OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

DRAFT REPORT ON THE ENVIRONMENTAL PROBLEMS IN THE LEATHER INDUSTRY

19309

CHAPTER VI ENVIRONMENTAL PROBLEMS

	Page
Introduction	1
The economic impact of environmental protection	2
The tannery environmental image	5
Official limits on tannery discharges	6
Anti-pollution strategies	9
1 Wet blueing	10
2 Zoning	10
3 End-of-pipe strategies	12
Specific pollutant problems	13
a.-Salt	14
b.-Pesticides	15
c.-Sulphides BOD COD	15
d.-Chrome	16
e.-Solvent emissions	17
f.-Water	18
g.-Solid waste	19
h.-Conclusion	21
The inter-regional impact and comparative advantages	22
The industry stance towards the environment	23

1991

CHAPTER VI ENVIRONMENTAL PROBLEMS

Introduction

The continuation of the dynamic growth in demand for leather footwear, upholstery and garments described in the previous chapters is under threat from two general directions, both directly or indirectly concerned with environmental and connected health issues. These threats could displace leather from the preferred place in consumer buying habits that had resulted from the popular reaction in the seventies and eighties in the OECD countries against synthetics in favour of things natural.

In the nineties, this reaction took on an ecological or green direction, stressing protection of the environment, preservation of resources and what was perceived to be the more efficient use of these resources. This became linked with a differently motivated preoccupation with personal health and with an extensive and militant defence of animal rights. The reorientation of direction underlined

1. the accumulator effect of industrial pollution on land and water quality,

2. the greater efficiency of utilising land for food production by growing cereals and pulses rather than by farming animals.

Animal rights activists, opposing meat eating, meat products, leather and leather goods, are arguing that animal farming destroys land fertility.

Against all expectations, the ecological argument is beginning to swing the direction of consumer preference in favour of alternative materials to leather and even back again towards synthetics. So far the pace of movement at the shop sales counter, where the dynamism really originated and its future properly lies, is not strong. At the supply end, however, it is growing and is already significant.

The per capita consumption of red meat, on which the leather supply ultimately depends, illustrates one result of this trend. Beef and lamb consumption has declined in developed countries where the top quality and at the moment the bulk of the hide and skin tradeable supplies originate. Though it has risen in developing countries, the overall trend is downwards (table 6.1).

Table 6.1. Per capita consumption

		1970			1985		
		World	Developing	Developed	World	Developing	Developed
Total meat	kg	26,0	10,0	66,8	29,0	13,0	74,0
Beef lamb pork	kg	22,0	8,6	55,6	23,0	10,5	58,6
Red meat	kg	12,0	4,6	29,7	11,6	5,2	29,5
Leather	sq ft	2,83	1,17	73,0	2,55	1,32	63,0
Leather footwear	pr	0,7	0,2	2,0	0,75	0,3	2,1
Human population	m	3705	2703	1002	4914	3706	1208

Source - FAO USDA MLC

Per capita consumption of leather for all purposes in consequence has also declined even though per capita pairage of leather footwear has grown. Longer trends indicate that considerable stresses will develop in the economics of leather production as these developments in consumer buying habits take shape.

The Economic Impact of Environmental Protection

Changes in consumer attitudes however take a long time to translate into action or reaction at the shop counter. More immediate strictures on the leather market stem from the increasingly stringent limits being imposed by national, regional and municipal authorities on liquid waste discharges to inland waters, rivers, estuaries and sewers, on solid waste deposits on land and on emissions to air.

This impact is both economic and technical. The Italian Association, UNIC,[1] quotes a figure of 450 billion lira spent up to 1979 on investment in setting up chemical treatment and sludge lines in nine centralised plants in Italian main leather production centres. These nine centres treat the effluent and

1) Tanneries for Environment - Unione Nazionale Industria Conciaria

solid waste from 85% of the Italian leather production, Europe's largest and one of the world leaders. Running costs exceeded 200 billion lira and sludge disposal cost a further 35 billion lira. Together these costs represented 4% of the turnover of the Italian leather industry.

