between the provision of adequate safety equipment's and the work output of employees. The study recommend that: qualified safety officers should be employed to manage the safety challenges facing the organizations in their business operations; employees should be sent on regular and seasoned training courses on safety management so that they can appreciate the need for safety precautions; the safety policies of business organizations must be effectively implemented and adhered to at all time. (safety practices and the productivity of employees in manufacturing firms , 2013)

confirming what mentioned examined the impact of health and safety policies on employees' performance and the results showed the inverse relationship between reducing the number of accidents and injuries through health and safety promotions and employees performance, therefore it was concluded that organizations need to pay much attention to their health and safety measures since apart from the fact that in other jurisdictions it is backed by law and is mandatory, it is classified as an existence need for which other motivational factors meant to improve employees' performance revolves. (al, 1985)

Whereas more over in addition to that (esi, 2012)this study investigated the Effects of Occupational Health and Safety Practices on Organizational Commitment, Work Alienation, and Job Performance. The findings of the

Analysis suggested that such OHS practices as safety procedures and risk management, safety and health rules, first aid support and training, and organizational safety support had a positive effect on organizational commitment. Moreover, it was seen that safety and health rules and organizational safety support decreased alienation, where first aid support and training played a role in increasing work alienation. Finally, safety

procedures and risk management, safety and health rules, and organizational safety support had indirect effects on job performance of the employees. (esi, 2012)

2.7. Treatment of tannery effluents:

2.7.1. Preliminary treatment:

Typically, in the case of common effluent treatment plants (CETPs) servicing tannery clusters often found in developing countries, it is essential to have pre-treatment units installed in individual tanneries. Their role is to remove large particles, sand/grit and grease, but also to significantly reduce the content of chrome and sulphides before the effluent is discharged into the collection network. (paper presented in UNIDO export meeting, 1991)

2.7.2. Physical-chemical treatment (primary):

The objective here is the removal of settle able organic and inorganic solids by sedimentation, and the removal of materials that will float by skimming. Approximately 25-50% of the incoming biochemical oxygen demand, 50-70% of total suspended solids (SS), and 65% of the oil and grease are removed during primary treatment. The effluent and sludge from primary sedimentation are referred to as primary effluent and sludge.

2.7.3. Biological treatment (secondary):

In most cases, secondary treatment follows primary treatment, its goal being the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment processes. Aerobic biological treatment is carried out in the presence of oxygen by aerobic micro-organisms (principally bacteria) that metabolize the organic matter in the wastewater, thereby producing more micro-organisms and inorganic end products (principally CO2, NH3, and H2O). Several aerobic biological processes are used for secondary treatment and the differences among them have to do primarily with the manner in which oxygen is supplied to the micro-organisms and with the rate at which organisms metabolize the organic matter.

2.7.4. Advanced (tertiary) treatment:

Tertiary or advanced wastewater treatment is employed to reduce residual COD load and/or when specific wastewater constituents are not removed by previous treatment stages. (paper presented in UNIDO export meeting, 1991)

2.8. Cleaner production (CP):

Cleaner production (CP) is a preventive business strategy designed to conserve resources, mitigate risks to humans and the environment, and Promote greater overall efficiency through improved production techniques and technologies. Cleaner production methods may include:

- substituting different materials
- modifying processes
- upgrading equipment

• redesigning products

In addition to environmental, health and safety benefits, many cleaner Production techniques provide opportunities to substantially reduce Operating costs and improve product quality. MSEs (Micro- and Small Enterprises) can profit from cleaner production through more efficient use of inputs and machinery, higher quality goods that can command higher prices, and reduced waste disposal. Experience has demonstrated that, with assistance, MSEs can frequently identify cleaner production opportunities that produce a positive financial return, sometimes with little or no investment. Many enterprises that change to CP methods may realize substantial financial and environmental benefits, indicating that CP should be the first option considered in addressing MSEs' environmental problems.

2.9. Adverse Environmental Impacts:

Several key environmental issues associated with leather processing are discussed below. For each environmental impact, by a number of mitigation strategies that can be considered, with an emphasis on cleaner production strategies where possible.

Leather processing uses large amount of toxic and environmentally dangerous chemicals. CP techniques can prevent these chemicals from becoming a threat to public health and save money for the micro-entrepreneur. (paper presented in UNIDO export meeting, 1991)

2.9.1. Chemicals:

Leather processing requires extensive use of chemicals to treat and soften hides. These chemicals are present in the firm's wastewater and can contaminate community water sources.

Selected mitigation strategies:

• Improve production methods to increase efficiency. Using higher In chrome baths helps chrome adhere to hides and reduces the amount of chemicals left in the wastewater. Instruct workers about the correct chemical ratios to use in tanning and finishing baths. Use measuring equipment to minimize overuse.

• Improve chemical storage to reduce waste and spills. Store chemicals in Sturdy, water proof containers. Instruct employees to seal containers after use to avoid spills.

• Consider using alternative chemicals that are less hazardous. for Instance, vegetable-based tanning solutions can be substituted for chrome. Take into consideration, though, that switching to low-polluting chemicals may involve a tradeoff in quality. for example, vegetable dyes may produce unpredictable colors.

