CHAPTER – V

VELLORE TANNERIES

AND GROUNDWATER

ISSUES
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INTRODUCTION:

India is the largest user of groundwater in the world. The stage of groundwater development is fifty eight percent. However, the development of groundwater in different areas of the country has not been uniform. Approximately 200 billion cubic meters of groundwater is extracted annually in India, which is the highest volume of annual groundwater extraction in the world.\textsuperscript{354} As per a report,\textsuperscript{355} India is the world’s largest groundwater user in terms of both absolute volumes pumped and the total number of users. Currently, there are approximately 20 million wells, a number that has been increasing at approximately at one million per year; the majority of which are equipped with electrical pumps.\textsuperscript{356} More than 60% of irrigated agriculture and 85% of drinking water supplies are dependent on groundwater.\textsuperscript{357} However, managing groundwater is not an easy task.

In India, groundwater quality issues have assumed great importance with increasing population and contamination of aquifers from point and non-point sources. The population of India exceeds 1.1 billion people and is growing annually at an astonishing 1.4%.\textsuperscript{358} The economy is experiencing even greater growth rates, with roughly 8% increases in Gross Domestic Product.

\textsuperscript{354} Shah, (2005).
\textsuperscript{356} Mukherjee and Shah, (2005).
\textsuperscript{357} World Bank, 2010, go.worldbank.org/MGZWD 57 DQO.
(GDP) annually in the past several years. The nation’s use of water has naturally intensified in step with the jumps in population and economic growth. The country boasts approximately nineteen million groundwater extraction structures, over four times the amount in China, Pakistan, Mexico, and the United States combined\textsuperscript{359}.

In India, groundwater is used intensively for irrigation and industrial purposes. The expanding economy and population make sustainable access to water are of the critical issues. Be it air or water or land, pollution is prevalent everywhere. It puts us in danger, each and everyone in this country is affected by it. In recent years, water pollution has become a serious problem across the country, mostly due to the presence of untreated effluents, chemicals and pesticides in it. Sadly, a variety of water and land based activities continue to cause water pollution. Despite, strict environment laws, there is nothing done to tackle this problem.

**INDUSTRIALIZATION:**

Rapid industrialization and improved life style have consequently led to increase in the quantity of wastewater discharged into the environment\textsuperscript{360}. The wastewater released from chemical process industries has potential hazard to the environment due to its contaminants such as high COD, heavy metals, oil and grease, VOC, color etc\textsuperscript{361}. which is one of the major concern among industries/researchers and environmentalists. Today, humans are inducing environmental changes in the planet as a whole. The waste minimization/ water conservation in recent years has also resulted in addition of toxic residues in the environment.

\textsuperscript{359} Ibid.
\textsuperscript{360} Dutta 1999; Miller 2001; Sawyer 1994.
\textsuperscript{361} Sarkar 1997; Adams 1990; WHO 2004.
The paramount importance of environmental challenges is to dispose off these residues through proper technique and keep the pollutant level in the effluent stream below the tolerant limit to comply with environmental norms. The release of pollutant differs from industry to industry. Though India has implemented relatively stringent environmental regulations, the country continues to encounter enormous environmental problems, many of these due the result of industrial activities. This is also the case with leather tanning industry.

VELLORE DISTRICT IN TAMIL NADU:

Vellore district is one of the 32 districts in the State of Tamil Nadu. Vellore City is the headquarters of this district. It had a population of 34,77,317 as of 2001. According to the 2011 census Vellore district has a population of 39,36,331 with a growth rate of 13.20%. The literacy rate is 79.17% with the density of population of 648. As of 2011 Census, it is the third most populous district of Tamil Nadu after Chennai and Kancheepuram. In terms of urbanization level, Vellore district ranks 8th place among the other districts in Tamil Nadu. Vellore is a major transit point for travellers, a hub for medical tourism and is emerging as a tourism hot spot. This place is known for its extreme climatic conditions.

Vellore has an arid and dry climate, reaching high temperatures during summer. The city experiences wet winters and dry summers and has an elevation of about 224 meters with the north-east monsoon the highest contributor to rainfall. The mean maximum and minimum temperatures during summer and winter varies between 38.3°C and 18.95°C. Palar River is the major river draining of the district, flowing towards east for a distance of about 295 km. It runs

364 Ibid.
365 Ibid.
parallel to the hill ranges of the Eastern Ghats forming a major part of its course. It has a vast flood plain in the lower reaches, but is dry for major part of the year. Ponnaiyar, Cheyyar, Pambar and Malattar are some of the major tributaries of Palar draining the district. Almost all the streams are ephemeral in nature and are mostly structurally controlled. Due to migration of population, it becomes necessary for the corporation to give clean drinking water for the entire population.

The City of Vellore had a very interesting history and also has some historical places for great remembrance. The district finds an important place in the Indian freedom struggle. The Sepoy mutiny of 1806 that took place inside the Vellore fort was seen as a prelude to the Revolt of 1857. The Vellore fort which was probably built during the rule of Chinna Bommi Nayak (1526-1595A.D.), was considered to be a strong fort during the Carnatic War in the 17th century. The modern Vellore district was formerly part of North Arcot District which was established by the British in the 19th century. On 30th September 1989 the district was split into Tiruvannamalai-Sambuvarayar (present day Tiruvannamalai) and North Arcot Ambedkar Districts.

The North Arcot Ambedkar District was later on renamed as Vellore District in 1996. The district is bound on the northeast by Tiruvallur District, on the southeast by Kancheepuram District, on the south by Tiruvannamalai District, on the southwest by Krishnagiri District, and on the northwest and north by Andhra Pradesh State. Major towns in the district include Ambur, Arakkonam, Arcot, Jolarpet, Gudiyattam, Melvisharam, Ranipet, Sholingar, Tirupattur, Vaniyambadi, Vellore and Walajahpet. Kaveripakkam is the panchayat town in Vellore with the second largest lake in Tamil Nadu.
The bed of the River Palar, flowing through the North Arcot district of Tamil Nadu is dry with overexploitation, the groundwater is colored, saline and contaminated with the leather industry’s effluents and the air is thick with the stench from the tanning process. Like the foundry cluster in Haora, the leather industry in this region was the center of a national debate due to the high levels of pollution it created. In this case as well, the Supreme Court had intervened to try and find a solution to the problem. A section of the local community was up in arms against the leather industry. Like in Tirupur and Haora, the cluster of tanneries was a nearly homogeneous group of small industries that used similar processes.