The costs of treating effluent and of solid waste disposal vary from tannery to tannery and country to country, depending on the exact operation, the water demand and supply, the infrastructure, the legislative requirements, the locality etc. The critical consideration is the overall effect on the cost of production, modified by the degree of subsidy that a government, the World Bank or other body will provide.

Both developed and developing countries look to their governments for help in paying for the initial investment in effluent treatment plant. Spain subsidises up to 30% of the total capital cost of effluent treatment plant, Italy up to 60% of investment and France up to 50% of R & D on effluent treatment. Firms in developing countries get similar help from governments and from the World Bank for capital costs and tax reductions and subsidies on running costs.

Studies by Urwick Technology in 1972 indicated that a conventional effluent treatment to 200 ppm BOD and 30 ppm suspended solids in a bovine hide leather tannery processing 100 tons of raw hides per week into full chrome side upper leather cost 3,2%. A similar study of a sheepskin tannery processing 3000 pickled pelts per week calculated a cost of 2,1%. A report to the European Commission in 1990 concluded that in the European leather industry generally the costs of treatment against environmental pollution were 2-4% of turnover or 4-8% of added value (table 6.2). Reports by member associations of the

Source and date

[illegible]

Table 6.2 - Cost of effluent treatment in tanneries

Italy	2-4 % of turnover
Spain	2 % " "
France	2-2½% " "
UK	3½% " "
Germany	5 cents per square foot in a fully automated wet shop.

Source - SEMA report to European Commission

International Council of Tanners confirmed these figures. The large tanneries in Argentina and Brazil which have installed similar treatment systems appear to incur similar costs. In the developing countries in South and East Asia the level of costs at the moment is significantly lower even if prescribed limits in line with those in Europe and North America exist. At the central treatment complex in Vyanambody in India a percentage of less than 2% has been indicated but this is on a total leather production cost of probably 80-85% of the total production cost of Western tanneries.

In many countries tanners ignore any regulations that may be specified either because the infrastructure does not exist or because local authorities are reluctant to enforce the regulations. This applies both to developed and developing countries. For example in Greece the local authority successfully prosecuted a tannery for polluting sea and other waters but stayed the execution of sentence whilst a long drawn out decision was being reached on a wholesale relocation to a new but so far undetermined tannery complex site where central effluent treatment facilities will be installed. In Italy when tannery effluent overwhelmed the new communal town and tannery effluent plant in Santa Croce sull Arno, the tanners who were held to be responsible did not have to serve their sentences.

Generally, however, in Europe and North America regulatory authorities enforce laid down requirements whatever the consequence to industry. The American tanners had to take the Environmental Protection Agency to the High Court to have the original EPA limits set aside. These would probably have closed down a large part of the US tanning capacity. Tanners in California and New England have closed rather than incur the capital costs needed to bring their effluents up to local State standards. In Holland, with the low-lying land mass and high water table, the authorities are sensitive to any threat to the water supply and have enforced stringent limits on tanneries, which have closed. The same has happened in Denmark. For example, a successful Danish tanner who was wishing to expand his production and export capacity closed because the central rather than the local authority would not allow the few extra months grace needed to bring the new capacity up to the required effluent quality levels being achieved in the parent plant. Nevertheless, tanners in Europe and North America who felt able to stay in business do so whatever the environmental cost and those that have closed ostensibly because of effluent charges had other commercial reasons for their decision - low-cost competition, mounting losses, rationalisation, opportunities to capitalise on property sales.

The tannery environmental image

Traditionally tanning is regarded as a dirty, malodorous occupation, forced to locate away from residential areas or, in certain countries, in specially designated zones. Because of this the social standing of tanners and even of shoe manufacturers and others handling leather is generally low. Japan justifies her quotas on imported leathers and leather footwear on the grounds that these occupations are among the few open to the untouchable Dowa class.