• Recycle chrome and tanning bath solutions. chrome and lime effluent can be reused in future production stages without loss of effectiveness use filters to screen out solid wastes and then set aside the solution to use it again. Assess the cost-effectiveness of such strategies before Proceeding, however. for example, some chrome-recycling strategies may not be cost-effective for smaller operations.

2.9.2. Water use:

Leather processing requires water in almost every stage of production, but certain production methods or machinery can lead to overuse. If well or pump water is used, excessive water use can deplete water sources for future production or community use. Energy costs for pumping**.**

Selected mitigation strategies:

• Reuse water from "cleaner" stages of production in "dirtier" stages of The next production cycle.

• Conserve water by improving production methods. Turn off water between batches or while transferring hides between baths. Water levels closely or installing an automatic shut-off mechanism.

• Use dry cleanup methods. Wipe down spills with dry material; use brooms or cloth to remove as much solid or semi-solid waste as possible From floors or machinery before rinsing them down with water.

2.9.3. Worker health hazards:

Certain working conditions in leather processing-such as exposure to Chemicals in the air or in solution baths—can be hazardous to workers. Symptoms can include skin irritations, dizziness and breathing problems. Unhealthy workers may be less productive, miss work too often and make Potentially costly mistakes.

Provide safety equipment such as face masks, rubber gloves and boots forworkers. Small improvements can increase worker safety dramatically and improve long-run productivity.

Selected mitigation strategies:

• Ventilate the production sites well. Organic solvents, in particular, are Harmful when inhaled. Over time, even minor exposure can cause long term damage to health.

• Train workers in the proper handling of chemicals. Minimize chemical Spills and accidental exposure by educating workers about preventive Safety measures. For example, sealing chemical containers when not in Use can prevent both spillage and evaporation and thus reduce input costs.

2.9.4. Odor:

Collagen wastes and fats produce odors, but they can be reused as Agricultural fertilizer if not contaminated by chemical wastes. (Anon., 28 April 2014)

Selected mitigation strategies:

• Implement a waste disposal or treatment system. avoid simply dumping Solid wastes; instead, use a pit and bury waste to minimize odors. wher-ever solid waste is disposed of, make sure it is away from water sources and cannot be washed away.

• Control sludge to decrease odors. Do not let sludge stagnate in or around the tannery site. Place it in a landfill or treatment area. Standing pools of liquid smell bad and are potential breeding grounds for insects particularly

Some Findings:

Though it is not possible to conclusively relate any particular ail-ment of a worker to the working conditions of a tannery mainly due to the

high turnover of workers, generally the following health hazards or impairments have been reported among some tannery workers of the developing countries of South East Asia:

· Loss of limb due to machine accidents;

· Loss of life due to exposure to H2S

· Full or partial loss of hearing;

· Skin irritation and ailments due to direct contact with chemicals;

· Burns due to contact with / spillage of corrosive chemicals on skins of workers;

· Respiratory disorder due to inhalation of dust / vapour.

2.10. Safety of Machines and Installation:

2.10.1 Such Accidents Do Happen In Tanneries:

• Trapping of fingers/forearms between rollers and bladed cylinders of shaving, fleshing and setting machines.

·Trapping of finger/forearms between belts and pulleys of drive of drums, paddles and other machines.

• Trapping of fingers between glass roll and bed of glazing machine.

• 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 Slocomb staking machine.

•Trapping of fingers/arms between plates of a hydraulic press.

• Contact with the grinding wheel of a shaving machine.

• Contact with knife band of splitting machine.

• Contact with rotating fleshing cylinder.

• Contact with live parts of electrical installations on the machine.

• Contact with hot plates of plating machine, vacuum dryer and boiler system.

• Hit by parts of disintegrating grinding stones. (Anon., 1991)

2.10.2 Check Safe Installation Of Machines And Electricals:

In general, regardless of the specific machine, check the following on the machines in your tannery and effluent treatment plant:

- Availability of passive safety devices (e.g. guards, fences) on prime movers, belts, open gears and transmission parts and other moving parts of machine.
- Availability and functioning of active safety.
- Standards of electrical installations with regard to electrical cabling, adequacy of electrical protection, control panel location (consistent with safety regulations), suitability of motors and switch gears for area of use.
- Operation controls (e.g. controls labelled in local language, emergency OFF button within easy reach of operators, work position of operator and helpers on the machine).

Adherence to good safety and maintenance practices in the use of machines and mechanical equipment in tanneries and effluent treatment plants

√ reduces the number and severity of accidents;

√ reduces machine down-time;

√ reduces energy consumption;

√ improves workflow due to higher rate of machine production (Anon., 1991)

CHAPTER THREE METHODOLOGY:

3.1. Introduction:

This chapter describes the methods and procedures used to collect and analyses data in order to assess the health and safety standards in Sudan leather industry.

This chapter include the study design, sample size and sampling procedures, instrumentation, data collection and procedures for analysis and presentation.

3.2. The study area:

The study was carried out in Sudan (case study four biggest tanneries in Khartoum state- namely– Amatong ,White Nile, Afrotan, and krawan) Subjects of the study specifically included consisted of Head department laboars, and safety employees, (these employees may hold different opinions on how health and safety of employees is ensured within the organization and its impact on their work performance).