**Evolution of the Leather Industry in India:**

The history of leather manufacture in India can be traced back to ancient times as is evident from references to it in Vedic literature and reports from Marco Polo. Leather has had universal appeal from time immemorial. The manufacture of leather is one of the oldest technological professions. Until 1845, the Indian leather industry remained a rural cottage industry. The village artisans utilized locally available raw materials and produced leather products to meet primarily the local demand. The first modern tanning unit was established in 1845 at Madras. The development of railway network provided increased access to hides and skins from the hinterland for the tanning unit and existence of port facility made exports of tanned hides and skins to Great Britain possible.

The Government found that the alternative system of obtaining stores from England was costly and wasteful. Hence, it established the Government Harness and Saddlery Factory at

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366 *Central Leather Research Institute in the Dissemination of Leather Information – A Case Study Dissertation submitted by P.R.Raghavendran, (1984).*

367 *See Sinha,S and Sinha,S (1992), p.27. For details see, supra note 366.*
Kanpur in 1867 to undertake tanning of leather to make harness and saddlery for the British army in India. A few private tanneries were also set up. These developments led to the change in the mode of production from a cottage unit owned and operated by a village tanner to a workshop owned and operated by capitalist. The exports were mainly in the form of hides and skins and semi-finished leather.

After the independence, the Government’s policies helped the establishment of many tanneries in the small-scale sector during the fifties and the sixties. In the early seventies both external factors and domestic conditions were ripe for the rapid expansion of the leather industry in India. in U.S.A., U.K., and Germany, rising real wages in manufacturing as well as the public concern about environmental damages from the tanneries resulted in a gradual shift of the industry to relatively low wage and less pollution conscious countries such as Spain, Portugal, Turkey, Italy, Japan and South Africa. In India, the chrome tanning process was introduced for the first time. Its speed of production combined with the myriad applications for which it is ideally suited made chrome tanning the popular method of tanning.

The twentieth century marked a new period in the trade history of the Indian leather industry. During 1900-1914, the export scene was dominated by Calcutta and Madras with the former exporting raw goods and the latter tanned ones. In 1912-13, the total exports of hides/skins amounted to Rs.8 crores as against Rs.4 crores from Madras. This was because 17 of the 22 organised tanneries were in Madras and the rest remained scattered in Bengal, Bihar,

368 Ibid, p.28.
369 See Ray Chaudhuri, T and Kumar, Dharma (Eds.) (1982).
371 Supra note 366.
Orissa and Bombay. The outbreak of World War II gave an impetus to the development of leather and leather goods industry in India. While in 1913-14 only 25 large units, employing 2,753 workers, were established, by 1941, the number of units had increased to 114 and the workers to 26,056. Before 1947, though the British had shown considerable interest in leather manufacturing in India and had even established some chrome tanning units in Bengal, India mainly exported raw hides and skins. After Independence, planned efforts were made by the Government of India to promote and develop export trade by the adoption of the Export Policy Resolution in 1970 and implementing the recommendations of the Seetharamiah Committee.

The Committee noted the favorable internal and external environment for the growth of the industry in India and recommended:

a) a ban on export of raw hides and skins,

b) quota restriction on export of semi-finished leather,

c) an increase in finished leather manufacturing capacity, and

d) a comprehensive scheme of incentives for boosting exports of finished leather and leather products.

These recommendations necessitated a simultaneous increase in the capacity of the finished leather sectors. In 1979 the Kaul Committee recommended reduction of import duty to a uniform rate of 25 per cent on all tannery, finishing, footwear and other leather goods machinery, which were placed on the Open General List (OGL). In 1985 the Pande Committee

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374 Kaul Committee was constituted by the Government of India in 1979.
recommended duty-free imports of hides and skins, wet blue and crust leather and finished leather under OGL, liberal imports of machinery and equipment needed for the industry at low rate of duty under OGL, and strengthening and enlargement of production infrastructure to help increase the export of footwear. In the context of the recent developments in the leather industry, both at the national and international levels, and recognizing the need to provide impetus to this sector for export promotion and growth, the Government of India constituted the Murthy Committee, which went into the growth prospects of the Indian leather industry and submitted a number of recommendations aimed at capturing at least 10 per cent of the global market share by India.

**Growth of the Industry:**

The growth of the industry was spectacular. It was also aided by the fact that many of the developed countries did not wish to dirty their hands any more with the tanning process. The tightening of the environmental legislation in the West also made India a much more attractive production center than the developed countries. Much of the growth of the industry in India was in the small-scale sector. The total investment in plant and equipment of most of the industries is less than that prescribed to qualify as small-scale units (US$ 70,000 at that time). The operations are mostly manual. The government tends to be considerably more tolerant with the

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375 Pande Committee was constituted by the Ministry of Commerce, Government of India and submitted its report in 1985 which was published by CLRI in 1987.
small-scale units in matters concerning law enforcement. Laws concerning environment protection are no exception.

According to the CLRI survey\(^{378}\) on capacity utilization, there are 1,083 tanneries in the country out of which 1008 units are in the small scale sector and 75 are DGTD units. Tamil Nadu with 577 units, west Bengal with 233 units and Uttar Pradesh with 147 units, account for 88 per cent of the tanneries in the country. A survey of the growth of the Indian leather industry over the past four decades has revealed that, of the 436 units under the SSI sector that were surveyed, only 57 (13%) were set up before 1950; 31 (7%) between 1951-60; 77 (18%) between 1961-72; 111 (25%) between 1973-80 and 160 (37%) between 1981-88\(^{379}\). Out of 66 units surveyed in the DGTD sector, 29 per cent came into existence between 1961-72 and 39 per cent during 1973-80. Only 9 per cent were set up after 1980\(^{380}\). In other words, 62 per cent of the existing units were set up after 1973.

The production in Tamil Nadu is 44% of the total all-India production. Over 66% of the total production in Tamil Nadu is from the Chennai and North Arcot regions. The data regarding the number of tanneries relates to the year 1990\(^{381}\). Since most of the tanneries are in the small-scale sector, they are often not registered with any statutory authority. Authentic figures later than those given here were not immediately available. The CLRI Field Survey identified 577 tanneries in Tamil Nadu – 536 in the SSI sector and 41 in the in DGTD sector.

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379 Ibid.
380 Ibid.
Most of these tanneries were located in clusters. 344 in the Palar river basin in Ranipet, Vaniyambadi, Ambur, Pernambut, Vellore, Melvisharam and Gudiyatham of Vellore District; 68 in the Cauvery River Basin in Trichy and Erode; and 113 in Chennai.  

