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Comprehensive Intervention in Occupational Health and Safety in Leather Industry

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Contents

INTRODUCTION

Leather is a material that is used by everyone around the world in any form, for its excellent abrasive and wind-resistance properties. From time immemorial, man has used this material to accustom himself to rough or stormy weather, and to cover the body parts. Leather's sturdiness makes it a stuff of everyday utility. Leather is widely used in making footwear, bags, belts, clothes and other accessories.

Looking back in history, primitive man hunted wild animals for food and used the hides and skins from the dead animal carcass for tents, clothing and footwear. These skins used to putrefy rapidly and became useless, as no method of preservation was known initially. The earliest method used for preservation was to stretch the hides and skins on the ground to dry; rubbing them with fats and animal brains. However, this method had a very limited preserving and softening action. As time passed, it was discovered that the bark of certain trees contains an active component, 'tannin', which can convert the raw skin into a rot-resistant and significantly softer product, and this process was known as vegetable tanning. Much later, the use of earth salts containing alum as a tanning agent to produce soft white leather was discovered. The alum leather could be dyed with naturally occurring dyestuffs of various plants.

Simply defined, tanning is a process by which the hide or skin of an animal is cured through the removal of the flesh, fat, moisture and bacteria that causes putrefaction, and thus converts the hide or skin into a stable, pliable material called leather. The word 'tanning' also derives from tannin, a chemical found in many plants.

The treatment of animal hides to make leather is an ancient art. Mammal hides are composed of three layers – a hairy outer layer, a thick central layer, and fatty inner layer. The process of making leather from raw skin, called tanning, involves removing the fat and the hair, and working a chemical change on the thick middle layer to preserve and strengthen it while giving it flexibility. By the eighteenth century, the crude leathers were made by first immersing the raw hides and skins in a fermenting solution of organic matter in which bacteria grew and attacked the hides or skins, resulting in a loosening of the hair or wool and some dissolving out of skin protein. The hair or wool was then scraped off with a primitive blunt stone or wooden scrapers, and fat or meat still adhering to the flesh side was removed in a similar manner. Tanning was done by dusting the raw stock with ground-up bark and other organic matter, and placing them in shallow pits or vats of tannin solution. Further additions of ground bark were made from time to time, until the tannin solution had penetrated right through the skin structure, taking up to two years for very thick hides. The leather was then hung up for several days in open sheds. The dressing of the leather involved paring or shaving it to a level thickness, colouring, treatment with oils and greases, drying and final treatment of the grain surface with waxes, proteins such as blood and egg albumins, and shellac to produce attractive surface finishes.

During the Middle Ages, leather was used for all kinds of purposes such as footwear, clothes, leather bags, cases and trunks, leather bottles, saddlery and harness, upholstery of chairs and couches, bookbinding and military uses. It was also used to decorate coaches, sedan chairs and walls.

The basic technique of vegetable tanning of leather was used by the ancient Egyptians and the Hebrews with plant products. The Hebrews used oak bark, and the Egyptians used the pod of a plant called babul. The Romans had a thriving tanning industry, using certain tree barks, berries, and wood extracts. Tanning was lost in Europe during the Middle Ages, but the art was kept alive in

the Arab world, and reintroduced to Europe later. By the eighteenth century, tanning was widespread in both the Old World and the new one. Though tanning was a relatively low-technology operation, it still required some specialised tools such as fleshing knives, scrapers, and soaking vats. Up until the late nineteenth century, all tanning chemicals were plant derivatives, such as hemlock, oak, and sumac bark. Tanners salted hides, soaked them in lime to dehair them, delimed them in an acid solution, usually manure, and then soaked the hides in increasingly strong solutions of vegetable tannin.

During the nineteenth century, chemical tanning became possible. With the discovery and introduction of basic chemicals like lime and sulphuric acid, tanners gradually abandoned their traditional method. Later on, Augustus Schultz, a New York dye salesman, and Martin Dennis, a scientifically trained tanner, developed chrome tanning, which reduced tanning time and overcame the dependence on bark. Leather production slowly became a chemically based series of processes. The process was discovered in 1858, and the first commercial production of chrome-tanned leather was in New York in 1884.

By the end of the nineteenth century, the invention of the motorcar, modern roads, and new ranges of coal tar dyestuffs increased the demand for softer, lightweight footwear with a fashionable appearance, and a general rise in the standard of living created a demand for soft, supple, colourful leather. The traditional vegetable-tanned leather was too hard and thick for these requirements, and thus, the use of the salts of the metal chromium was adopted, and chrome tanning became the staple for modern footwear and fashion leathers. It produces soft, supple, beautiful and fine leathers, reflecting the way we live.

Mechanisation of Leather Production

There are relatively few changes in the basic methods used to produce leather in the last 200 years. However, with the industrial revolution, scientific processes were introduced to the art and craft of leather making. A wider range of dyestuffs, synthetic tanning agents and oils were introduced. Along with precision machinery, these changes and continued innovations have made tanning a viable, modern manufacturing industry.

By 1850, some mechanisation had occurred in auxiliary occupations. Over the second half of the nineteenth century, the mechanised factories eliminated most of the hand labour in leather industries. Tanners and leather-machinery firms developed machines to remove hair, scrape, beat, spill, tan, dry, and finish leather, including steam-driven mechanisms to feed tannin and stir hides. Leather goods work was also mechanised, most importantly through sewing machine, which had initially been used to make clothing. First used to stitch shoe uppers in 1852, the sewing machine increased productivity in factories and was adopted widely by 1860.

In the 1950s and 1960s, the leather industries were mostly clustered in the United Kingdom, Italy, France, Germany and the United States. These countries were the largest producers as well as the largest consumers of leather products. During the late 1960s and early 1970s, though, there was a major shift from these countries to South Korea and Taiwan because of increased cost of production due to higher wages and stiff regulations on environmental protection. The second migration of the leather industry, towards countries in Asia and Southeast Asia, has been witnessed during the 1970s and ‘80s.

In India, tanning had begun during the Indus Valley civilisation, where the inhabitants used it as footwear and cover. From ancient times, Indian leather was famous across the world for its fineness and sturdiness. Its reference can also be found in Vedic literature. Earlier, leather-making activities

were mainly in the hands of village *chamar*s[1] and leather was produced to meet the local needs. The international trade in Indian leather started in the 1880s. During 1900-14, Calcutta (now Kolkata) and Madras (now Chennai) dominated the exports of raw and tanned material, Madras having 17 out of 22 organised tanneries at that time[2]. Nowadays, it is done at a grand scale in many parts of India including Chennai, Tamil Nadu, Maharashtra, Uttar Pradesh, Punjab and Delhi. Leather items are manufactured in India with a blend of traditional and modern techniques.

[1]The Chamars are one of the major communities found in almost all the states of northern India. The word Chamar is derived from the Sanskrit word 'ckarmakara', which means 'leather worker'. The Scheduled Castes by K.S. Singh, in *People of India*, National Series, vol. II. Oxford University Press, 2002

[2]Das, Samantak, and Mukhopadhyay, Dripto. *The Indian Leather Industry - A Perspective in Margin*, vol. 33, No. 4; July-Sep 2001

INDIAN LEATHER INDUSTRY: AN OVERVIEW

International trade in leather and leather products has grown dramatically in the past few years. The value of global import of leather and leather products has increased from about US$62,441.87 million in 2001 to US$79,059.7 million in 2005. Western and central Europe, the United States, Japan and Australia are the major consumers of leather and leather products, while manufacturing of these products predominantly takes place in the developing countries of Southeast Asia and Central and South America because of comparative cost advantage[3].

The raw material for the leather industry, i.e., hides and skins, are obtained from the livestock. There was an increase in the number of bovine animals[?] and goats and kids during 1990-2005, while the population of sheep and lambs was on a decline. Developing countries are the major source of raw hides and skins, constituting 78 per cent bovine animals and 93 per cent goats and kids of the total world population. China plays a significant role in turning developing countries as a major source of raw material. It accounts for 24 per cent of the total population of goats and kids (highest in the world), and nine per cent of world bovine animal population[4]. India constitutes 15 per cent of the world's total livestock population, with a share of 19 per cent (largest in the world) of the total bovine population and 6 per cent of the world's sheep and lamb population.

The Indian leather industry occupies a prominent place in the Indian economy in view of its substantial export earning, employment generation and growth. According to the Council for Leather Exports (CLE), global trade in leather products rose from US$77.33 billion in 2000 to US$97.60 billion in 2004, while India's trade in such products increased from US$1.99 billion to US$2.38 billion during the same period, and contributed 2.44 per cent of world trade in leather products in 2004[5]. Italy is the global leader in leather and leather product trade, followed by China, the United States and Korea.

The National Manufacturing Competitiveness Council (NMCC)[*] has identified the leather industry sector as one of the twelve focus manufacturing sectors in terms of competitiveness and untapped potential in the country. The sector is one of the top eight foreign exchange earners of the country, garnering Rs 10,000 crore per annum and accounting for 2.5 per cent of the global leather-related trade of Rs 387,200 crore. An estimated 15 per cent of total purchase of leading global brands in footwear, garments, leather goods and accessories in Europe and 10 per cent of global supply is outsourced from India[6].

The Indian leather industry is spread over the formal as well as informal sectors all over the country. It comprises tanneries (where raw hides and skins are converted into leather) and factories

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[3] *Occupational Safety and Health in the Tanning Industry in Southeast Asia*: *Fourteenth Session of the Leather and Leather Products Industry Panel*, 13-15 Dec., 2000, Zlin, Czech Republic; United Nations Industrial Development Organization

[?] Bovine animals refer to a diverse group of medium-sized to large-hoofed animals including domestic cow and buffalo

[4] *Indian Leather Industry: Perspective and Export Potential*; Exim Bank: Research Brief No. 22 March 2006

[5] 'New marketing window opens for leather industry'. *Business Line*. Oct 13, 2005

[*] An interdisciplinary and autonomous body set up by government of India in 2004, to energise and sustain the growth of manufacturing industries in the country

[6] India: Positive Outlook for Footwear and Leather Industry: CII Report

converting leather into a wide range of products such as footwear, garments and other assorted leather goods.

The Indian footwear segment ranks second in the world, next to China. The global trade in leather footwear is US$30 billion and in non-leather footwear it is US$18 billion. India has a respective share of 1.4 per cent and 0.15 per cent in the two sectors. In the last five years, the leather footwear and footwear components production has increased by 60 per cent. In tune with the whole sector, 90 per cent of total production takes place in small and medium enterprises (SME). There are around 42,000 footwear units registered under SSI units, which are largely clustered in Uttar Pradesh and Tamil Nadu.