3.3. Sampling and Sampling Procedures:

Survey is the main research method of this study. Personal scanning tool (questionnaire) was used, the questionnaire was initially written in English language and then translated to Arabic. Next, the questionnaire was reviewed by three academics to ensure that content and translations were appropriate for the research purpose. And analysis Based on the received comments, the questionnaire was revised as needed.

Then the randomly among the respondent of questionnaires were distributed to collect primary data and to measure occupational health and safety in Sudanese leather industry.

Firstly 30 exploratory samples were distributed on Amatong tannery to calculate questionnaires reliability and validity, Then sixty questionnaires were distributed on other tanneries (White Nile, Afrotan, and krawan) in

Khartoum. Ninety all questionnaires were recovered, 8disqualified as not eligible for analysis, As a result, 82 questionnaires were analyzed, The Measurement scales for our constructs were adapted from the literature.

Respondents were required to assess their agreement or disagreement with the statements provided in the questionnaire using yes and no questions.

The questionnaire was viewed by a panel of experts to determine its validity and take notes. Then it was consequently modified until it reached its final draft. Chronbach's alpha coefficient was used to determine the tool's reliability and consistency in the study population's responses. Generally, in operations management research Cronbach's $\alpha \geq 0.60$ is acceptable, all our constructs met the recommended value of $\alpha \geq 0.60$ as shown in Table 1 indicating that the constructs are valid and internally consistent.

Table 3.1: pilot reliability and validity test

Variables	Reliability%	validity%
Total	86	93

CHAPTER FOUR RESULTS AND DISSUASION:

4.1Descriptive statistical Analysis of the Study questions :

4.1.1 Demographic information:

4.1.1.1 Gender:

Table 4.1: sample distribution according to Gender

	Frequency	Valid Percentage
female	11	13.4
Male	71	86.6
Missing		
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Table 4.1 shows that out of the 82 respondents who participated in the study, majority 71 of the respondents representing 86.6% were males, while the remaining 11 respondents representing 13.4% being females. Naturally, males and females have different attitudes and views toward events at the work place.

4.1.1.2 Age:

Table 4.2: sample distribution according to respondent age through frequency and percentage:

	frequency	Valid Percentage
20-30	34	50
31-40	17	25
41-50	8	11.8
>50	9	13.2
Missing	14	
Total	88	100

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Table 4.2 depicts the age distribution of respondents who participated in the study. The purpose was to find out the average age of the employees who are actively involved in the operations within the organization. A close look at the Table shows that 34 respondents representing 50% fall within the age brackets 20-30 years; 17 representing 25% fall within the age brackets 31-40 years. Eight respondents representing 11.8% fall within 41-50 years while nine respondent representing 13.2% were more than 50 years. The data shows that majority of the employees in the organization fall within 20-30 years.

4.1.1.3. Educational level:

Table 4.3: sample distribution according to respondent educational level through frequency and percentage:

	frequency	Valid Percentage
PS	7	8.8
SS	15	18.8
Bsc	36	45
Others	22	27.5
Missing	2	
Total	82	100

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

The respondents were asked to indicate their educational background. The purpose was to find out the educational/academic qualifications of employees who participated in the study. Table 4.3 shows responses elicited, 7 respondents representing 8.8% have obtained PS/primary school certificates; 15 representing 18.8% have obtained SS/secondary school certificates. 36 respondents representing 45% have Bsc degree while 22 representing 27.5% have other levels of education. The data shows that majority of the employees have attained some level of education whose opinions and views are guided and well informed.

4.1.2 Summary of statistics of study questions:

Table 4.4 Which exercise you practiced?

Values	frequency	Valid Percent
fire cycle	21	25.6
risk assessment cycle	6	7.3
didn't practice	55	67.1
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

It can be observed from Table 4 that majority (55) of the respondents representing 67.1% did not attend any safety practices while 21 representing 25.6% attended fire cycle safety practice and 6 representing 7.3% attended risk assessment cycle

Table 4.5 Is there first aid bag or system?

Values	frequency	Valid Percent
yes	72	87.8
No	10	12.2
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

72 respondents representing 87.7% said there is first aid bag or system while 10 respondent representing 12.2 said that there is no first aid bag or system.

Table 4.6 Are the means of personal protection available?

Values	frequency	Valid Percent
yes enough	50	61.0
not sufficient	31	37.8
no at all	1	1.2
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

50 respondents representing 61% said there is enough means of personal protection and 31 respondents representing 37.8% said there are means of personal protection but not sufficient while only one respondent representing 1.2 said that there is no means for personal protection.

Table 4.7 Is drinking water and water used for personal hygiene favor?

Values	frequency	Valid Percent
yes	71	86.6
no	11	13.4
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

71 respondents representing 86.6% said that the drinking water and water used for personal hygiene favor is available, while 11 respondent repre-

senting 13.4% said that that the drinking water and water used for personal hygiene favor is not available.

Table 4.8 Is there a clean, prepared place to eat?

Values	Frequency	Valid Percent
yes	68	82.9
no	14	17.1
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

68 respondents representing 82.9% said there is a clean and prepared place to eat, while 14 respondent representing 17.1% said there is no clean, prepared place to eat.

Table 4.9 Which kind of following safety guidelines are available in the workplace?