According to the survey conducted by the CLRI, in 1987, on capacity utilization and modernization, there are 1083 tanneries in India with a total processing capacity of 62.05 million hides and 161.34 million skins. 75 of these tanneries have been reported to be major tanning and finishing units registered with the DGTD. These, however, account only for a small percentage of the leather, since the small scale units account only for a small percentage of leather, since the small scale units account for 80 per cent of the processing capacity. The organized sector as a whole processed 85 per cent of hides and 94 per cent of skins available for processing in 1987.  

Though tanning is undertaken throughout the country, the major finishing units are in and around Madras in Tamil Nadu, Kanpur in UP and Calcutta in West Bengal. The leather tanning centres, viz, Madras, Calcutta and Kanpur, together account for about 85 per cent of the total tanning and finishing capacity, with Madras accounting for 60 per cent; Calcutta 15 per cent and Kanpur 10 per cent. Bombay, Aurangabad, Kolhapur, Dewas, Jullundar and Agra are other centres.  

**Origin of the Leather Industry in Vellore District:**

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Chennai was one of the important trading centers during the British days in India. Hides and skins were major items of trade. Much of the export consisted of raw hides and skins. Of the 25 tanneries reported in India in the early 20th century, 14 were said to be in Chennai. In 1972, the Dr. Seetharamiah Committee, set up by the Government of India, recommended that export of raw hides and skins should be banned and the export of semi-processed leather should be restricted. The aim was to encourage exporters to process the hides and skins and export finished products. The government accepted the recommendations, as it was keen that there be substantial value addition to the exports. This would not only improve the foreign exchange inflow, a national priority, but also provide employment to thousands of people. Issues of environment were not an important part of the agenda in India before the early 1980s. The government, partly with the help of legislation and partly with a system of incentives, banned the export of raw hides and skins and discouraged the export of semi-processed leather. This accelerated the growth of tanneries.

As Chennai was the major trading center for hides and skins as well as the little processed products that were exported, it was not surprising that the new leather processing units were founded close to the city. Some of the tanneries, were located on the outskirts of Chennai city. With the aim of shifting the industries out of the cities, and providing equitable employment opportunities to the population in the hinterland, the state government provided a wide range of incentives to the industrialists to set up industries in pre-designated backward regions of the State. One such region was the belt in the North Arcot District of Tamil Nadu, half-way between the cities of Bangalore and Chennai, which was witness to the phenomenal growth of the leather industry. The river Palar cuts through this region and the water flow in the river was considered adequate to meet the requirements of the industry.
The tanneries of the Palar Valley were established predominantly by Labbai Muslims who took advantage of the opportunities opening up in leather. Strengthened in number locally through migration from other parts of the region, members of this community undertook to organize the formerly village-based production of leather into more modern manufacturing units. Labbias and other groups of “Tamil Muslims” have traditionally been involved in commerce and trade and they could mobilize their networks to realize capital investments. Interestingly, there appear to be few organic links between agriculture and industry in this specific case, in the sense that the industry has not depended on investments from local agricultural surplus. However, rural areas have supplied labour to the tanneries for many decades and interaction between the two sectors have intensified in recent years with the increasing demand for labour in leather goods manufacturing. The historical absence of Hindu investment in this history can be explained by the impurity associated with leather in the brahmanical value system.

According to the most historical accounts, the main reasons that tanneries located in the Palar Valley were: abundance of water, and perhaps its quality, the proximity to traditional tanning materials, mainly tannins from the bark of trees collected from nearby mountainous areas (Mysore plateau, Javadi Hills), and the proximity to Chennai (formerly Madras). Chennai was a major colonial seaport, from which leather was dispatched to distant markets, and the city itself constituted an important leather market. While local labourers may have constituted the initial

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384 The labbais are a sub-group of “Tamil Muslims”, term indicating those groups whose traditional mother tongue is Tamil. See Loraine Kennedy, (editor), INDUSTRIALIZATION AND SOCIO-CULTURAL CHANGE IN THE TANNERY BELT OF THE PALAR VALLEY (TAMIL NADU), French Institute of Pondicherry.
385 Farmers often complain of a shortage of agricultural labour, a situation they attribute to increasing employment in factories. While this is one factor put forward to explain changing cropping patterns, characterized by a switch from rice to less labour – intensive crops, other factors also play a role.
work force, field surveys conducted in several towns indicate that groups of people from other regions, whose traditional occupation was leatherwork, were also recruited. These families migrated and settled in the Palar Valley. These migrations, which concerned both Tamil and Telugu speaking groups, were staggered over several decades at least\(^{387}\).

**TANNING PROCESS:**

The Indian leather industry is a large player in the global market, and a major source of foreign exchange revenues. India is the third largest leather producer in the world, behind China and Italy. Tanning industry contributes significantly towards exports, employment generation and occupies an important role in Indian economy. On the other hand, tannery wastes are ranked as the highest pollutants among all the industrial wastes. The process of tanning requires large amount of fresh water and various chemicals. More than 300 litres of water is required for every 10 kg of raw skins processed. Similarly, for every ton of skin processing, about 300 kg of chemicals are required\(^{388}\). The tanning process consists of a sequence of mechanical and chemical processes in which the animal skins and hides are converted into leather products\(^{389}\). There are four basic stages in the tanning process: preliminary processing, tanning, post-tanning and finishing.

**Preliminary Processing:**

In preliminary processing, the raw material is prepared for tanning through various cleaning/conditioning steps: x Soaking: removes dirt and impurities, blood and preservatives

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\(^{387}\) See Raj and Venkatasubramanian 1998.

\(^{388}\) Verheijen 1996.

(NaCl), helps the hide to regain their normal water content, softness and shape x De-hairing: removes hair, wool and keratin from the hides. x Deliming: removes excessive lime used in de-hairing by (NH4)2SO4 / CO2.3 x Bating: eliminates the impurities by adding enzymes. x Pickling: reduces hide pH, which favors tanning. The low pH condition also inhibits the enzyme activities. In pickling, salts are added to prevent the hides from swelling. The wastewater generated from preliminary processing contains excessive chemicals, animal residues such as hair and fleshing sludge.

**Tanning:**

Tanning is the process which converts animal hides into leather. In this process, the leather is made resistant to biological decay by stabilizing the collagen structure of the hide, using natural or synthetic chemicals. The hides and skins have ability to absorb other chemical substances, which make the hide resistant to wetting and prevent decaying. During the tanning phase, the tanning agents interact with the collagen matrix of the hide, stabilizing both the collagen and proteins. The leather thus attains resistance towards chemical, thermal and microbiological degradation. The tanning can be done either with vegetable tanning agents such as bark from the quebracho (Argentine) or chemically with chrome. After tanning, the hides are split horizontally into an upper layer called the grain, and a layer from the flesh side called the split. These layers are separately processed further, sometimes retanned and then pressed, stretched and dried. The waste stream generated from tanning process contain excess tanning agent, and trace of hide residue.