The Indian market has been fragmented with about 2,200 tanneries (of which 2,100 are small-scale units) and over 8,000 leather-products manufacturing units. The turnover of the tanning industry is estimated at Rs 8,000-Rs 9,000 crore for 1999-2000. In the Indian tanning sector, the tiny units primarily engage in producing semi-finished leather, the small units engage in semi-finished and finished leather, and the large units are usually fully integrated units.

While tanning is broadly distributed among Tamil Nadu (55-60 per cent), Kolkata (18-20 per cent), Kanpur (12-15 per cent), and Jalandhar (5-7 per cent), the footwear industry is concentrated in Agra, Kanpur, New Delhi, Chennai, Ambur and Ranipet. Kolkata and surrounding areas produce footwear for domestic market[7].

There are nearly 4,000 units engaged in manufacturing footwear in India. The industry is dominated by small-scale units with a total production of 55 per cent. The total turnover of the footwear industry, including leather and non-leather footwear, is estimated at Rs 8,500-Rs 9,500 crore, including Rs 1,200-Rs 1,400 crore in the household segment. India's share in global leather footwear imports is around 1.4 per cent. Major competitors in the export market for leather footwear are China (14 per cent), Spain (6 per cent), and Italy (21 per cent).

The share of leather garments in total exports of leather and leather products has been rising and is presently around 24 per cent, having grown at a CAGR[#] of 9 per cent since 1995-96 to reach Rs 2,104 crore in 2000-01. India's share in the global import of leather garments is around 11 per cent. The main competitors are China, Italy and Turkey.

Indian leather industry employs around 2.5 million people, and 30 per cent of the total constitutes of women only. The sector is expected to add about one million jobs directly or indirectly by 2010.

Realising the growth potential of the leather industry, the government of India has been making significant efforts to promote rapid advancement of the industry. On June 30, 2005, the Cabinet Committee on Economic Affairs (CCEA) decided to implement a Rs 2.9-billion scheme for the integrated development of the leather sector. Under the scheme, existing tanneries will be modernised and new units set up for footwear, components and leather products. This scheme is expected to result in gains in terms of productivity, right-sizing of capacity, cost-cutting, and design development[8].

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[7]Strategies and preparation of SMEs for globalization in India - A study of the leather industrial sector by Indian Leather Industry Foundation, Chennai

[#]Compound annual growth rate (CAGR) is the year-over-year growth rate of an investment over a specified period of time.

[8]Industry Report: Leather Industry in India - http://www.businessinsights.biz/

PROCESS OF TANNING

Leather is made from animal skin (generally the skins or hides of mammals) that has been chemically treated to prevent it from microbial decomposition and to preserve its natural beauty and quality. Raw animal skins go through several steps during the tanning process. Depending on the type of hide used and the desired end product, the steps taken during tanning can vary greatly. The process of leather tanning can be summarised as follows:

Curing

Deterioration begins immediately when an animal is killed. To prevent deterioration, fresh skins must be preserved within about three hours after stripping. Curing is a preservation process, which involves salting and/or drying the hide once it's been stripped from the animal. Skins are salted by using sodium chloride (NaCl) that also acts as mild disinfectant. This dehydrates the skin to some extent, thereby significantly decreasing the micro-organisms' chances of survival. Then they are dried for three to six days. Drying causes the skin to lose its soft and supple nature, turning it as hard as horn and making it transparent. The dried and salted skins are stored at low temperatures (about 5º C). The raw hides are then sold to tanneries.

Soaking

In order to start tanning process properly, the dry salted hides must be washed free of salt. This is done by soaking the hides in water for one day. This soaking procedure rehydrates the hides to their original flaccid condition and removes the dirt. This also helps to rid the skin of salt, dirt, debris, blood and excess animal fats.

Liming and Dehairing

The hides are then transported to a large vat, where they are immersed in a mixture of lime and water, which loosens the hair from the skin. After a day's soaking, the hair is mechanically removed from the hide with the help of a wooden stick or a knife. At the same time, liming also loosens the subcutaneous layer so that it is more easily removed later on. Liming takes 24 hours. At the end of the process, the skin becomes very alkaline (pH 13-14).

Fleshing and Scudding

Excess flesh, fat and muscle are now removed from the hides. This is done traditionally by means of a knife.

Deliming

After liming, all the alkaline substances present in the skin are removed. If this is not done, the acid environment during tanning would result in a rapid and unnecessary hardening of the fibres. Alkaline substances are removed by washing the hides in ammonium sulphate or ammonium chloride and clean water in big drums.

Pickling

The hides are then placed in an acid environment (low pH) to prepare them to accept the tanning materials, because chrome tanning agents are not soluble under alkaline conditions. Pickling is accomplished by adding salt and acid to the hides. This is a preserving process in itself, as hides can be kept in this state for extended periods of time, without worrying for deterioration.

Tanning

The raw collagen fibres of the hides must be converted into a stable product that is no longer susceptible to rotting. This is done by adding chrome tanning agents to the hides in a revolving drum. These tanning agents also significantly improve the hide's dimensional stability, abrasion resistance, resistance to chemicals and to heat, ability to flex innumerable times without breaking, and ability to endure repeated cycles of wetting and drying.

Wringing or Drying

Excess moisture must be removed from the hides. This is done either by exposing the hides to sunlight or passing each hide through two large rollers.

Splitting

The hides must now be split into the desired thickness. The hides are put through a splitting machine that is set to split the hides to the desired thickness, cutting off the top grain first, followed by another layer, and sometimes two. These layers are called splits.

Shaving

The thickness of the hides must be made uniform. This is done with a shaving machine through which the hides are run. The helical-shaped cutting blades level the overall thickness to exact specifications and open the fibre structure in a way that it can receive subsequent chemical processing.

Re-tanning

This process is done to impart special end-use properties with other tanning chemicals. The substances used add solidity and body to chrome leather, and help minimise variations in the character of the leather which may still exist between different parts of the hide.

Colouring

As soon as the re-tanning process is completed, aniline dyes, derived primarily from petroleum, along with very hot water are added to rotating drums to penetrate the hides for the desired colour.

Fatliquoring

This is the last of the wet chemical operations to which the leather is subjected. Fatliquoring has the most pronounced effect on how soft leather will be, and it contributes greatly to its tensile strength. The more the fatliquors, the softer the hides will be.

Setting out

This operation smoothes and stretches the hide, while compressing and squeezing out the excess moisture. This puts the hides in the proper condition for drying.

Toggling (Jarai)

The hides are stretched across a wooden frame and held in place with moles. One hide is clipped to each side of the frame. The frames are then kept under sunlight or slid into channels in drying ovens.

Staking

Leather is staked to make it pliable. In combination with the correct fatliquoring treatment, staking governs the final firmness or softness of the leather.

Dry Milling

The hides are placed in a large dry drum and tumbled until the desired softness is obtained.

Buffing

This process improves the final appearance of the hides by lightly sanding the surface to remove some of the natural imperfections such as scratches and healed scars. It provides the hide with better cutting yield.

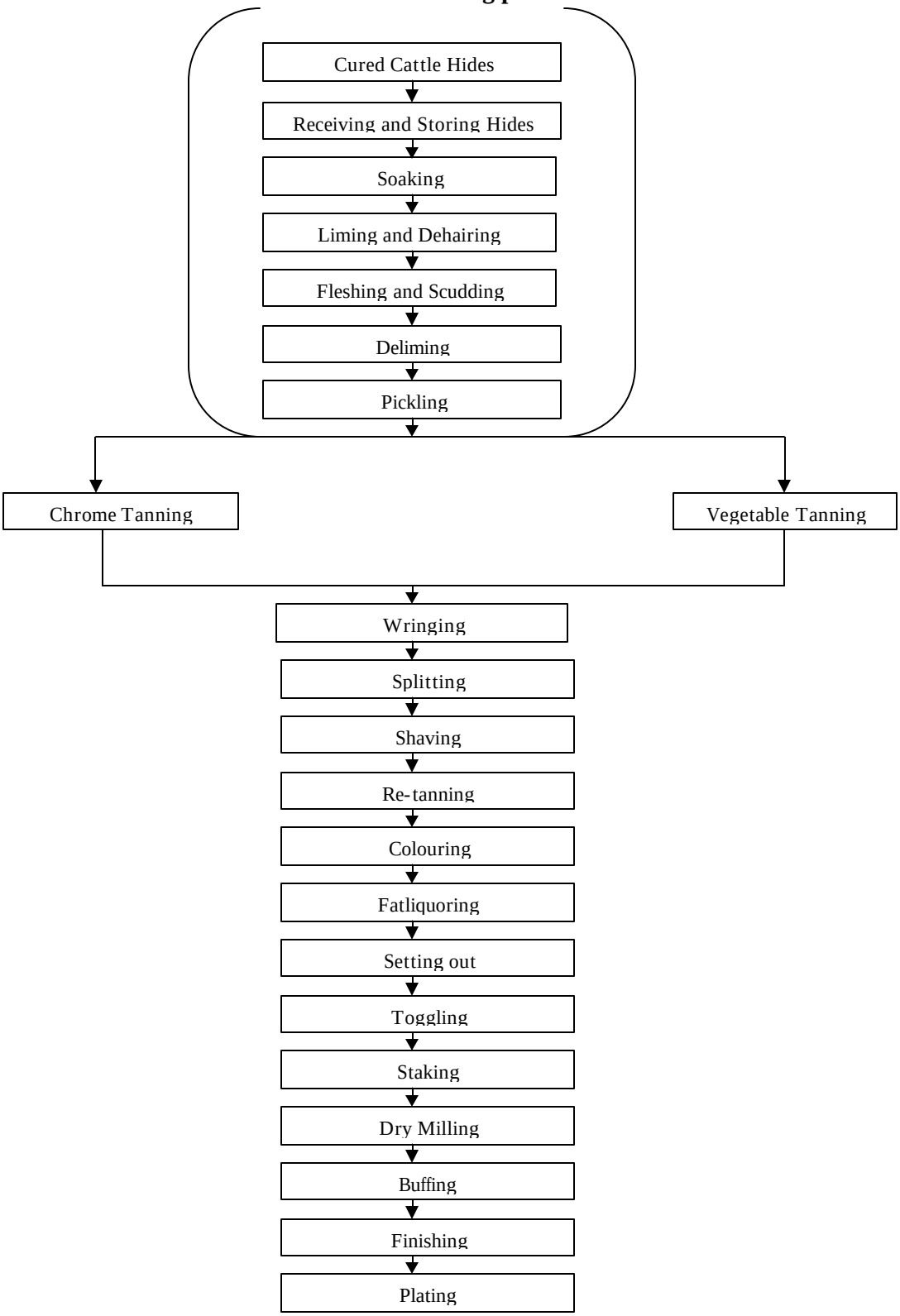
Finishing

This process applies film-forming materials on the surface of the hide. Here is where layers of pigments are added if required. This process also adds the protective sealant to the surface.