Values	Frequency	Valid Percent
Seminars guidance	9	12.0
Boards and signs of guidance in the workplace	47	62.7
Boards alerting the dangerous places	19	25.3
Missing	7	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

The above tables shows that majority (47) respondent representing 62.7 said there is boards and signs of safety guidance in the workplace, 19 respondent representing 25.3% said there is boards alerting the dangerous

places and 9 respondent representing 12% said there is seminar guidance while 7 respondent did not answer the question.

Table 4.10 is the safety of workers is a priority for the administration?

Values	frequency	Valid Percent
Yes	68	84.0
No	13	16.0
missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of the respondent (68) representing 84% said that the safety of workers is priority for the administration, while 13 respondent representing 16% said that the safety of workers is not priority for the administration.

Table 4.11 Is there a person in charge of the security system of the institution?

Values	frequency	Valid Percent
yes	77	93.9
no	5	6.1
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

77 respondent representing 93.9% said that there is a person in charge of the security system in the institution, while only 5 respondent representing 6.1% said that there is no person in charge of the security system in the institution.

Table 4.12 In places with high noise are all workers wearing necessary protective means?

Values	frequency	Valid Percent
Yes	37	46.3
No	42	52.5
missing	3	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority (42) respondent representing 52.5% said that in places with high noise all workers were not wearing necessary protective means, while 37 respondent representing 46.3% said that in places with high noise all workers wearing necessary protective means.

Table 4.13 Are you committed to safety and security rules?

Values	frequency	Valid Percent
yes	65	79.3
sometimes	4	4.9
No	13	15.9
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of the respondent (65) representing 79.3% said that they are committed to safety and security rules, and 4 respondent representing 4.9% said that they are sometimes committed to safety and security rules, while 13 respondent representing 15.9% said that they are not committed to safety and security rules.

Table 4.14 From your point of view are security and safety rules important?

Values	frequency	Valid Percent
Yes	76	93.8
Not much	2	2.5
No	3	3.7
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of respondent (76) representing 93.8% thinks that security and safety rules are important, 2 respondents (2.5%) thinks it is not much important while 3 respondent (3.7%) thinks that security and safety rules are not important.

Table 4.15 Rate the rules of security and safety in the tannery?

Values	frequency	Valid Percent
excellent	27	32.9
good	32	39.0
weak	23	28.0
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

27 respondent representing 32.9% give the rules of security and safety in the tannery excellent rating, 32 respondent representing 39% give it good rating while 23 respondent representing 28% give the rules of security and safety in the tannery weak rating.

Table 4.16 From your point of view what is the thing that the staff must be aware of?

Values	Frequency	Valid Percent
Explanation of security and safety ways	15	18.5
security and safety importance	5	6.2
both	61	75.3
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (61 representing 75.3%) thinks that the staff must be aware of both Explanation of security and safety ways and security and safety importance, 15 respondent representing 18.5% thinks that the staff must be aware of Explanation of security and safety ways while only 5 respondent representing 6.2 thinks that the staff must be aware of safety security and safety importance.

Table 4.17 Is there workplace maintenance?

Values	Frequency	Valid Percent
Weakly	22	28.9
monthly	5	6.6
Not	49	64.5
Missing	6	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of 49 respondent representing 64.5% said that there is no work-place maintenance, 5 respondent representing 6.6% said there is work-

place maintenance carried out monthly while 22 respondent representing 28.9% said there is workplace maintenance carried out weekly

Table 4.18 Does the ventilation system is available in the tannery?

Values	Frequency	Valid Percent
Yes and it works well	53	65.4
Yes, but out of action	18	22.2
no	10	12.3
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

53 of the respondents representing 65.4% said there is well ventilation system in the tannery and 18 respondent representing 22.2% said there is ventilation system but out of action while 10 respondent representing 12.3% said there is no ventilation system in the tannery.

Table 4.19 Is there a proper sanitation, especially in the beam house?

Values	Frequency	Valid Percent
Yes and it works well	71	87.7
Yes, but out of action	8	9.9
no	2	2.5
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of respondent (71 representing 87.7%) said there is proper sanitation, especially in the beam house and 8 respondent representing 9.9%

there is sanitation but out of action while only 2 respondent representing 2.5% said there is no proper sanitation.

Table 4.20 Are fire extinguishers available**?**

Values	Frequency	Valid Percent
Yes and it works well	75	91.5
Yes, but out of action	7	8.5
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (75 representing 91.5%) said there is well fire extinguisher while 7 respondent representing 8.5% said there is fire extinguisher but out of action

Table 4.21 Is there a unit responsible for the application of security and safety in the tannery**?**

Values	Frequency	Valid Percent
Yes	67	81.7
No	15	18.3
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of respondents (67 representing 81.7% said there is a unit responsible for the application of security and safety in the tannery while 15 respondents representing 18.3% % said there is no unit responsible for the application of security and safety in the tannery.

Table 4.22 Are there frequently cleaning for tannery residues**?**

value	Frequency	Valid Percent
yes	77	93.9
no	5	6.1
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of respondents (77 representing 93.9%) said there is frequently cleaning for tannery residues while 5 respondent representing 6.1% said there is no frequently cleaning for tannery residues.

Table 4.23 Is there any equipment to deal with leaks and spills of hazardous substances**?**

value	Frequency	Valid Percent
yes	62	75.6
no	20	24.4
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (62 representing 75.6%) said there are equipment's to deal with leaks and spills of hazardous substances while 20 respondent representing 24.4% said there is no equipment to deal with leaks and spills of hazardous substances.