**Chrome Tanning:**

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391 Dhayalan et al 2006; Rameshraja and Suresh 2011.
Leathers are generally produced by chrome tanning. It consumes less processing time than traditional vegetable tanning. The chrome tanned leather is better suited for various applications, particularly for the upper parts of boots and shoes. No two tanneries are identical; each has its unique characteristics and sub processes. Some tanneries perform only certain processes and ship their goods to another tannery to complete the processing. As stated earlier (preprocessing), the hides are received from meatpacking plants by truck or railroad car. The hide bundles are cut open and the hides are unfolded, inspected, and usually split along the backbone, producing two sides from each hide. The hides are soaked in water to return some of the lost natural moisture. The hides are then soaked in a lime and sulfide solution which either loosens or dissolves the attached hair. In some operations, the hair is only loosened through the caustic action of the lime, with the hair removed mechanically, followed by washing, drying, and sold as a by-product (for carpet pads and similar uses). The hides are now ready for actual tanning operation. The hides are placed in large rotating drums and treated in turn with an enzyme solution and then a salt-acid solution (bating and pickling) to prepare the hide for the tanning process.

Chromium sulfate solution is added to the drum and the hides and chrome solution are mixed for about 24 hours. The excess moisture in the hide after tanning is removed through wringing operation. The cattle hides are too thick for most purposes so the tanned hides are split using a machine similar to a horizontal band saw. The splitting operation yields a thin, inner portion of the hide known as a "split" or "blue drop." Splits have no graining and are often used for garments. Both the grain side and the split may be further processed to form a piece of material of uniform thickness. This operation is called shaving and results in the removal of small pieces of leather with a consistency similar to very coarse sawdust. The tanned hides are
further placed into another drum to produce a further stabilization of the collagen network called retanning. Retanning is shorter tanning operation normally done with tanning agent other than chromium. The fiber elements dehydrated by tanning are coated with a fat layer to give leather the desirable softness called fat liquoring. The fat liquoring influences the physical properties of the leather, such as extensibility, tensile strength, wetting properties, waterproof and permeability to air and water vapour.

**Vegetable Tanning:**

Vegetable tanning uses the extracts from various tree barks as the tanning agent. Since the introduction of chrome tanning, the vegetable tanning has lost its importance in tannery operation. Many of the basic steps used in the chrome tanning process present in vegetable tanning except some changes in the sequence of processing. The hides are soaked in lime to loosen the hair and subjected for fleshing operation. After fleshing, the hides are trimmed into a roughly rectangular shape and then passed through pickle operation similar to that is used in the chrome tanning process. The hides are then colored with tanning solution. In general, the vegetable tanned leather is not strongly colored. The colored hides are placed into vats containing the bark extract tanning solution and moved from a strong tanning solution to a slightly weaker one, then rinsed and partially dried. In vegetable tanning, a process called leveling is practiced in the place of true splitting to produce uniformly thick leather. Then the hide is oiled (similar to the fat liquoring in chrome tanning), dried and conditioned.

**Post-tanning:**

In post tanning operation, the tanned hides are washed to remove the unfixed tanning agents.
Finishing:

After the tanning process, the hides are processed with a series of coatings on the surface in order to improve their resistance and produce appealing and uniform surface effects. The overall objective of finishing is to enhance the appearance of the leather and to provide the performance characteristics expected of the finished leather with respect to: colour, gloss, handle, flex, adhesion, rub fastness, as well as other properties including extensibility, break, light and perspiration fastness, water vapour permeability and water resistance as required for the end use.

TREATMENT OF TANNERY INDUSTRIAL EFFLUENT:

The tannery effluent is conventionally treated by physical, chemical and biological methods. The physico-chemical treatment of organic effluent consists of adsorption, coagulation, precipitation, flocculation, sedimentation, filtration, ion exchange and chemical oxidation. Coagulation has been traditionally used in tannery industry to reduce COD and suspended solids. While chromium and ammonia present in the effluent are removed through adsorption method. The biochemical methods include biodegradation, bisorption etc. Biological methods of treating industrial effluents are suited for easily degradable organics only. However, these methods become ineffective for the effluents containing refractory (resistant to biological treatment) organic pollutants.

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Though the conventional methods are traditionally used in tannery industry, these methods have limitation and cannot meet the stringent norms of pollution control board standards. As a result, the industries are forced to look for alternative treatment technologies to treat the tannery effluent effectively. Among them, advanced oxidation processes have already been used for the treatment of industrial effluent containing recalcitrant organics\textsuperscript{394}. Groundwater is the primary source of water for human consumption, and industrial uses in many regions all over the world. In India, most of the population is dependent on groundwater as the only source of drinking water supply. The groundwater consumption rate is increasingly day by day in the areas where surface water sources are not enough to meet the demands.

The quality of world water resources is being increasingly degraded as a consequence of its intensified anthropogenic exploitation. The resources in several locations become contaminated from numerous human activities or natural source. Industrial, residential, municipal and agricultural activities affect groundwater quality. Contaminations of the groundwater result in the poor quality of drinking water, loss of water supply and potential health problems\textsuperscript{395}. The Palar river basin has been polluted by a cluster of tanneries which are distributed along its banks. Tannery industries in Tamil Nadu concentrated more than 70% tanneries are located in Ranipet, Vanaiyambadi, Dindigul, Ambur and Chrompet as per CPCB. More than 14% tanneries are at Pernampet and Erode and there are less than 16% tanneries located at the other places. The process of tanning involves the use of large amount of fresh water and various chemicals. The various chemicals used in tanning are lime, sodium carbonate, sodium bi-carbonate, common salt, sodium sulphate, chrome sulphate, fats, liquors, vegetable oils, dyes etc.

\textsuperscript{394} Ibid.
\textsuperscript{395} BIS, Indian standard specification for drinking water, IS 10500, New Delhi, (1991).
This industry is one of the major consumers of fresh water and most of the water is discharged as wastewater. The quantity of total wastewater discharged for 100 kg of skins and hides processed varies from 3000 to 3200 liters. Common salt (Na+Cl-) is the biggest polluting material in the tanning industry. The amount of wastewater generated by the tanneries is approximately from 2.5 to 3.0 million liters per day, which in turn collected in irrigation lakes. Then the pollution penetrated vertically and makes it unfit for drinking, irrigation and for general consumption. According to a report, a sole tannery is capable of causing the pollution of groundwater in a scope of about 7 to 8 km in radius.