Plating

This is the final step in the leather process. During this process, heat presses a chosen grain into the surface of the hides.

Flow chart of tanning process



OCCUPATIONAL HAZARDS IN LEATHER TANNERIES

The various production processes in tanning industry pose many hazards to the health of its employees. Toxic chemicals such as hydrogen sulphide, chromium, bleaching agents, disinfectants, dyes and physical and biological agents like anthrax are a few elements that affect workers in the industry. The repercussions vary from minor irritation while working to serious and disabling chronic diseases.

For most workers, the degree and types of exposure depend upon their specific occupation and work area within the tannery. For example, the unloading of a hide-processing drum may result in simultaneous contact with the chemical substances within the drum, by inhalation and dermal contact, and with the chemical dusts generated while recharging the drums. In the case of a tannery, which incorporates all the processes of leather production, beamhouse workers may also be exposed to the organic vapours generated in the finishing department; however, their exposure to these agents may be lower than that of those employed within the finishing area. Workers in the buffing area are exposed to leather dust and to its burden of tanning chemicals, while those working in the hide receiving and sorting area are exposed to hide dust. Buffing area workers may also be exposed to solvent vapours from the finishing area; due to the proximity of the hide-sorting area to the beamhouse, hide sorters may also be exposed to beamhouse contaminants. The use of a wide variety of chemicals in tanning process results in worker exposure via inhalation, ingestion, or dermal contact to multiple and changing chemical pollutants[9].

A) Chemical Hazards

1) Dusts

Dusts of vegetable tanning materials, lime, and leather are generated in many operations carried out in tanneries. It is known that the main exposures to these dusts occur around rotating drums and shaving and buffing machines. There is no threshold limit value (TLV) laid down for leather dust. Concentration of the dust varying between 4 and 24 million particles/cubic foot was found in a study[10] conducted on tanneries of northern India.

2) Toxic Gases

Risk of exposure to hydrogen sulphide (H2S) gas is reported especially during cleaning out of tanning pits if strict precautions are not undertaken. The main source of this chemical asphyxiant gas is the decomposition and degradation of sulphur containing protein of tanned waste. The gas remains dissolved in tan pits and is released in high concentration into the atmosphere if this tan liquor is stirred.

3) Chemicals

Following are some of the hazardous chemicals used in tanneries: naphthol; acrolein; amino resins; ammonia; arsenic compounds; bleaching powder; borax; chlorine; chlorophenols; chromium

[9]The Leather Tanning and Processing Industries, Vol. 25, 1981, p. 199 - International Agency for Research on Cancer (IARC)

[10]Chakraborty, R.N. et al. An industrial waste survey report, Para I Tanneries of V.P. Environmental Health, Vol. VII

(trivalent) sulphate; DDT; proteolytic enzymes; formaldehyde; formic acid; glutaraldehyde; hydrochloric acid; mercury (ammoniated); milk of lime; naphthalene derivatives; nickel sulphate; organic dyes (this includes a variety of dyes based on benzidine, o-toluidine, o-dianisidine, and other intermediates); oxalic acid; p-nitrophenol; phenol derivatives; sodium acid fluoride; sodium hydroxide; sulphuric acid; tricresyl phosphate; vegetable tannins; and zinc chloride.

B) Biological Hazards

For the tanning process, the epidermis of the hide is first removed and only the dermis is transformed into leather. During this process, infection is a constant hazard since the hide serves as a medium for numerous micro-organisms. Colonies of fungi may develop, specifically *Aspergillus niger* and *Penicillus glaucum*. (Martignone, 1964) To avoid the development of fungi, chlorinated phenols, specifically pentachlorophenol, are widely used, but these are found to be toxic. Tetanus, anthrax, leptospirosis, epizootic aphtha, Q fever and brucellosis are examples of diseases that workers could contract during the tanning process due to infected hides. (Valsecchi and Fiorio, 1978)

C) Accidents

Accidents are one of the leading causes of disability in leather tannery workers. Slips and falls on wet and greasy floors are common, so are knife cuts while trimming hides. In addition, the machines used to process the hides are capable of crushing and inflicting bruises, abrasions and amputations. For example, United States Bureau of Labour Statistics (BLS) data for 1994, in Standard Industrial Classification (SIC) 311, shows an incidence rate for injuries and illnesses combined to be 19.1 per 100 full-time workers, and an incidence rate for injuries alone of 16.4 per 100 full-time workers. These results are about 50 per cent higher than the all-manufacturing incidence for illnesses and injuries combined, 12.2 per 100 full-time workers, and the incidence of 10.4 per 100 full-time workers for injuries alone (BLS 1995).

Fatal injuries by drowning and scalds are reported in tanneries. This is due to wet, greasy and slippery floor, and unfenced pits and vats. The risk is further increased due to poor illumination of workrooms. Finger injuries are common, especially when fleshing and dehairing operations are carried out manually using sharp, long knives.

D) Hazards of Untreated Effluents

The liquid wastes from tanneries have high pH level and alkalinity. It also contains toxic chemicals like chromium, arsenic and lime. It was noticed that tannery waste could cause choking of corporation sewers, and is toxic for fish and aquatic life. Bathers may get anthrax if the tanning waste is discharged into rivers without appropriate treatment.

In India, the tanning industry is identified as hazardous and, through an amendment in 1987, was included in Schedule I of the Factories Act, 1948.

POSSIBLE HEALTH EFFECTS ON WORKERS OF LEATHER TANNERIES

Occupational diseases are disorders of health resulting from conditions related to the workplace, and are related to exposures to physical, chemical, ergonomic, or psychological hazards. Occupational injuries are disorders resulting from trauma such as strains or sprains, lacerations, burns, or soft-tissue injuries such as bruises. They are mostly the immediate result of mechanical factors such as lifting or bending, or inadequate safety measures resulting in accidents. However, some types of injury, such as tendonitis resulting from repetitive movements, are counted as 'diseases', while acute poisoning by chemicals discovered immediately is counted as an 'injury'.

Richard Helmer, director for occupational health at WHO, at an international conference on occupational health in Helsinki, Finland, said that developing countries account for three-fourth of the global workforce. This has been on a continuous rise because of shifting of industries from the industrialised world to the developing countries, but lack of infrastructure to provide good working conditions and poor implementation of labour laws may further deteriorate the health of workers[11].

According to the International Agency for Research on Cancer (IARC), leather tanning and processing is not classifiable as to its carcinogenicity to humans, although the production process involves exposure to numerous chemicals, for some of which there is evidence of carcinogenicity in humans[12]. However, in 1981, IARC had reported an increased risk for bladder cancer in the only study available at the time[13].

Tannery workers have been known, from previous studies, to have the potential for exposure to numerous known or suspected occupational carcinogens including hexavalent chromium salts and arsenic-containing organic solvents (benzene, formaldehyde, butyl acetate, ethanol, aceta acetate, toluene and acetone). The two major sources of chromium particulates in the tannery work environment are chromium sulphate in inorganic form and in the protein-bound form that is known as leather dust. The leather dust produced by mechanical operations including buffing and shaving contains three per cent of mostly protein-bound chromium[14].

Workers in the tannery are exposed to these chemicals and dust (including leather and hide dust) in various ways: (a) inhalation in the form of gases, dust, vapours, mist and fumes; (b) ingestion, when workers are eating, drinking, or smoking in the work area without washing contaminated hands; and (c) dermal absorption generally through the pores or cuts/wounds or adsorption. Though each chemical is not necessarily hazardous to human health, it can be an inherent source of the hazard. It can be the chemical itself, any emissions generated during the handling of the chemical, or the container used for storage and transport of chemicals. The impact of such

[11]http://activeforindia.org/occdisease.htm

[12]International Agency for Research on Cancer (IARC). IARC monographs on the evaluation of carcinogenic risks to humans. Leather tanning and processing. WHO: Lyon; 1987. p. 25:7

[13]International Agency for Research on Cancer (IARC). (In preparation) IARC Monographs on the evaluation of carcinogenic risks to humans. WHO: Lyon; 1988

[14]Rastogi, S., Kesavachandran, C., Mahdi, Farzana, and Pandey, Amit. Occupational cancers in leather tanning industries: A short review. *Indian Journal of Occupation and Environmental Medicine*. Issue 1, Vol. 11. Jan-Apr 2007

exposure can cause temporary dizziness, headache, irritation of eyes, skin or lungs, poisoning of liver, kidney, or nervous system, or collapse due to lack of oxygen. Long-term illnesses can readily occur including occupational asthma, dermal/nasal ulcers, bronchitis, or genetic defects. In some cases, even instantaneous death can occur[15].

Respiratory Effects

The most common morbidity as a result of dust exposure is reported to be chronic bronchitis due to multiple and continuous exposures to leather dust, hide dust, chemical vapours, fumes and toxic gases. Irritation of upper respiratory tract is common on acute exposure to these hazards, and sometimes may result into occupational asthma. Acute respiratory toxicity can occur on exposure to high concentration of gases in the work environment. In a study on tannery workers, the number of those with respiratory obstruction detected by spirometry was 294 cases (40.27 per cent), more than the number of cases, at 263 (36.02 per cent), who claimed having respiratory problems. [16]

Skin Disorders

Skin disorders such as eczema and allergic contact dermatitis have been diagnosed among leather tanners exposed to preservatives applied to the hides. (Abrams and Warr, 1951) The leather tanning and finishing process has been shown to have the highest incidence of dermatoses of any working group in the United States. (Stevens, 1979) Irritations of the mucous membranes of the throat and nose, and perforations of the nasal septum may also occur after inhaling chromic acid fumes liberated during the chrome-tanning process.

Chrome ulcers of skin are painless, multiple ulcers or holes on the skin of the exposed parts of the body, especially hands and feet. In a study conducted on tanneries of northern India, the prevalence of ulcers of fingers and toes among chrome tanners was found to be 10.6 per cent. Chrome ulcer of the skin is a notifiable disease under the Indian Factories Act, 1948. It is a compensable disease as well.

Anthrax is caused by a biological agent *Bacillus anthracis*. Infection to the workmen occur when the infected hides or skins are handled and anthrax spores find their way through skin abrasions, resulting in skin ulcerations commonly known as cutaneous anthrax or malignant pustule. Inhalation of spores does occur rarely and the worker may develop haemorrhagic pneumonia of lungs known as pulmonary anthrax. It is a fatal disease. Anthrax is a notifiable disease under the India Factories Act, 1948. It is also a compensable disease prescribed under Workmen's Compensation and ESI acts. Some years back, cutaneous anthrax had been very prominent among tannery workers in Australia, but is not reported now[17].

Callosities (thickening of skin at pressure points), especially of shoulder and palm, is caused due to repeated pressure and motion effects while the hides and skins are handled and transported manually by the workers.