Table 4.24 Does the store floor non-slip**?**

value	Frequency	Valid Percent
Yes	71	88.8
No	9	11.3
Missing	2	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (71 representing 88.8%) said the store floor is non-slip while 9 respondent representing 11.3% said the store floor is slippery

Table 4.25 Are there signs and boards to identify the dangerous substances?

Value	Frequency	Valid Percent
Yes	66	80.5
No	16	19.5
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (66 representing 80.5%) said there are signs and boards to identify the dangerous substances while 16 respondent representing 19.5% said there are no signs and boards to identify the dangerous substances.

Table 4.26 Is there ventilation and lighting system in the depot**?**

value	Frequency	Valid Percent
yes	73	89.0
no	9	11.0
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (73 representing 89%) said there are ventilation and lighting system in the depot while 9 respondent representing 11% said there is no ventilation and lighting system in the depot.

Table 4.27 Are there fire extinguishers in the depot**?**

value	Frequency	Valid Percent
yes	77	93.9
no	5	6.1
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of respondent (77 representing 93.9%) said there are fire extinguishers in the depot while only 5 respondent representing 6.1% said there are no fire extinguishers in the depot.

Table 4.28 Are machines used modern and have effective safety system?

value	Frequency	Valid Percent
yes	61	74.4
no	21	25.6
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (61 representing 74.4%) said the machines are using modern, effective safety system while 21 respondent representing 25.6% said the machines are not using modern, effective safety system.

Table 4.29 Are machine maintenance periodically**?**

value	Frequency	Valid Percent
yes	70	85.4
no	12	14.6
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (70 representing 85.4%) said the machines are maintained periodically while 12 respondent representing 14.6% said the machines are not maintained periodically.

Table 4.30 Are flammable materials stored and tightly closed when not in use?

value	Frequency	Valid Percent
yes	74	90.2
no	8	9.8
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (74 representing 90.2%) said the flammable materials are stored and tightly closed when not in use while 8 respondent representing 9.8% said the flammable materials are not stored and tightly closed when not in use

Table 4.31 Is there an immediate clean when leakage of liquid materials (flammable and the Holocaust)?

value	Frequency	Valid Percent
yes	76	92.7
no	6	7.3
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Majority of respondent (76 representing 92.7%) said there is an immediate clean when liquid leaked while 6 respondent representing 7.3% said there is not an immediate clean when liquid leaked.

Table 4.32 Are poster (No Smoking) subject clearly in the flammable materials stores?

value	Frequency	Valid Percent
yes	66	81.5
no	15	18.5
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

Most of respondent (66 representing 81.5%) said the (No Smoking) poster are subject clearly in the flammable materials stores while 15 respondent representing 18.5% said the (No Smoking) poster are not subject clearly in the flammable materials stores.

Table 4.33 Toxic sign

Value	Frequency	Valid Percent
Poisonous	53	66.3
Murderous	23	28.7
Explosive	4	5.0
Missing	2	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

In the toxic sign 53 respondent representing 66.3% have the right answer while 27 respondent representing 33.7% have the wrong answer

Table 4.34 Fire exit sign

Value	Frequency	Valid Percent
general entrance	2	2.4
emergency exit	80	97.6
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

In the fire exit sign 80 respondent representing 97.6% have the right answer while 2 respondent representing 2.4 % have the wrong answer.

Table 4.35 Explosive sign

Value	Frequency	Valid Percent
disturbance	5	6.2
explosive	59	72.8
leaked material	17	21.0
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

In the explosive sign 59 respondent representing 72.8% have the right answer while 22 respondent representing 27.2% have the wrong answer.

Table 4.36 Corrosive sign

Value	Frequency	Valid Percent
Do not touch	12	14.8
fiery material	26	32.1
corrosive material	43	53.1
Missing	1	
Total	82	100.0

Source: prepared by the researcher based on the results of the statistical analysis of the questionnaire

In the corrosive sign just 43 respondent representing 53.1% have the right answer while38 respondent representing 46.9% have the wrong answer.

As noticed from the response rate of the previous questions the tanneries application of occupational health and safety is modest and do not confirming with the general guidelines on occupational safety and health endorsed by the standards and metrology Institute for Islamic countries (SMIIC)

CHAPTER FIVE CONCLUSIONS AND RECOMMENDATIONS

5.1Introduction:

This chapter presents a summary of the research process and the major findings from the study. It then draws conclusions and makes recommendations for policies and practice. Suggestions are also made for future research.

5.2. Overview of the Study:

The study was limited to access the effects of organization, machines and store safety on people safety in the tannery. The study purposed to evaluate the effect of organization, machines and store safety on people health and safety in Sudan tanneries.

Additionally, it purposed to assess the attitude of management towards health and safety of employees and to identify the challenges associated with health and safety standards in the organization. The target population consisted of labor and management in the selected tannery. The total sample size was 82. Simple random sampling technique was used to select the respondent. Questionnaire was designed and used to collect data for the study. The items were administered personally by the researcher. The research instruments were designed with the assistance of the supervisor. Data collection lasted for three weeks. The data were edited, coded, presented and analyzed using statistical tools such as percentages, Frequency tables, were used to summarize the data and the results were presented in the form of tables for discussion which aided in answering the research questions.