As per current analysis, this is observed that the groundwater get polluted, drastically because of industrial activities, because of which, water borne diseases has been seen which a cause of health problems a lot. The results of the study shows that the water in and around Ranipet industrial area is significantly contaminated. This indicates those groundwaters are significantly degraded and suffer from extensive salinization. It may cause laxative effects on health of the people consuming that water and it is not suitable for domestic purpose. The pollution from tanneries has caused irrevocable deterioration of quality of groundwater in vast area. Hence proper water treatment is required in terms of community health.

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399 Supra note, 372.
EXTENT AND CONSEQUENCES OF GROUNDWATER DEPLETION IN VELLORE DISTRICT:

The present position of Vellore District denotes that it is highly polluted place due to tannery industries apart from chrome chemicals, refractories, ceramic and other chemical industries which release heavy matters into the environment. The effluents of the leather industries, usage of the chemical fertilizers for agriculture and small scale dying industries falls heavily on the quality of the drinking water. The impact is felt very much on the drinking water sources which are available for the people, settled on the banks of the river.

As on November 1, 1996, Tamil Nadu had more than 1000 tanneries. Particularly in Ranipet and Vaniyambadi regions of North Arcot District had 570 tanneries, of which 303 were connected to 5 operational Common Effluent Treatment Plants (CETPs), 257 were members of 9 CETPs under construction and 10 isolated units. Number of unorganized tanneries is coming up day by day; therefore these numbers may not reflect the exact. When these tannery effluents percolate the groundwater, it gets contaminated. Groundwater is the major source of irrigation in these areas throughout the year. Heavy metals concentration in the groundwater and surface water of Ranipet was in the higher limit compared to WHO. Permissible limit of heavy metals

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403 Gowd and Govil, 2008.
404 Supra note 372.
405 Supra note 370.
406 World Health Organization.
in drinking water. Human populations in these areas are seriously affected from occupational
diseases such as asthma, chromium ulcers and skin diseases.\textsuperscript{407}

The Problem Over the years the groundwater in the areas where the tanneries are
located, has become intolerably polluted. The industry is highly water-intensive. Each tonne of
hide/skin tanned requires over 40,000 liters of water. Hence even a small tannery with a capacity
to process 3 to 4 tonnes a day uses up well over 100,000 liters of water a day—the daily
household requirement of at least 2,500 people.\textsuperscript{408} The pollution control authorities have been
following their routine procedures in bringing the pollution from the tanneries under control. The
magnitude of groundwater pollution due to indiscriminate discharge of solid and liquid waste by
the industries and fertilizers/pesticides used excessively by farmers has reached an “alarming
stage” in the State of Tamil Nadu. Further, a study of analytical results of groundwater quality
tested by Central Ground Water Board and the State Government’s agencies showed that the
quality of shallow groundwater, in general, had deteriorated much. The concentration of
dissolved solids and chlorides in water samples collected from dug wells was extremely high,
ranging between 20000 mg/litre and 35000 mg/litre especially in the tannery belts.\textsuperscript{409}

Studies in Vellore District indicated that the Common Effluent Treatment Plant had not
been effective in reducing total dissolved solids to permissible limit for domestic use. It was
further observed that the people in the area are seriously affected and suffering from
occupational diseases such as asthma, chromium ulcers and skin diseases. Incidence of
respiratory diseases among workers exposed to occupational and environmental risks of tannery

\textsuperscript{407} Supra note 402.
\textsuperscript{408} Tolerance Limits for Industrial Effluents, Indian Standards Institution, December (1985).
\textsuperscript{409} Supra note 402.
industry at Ranipet industrial area. The concentration levels of these metals are much above the permissible limits in surface water and are health hazards especially for the people working in the tannery industries. In these areas of Tamil Nadu, particularly in Vellore District, groundwater is not suitable for domestic use. The villagers are forced to travel 4-5 km for water. Much of the groundwater is unsuitable for irrigation, and hundreds of wells in the region can no longer be used. High levels of Cr, Ni, Zn, Pb are present in the soil due the chemicals use during tanning and accumulation of discharged wastes into the groundwater and in the soil.

Tanneries are classified under the “red” category-highly polluting industries. The production process requires large quantity of water and application of many chemicals. As a result the undesirable by-products of semi-finished leather products are large quantities of effluents with high concentrations of pollutants and generation of solid wastes. Tanning operations can be divided into three stages. The beam house operation consisting of soaking, liming and unhairing, fleshing, deliming and bating. These operations require water ranging from 191 to 221 per kg of hides and skins processed (HSP). They generate waste water ranging from 181 to 211 per kg of HSP which contains pollutants measured in terms of parameters such as BOD, COD, pH, TDS and TSS. The solid waste generated from raw trimmings, lime sludge and fleshing ranges from 0.21kg to 0.47 per kg HSP. The result of the study stated that the actual usages are much higher than the expected values for units engaged in conversion of semi-finished leather to finished leather.

Tannery effluents, being voluminous and highly puerile, when discharged untreated, damage the normal life of the receiving water bodies, and if allowed to percolate into the ground

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412 Supra note, 370.
for a prolonged period, will pollute the groundwater permanently and make it unfit for drinking, irrigation, and domestic consumption. During the process of leather manufacturing, several chemicals are extensively used. In the State of Tamil Nadu, where more than 60% of India’s economically important tanning industry is located, tannery waste containing chromium and sodium compounds has, many years, contaminated agricultural land. Thousands of farmers lost their farms, or part of their earning capacity because of this contamination. This is also one of the contaminated sites identified by the Central Pollution Control Board, India\textsuperscript{413}.

As per the technical report submitted by Mr.T.Balakrishnan\textsuperscript{414} in the year 2009, the groundwater resources have been computed jointly by Central Ground Water Board and State Ground & and Surface Water Resources and Data Centre, PWD, WRO, Govt. of Tamil Nadu as of 31\textsuperscript{st} March 2004. The computation of groundwater resources available in the district has been done using GEC 1997 methodology. One of the salient features of the computation is the pollution from tanneries has caused irrevocable deterioration of quality of groundwater and soil in vast areas. There is an urgent need to arrest/prevent further deterioration of groundwater and soil quality through a comprehensive plan. Providing Common Effluent Treatment Plant (CETP) and adoption of environment friendly technologies for tanning and safe disposal of waste in the area.