Musculoskeletal Injuries

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[15]IUE Recommendations for occupational safety and health in the use of chemicals in the tannery

[16]Respiratory Problems in tannery workers in Istanbul, Indoor and Built Environment, Vol. 16, No. 2, pp. 177-183 (2007)

[17]Australia's Notifiable Disease Status, 2001: Annual report of the National Notifiable Diseases Surveillance System. Communicable Diseases Intelligence, Vol. 27, No. 1, March 2003

Acute musculoskeletal injuries are caused by physical overexertion and awkward posture while moving heavy or bulky loads, in particular bundles of hides, skins and leather. Lower-back pain due to prolonged working in a standing or semi-bending posture is common.

Prolonged standing may also lead to pain in feet and lower back, bunions/corns, locking of joints, varicose veins and problems related to reproductive system, heart and blood circulation. Muscle fatigue can also occur, as both standing and walking require constant muscle work[18]. Long sitting postures may also cause some gastrointestinal problems or problems related to excretory system.

Heat stress, in particular when working on warm days in premises lacking good ventilation or air conditioning, has also been reported.

Cancers

Tannery workers are likely to be exposed to numerous known or suspected occupational carcinogens including hexavalent chromium salts, benzidine-based azo dyes, organic solvents (e.g., benzene and formaldehyde), pentachlorophenol, N-nitroso compounds, arsenic, dimethylformamide and airborne leather dusts. These exposures may result in the development of various site-specific cancers. An excess of lung cancer has been observed in studies carried out in Italy[19/20] and in a case-control study carried out in the United States[21], but this result is not always supported by other studies[22/23/24]. Chromium and arsenicals were mentioned as possible contributors to the lung-cancer excess. A significantly increased risk of soft-tissue sarcoma has been observed in at least two separate tannery studies, one in Italy and one in the United Kingdom; the investigators of both studies suggest that the chlorophenols used at the tanneries may have produced these malignancies[25].

A threefold statistically significant excess in pancreatic cancer mortality was noted in a Swedish case-control study[26]. Despite the excess risk of pancreatic cancer, no specific environmental agent was identified, and dietary factors were considered a possibility. An excess risk of testicular cancer was observed among leather tanners from the finishing department of one tannery; all three workers with testicular cancer had worked during the same time period and were exposed to

[18]Rory O'Neill. Standing problem. Hazard 91, Aug 2005

[19]Seniori, Costantini A., Merler, E., and Saracci, R. Epidemiological studies on occupational cancer risk in tanning, leather and shoe industries. Med Lav 1990; 81:184-211

[20]Bonassi, S., Merlo, F., Puntoni, R., Fernaris, F., and Bottura, G. Epidemics of lung tumors in a Biella tannery. Epidemiol Prev 1990; 12:25-30

[21]Garabrant, D.H., and Wegman, D.H. Cancer mortality among shoe and leather workers in Massachusetts. Am J Ind Med 1984; 5:303-14

[22]Mikoczy, Z., Schultz, A., and Hagmar, L. Cancer incidence and mortality among Swedish leather tanners. Occup Environ Med J 1994; 51:530-5

[23]Stern, F.B. Mortality among chrome leather tannery workers: An update. Am J Ind Med 2003; 44:197-206

[24]Pippard, E.C., Acheson, E.D., and Winter, P.D. Mortality of tanners. Br J Ind Med 1985; 42:285-7

[25]Mikoczy, Z., Schultz, A., and Hagmar, L. Cancer incidence and mortality among Swedish leather tanners. Occup Environ Med J 1994; 51:530-5

[26]Edling, C., Kling, H., Flodin, U., and Axelson, O. Cancer mortality among leather tanners. Br J Ind Med 1986; 43:494-6

dimethylformamide[27/28]. An excess risk of sinonasal cancer among leather tannery workers was observed in a case-control study in Italy; chromium, leather dust and tannins were indicated as possible etiological agents[29/30]. However, IARC research in the early 1980s found no evidence of an association between leather tanning and nasal cancer. (IARC, 1981) The results of a study of the Chinese leather tanning industry showed a statistically significant excess morbidity from bladder cancer among those tanners ever exposed to benzidine-based dyes, the incidence of cancer increasing with duration of exposure[31].

[27]Levin, S.M., Baker, D.B., Landrigan, P.J., Monagha, S.V., Frumin, E., and Braithwaite, M., *et al.* Testicular cancer in leather tanners exposed to dimethyl formamide. Lancet 1987; 2:1153

[28]Calvert, G.M., Fajen, J.M., Hills, B.W., and Halperin, W.E. Testicular cancer, dimethyl formamide and leather tanneries. Lancet 1990; 336:1253-4

[29]Comba, P., Battista, G., Belli, S., De Capua, B., Merler, E., and Orsi, D. 1992. A case-control study of cancer of the nose and paranasal sinuses and occupational exposures. Am J Ind Med 22:511–520

[30]Battista, G., Comba, P., Orsi, D., Norpoth, K., and Maier, A. Nasal cancer in leather workers: An occupational disease. J Cancer Res Clin Oncol 1995; 121:1-6

[31]Chen, J.G. A cohort study of the cancer experience among workers exposed to benzidene derived dyes in Shanghai (China) leather tanning industry. Zhonghua Yu Fang Yi Xue Za Zhi 1990; 24:328-31

METHODOLOGY

Objective

- To collect, analyse and correlate the health and safety data of the leather tannery workers
- To work out the feasibility of (a) interventional studies to ascertain cause-and-effect relationship of potent health hazard exposures, (b) training workshops/programmes, (c) capacity building, advocacy and campaign for the implementation of the occupational health and safety measures based on the accumulated data

Methodology

Location of Study

A convenient sample of 100 tannery workers was taken from Kanpur, an industrial hub of leather processing and products situated in eastern Uttar Pradesh, about 100 kilometres from Lucknow, capital city of Uttar Pradesh (UP). Historically, Kanpur has been referred to as the Manchester of India since it was a major cantonment during British rule and a centre for the textile industry.

At present, Kanpur supports many small-scale industries such as leather, soap and detergents, spices, paan masala, readymade garments, chemicals, packaging, engineering, and defence supplies. Until March 31, 2007, there were around 16,939 small-scale industries, with an investment of Rs 322.51 crore and employing some 68,381 direct/indirect workers (as per UP govt website). There are 76 large- and medium-scale industries (including leather finished goods, vegetable oil, two/three-wheelers, sugar, printing, industrial thread, nylon yarn, industrial machinery) in Kanpur, with investment of Rs 2,834.28 crore and 54,851 employees.

There are 396 tanneries in Kanpur, employing 86,000 workers. Kanpur and Unnao (another nearby district) have 342 leather export units with an investment of Rs 3,637 crore. Major countries importing from these units are the United States, Australia, the United Kingdom, South Africa and EU countries.

Inputs of Study

A detailed questionnaire was prepared to obtain information on demography, personal habits, exposure history, and health hazards of chemicals, as also injuries taking place during work in tanneries. To study the health conditions, specific questions were asked on respiratory, gastrointestinal, neurological, dermal and eye-related problems. Questions on personal and family history of medical illness were also included in the questionnaire.

The collected data was organised, entered and analysed with the help of Epi Info 2005, an epidemiological data management software recommended by World Health Organization (WHO).

OBSERVATIONS AND FINDINGS

AGE DISTRIBUTION

Table 1: Age Group Distribution

Age group (years)	Number
<= 14	-
15-18	6
19-30	44
31-40	35
41-50	11
51-60	4
> 60	-
Total	**100**

The information collected from the 100 workers was analysed with regard to the age of the workers. Table 1 shows that the maximum number – 44 (44 per cent) workers – is in the age group of 19-30 years, and 10 of them are 22 years old. Thirty-five per cent of the studied population belong to 31-40 years age group. The minimum age of the worker recorded in the study is 16 years, while the maximum age is 60 years. The mean age of workers is 31.7 years (standard deviation 10).

The following reasons can be attributed for entering this occupation at an early age:

- Easy entry if any known person or relative is already working
- Fewer employment opportunities in their native villages
- Prefer to join because their own society, which provides mental and physical support, and with whom they can enjoy their own culture and traditions, is working there
- Belong to poor family, so cannot afford to study. Only option available is to work

A majority of the workers, 80 per cent, belong to the state of Bihar, whereas 19 per cent workers belong to the state of Uttar Pradesh. One worker was from the state of West Bengal.

Here, the noticeable point is that despite the tanneries being located in Kanpur (UP), the majority of the workers belong to Bihar. This can be attributed to the reluctance of tannery owners to employ local people. This results in greater migration among workers of both the states as workers from Bihar prefer to come to Kanpur (UP) because of easy employment opportunities, and people from Uttar Pradesh are forced to migrate to other places.

Studies on migration have termed this migratory trend as push factor and pull factor. Push factors include hunger and poverty, whereas pull factors include employment opportunities and cultural and religious freedom[32/33]. As far as occupational hazards are concerned, migration often implies

[32]Mygind, A., Kristiansen, M., Krasnik, A., and Norredam, M. Risk perception among ethnic minorities - the influence of ethnicity and migration. Copenhagen: The National Board of Health, 2006

several strains and losses, which may cause increased risk behaviour leading to negative consequences for migrants' physical and mental health[34]. Fundamentally, there is limited knowledge about the migrants and their health status due to lack of data.

EDUCATION STATUS

The majority of workers (84 per cent) are illiterate. Out of the rest 16 workers, ten have studied up to middle standard (eighth pass), five are matriculate, and only one has studied up to 12th standard. The reasons for high level of illiteracy can be large family size and poor family income, or non-availability of schools in approachable proximity. One psychological factor is that they give priority to employment over education, and moreover, easy job entry into small-scale industries supports this mindset.

The interstate comparison of literacy calculations reveals that almost 50 per cent of the total workers from Uttar Pradesh (10 out of 19) are literate. Further, out of the total 16 literate workers in the sample, 10 (62.5 per cent) are from Uttar Pradesh, an indication that Bihar lags way behind Uttar Pradesh in education level of tannery labourers.

CIVIL STATUS

Table 2: Civil Status

Status	Age group (years)					Total
	15-18	19-30	31-40	41-50	51-60	
Married	1	37	35	10	4	87
Unmarried	5	7	-	-	-	12
Widower	-	-	-	1	-	1
Total	6	44	35	10	4	100

Out of the total 44 workers in the 19-30 years age group, married and unmarried workers account for 84 per cent and 16 per cent, respectively. On the other hand, 42.5 per cent of total married workers and 58 per cent of total unmarried workers belong to this age group. No unmarried worker is found between the age of 31 years and 60 years. One worker was found married at the age of 18 years (minimum marriage age). However, most of the married workers are staying alone, as they find it difficult to afford keeping their spouses and children with them.