5.3. Conclusions:

Based on the findings it can be concluded that occupational health and safety practices at Sudan tanneries is not in conformity with what has been described as “best practices”. This is because; responsibilities of employees and management are not clearly spelt out with regards to health and safety. Employees are not trained in strategies for protection against hazards at the workplace. Increasingly, occupational health and safety is recognized as an issue that can impact on the effective functioning of firms and economic growth of the country. Safety of employees is primarily important at any workplace and it cannot be over simplified. Because, if there is not adequately invest in the competence of the labor force, in modernizing the plants and factories or in improving the efficiency of the operations, that would affect the organization. Adaptation of safety measures, policies and procedures not only ensure safety of life of the employee and fellow workers but also their family dependents.

The findings of the study have shown that employees health and safety in Sudan tanneries, is influenced negatively by poor management of safety practices and safety programs, bad management attitude towards health and safety, and training of employees on safety standards in the organization. Therefore all stakeholders should play active roles accordingly in measuring safety and continuous improvement in integrated safety management systems.

5.4. Recommendations:

From the findings and conclusions of the study, the following recommendations are made.

Management should be more responsible for the needs and concern of their employees‟ safety and health by being more sensitive to the problems of the employees. This can be carried out by the provision of a suggestion box or other avenues for employees to give their suggestions on how safety can be improved.

Furthermore, management should put in place policies and structures for improving occupational health and safety within the organization. Management should not wait to form ad hoc committees after an accident has occurred in the organization. Near misses should also be investigated thoroughly to forestall re-occurrence of accident in the near future.

Management should allocate funds and invest in occupational health and safety programs. This program should include proactive measures like near miss reporting, accident investigations, risk assessment, auditing for compliance and using inherently safe technologies. .

Again management must focus on health and safety programs workshops training sessions and conferences for employees and labors to increase their understanding and awareness of the importance of health and safety policy application, this must be accompanied with periodical system of awards and recognition.

There should be a continuous review of occupational health and safety policies, to ensure that firms have up to date safety measures in place.

5.5. Suggestions for Future Research:

To the importance of this research similar study should be conducted to evaluate the impact of health and safety on performance, productivity, environmental pollution and other domains of tannery industry in Khartoum

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Appendices

Appendix 1: Questionnaire

بسم الله الرحمن الرحيم

التاريخ: / /2016م

السيد/ .....

الموضوع / استبانة بغرض البحث العلمي

هذا الاستبيان يهدف الي رفع مستوي حماية العاملين بالمدابغ وحماية الممتلكات وتحقيق الامن والطمانينة للعنصر البشري وكذلك خفض نسبة الحوادث والاصابات. وقد صممت في اطار دراسة بعنوان (الصحة والسلامة المهنية في المدابغ دراسة حالة مدابغ ولاية الخرطوم) وذلك بغرض نيل درجة الماجستير في ضبط الجودة الشاملة . علية يرجو الباحث من السادة العاملين في المدابغ قراءة اسئلة الاستبانة والاجابة بوضع علامة (√) في المكان المخصص او الاجابة حسب مايقتضيه السؤال علما بان المعلومات التي سوف ترد في هذا الاستبيان سوف تستخدم في غرض البحث العلمي المذكور فقط .

ولكم جزيل الشكر

الباحث.....

بيانات اولية:

الجنس: انثى ☐ ذكر ☐ **العمر:** ☐ سنة

التعليم: ☐ ابتدائي(اساس) ☐ ثانوي ☐ جامعي ☐ اخري .....

- **المحور الاول: امن وسلامة الافراد**

1- اي من التدريبات مارستها

- ◯ دورة الحريق
- ◯ دورة تقييم المخاطر
- ◯ لم امارس

2- هل يوجد نظام او حقيبة اسعافات اولية

◯ نعم ◯ لا

3 - هل وسائل الوقاية الشخصية متوفرة

- ◯ نعم بشكل كافى
- ◯ غير متوفرة بشكل كافى
- ◯ لا توجد على الإطلاق

4- هل مياه الشرب والمياه المستخدمة في النظافة الشخصية صالحه

◯ نعم ◯ لا

5- هل يوجد مكان نظيف ومهيئ لتناول الطعام

◯ نعم ◯ لا

4- أى انواع إرشادات السلامة الاتية متوفرة فى مكان العمل

- ◯ نشرات إرشادية
- ◯ لوحات وعلامات إرشادية داخل مكان العمل
- ◯ لوحات تنبيه على الأماكن الخطرة

5- هل سلامة العاملين من اولويات الادارة

◯ نعم ◯ لا

6- هل يوجد شخص مسؤول من نظام الامن بالمؤسسة

◯ نعم ◯ لا

7- في الاماكن ذات الضوضاء المرتفعة هل يرتدي جميع العاملين وسائل الحماية الازمة

◯ نعم ◯ لا

8- هل تلتزم بقواعد الامن والسلامة

◯ نعم ◯ لا ◯ احياناً

9- من وجهة نظرك هل لقواعد الامن والسلامة اهمية

◯ نعم ◯ لا ◯ ليس كثيراً

10- ماتقيمك لقواعد الامن والسلامة في المدبغة

◯ ممتازه ◯ جيدة ◯ ضعيفة

10- من وجهة نظرك ماهو الشئ الذي يجب ان تتم توعيةالموظفين عليه

◯ شرح طرق الامن والسلامة

◯ اهمية الامن والسلامة

◯ كلاهما

- **العنصر الثاني: امن وسلامة المؤسسة:**

1- هل يتم صيانة مكان العمل

◯ اسبوعياً
◯ شهرياً
◯ بصورة غير دورية

2- هل نظام التهوية متوفر في المدبغة

◯ نعم ويعمل بشكل جيد
◯ نعم ولكن متعطل
◯ لا يوجد

3- هل يوجد صرف صحي سليم خصوصا في(beam house)