With regard to groundwater management strategy, based on the estimation of resources, 16 Blocks viz, Alangayam, Anaicut, Arcot, Gudiyatham, Jolarpet, K.V.Kuppam, Kandhili, Kanniyambadi, Katpadi, Madhanur, Natrampalli, Pernampattu, Sholingthur, Thimiru, Thirupattur

\textsuperscript{414} Scientist-D, Central Ground Water Board, Govt. of India, Ministry of Water Resources, South Eastern Coastal Region, Chennai.
and Vellore have been categorized as over exploited and the Nemili block has been categorized as critical. As such, these blocks are not to be considered for any further development of groundwater unless the re-estimation of the resources is completed and the balance potential computed. Groundwater development therefore should be taken up in a judicious manner in the remaining 3 blocks viz, Arakkonam, Kaverpakkam, and Wallajah. Finally the recommendations of the technical report stated thus,

- No further development of groundwater resources should be taken up in areas categorized as “Over exploited or Critical”.
- There is an urgent need to replenish the groundwater resources through construction of appropriate groundwater conservation / artificial recharge structures.
- There is an urgent need to arrest / prevent further deterioration of groundwater and soil quality through a comprehensive plan incorporating measures. Viz., CETP for industrial areas.
- In the areas already affected by groundwater pollution, cultivation of suitable salt tolerant crops / fodder can be taken up in consultation with the Department of Agriculture.

But the above recommendations of the technical report are not providing a broader or permanent solution for preventing groundwater pollution in these notified areas. It gives only the temporary and indirect solution for groundwater development.

ENVIRONMENTAL IMPACTS OF TANNERY INDUSTRIES:

Some evidences from the secondary sources have pointed out the cumulative impact of discharging the untreated tannery effluents on water, soil and human health. PWD data on
observation, wells, which are, located within the radius of 15km of Ranipet and Vaniyambadi for the year 1972 to 1973 showed deterioration in water quality over time. The measurements on electrical conductivity show that 7 of the 12 villages were under the “injurious” class and only in 3 of the 12 villages the measured values were below the permissible values during whole period. As for the TDS measurements, the minimum values were below the standard in all the 12 villages, but the maximum values were below the standard in only 4 out of 12 villages. A trend analysis reveals that in 8 of the 12 villages TDS values increased with time. During the period, the observed values for chloride exceeded the tolerance limit for irrigation at least once in 9 of the 12 villages\textsuperscript{415}.

The CPCB Groundwater Quality Monitoring Data at monthly intervals for 8 dug wells within a radius of 15 km of Ranipet and Vaniyambadi for the calendar year 1994 provide information on the quality of water used for irrigation. All the TDS standards are above the standard of 2100 mg/l\textsuperscript{416}.

A report on \textit{Tannery v. Agriculture}, North Arcot District, collected and analyzed soil samples in two severely affected villages in the Ranipet Zone. Comparing N and P measurements in the soil samples with the values given by the Fertilizer Association of India in its Rating Chart for soil test data, it found that all the sample plots came under the rating “low”\textsuperscript{417}.

In 1971, the International Agency for Research on Cancer (IARC) initiated a programme on the evaluation of the carcinogenic risk of chemicals to humans with the object of producing monographs on individual chemicals. Since 1972, the programme has undergone considerable

\textsuperscript{415} PWD data for the year 1972 to 73.
\textsuperscript{416} The CPCB Groundwater Quality Monitoring Data for the calendar year 1994.
\textsuperscript{417} The Soil Survey and Land Use Organization’s Report on \textit{Tannery v. Agriculture}, North Arcot District.
expansion, primarily with the scientific collaboration and financial support of the US National Cancer Institute. In June 1980, an IARC Working Group met to evaluate for the first time the carcinogenic risk of exposures in certain industries.

In view of the large numbers of chemicals used in the leather tanning and processing industry, it is surprising that no more reports on toxicological effects than those reported here were available to the Working Group\(^{418}\). Skin disorders as well as systemic poisoning may result from the handling hides and skins which have been treated with arsenic or mercury as preservatives\(^{419}\). Eczema and contact and allergic dermatitis have been diagnosed in tannery workers\(^{420}\) and in hide, leather and fur workers\(^{421}\).

Inhalation of both chemical vapours and dust (including leather and hide dust) and dermal contact with these agents could occur simultaneously. 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. The chemical complexity of the tanning process and the wide variety of finishing agents used will almost certainly result in worker exposures \textit{via} inhalation and dermal contact to multiple and changing chemical pollutants\(^{422}\).

The industry is moving towards greater automation and mechanization. However, in many plants wet hides are still handled manually throughout the manufacturing process. Some


\(^{419}\) McConnell et al., 1942.

\(^{420}\) Abrams & Warr, 1951; Sinitsyna, 1972.

\(^{421}\) \textit{Ibid.}

\(^{422}\) \textit{Supra note} 418.
workers may subject their hands and arms to tanning chemicals both by handling wet hides and by direct exposure to chemicals. It must be emphasized that often more than one of the operations are carried out in the same work room, and this result in cross pollution. Furthermore, in some operations, the work load and elevated temperature and relative humidity may change the environmental exposure. Employment in tanneries may entail exposure to a number of chemicals for which there is evidence of carcinogenicity in humans.\textsuperscript{423}

A sample survey\textsuperscript{424} of 352 persons in three highly polluted villages in Vellore District on the impact of the tannery effluent on the environment provides the following information. 72 per cent of the respondents reported run off tannery eflluents near their houses. 77 per cent of the people interviewed said odour, water contamination and mosquitoes as serious problems. 88 per cent of them said that hardness/salinity of groundwater had increased during the last 20 years. 31.5 per cent of the respondents reported that they suffered from one or more diseases during 1995-96. Respiratory disease was the most frequent disease followed by allergy related disease. 78 per cent of those who suffered from illness attributed water pollution as a cause for their illness. 9 per cent of the respondents reported that they could not attend to their works for more than 30 days due to illness, 19 per cent reported income loss of Rs.5000 and nearly one-third income loss of Rs.1000 or less. Of the 80 respondents who owned land, more than half said that they had to leave part or all their land uncultivated because of soil or/and water pollution. 64 of the 66 respondents replied that the yield had been decreasing. More than three-fourth of the respondents said that the market values of the lands had been declining.

\textsuperscript{423} Ibid.
\textsuperscript{424} Supra note 393.
Valuation of damages is highly subjective in the absence of the relevant dose-response functions. For these reasons, no attempt was made to value the damages due to the cumulative discharge of tannery effluents on land, water bodies, and human health. Nevertheless, the secondary evidences as well as the perceptions of the sample villagers on the environmental damages from tannery effluents and solid wastes indicate the need for and the urgency of solving the pollution problem.