[33]Carta, M.G., Bernal, M., Hardoy, M.C., Haro-Abad, J.M. Migration and mental health in Europe. The state of the Mental Health in Europe Working Group: appendix 1. Clin Pract Epidemol Ment Health 2005; 1(13)

[34]Maria, K., and Mygind, A. Health effects of migration. Dan Med Bull 2007; 54:46-7

JOB PROFILE

Table 3: Job Profile Distribution

Job profile	No. of workers
Labourer	32
Jarai	26
Machine operator	20
Drum operator	19
Finishing	3

The collected data was analysed to know the different work profiles involved in the tannery work (Table 3) As the data was collected randomly, the above distribution cannot be projected as the distribution of workers' job profile in a single tannery. However, some idea can be had as to the various activities involved and the intensity of those activities. Most of the tannery processes/operations can be done by semi-skilled labourers and general labourers or helpers.

Workers who perform the miscellaneous activities like loading and unloading of the material in drum, chemical transportation, etc., in tanneries are called labour. They work at any place or help in performing any operation. Labour also includes workers at *chuna-godam* (place of activity before the material enters the drum-operation process). *Chuna-godam* workers have fixed duties to perform at this place only.

Jarai workers fix semi-processed leather on the wooden board with the help of nails and leave it to dry in daylight.

Machine operators handle machines like shaving machine (for giving uniform thickness to hide), stake machine (for giving hard or soft texture to leather), press machine (for finishing purpose), and buff machine (for giving smoothness). Out of 20 machine operators in the sample, 15 worked on shaving machine, 3 on stake machine, and 1 each on press and buff machines.

Drum operator refers to a worker operating drums in which leather is mixed with chromium for colouring (tanning). Workers in finishing perform functions like colouration of leather and tabbing (selection) of leather.

MONTHLY WAGES

Wages are neither uniform nor fixed across all the tanneries. All the workers work either on daily-wage system or under contractor on hourly basis. Wages also depend on the profile of the workers. Except the jarai workers, all can approach the tannery directly for a job. Jarai workers work on hourly basis under contractual system. This job is performed under the supervision of contractor either inside or outside the factory premises.

In the study, 41 per cent workers reported their monthly earning at Rs 1,500-Rs 2,500 per month, whereas 57 per cent workers earn Rs 2,500-Rs 4,000 per month. Only two of the surveyed workers earn Rs 4,000-Rs 6,500 per month. No worker earns more than Rs 6,500 per month (Table 4)

Table 4: Wages per Month vs Job Profile

Job profile	Wages per month (in Rs)		
	1,500-2,500	2,500-4,000	4,000-6,500
Labour (including *chuna-godam* workers)	15	16	1
Jarai	14	12	-
Machine operator	4	15	1
Drum operator	8	11	-
Finishing	-	3	-
Total	**41**	**57**	**2**

Labour and jarai workers have almost equal distribution among their respective income groups. Basically, earning of these two depend on their working hours. It can be impressed upon that if they work for 8-10 hours in a day, they earn Rs 1,500-Rs 2,500 for the month, and if they work for more than 10 hours in a day (generally 12 hours a day), they earn Rs 2,500 - Rs 4,000. In case of machine operators, a relatively good number of workers (75 per cent) earn Rs 2,500-Rs 4,000. The reason is that employers rank the job of machine operations higher than other jobs (except tanning) because more skill is required to perform the job to maintain the quality of product, and this helps the machine operators to negotiate their wages. Only two workers earn Rs 4,000-Rs 6,500 per month, out of which one is a machine operator and the other works as labour.

WORKING HOURS

The working hours also depend on the respective job profiles. As table 5 depicts, 89 per cent workers work more than eight hours, while only 11 per cent work less than eight hours or complete eight hours.

Table 5: Trend of Working Hours among Different Job Profiles

Job profile	Working hours	
	</=8	>8
Labour	2	30
Jarai	3	23
Machine operator	6	14
Drum operator	-	19
Finishing	-	3
Total	11	89

Among machine operators, 70 per cent work more than eight hours and 30 per cent work less than or equal to eight hours. The discrepancy among working hours of machine operators is based on their specific job profiles (i.e., which machine they are working upon) and the amount of work they have to complete in a certain period of time. So, there is no fixed time schedule for them.

HOUSING STATUS

As seen earlier, most of the workers have migrated from Bihar and other districts of Uttar Pradesh. Thus, 90 per cent workers live in rented accommodation, whereas only eight per cent have their

own house. Some reported that they reside in a makeshift hut or '*kutccha*' house on any unoccupied land for which they do not have to pay rent. Two workers reside inside the tannery premises. Mostly, workers reside in a compound known as '*ahata*'. Every *ahata* has 10-40 rooms, depending on the size of the *ahata* or the size of the room, and each room is shared by 2-4 workers. Monthly rent of the room varies from Rs 300 to Rs 450 per person. Some of the *ahata*s have the facilities of common bathrooms and toilets. Mostly, open fields are used for defecation and open space inside the *ahata* is kept for bathing. Food is usually cooked inside the rooms.

SOURCE OF DRINKING WATER

At home

Workers depend on the nearest source of water for drinking. In the study, 67 per cent workers reported using tap water provided by municipal corporation, while 29 per cent workers take water from hand pumps (bore wells). Three workers reportedly obtain drinking water from tannery – two of them reside in the tannery itself and one resides near the tannery. One worker takes water from the railway's supply.

At workplace

In tanneries, the same water is used for drinking as well as tanning processes. No separate provision for drinking water is made there. Water is pumped from bore wells inside the tanneries and stored in overhead tanks, made up of plastics or iron, and supplied through pipelines. It must be noticed that this groundwater may be contaminated with harmful chemicals because of leaching of chemicals into groundwater or through direct disposal of untreated tannery effluent into drains. Besides, the local people have reported that exhausted bore wells are being harvested with this untreated tannery effluent.

PERSONAL HABITS

Table 6: Smoking and Drinking Alcohol

Addiction	Status				Duration (in years)		
	Occasional	Regular	Former	Never	</=5	6-15	>15
Smoking	23	7	1	69	1	5	1
Drinking alcohol	21	5	2	72	5	-	-
Tobacco	_	82	_	18	36	29	17

Of the total, 69 per cent workers are non-smokers, while distribution of occasional, regular and former smokers is 23 per cent, 7 per cent and 1 per cent, respectively. Out of the seven regular smokers, five have been smoking since the last 6-15 years, and one each have been smoking since **<**/**=** 5 years and >15 years, respectively.

The pattern of alcohol drinking is almost similar to that of smoking. Non-alcohol drinkers constitute the majority, i.e., 72 per cent, while occasional, regular and former alcohol drinkers constitute 21 per cent, 5 per cent and 2 per cent, respectively. All five alcohol consumers have been consuming alcohol since the last 5 years or less than 5 years.

Chewing tobacco

Unlike in the cases of smoking and drinking, a majority of workers (82 per cent) are tobacco users. Out of 82 workers who are regular tobacco users, 36 (44 per cent) have been consuming tobacco since last 5 years or less than 5 years, while 29 (35 per cent) workers have been consuming tobacco for 6-15 years and the rest 17 (21 per cent) for 16-30 years. The probable reason behind high intake of smokeless tobacco may be the cultural acceptance of consumption of these products in Bihar and Uttar Pradesh. Societal influence is also very high as a majority of the youngsters adopted this habit after developing their own society and becoming financially independent. Tobacco includes all kinds of tobacco available in the market like gutkha, khaini and surti.

Food habits

The majority of workers (95 per cent) eat both vegetarian and non-vegetarian food. Only five per cent workers claimed to be exclusively vegetarian. Two workers eat non-vegetarian food at least once in a day.

JOB STATUS

This question was asked to estimate the number of unskilled, semi-skilled and skilled workers. Sixty per cent of the workers surveyed are performing unskilled jobs, while the rest 40 per cent workers are involved in semi-skilled jobs. None can be termed as a skilled worker as none has undergone any formal education or training in tannery work. High percentage of illiteracy, lack of awareness, non-availability of resources and low family income contribute towards unskilled employment. Semi-skilled jobs require understanding and performance of technical aspects of the work involved. Thus, all the machine and drum operators can be classified as semi-skilled workers. One worker from finishing (sprayer) has also been included in this category. Some workers perform both semi-skilled and unskilled operations.

WORK EXPERIENCE IN TANNING INDUSTRY

Table 7 indicates that 55 workers have been working in this sector for more than 10 years, while only one worker has been working for less than a year. Twenty-two per cent workers have been working for 1-5 years, and another 22 per cent for 6-10 years.

Table 7: Total Working Experience in Tanning Industry

Duration (years)	No. of workers	Age group (years)				
		15-18	19-30	31-40	41-50	51-60
<1	1	-	1	-	-	-
1-5	22	5	16	1	-	-
6-10	22	1	17	3	1	-
>10	55	-	10	31	10	4
Total	100	6	44	35	11	4

Out of the 55 workers who have been working for more than 10 years, 31 (56.3 per cent) belong to the 31-40 years age group, while only 4 (7.3 per cent) belong to 51-60 years age group. Age groups of 19-30 years and 41-50 years feature 10 (18.2 per cent) workers each. The work duration segments of 1-5 years and 6-10 years constitute almost similar numbers of workers – 16 (73 per cent) and 17 (77 per cent), respectively, and all workers in this category belong to 19-30 years age group. Five (22.7 per cent) out of 22 workers belonging to 15-18 years age group have been

working since last 1-5 years in the tanning industry. This is an indicator of employability at a very early age.

WORKING IN SHIFTS AND SHIFT CHANGEOVER PATTERN

Of 100 workers, 37 reportedly work on shift basis. Table 8 depicts the pattern of shift workers among different job profiles involved in tannery. Out of the total 37 shift workers, 14 (37.8 per cent) are labourers, 11 (29.7 per cent) are drum operators, 9 (24.3 per cent) are machine operators, 2 (5.4 per cent) are jarai workers, and 1 (2.7 per cent) worker does finishing work. As shown in the table, the maximum percentage of shift workers is among drum operators (58 per cent), followed by machine operators (45 per cent) and labourers (44 per cent).

Table 8: Distribution of Total Shift Workers among Different Job Profiles

Specific job profiles (No. of workers)	No. of workers working on shift basis (per cent)	Percentage of shift workers in respective job profiles
Labour (32)	14 (37.8)	44
Drum operators (19)	11 (29.7)	58
Machine operators (20)	9 (24.3)	45
Jarai workers (26)	2 (5.4)	7.7
Finishing (3)	1 (2.7)	33

Analysis of the frequency of shift changeover (Table 9) indicates that 18 (48.6 per cent) workers have weekly shift changeover, 14 (37.8 per cent) have an irregular schedule of shift changeover, and 4 (10.8 per cent) work on a 15-day shift changeover pattern. Only one worker reported a monthly shift changeover pattern.