◯ نعم ويعمل بشكل جيد
◯ نعم ولكن متعطل
◯ لا يوجد

4- هل طفايات الحريق متوفره

◯ نعم وتعمل بشكل جيد
◯ نعم ولكن متعطلة
◯ لا توجد

5- هل توجد وحدة مسؤولة عن تطبيق الامن والسلامة بالمدبغة

◯ نعم ◯ لا

6- هل توجد نظافة متكرره لمخلفات المدبغة

◯ نعم ◯ لا

- **المحورالثالث : امن وسلامة المخازن**

1- هل توجد معدات للتعامل مع تسرب وانسكاب المواد الخطره
◯ نعم ◯ لا

2- هل ارضية المخزن غير قابلة للانزلاق
◯ نعم ◯ لا

3- هل توجد علامات ولوحات للتعرف علي خطورة المواد
◯ نعم ◯ لا

4- هل يوجد نظام تهوية وإنارة بالمستودع
◯ نعم ◯ لا

5- هل توجد طفايات حريق بالمستودع
◯ نعم ◯ لا

- **المحور الرابع: امن وسلامة المواد والماكينات**

1- هل الماكينات المستخدمة حديثة وبها نظام سلامة فعال ان كانت اجابتك (لا) اذكر السبب
◯ نعم ◯ لا .....

2- هل تتم صيانة الماكينات بصورة دورية

◯ نعم ◯ لا .....

3- هل المواد القابلة للاشتعال مخزنة ومغلقة باحكام في حالة عدم الاستخدام

◯ نعم ◯ لا .....

4- عند تسرب المواد السائلة(القابلة للاشتعال والمحرقة) هل تنظف حالا

◯ نعم ◯ لا .....

5- هل ملصق (No Smoking) موضوع بصورة واضحه عند مخازن المواد قابلة للاشتعال

◯ نعم ◯ لا

- **المحور الخامس :اقتراحات عامة**

ماهو رايك الشخصي في طرق الامن والسلامة المتبعة داخل المدبغة

.....
.....
.....

هل لديك اقتراحات لتوفير والتاكد من امن وسلامة مؤسستك

.....
.....
.....

اي اقتراحات اخري:

.....
.....

هل يمكنك التعرف علي الارشادات الاتيه؟ الرجاء كتابة ماتعنيه الصورة

	1- ◯ سام 2- ◯ قاتل 3- ◯ قابل للانفجار
	1- ◯ مدخل عام 2- ◯ مواصلات 3- ◯ مخرج طوارئ
	1 - ◯ ازعاج 2 - ◯ قابل للانفجار 3 - ◯ مادة قابله للتسرب
	1- ◯ ممنوع اللمس 2- ◯ مادة حارقة 3- ◯ مادة تآكلية

Appendix 2: Reliability test

Reliability Statistics

Cronbach's Alpha	N of Items
.816	33

Appendix 3: frequencies:

gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	11	13.4	13.4	13.4
	female	71	86.6	86.6	100.0
	Total	82	100.0	100.0	

age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30	34	41.5	50.0	50.0
	31-40	17	20.7	25.0	75.0
	41-50	8	9.8	11.8	86.8
	>50	9	11.0	13.2	100.0
	Total	68	82.9	100.0	
Missing	System	14	17.1		
Total		82	100.0		

educational level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	PS	7	8.5	8.8	8.8
	SS	15	18.3	18.8	27.5
	BSC	36	43.9	45.0	72.5
	others	22	26.8	27.5	100.0
	Total	80	97.6	100.0	
Missing	System	2	2.4		
Total		82	100.0		

which exercise you practiced

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	fire cycle	21	25.6	25.6	25.6
	risk assessment cycle	6	7.3	7.3	32.9
	didn't practice	55	67.1	67.1	100.0
	Total	82	100.0	100.0	

is there first aid bag or system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	72	87.8	87.8	87.8
	no	10	12.2	12.2	100.0
	Total	82	100.0	100.0	

Are the means of personal protection available

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes enough	50	61.0	61.0	61.0
	not sufficient	31	37.8	37.8	98.8
	no at all	1	1.2	1.2	100.0
	Total	82	100.0	100.0	

Is drinking water and water used for personal hygiene favor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	71	86.6	86.6	86.6
	no	11	13.4	13.4	100.0
	Total	82	100.0	100.0	

is there a clean, prepared place to eat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	68	82.9	82.9	82.9
	no	14	17.1	17.1	100.0
	Total	82	100.0	100.0	

which kind of following safety guidelines are available in the workplace

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Seminars guidance	9	11.0	12.0	12.0
	Boards and signs of guidance in the workplace	47	57.3	62.7	74.7
	Boards alerting the dangerous places	19	23.2	25.3	100.0
	Total	75	91.5	100.0	
Missing	System	7	8.5		
Total		82	100.0		