Several key environmental issues are associated with leather processing. It can be noticed that a large amount of wastewater is generated at various stages of tanning processing. The polluting nature of tanneries is evident from the notorious odour and the presence of unused toxic chemical in the discharge. The effluent generated at various stages of tanning processing are more concerned with liquid effluents discharged from tanneries which contain high organic and inorganic suspended solids, high COD and potentially toxic metals.

The tanning industry is known to be very polluting especially through effluents which are high in organic and inorganic dissolved and suspended solids content accompanied by propensities for high oxygen demand and containing potentially toxic metal salt residues. Disagreeable odour emanating from the decomposition of protein solid waste, presence of hydrogen sulphide, ammonia and volatile organic compounds are normally associated with tanning activities. A significant part of the chemical used in the leather processing is not actually absorbed in the process but is discharged into the environment. The wastewater from leather industries contains organics, chromium, sulphide, solid waste, buffing dust etc. Since more than

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80 per cent of the organic pollution load in terms of BOD comes from early wet processing, this is the primary target of most pollution control measures.

The main hurdle for adoption of environmentally acceptable leather processing methods and effluent treatment are the cost factor and the traditional conservatism derived from hesitation over process alterations especially when satisfactory leather is being currently produced. This is more particular with small and medium sized units. In India, the tanning operations is a family business, carried out in small to medium scale semi-mechanized units and frequently grouped tightly in clusters which used to be outside residential areas. Tanners in such units have no formal education and have little or no understanding of the complexities of the leather processing, their skills acquired from their elders with hardly any perception of environmental protection. Generally speaking, tanneries in India require better skilled personnel and closer technical control than conventional processing. Thus, lack of properly trained staff at different levels remains one of the crucial constraints. Further, the adoption of low waste technology often requires a radical alteration of most tannery processes while, at the same time, ensuring that the ultimate product retains its marketable properties.

It is known fact that the leather industries in India suffer from economic constraints due to increased capital or inflation rates. The escalation of chemical, machinery parts, import duties on chemicals and machinery resulted exponential investment increase in the capital cost for tannery industries. In fact this is the case with all chemical process industries, but it is obvious for small entrepreneurs. The industry has been making the plea that available technology does not permit it to adhere to the legal requirement. Process economics do not allow them to treat their effluents adequately. This is particularly so as the units are very small. The investment in pollution abatement systems as a proportion of the investment in the plant is very high. Some
parts of the local community have taken the issue to court and the matter is the subject of an intense legal battle. The industry has been using to advantage the fact that the legal processes in India are slow and it could take years before the Government can act. In the meantime, the problem persists.

In addition to the economical barrier, the tanners traditionally regarded as socially inferior because of the nature of their work, makes more difficult for the government to deal with tanneries for modernization.

Inadequate Legislation and Lack of Monitoring Facilities:

Effluent discharge standards in most developing countries are rigid and have a disregard for specific site conditions. The tanneries are under pressure to adopt an effective treatment system which can meet the norms of environmental legislation at once instead of gradual upliftment of treatment facilities, which is beyond their capacity as most of the tanneries are small and medium scale. However, this forced the tanneries to come forward with the help of government for implementing Common Effluent Treatment Plant (CETP) to meet the present challenges.

The Indian government has taken a number of steps to support the modernization of the leather industries. For example, it launched leather Technology Mission in 1995. An important objective of the Mission is to improve the environmental performance of the industry through the development and diffusion of cost effective environment friendly 12 technologies for the tanning industry. The Mission resulted in implementation of 170 projects at 62 locations in 16 states. The Mission is claimed to have resulted in the demonstration of cleaner tanning technologies in over 200 tanneries and microprocessor based controlled wet operations in six tanneries. It also
designed and commissioned 6 CETPs for tannery clusters in South India. More recently, the government has initiated a programme providing subsidy to encourage the leather industry to modernize its production facilities. The scheme, which is administered by the Ministry of Commerce, has the following objectives

- Replacement of obsolete machinery
- Replacement of pit technology with drums
- Installation of instrumentation and process control systems
- Promote float recycling
- In-house chrome recovery re use facilities
- Up gradation of finishing facilities
- Promotion of non-conventional sources of energy

The scheme provides considerable subsidy of the total investment in modernization. There is also widespread criticism on the present subsidy policy for establishing the CETPs. The ceiling on subsidy encourages the formation of small size CETPs which cannot reap the benefits of economies of scale in eth waste water treatment. The Government has also changed its policies on subsidy issue over time, which created uncertainties for the CETP managements and consequential delays.

The process of forming a CETP from its concept to its completion is cumbersome and time consuming. Apart from the initial difficulty in the formation and preparation of a technical plan for a CETP, the organizers have to interface with multiple government agencies at different levels and financial and technical institutions. The government should set up a “single window clearance system” to expedite the completion of all the formalities.
Regarding the Supreme Court’s direction on payment by the polluters for restoration of ecology and compensation for the victims, about four-fifth of the tanners said that the Government and society should bear most of the burden. Many of them asked why the tanners alone be penalized for the past environmental degradation. For a question whether they would contribute to launching of a bio-remediation programme for cleanup of the environment, about half of them did not answer the question and one-third said that they could provide some financial support or supply labour. Degraded lands which come under the categories “severely affected” and “very severely affected” may be set aside as sites for the storage of the sludge from CETPs and IETPs.

Determination of compensation at the individual level poses not only many conceptual and measurement problems but it will involve huge transaction costs and create the moral hazard problem. Every effort should be made to apply the principle in a manner which will enable the polluters to internalize the environmental costs in their production and pricing decisions. The existing pollution control type of instruments for non-compliance with the standard, does not signal the true costs of pollution prevention and control to the polluters. Imposition of punitive measures such as disconnections of water supply and electricity supply, or imprisonment of the officials or closure of the units do involve costs to the polluters, but very often these costs are unrelated to the value of damage or cost of compliance with the standards.

There is a need of a policy regime which conveys the social costs of pollution to the polluters and which encourages the polluters to search for and adopt methods to comply with the standards at least cost. The Supreme Court decisions give three options to a tannery for compliance with the standards-joining a CETP, erecting an IETP or relocating a tannery. Each tannery may be given the freedom to choose among the three options. Each option may be a
necessary condition, for ensuring compliance with the standards. It may be considered that these three options in the context of the proposed “standards and a mix of regulatory and incentive based policy regime” for prevention and control of pollution.\textsuperscript{427}

THE PRESENT APPROACH:

The pollution control authorities, as well as a number of research institutions such as the Central Leather Research Institute in Chennai, have been working to develop systems and processes to help the industry to conform to the law. The United Nations Industrial Development Organization (UNIDO) also has a special program for working on issues concerning the pollution from tanning. As most of the tanneries are in the small-scale sector and cannot afford expensive treatment systems on their own, Central Effluent Treatment Plants (CETPs) are being established under the aegis of the local industry association. Although this is helping to some extent, the water after treatment is still not fit for re-use by the industry or by the population. One major problem continues to be the high salinity of the water. In addition, there is no answer as of now to the huge quantity of solid waste generated from water treatment (the quantity is estimated at 150 kilograms per tonne of hide tanned). Since the solid waste is carelessly disposed of, it finds its way into the groundwater during the seasonal rains.