Table 9: Pattern of Shift Changeover among Different Job Profiles

Specific job profiles (Total workers)	Frequency of shift changeover				Total
	Weekly	Every 15 days	Monthly	Irregular	
Labour (32)	7	1	-	6	14
Drum operators (19)	7	1	-	3	11
Machine operators (20)	4	1	-	4	9
Jarai workers (26)	-	-	1	1	2
Finishing (3)	-	1	-	-	1
Total	18 (48.6 per cent)	4 (10.8 per cent)	1	14 (37.8 per cent)	37

The frequency of shift changeover is completely dependent on the specific job profile or operation. Drum operation is the most important and time-consuming process of tannery; generally, drums are operated day and night continuously, and drum operators have to be there to carry out the operations. In case of labourers, most of them work as labourer in drum operations. Out of the total nine machine operators, seven operate shaving machines and one each operate stake machine and buff machine.

REST BREAK

The question of rest break was asked to know whether the workers are allowed dedicated time for rest. In this regard, 44 out of 100 workers, as reflected in table 10, reported getting time for rest.

The remaining 56 workers get time for taking their lunch, and the interval may vary from 10 to 15 minutes.

Table 10: Pattern of Rest Break among Different Job Profiles

Job profile (Total workers)	Rest		If yes, break duration		After	
	Yes	No	<= half-an-hour	One hour	4 hours	5 hours
Labour (32)	19	13	1	18	2	17
Drum operators (19)	11	8	1	10	1	10
Machine operators (20)	6	14	-	6	1	3
Jarai workers (26)	5	21	-	5	-	5
Finishing (3)	3	-	1	2	-	2
Total	44	56	3	41	4	37

The majority of workers enjoy one-hour rest time after a five-hour working period. Out of the total 44 workers, 19 are labourers, 11 are drum operators, 6 are machine operators, 5 are jarai workers, and 3 do the finishing work.

From the point of view of job profiles, almost all labourers, drum operators and finishing workers are provided one-hour lunch break. All machine operators and jarai workers also enjoy a one-hour lunch break.

Almost all labourers, drum operators, finishing workers and jarai workers take break after five hours of work Some machine operators do not have any fixed time to take break.

DISTANCE AND TRANSPORT

Table 11: Distance and Mode of Transport

Distance (km)	Mode of commuting		
	Bicycle	By walk	Mixed mode*
<1	1	31	-
1-5	7	56	1
11-20	-	-	1
>20	-	-	1
Total	8	87	3

**Use of more than one mode of conveyance to reach workplace*

Table 11 denotes that only two workers travel the distance of 11 to >20 km; the rest of the workers live in close proximity ranging from 0 to 5 kilometres. Of the total, 87 workers commute by walking, eight use bicycles, and the rest three use mixed mode to commute.

EXPOSURE ASSESSMENT

Of all surveyed workers, 54 claimed to be aware of the health implications of working in a leather tannery. However, to ascertain the actual level of awareness was beyond the scope of this study. Only a customary enquiry was made to learn about their understanding of the elements at their workplace which can harm them.

A majority of the workers, despite being illiterate, can spell out many of the hazardous elements, and 50 per cent workers claim to have analysed their working conditions themselves. They were never given any formal training or instructed on an awareness protocol about the hazards present in their work environment and their effect on the human body. A majority of the workers (41 out of 54 workers, 76 per cent) marked chemicals as the harmful elements present in their workplace; 15 workers (27.7 per cent) included mechanical factors as prominent in causing injuries; and 6 workers are aware of being exposed to leather dust, 5 to excessive environmental conditions (heat, cold, etc.), 4 to gases, and 1 to excessive workload. This may be correlated to their limited consideration to their own job profiles and inability to assimilate the working conditions at the next workstation.

Fifty-one of the 54 workers were able to provide some account of the harmful effects the workplace hazards can have on them. Respiratory effects (43.1 per cent, 22 out of 51 workers) were paramount, followed by skin effects (33.3 per cent, 17 out of 51 workers) and mechanical effects in the form of injuries to body parts (25.4 per cent, 13 out of 51 workers). Two workers were correlating their gastrointestinal symptoms to their workplace exposure, and 4 to their persisting allergic conditions. One worker said that wrong work practices can intensify the harmful effect of these hazards.

The disparity between integration of this indigenous knowledge of hazards and their practical ability to get protected from health harms was clear from the use of personal protective equipments. Of the 54 aware workers, 21 chose to ignore the issue of their health. The rest 33 workers were trying to get some protection from a tiny umbrella, which can provide only inadequate protection. Thirty-two workers use shoes and gloves as their foremost armour. Three workers were also using the additional protection of an apron. However, none of them was using any mask, eye protection, head cover, or ear protection.

On probing further into the reason for not using personal protective equipment, the number of respondents came down to 28 as compared to the 33 workers who were using personal protective equipment. Most of them (71.4 per cent, 20 out of 28 workers) stated that the same is not provided by the employer. Three workers said that it was uncomfortable to work wearing these protective equipments. Two were of the view that the equipments are of poor quality, and one even said that these equipments are inappropriate for the work they are doing.

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Table 12: Specific Symptoms Reported by Workers of Different Job Profiles

N=100

Organ	Symptoms (total no. of workers reported the symptom)	Job profile (no. of workers in respective profiles)				
		Labour (N=32)	Jarai worker (N=26)	Machine operator (N=20)	Drum operator (N=19)	Finishing* (N=3)
Eye	Irrit ation (N=9)	5 (15.6)	2 (7.7)	-	2 (10.5)	-
	Pain (N=7)	1 (3.1)	2 (7.7)	-	3 (15.8)	1 (33.3)
	Burning (N=14)	7 (21.9)	2 (7.7)	1 (5)	3 (15.8)	1 (33.3)
	Watering (N=23)	10 (31.3)	6 (23)	4 (20)	3 (15.8)	1 (33.3)
	Tiredness (N=4)		3 (11.5)		1 (5.3)	
	Blurred vision (N=20)	8 (25.0)	5 (19.2)	2 (10)	4 (21.1)	1 (33.3)
	Headache (N=29)	13 (40.6)	7 (26.9)	3 (9)	6 (31.6)	-
Ear	Difficulty in hearing (N=3)	2 (6.3)	-	1 (5)	-	-
GI	Flatulence (N=36)	14 (43.8)	12 (46.1)	5 (25)	5 (26.3)	-
	Hyperacidity (N=28)	9 (28.1)	12 (46.1)	5 (25)	2 (10.5)	-
	Abdominal pain (N=19)	8 (25.0)	7 (26.9)	3 (9)	1 (5.3)	-
	Nausea (N=8)	3 (9.4)	2 (7.7)	2 (10)	1 (5.3)	-
	Vomiting (N=6)	2 (6.3)	2 (7.7)	-	2 (10.5)	-
	Diarrhoea (N=5)	2 (6.3)	2 (7.7)	-	1 (5.3)	-
	Loss of appetite (N=5)	2 (6.3)	2 (7.7)	-	1 (5.3)	-
	Disturbed sleep (N=9)	3 (9.4)	3 (11.5)	1 (5)	2 (10.5)	-
Respiratory system	Irritation (N=13)	6 (18.6)	2 (7.7)	2 (10)	3 (15.8)	-
	Cough (N=48)	18 (56.3)	11 (42.3)	6 (30)	11 (57.9)	2 (66.6)
	Cough with sputum (N=12)	4 (12.5)	2 (7.7)	3 (9)	2 (10.5)	1 (33.3)
	Blood in sputum (N=1)	1 (3.1)	-	-	-	-
	Wheezing (N=7)	3 (9.4)	3 (11.5)	-	1 (5.3)	-
	Breathlessness (N=35)	13 (40.6)	6 (23)	6 (30)	8 (42.1)	2 (66.6)
	Running nose (N=12)	5 (15.6)	3 (11.5)	-	3 (15.8)	1 (33.3)
	Sneezing (N=33)	14 (43.8)	6 (23)	2 (10)	9 (47.4)	2 (66.6)
	Nose bleeds (N=1)	-	-	-	1 (5.3)	-

Organ	Symptoms (total no. of workers reported the symptom)	Job profile (no. of workers in respective profiles)				
		Labour (N=32)	Jarai worker (N=26)	Machine operator (N=20)	Drum operator (N=19)	Finishing* (N=3)
Skin	Irritation (N=22)	7 (21.9)	7 (26.9)	-	6 (31.6)	2 (66.6)
	Redness (N=9)	2 (6.3)	3 (11.5)	-	3 (15.8)	1 (33.3)
	Ulcer (N=5)	3 (9.4)	-	-	2 (10.5)	-
	Rash (N=5)	-	3 (11.5)	-	2 (10.5)	-
	Pustules (N=18)	7 (21.9)	6 (23)	-	4 (21.1)	1 (33.3)
	Oozing (N=12)	3 (9.4)	4 (15.4)	-	4 (21.1)	1 (33.3)
	Excessive dryness (N=12)	5 (15.6)	1 (3.8)	-	5 (26.3)	1 (33.3)
Urinary symptoms	Pain/burning on passing urine (N=10)	2 (6.3)	6 (23)	-	2 (10.5)	-
	Dark colour urine (N=5)	1 (3.1)	3 (11.5)	1 (5)	-	-

Figure in parenthesis (except title column) show percentage

**Number of workers involved in finishing may not be statistically significant, but are considerable from study point of view.*

Table 12 provides an account of symptoms suffered by the workers from exposure to chemicals being used in the tannery work. The percentage of symptoms may vary according to the job profile of that worker. However, there is a possibility of multiple exposures from the adjacent workstation, and may be present in the form of other symptoms not associated with that particular work to which the worker is primarily exposed to.

A majority of the eye-related problems reported by workers are watering of eyes (23) and blurred vision (20). In the study, 33.3 per cent finishing workers, 31.3 per cent labourers, 23 per cent jarai workers and 20 per cent machine operators complained about watering of eyes. Blurred vision is reported by 33.3 per cent finishing workers, 25 per cent labourers and 21 per cent machine operators. Headache is reported by 40.6 per cent labourers, 31.6 per cent drum operators and 26.9 per cent jarai workers. As workers of different job profiles have reported these problems, the attributing factors causing these symptoms are probably different. Among labourers, drum operators and finishing workers, the major exposure to various kinds of chemical vapours can affect their eyes, whereas among jarai workers, focused and continuous attention on their work to prevent mechanical injuries may affect their eyes. Similar exposures can also trigger headaches.