Is the safety of workers is a priority for the administration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	68	82.9	84.0	84.0
	no	13	15.9	16.0	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

Is there a person in charge of the security system of the institution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	77	93.9	93.9	93.9
	no	5	6.1	6.1	100.0
	Total	82	100.0	100.0	

in places with high noise Are all workers wearing necessary protective means

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	37	45.1	46.2	46.2
	no	42	51.2	52.5	98.8
	3	1	1.2	1.2	100.0
	Total	80	97.6	100.0	
Missing	System	2	2.4		
Total		82	100.0		

Are you committed to safety and security rules

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	65	79.3	79.3	79.3
	sometimes	4	4.9	4.9	84.1
	3	13	15.9	15.9	100.0
	Total	82	100.0	100.0	

From your point of view Are security and safety rules important

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	76	92.7	93.8	93.8
	not much	2	2.4	2.5	96.3
	3	3	3.7	3.7	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

Rate the rules of security and safety in the tannery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	excellent	27	32.9	32.9	32.9
	good	32	39.0	39.0	72.0
	weak	23	28.0	28.0	100.0
	Total	82	100.0	100.0	

From your point of view what is the thing that the staff must be aware of

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Explanation of security and safety ways	15	18.3	18.5	18.5
	security ad safety importance	5	6.1	6.2	24.7
	both	61	74.4	75.3	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

is there workplace maintenance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	weekly	22	26.8	28.9	28.9
	monthly	5	6.1	6.6	35.5
	not preodically	49	59.8	64.5	100.0
	Total	76	92.7	100.0	
Missing	System	6	7.3		
Total		82	100.0		

Does the ventilation system is available in the tannery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes and it works well	53	64.6	65.4	65.4
	Yes, but out of action	18	22.0	22.2	87.7
	no	10	12.2	12.3	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

Is there a proper sanitation, especially in the beam house

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes and it works well	71	86.6	87.7	87.7
	yes but out of action	8	9.8	9.9	97.5
	no	2	2.4	2.5	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

Are fire extinguishers available

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes and work well	75	91.5	91.5	91.5
	yes but out of action	7	8.5	8.5	100.0
	Total	82	100.0	100.0	

Is there a unit responsible for the application of security and safety in the tannery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	67	81.7	81.7	81.7
	no	15	18.3	18.3	100.0
	Total	82	100.0	100.0	

Are there Frequently cleaning for tannery residues

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	77	93.9	93.9	93.9
	no	5	6.1	6.1	100.0
	Total	82	100.0	100.0	

Is there any equipment to deal with leaks and spills of hazardous substances

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	62	75.6	75.6	75.6
	no	20	24.4	24.4	100.0
	Total	82	100.0	100.0	

Does the store floor non-slip

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	71	86.6	88.8	88.8
	no	9	11.0	11.2	100.0
	Total	80	97.6	100.0	
Missing	System	2	2.4		
Total		82	100.0		

Are there signs and boards to identify the dangerous substances

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	66	80.5	80.5	80.5
	no	16	19.5	19.5	100.0
	Total	82	100.0	100.0	

Is there ventilation and lighting system in the depot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	73	89.0	89.0	89.0
	no	9	11.0	11.0	100.0
	Total	82	100.0	100.0	

Are there fire extinguishers in the depot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	77	93.9	93.9	93.9
	no	5	6.1	6.1	100.0
	Total	82	100.0	100.0	

Are machines used modern and have effective safety system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	61	74.4	74.4	74.4
	no	21	25.6	25.6	100.0
	Total	82	100.0	100.0	

Are machine maintenance periodically

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	70	85.4	85.4	85.4
	no	12	14.6	14.6	100.0
	Total	82	100.0	100.0	

Are flammable materials stored and tightly closed when not in use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	74	90.2	90.2	90.2
	no	8	9.8	9.8	100.0
	Total	82	100.0	100.0	

Is there an immediate clean when leakage of liquid materials (flammable and the Holocaust)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	76	92.7	92.7	92.7
	no	6	7.3	7.3	100.0
	Total	82	100.0	100.0	

Are poster (No Smoking) subject clearly in the flammable materials stores

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	66	80.5	81.5	81.5
	no	15	18.3	18.5	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

toxic sign

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poisonous	53	64.6	66.2	66.2
	murderous	23	28.0	28.8	95.0
	explosive	4	4.9	5.0	100.0
	Total	80	97.6	100.0	
Missing	System	2	2.4		
Total		82	100.0		

fire exit sign

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	general entrance	2	2.4	2.4	2.4
	emergency exit	80	97.6	97.6	100.0
	Total	82	100.0	100.0	

explosive sign

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disturbance	5	6.1	6.2	6.2
	explosive	59	72.0	72.8	79.0
	leaked material	17	20.7	21.0	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		

corrosive sign

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Do not touch	12	14.6	14.8	14.8
	fiery material	26	31.7	32.1	46.9
	corrosive material	43	52.4	53.1	100.0
	Total	81	98.8	100.0	
Missing	System	1	1.2		
Total		82	100.0		