With reference to International approach, the International Union of Environment IUE Commission is a vibrant wing of IULTCS with about 40 technical members from 32 countries and invitees from United Nations Industrial Organization (UNIDO), European Union (EU) and other relevant international organizations. The IUE Commission regularly meets every year in one of the member countries and update the development. The meeting for the year 2011 was:

\textsuperscript{427} Supra note 413.
The wastewater discharge from world tannery sector is more than 600 million m3/year. The estimated solid waste generation from tannery process is about 5 million tons/year from effluent treatment plants is one of the major unresolved issues in many countries. The sustainability of the small-scale units has become a serious issue in leather sector due to enforcement of environmental regulation in many countries. 400 small-scale tannery units have been closed in China during 2007-09. Currently environment is the major area of research carried out by the leather research institutes and universities. More than 50% of the research publications in the world leather sector deal with cleaner production & waste management. The IUE Commission has developed essential guidelines and practices adopted in cleaner production and treatment of effluent, solid waste management and environmental regulations.

The Central Leather Research Institute has a vast pool of expertise, which deals with every aspect of leather production and serves as a point of reference for the industry and the government. The institution has done commendable work in many aspects of pollution prevention and reduction in the leather industry. Some important contributions of the institution include a technology for recovery of chrome from the effluent and systems for minimizing the use of water in the process. Although, many laudable steps have been taken, such as the setting up of many Common Effluent Treatment Plants (CETP), a solution to the problem is still not in

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428 Dr.S.Rajamani, *Environmental Challenges and Recent Technological Developments in World Leather Sector, 47th LERIG 2013*, CSIR-Central Leather Research Institute, 28th-30th January 2013.
429 Ibid.
sight. All the studies so far had focused on the issue of pollution from the tanneries and ways to treat it. The attempt was to use science to bring the effluent as close to the acceptable norms as possible. The quest was for the Best Available Technology. However, it was obvious that the Best Available Technology was still not good enough in any practical sense. From the perspective of Industrial Ecology, it is not enough to just look at the end of-pipe, but at the beginning also—to consider the resources going into the system. Without any serious study, it was obvious that the major critical resource was water. Of course, this had to be considered along with the various chemicals that go into the process.

The problem is not just the pollution from the tanneries, but whether the local community could afford to provide this valuable resource to the industry. The second aspect is whether the community could afford its freshwater resources poisoned by the effluents. Water is a serious issue affecting the lives of the population of the region and an academic exercise of how close can we get to the prescribed standards is certainly not just adequate. If the industry were not using the water resources of the region, a major part of the problem would be solved. Hence it is logical that the industry find some other source of water and does not compete with the population for this scarce resource. Thus, any sustainable solution has to ensure that the industry does not use the water resources of the region. It also has to ensure that the industry does not pollute the water needed by the population.

SUMMARY:

The leather industry is of vital importance to the country as it generated foreign exchange and provided employment avenues. There is no doubt about it. So many institutions
like CLRI\textsuperscript{430} are working for developing and modernizing leather technology so as to compete with the Global market. They are conducting Seminars, Workshops, Conferences and Research works in this field. But, it should not be at the cost of destroying the ecology, degrading the environment and cause a health hazard. It could not be permitted to expend or even to continue with the present production unless appropriate action taken by the industry itself. The traditional concept that development and ecology are opposed to each other is no longer acceptable. "Sustainable Development" would be the answer. "Sustainable development" means development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. The "Sustainable Development" has come to be accepted as a viable concept to eradicate poverty and improve the quality of human life while living within the carrying capacity of the supporting eco-system. The "Precautionary Principle" and the "The Polluter Pays Principle" were the essential features of "Sustainable Development".

The impact of tannery wastewater disposal leads to environmental problem, even though this problem persists for a long time, it has attracted serious attention only in recent time\textsuperscript{431}. The chemical characteristics of tannery waste water are enriched in synthetic chemicals, some less degradable solids and salts, in addition to the toxic and carcinogenic pollutant metal\textsuperscript{432}. Today there is numerous wastewater treatment technologies available for tannery wastewater treatment, but these technological solutions appeared to be out of reach due to several economical factors. Release of ineffectively treated wastewater into the surface leads to the contamination of groundwater and surface water sources. Already the pollutants from a large number of tanneries

\textsuperscript{430} Central Leather Research Institute, Adyar, Chennai.
have caused a considerable amount of damage of water in river courses by affecting water supply and agricultural productivity.

The industry has been making the plea that available technology does not permit it to adhere to the legal requirement. Process economics do not allow them to treat their effluents adequately. This is particularly so as the units are very small. The investment in pollution abatement systems as a proportion of the investment in the plant is very high. Some parts of the local community have taken the issue to court and the matter is the subject of an intense legal battle. The industry has been using to advantage the fact that the legal processes in India are slow and it could take years before the Government can act. In the meantime, the problem persists.

The availability of water has become another worry for the industry. Earlier, the River Palar in North Arcot provided enough water for the process. Failing this, the plentiful availability of groundwater had been sufficient to meet their needs. Now, over the years, the surface water sources have dried up. The increasing population competes with the growing industry for this scarce resource. The groundwater table in most places has been going down with overexploitation. The available groundwater is polluted with effluents and highly saline. The industry most often brings in water by truck from distant places, where the well water is still of acceptable quality. The industry can still afford the cost of transporting water, but ordinary citizens, who are often from the poor sections of society, face the brunt of the scarcity of water.

Environment pollution is a worldwide problem, now receiving worldwide attention. As industrialization is responsible for environmental pollution and consequential human health hazards, it is necessary to curb the worst excesses committed by hazardous industries, by way of legal restrictions on the processes and the use of hazardous substances. As most of the
environmental legislations suffer from in-built loopholes, even at the legislative stage, they are implemented inadequately. Therefore, in a developing country like India, with alarming conditions of environmental pollution, lack of awareness of its causes and consequences, if unattended, mere enactments and amendments of legislations are not enough. What is more crucial is judicial interpretation towards sustainable development and the effective implementation of environmental laws by the enforcement machinery.