A rough estimate of hearing difficulty was made by asking the worker if they found it hard to understand the voice of other people in a normal course of conversation. Among the workers, 6.3 per cent labourers and 5 per cent machine workers claimed having this difficulty. It may be an indication towards early symptoms of noise-induced hearing loss, as all of these three workers are working in the mechanically-operated machine area where noise levels are high as compared to other workstations. Table 13 reveals that the symptom of hearing difficulty is reported by two workers who have worked for more than 10 years in the tannery, and by one worker who has been working for 6-10 years. Furthermore, table 14 indicates that one worker who is having hearing difficulty is from the 19-30 years age group, while the other two are from the 31-40 years age group.

Gastrointestinal symptoms were mainly reported by labourers, drum operators and jarai workers. The most common symptom reported is of flatulence by 36 workers (46.1 per cent jarai workers, 43.8 per cent labourers, and 26.3 per cent drum operators), followed by hyperacidity in 28 workers (46.1 per cent jarai workers, 28 per cent labourers, and 25 per cent machine operators). The next major complaint is of abdominal pain by 19 workers (26.9 per cent jarai workers and 25 per cent labourers).

Disturbed sleep was reported by nine workers, wherein jarai workers suffered most (11.5 per cent) followed by drum operators (10.5 per cent) and labourers (9.4 per cent).

Respiratory problems like cough (48 per cent) and breathlessness (35 per cent) were reported by workers in all job profiles. A total of 66.6 per cent finishing workers, 60 per cent drum operators, 56.3 per cent labourers, 42.3 per cent jarai workers, and 30 per cent machine workers reported the cough problem. Breathlessness has been reported by 66.6 per cent finishing workers, 42 per cent drum operators, 40.6 per cent labourers, 30 per cent machine operators, and 23 per cent jarai workers. Sneezing has also been observed among 66.6 per cent finishing workers, 47.4 per cent drum operators, 43.8 per cent labourers, 23 per cent jarai workers, and 10 per cent machine operators. The respiratory symptoms are due to presence of gases, dust, vapours and particulate matter in the working environment. These hazards can cause respiratory allergies, bronchitis, and occupational asthma of acute or chronic nature. Symptomatic workers must undergo further investigations like x-ray of chest and pulmonary function test to rule out any chronic effect on respiratory system. This will help in early diagnosis, prevention of further aggravation, and early rehabilitation of workers.

The tannery workers are most exposed to hazardous chemicals through skin contact as most of the processes are handled manually by these workers without the aid of any protective equipment. In the study, 33.3 per cent finishing workers have redness, pustules, oozing and excessive dryness of the skin, while 66.7 per cent of these workers feel irritation on skin during work. On other hand, 22 per cent labourers complained about irritation and pustules on the skin, and 30 per cent and 23 per cent jarai workers have irritation and pustules on their skins, respectively. A total of 31.6 per cent drum operators also experienced the skin irritation problem.

Urinary symptoms like pain/burning on passing urine and dark colour urine are reported mostly by jarai workers – 23 per cent and 11.5 per cent, respectively. With respect to the total workers complaining of these symptoms, 6 out of 10 jarai workers and 3 out of 5 jarai workers have these symptoms respectively. Jarai workers also reported the problem of hydrocoel/varicocoel, for which some of them have undergone surgery and some are under medication. The high percentage of genitor-urinary complaints by jarai workers indicates some specific exposure for these workers only, one of which may be sitting on legs for long hours.

Table 13: Symptoms vs Total Duration of Working in Tannery

Symptoms (Total no. of workers reported the symptom)	Total duration of work in tannery (years)			
	< 1 (N=1)	**1-5 (N=22)**	**6-10 (N=22)**	**>10 (N=55)**
Watering of eyes (23)	-	2 (8.7)* (9.1)#	7 (30.4) (31.8)	14 (60.9) (25.5)
Blurred vision (20)	-	1 (5.0) (4.5)	3 (15.0) (13.6)	16 (80.0) (29.1)
Headache (29)	-	6 (20.7) (27.3)	6 (20.7) (27.3)	17 (58.6) (30.9)
Hearing difficulty (3)	-	-	1 (33.3) (4.5)	2 (66.7) (3.6)
Flatulence (36)	-	6 (16.7) (27.3)	11 (30.6) (50.0)	19 (52.8) (34.5)
Hyperacidity (28)	-	4 (14.3) (18.2)	7 (25.0) (31.8)	17 (60.7) (30.9)
Cough (48)	1 (2.1) (100.0)	8 (16.7) (36.4)	11 (22.9) (50.0)	28 (58.3) (50.9)
Breathlessness (35)	1 (100.0)	5 (16.7) (22.7)	10 (28.6) (45.5)	19 (54.3) (34.5)
Sneezing (33)	1 (100.0)	17 (51.5) (77.3)	11 (33.3) (50.0)	14 (42.4) (25.5)
Skin Irritation (22)	-	5 (22.7) (22.7)	5 (22.7) (22.7)	12 (54.5) (21.8)
Pain/ burning on passing urine (10)	-	5 (50.0) (22.7)	2 (20.0) (20.0)	3 (30.0) (30.0)
Dark colour urine (5)	-	1 (20.0) (4.5)	1 (20.0) (4.5)	3 (60.0) (5.5)

**Percentage of total symptomatic workers vs duration of work in tannery*

#Percentage of no. of workers in each group of duration of work in tanning industry vs total symptomatic workers

Table 13 is the analysis of symptoms and the duration of work (in years) in tannery. The table indicates that the more the duration of working in tanning industry, the more the susceptibility of workers to various health problems. The overall number and percentage of workers reporting particular symptoms is more in the group who are working for more than 10 years. This percentage is little less when the total number of workers in this group is taken as a denominator as compared to the group who is working for 6-10 years. The respiratory symptoms of the sole member working for less than a year may represent the hypersensitivity of that worker towards chemical vapours in

the working environment. Such workers, with the early onset of symptoms, are potentially at higher risk to develop irreversible occupational diseases in due course of employment.

Table 14: Age Group-wise Distribution of Symptoms

Symptoms (Total no. of workers reported the symptom)	Age group (years)				
	15-18 (N=6)	19-30 (N=44)	31-40 (N=55)	41-50 (N=11)	51-60 (N=4)
Watering of eyes (23)	2 (8.7)* (33.3)#	5 (21.7) (11.4)	9 (39.1) (16.4)	7 (30.4) (63.6)	-
Blurred vision (20)	1 (5.0) (16.7)	5 (25.0) (11.4)	8 (40.0) (14.5)	5 (25.0) (45.5)	1 (5.0) (25.0)
Headache (29)	4 (13.8) (66.6)	10 (34.5) (22.7)	10 (34.5) (18.2)	4 (13.8) (36.4)	1 (3.4) (25.0)
Hearing difficulty (3)	-	1 (33.3) (2.3)	2 (66.7) (3.6)	-	-
Flatulence (36)	3 (8.3) (50.0)	14 (38.9) (31.8)	10 (27.8) (18.2)	7 (19.4) (63.6)	2 (5.6) (50.0)
Hyperacidity (28)	1 (3.6) (16.7)	10 (35.7) (22.7)	12 (42.9) (21.8)	4 (14.3) (36.4)	1 (3.6) (25.0)
Cough (48)	2 (4.2) (33.3)	18 (37.5) (40.9)	17 (35.4) (30.9)	8 (16.7) (72.7)	3 (6.3) (75.0)
Breathlessness (35)	2 (5.7) (33.3)	13 (37.1) (29.5)	11 (31.4) (20.0)	6 (17.1) (54.5)	3 (8.6) (75.0)
Sneezing (33)	3 (9.1) (50.0)	14 (42.4) (31.8)	11 (33.3) (20.0)	4 (12.1) (36.4)	1 (3.0) (25.0)
Skin irritation (22)	1 (4.5) (16.7)	11 (50.0) (25.0)	6 (27.3) (10.9)	3 (13.6) (27.3)	1 (4.5) (25.0)
Pain/burning on passing urine (10)	-	6 (60.0) (13.6)	4 (40.0) (7.3)	-	-
Dark colour urine (5)	-	3 (60.0) (6.8)	2 (40.0) (3.6)	-	-

**Percentage of total symptomatic workers vs no. of workers in respective age group*

#Percentage of no. of workers in respective age group vs total symptomatic workers

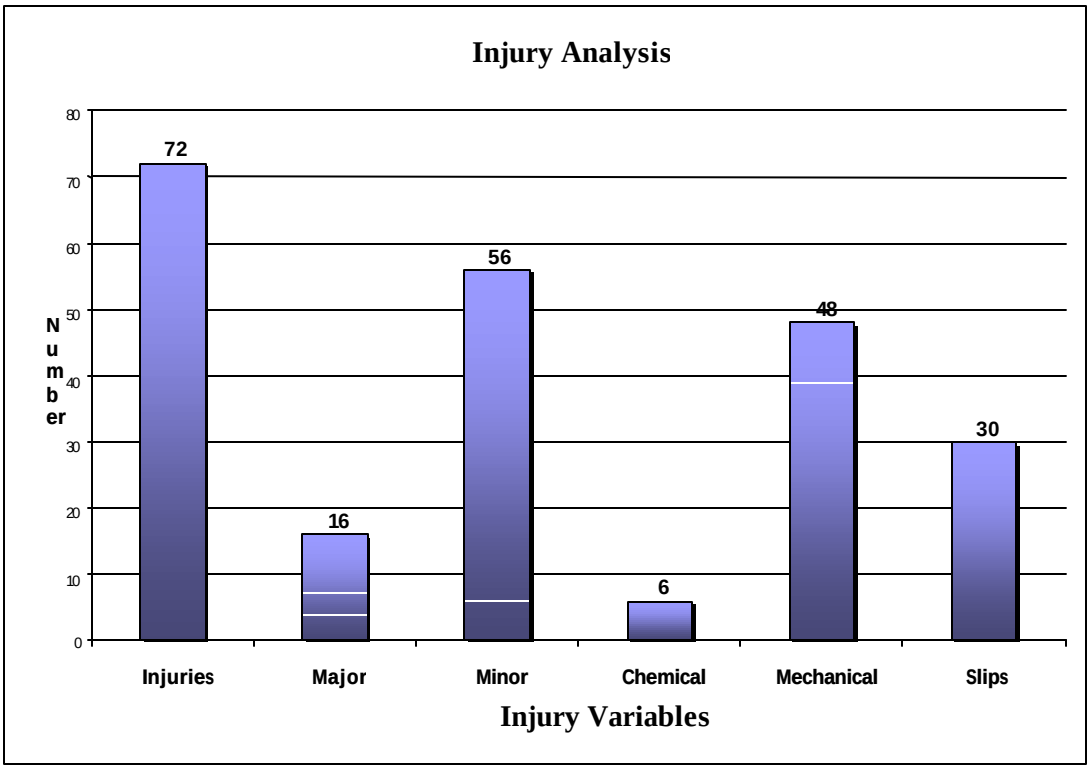
Table 14 is compiled to segregate the age groups and the percentage of workers in these age groups reporting the symptoms.

In the age group of 19-30 years, the symptoms of headache, flatulence, hyperacidity, cough, breathlessness, sneezing and skin irritation, are reported by 34.5 per cent, 38.9 per cent, 35.7 per cent, 37.5 per cent, 37.1 per cent, 42.4 per cent and 50 per cent of workers, respectively. Sixty per cent workers are suffering from pain during urination and dark colour urine.

In the 31-40 years age group, major health problems faced by the workers are headache, hearing difficulty, hyperacidity, cough, pain/burning on passing urine and dark colour urine, affecting 34.5 per cent, 66.7 per cent, 42.9 per cent and 35.4 per cent workers, respectively. Forty per cent workers are suffering from pain during urination and dark colour urine.

Injuries at workplace

The following graph represents the complete analysis of injuries suffered at the workplace. Seventy-two workers reported getting injuries, 56 escaped with minor injuries, and 16 received some major injuries. The most common are mechanical injuries (48) caused by machines or machine parts, followed by slip and falls (30) at workplace. Chemical injuries (6), though less in number, can be more serious than the other two types. Slips and falls were usually attributed to uneven and wet floors.



Eighty-five workers responded when asked if they received some compensation for any kind of workplace injury. Out of 85 workers, 29 workers informed that they have received compensation – 25 of them from the employer and 4 from the ESI hospital.

In case of major injuries, compensation is provided in terms of treatment only, but usually that too is not provided until the complete recovery/cure. Here, it may also be noted that the tannery jobs inherently lack any kind of job security, since a worker may be marked absent for the duration of

his hospitalisation, or some other worker may be hired for the same job. In case of casualties, monetary compensation is provided but only after the interference of the union people. Even then, tannery owners try to negotiate the compensation amount by offering cuts to union people. They also try to bypass further hassles by offering a big amount as compensation to the family of the victim.

Medical care

The trend of medical care among workers was analysed by asking them about their preferences in terms of healthcare during recent illnesses. Twenty-one workers have consulted a doctor for the symptoms suffered by them during the last six months. Five of them are on continuous treatment. Most of them prefer private treatment to government health centres (ESI dispensaries/hospitals, primary health centres, community health centres, district hospitals, etc.). Eighteen of them opted for private doctors, 4 visited nursing homes, and 14 exclusively depend on nearby medical stores for their medical requirements. Many others would go to any of them, though the preference is for a private doctor or the medical store (21 workers).

Twenty-four workers reported being admitted in hospital for their symptoms. Eight of them were admitted for gastrointestinal symptoms, 8 for injuries, 3 for respiratory troubles, 1 for nasal ulcer, 3 for kala-azar, and 1 for adverse drug reactions. Twenty-three of them were in hospital for less than a month (8 for 1-5 days, 6 for 6-10 days, 5 for 11-15 days, 4 for 16-30 days), and only one was admitted for around 6 months (exact reference to the nature of illness vs days of hospitalisation is beyond the scope of this study).

Twenty-eight workers have taken medicines for long times (>3 months duration), 8 have taken for 3-6 months, 5 for 7-12 months, and 1 each for 18 months and 24 months. Five workers are taking medicines for more than five years. Eight workers were unable to answer as to the duration of their use of medicines.

Seven workers reported suffering from some kind of permanent disability, which they have acquired during the course of employment. Five of them have amputation of fingers, while one each has movement limitation of upper limb and lower limb.

Fifty-six workers take leave from work on account of their ill health. Thirteen miss work for 1-2 days in a month, 39 for about 3-7 days a month, and 4 for 8-15 days a month.

Table 15: Details of Harmful Elements and Their Health Effects (as experienced and narrated by the workers)

Injury type	Source of injury	Harmful effects
Chemical	Acid, lime (calcium hydroxide), sodium, soda, white sulphide, aluminium sulphate, formic acid, basic chrome sulphate (BCS), vapours, gas exposure, colour spray	Skin: Deep abrasions, pustules, irritation, itching, burning, redness, deep cracks in palms and ankles, acid burns, ulcers Eye: Decreased vision, morning sticky eyes GI: Gastritis, acidity, diarrhoea, loss of appetite, abdominal pain/cramps Respiratory: Breathlessness, sneezing, cough Neurological: Confusion Accidents: Sudden death due to asphyxiation
Machines & tools	Shaving machine, stake machine, press machine, bolt of drum, ranch, moles, hammer, knife	Cuts with knife, eye/head injury with drum bolt, hand injury with knife, moles, or hammer, cloths getting entrapped by the machine, amputation of hands by the machines
Leather dust	Buffing machine	Breathlessness (difficulty in breathing), cheat pain, cough, bad odour, dry and cracked skin, skin allergies
Weather	Heat/cold	Respiratory problems like sneezing, cold and cough, fever, dark colour urine
Ergonomics	Wrong working postures/conditions	Pain in neck, shoulders, legs, back, chest and calves muscles due to prolonged standing and lifting and carrying heavy loads, multiple joint pains, pain and swelling in knees, body ache Long sitting on knees: hydrocoel/varicocoel, Dhat syndrome, piles, burning in urination, dark colour urine
Accidents	Wrong housekeeping	Slips and falls: Wet floors, uneven surfaces, stairs

Indigenous methods adopted by workers to cope with the harmful effects:

- Buffing machine operators take *gur* or banana before they start working or during the course of work, and spit out with deep cough when they finish the work. Dark-coloured sputum comes out
- Buffing machine operators tie a piece of cloth covering their mouth and nose trying to reduce the dust exposure
- Regular bath after the work. Some apply mustard oil all over the body after taking bath to reduce the dryness of skin
- Common belief: Eat more, work more
- Start smoking or tobacco chewing to bring down the mental pressure or burden. (This is also supported by the study findings that most of the workers adopt these habits when they start working.)

CASE STUDIES

Case Study I

Mohd Irshan Khan, 35 years old, had been working in tanneries since last 15 years, but he has stopped working for last 3-4 months. He mentioned several reasons for leaving the job. First is the excessive workload coupled with the long working hours. He had to transport 100-150 kilograms of weight (wet raw leather) from one place to another manually in a single attempt, and this activity is repeated 12-14 hours in a day. Another reason for leaving the job is the health hazards and injuries he experienced during his tenure at the tannery. He is suffering from shoulder pain, neck pain, leg pain and multiple joint pains. Chemicals like lime, acids, and salts also caused skin irritation, allergies and chemical injuries like deep cuts/abrasions on skin. He said that these cuts/abrasions cannot be cured because of the regular contact that the skin had with these chemicals. He further stated that the shoes provided by the owner for safety purpose were of such poor quality that the shoes ended up causing dehairing and injuries on the skin. That is why every worker wears a piece of jute cloth under the shoes to prevent the contact of shoes with skin. This practice is followed by all the workers in all tanneries. Now, Irshan is not able to work continuously for longer periods of time in the tannery. He works for two to four months in any tannery, and then takes a break until the savings is exhausted. His poverty compels him to work despite his health condition. Now he is neither financially and physically stable nor does he have any savings. Also, finding a new job is always a very tough task.

Case Study II

Bhala is 36 years old and has been working in the tanning industry since last 16 years. Some 5-6 years back (he could not recall exactly), he encountered an accident while operating the drum. After completing the process, he had opened the door of the drum and suddenly got exposed to the gas that is usually generated by chemical reactions taking place in the drum during its operation. He immediately lost his balance, fell down on the floor, and his left foot got injured. He spent 10 days in hospital and could not report for work for more than a month. When he recovered and returned to work, his employer asked him to join on contractual basis although before the accident he was working on a regular basis. The employer attributed this to his absence from work for more than a month, because of which he would have to learn the drum operation again. Hence, he would be considered as a fresher, and freshers are recruited through contractors. This was not acceptable to Bhala, and he joined another place as a fresher.

Case study III

Ajay Kumar, 22 years old, has been working in the tanning industry for the last six years. Presently, he is working as shaving machine operator. One year ago, he lost the distal ends (distal phalanges) of two fingers (ring finger and little finger) of his right hand, which was entrapped by the shaving machine. The employer provided neither treatment nor compensation for this injury. He still feels pain in those fingers, but has to work to earn a livelihood not only for himself, but also for his family members.

Case study IV

Ashrafi, 40 years old, lost the distal end of his right-hand middle finger while working on a shaving machine in a tannery in West Bengal. In this case, treatment expenses were shared by both employer and victim. Now, he has been employed as a jarai worker in Kanpur since the last six

years. He left the job of shaving machine operator out of fear, though the income was higher in that job as compared to the current one.

Careful scrutiny of the findings of this report indicates many improvement areas where long-term benefits can be implemented in a cost-effective manner. These recommendations are framed keeping the following paramount factors in focus:

1. Illiteracy among workers
2. Poor infrastructure
3. Poor long-term vision
4. Poor understanding of occupational health and safety
5. Poor technology

RECOMMENDATIONS

A) Awareness and Training

There should be regular training, education and awareness programmes for all stakeholders on the subjects of safety, health, emergency and hazards, first aid, and identification of hazard. Thus, workers can be trained to learn correct lifting techniques and work postures, to avoid lower-back pain.

B) Safety Procedures

- Safe handling of chemicals
- Wear safety shoes with non-slip soles
- Wear protective goggles and respiratory protection during buffing work
- Confined-space entry procedures
- Adequate lighting in the workrooms to be provided to reduce chances of accidental injuries
- Wastes must be adequately treated and the effluent should be rendered innocuous before being discharged into the drain
- Impervious long gloves made of either washable leather or fabric-lined rubber, sleeves, aprons and boots of impervious material to be worn by the workmen to avoid direct contact with chemicals
- Separate cloakroom facilities for outdoor clothing and work clothing, with interposed adequate washing facilities are the arrangement of choice for tannery workmen
- Display of precautionary notices in each department against risk of occupational injuries and diseases in a simple and lucid language. Some examples:
    - Prohibition of eating in the workrooms
    - Washing hands and scrub under the nails before eating
    - Bleach and strong alkali soaps not to be used for removing dyes from hands

C) Medical Procedures

- Periodic medical examination of workers
- Seek medical attention if skin rashes develop
- Keep a high level of personal hygiene; change clothes at the beginning and end of shift; do not take work-soiled clothes home
- Isolation of cases of chrome ulceration and occupational dermatitis is necessary to prevent aggravation of the diseases
- Adequate first-aid facilities to be provided and the workers trained in first aid

D) Technological Improvement

- Install effective exhaust ventilation to remove hazardous gases and vapours, and eliminate obnoxious odours from the tannery. This should be provided at the point of dust generation, especially at buffing and shaving machines and at rotating drums
- Erect fences and post warning signs around open pits in the tannery
- Use mechanical aids for the lifting and transport of heavy loads