Because tanners use large volumes of water taken from and returned after use in varying degrees of potency to rivers and other water sources, they are also classed as major polluters. However, as long as tanning was vegetable, pollution levels were not regarded as abnormal or even polluting. In fact there was some tacit acceptance of the tanners' view of themselves as an industry which converts a potentially major pollutant of the meat industry into an ecologically sound material. During the last 100 years tanners of East Indian vegetable tanned crust leather have regularly deposited their discharges into the neighbouring fields without deleterious effect despite the high BOD level and indeed with some benefit in providing a high level of humus soil conditioner. An acceptable criterion for water quality is its ability to support fish life and one English sole leather tanner whose tannery is located across a trout stream maintained that the biggest and best fish can be caught downstream of the discharge pipe.

Official limits on tannery discharges

With chrome tanning the position is radically different. Tables 6.3 and 6.4 list the limits on discharges to sewers, surface waters, land etc demanded by regulatory authorities in a number of countries. These show a degree of variation, which reflects the different priorities each perceives.

Regulatory authorities also differ in principle on how limits shall be applied. The European Commission supports the concept of absolute limits, though for the moment it leaves the decision on what limits should be imposed and how they shall be interpreted to the individual member States. Most of the EC countries accept the absolute approach but the British approach has been traditionally empirical - discharge criteria should be governed by the quality of the receiving waters. After being forced to abandon absolute limits, the EPA in America adopted the principles of Best Practical Technology (BPT) leading eventually to Best Available Technology (BAT) and has since moved a little away from this conceptual base towards the criterion of the quality of the receiving waters. American tanners fear that this could result in more stringent regulations for certain effluent constituents though probably still below European standards.

In continental Europe tanneries discharge a higher proportion of their effluent

Parameter (mg/l unless other)	Brazil	Denmark	France	Germany	Hungary	India	Italy	Netherlands	Switzerland	UK	USA	Japan
pH units	5.0-9.0	6.5-8.5	5.5-8.5	6.5-9.5	5.0-10.0	5.5-9.0	5.5-9.5	6.5-8.5	5.5-8.5	6.0-9.0	6.0-9.0	5.8-8.6
Temperature °C	40	30	30	35			30	25	30	25		
BOD_5	120		40-200	20-25		30	40	50	20	20-130	40	160
COD	360			200-250		250	160					160
Susp. solids	130	30	30-100		50-150	100	80	30	20	30-80	60	200
Sulphide	1.0	2.0	2.0	1.0	0.01-5	2.0	1.0		0.1			
Chrome (III)		1.0	1.0	1.0	2.0-5.0	2.0	2.0		2.0	2.0-5.0		
Chrome (VI)		0.1	0.1	0.5	0.5-1.0		0.2		0.1	0.1		
Chrome total	0.5							0.05			1.0	2
Chloride							1200	1200	200		4000	
Sulphate		300				1000	1000	150				
Ammonia	1.5	2.0	15-80	5-10	2.0-3.0		15			100		
Phosphorus	1.0						10					10
TKN		5.0	10-60					3.0				
Oil/grease	30	5			8-50		20		20			30

Table 6.3 Comparison of Discharge Standards for Tannery Wastewaters for Several Countries (source: ICT/Leather)

Parameter (mg/l unless other)	Brazil	Denmark	France	Germany	Hungary	Netherlands	NewZealand	Switzerland	UK	USA
pH units	5.0-9.0	6.5-9.0	4.5-9.0	6.5-10.0	6.5-10.0	6.5-10.0	6.0-9.0	6.0-9.5	6.0-10.0	6.0-10.0
Temperature °C	40	35	30	35		30	55	40	40	
BOD_5			1000			no limits				
COD									3000-6000	
Susp. solids			500		75				500-1000	
Sulphide	5.0			2.0	1.0		1.0-5.0	1.0	5.0	24
Chrome (III)	5.0				5.0			2.0	5-10	8-19
Chrome (VI)				0.5	1.0	0.0			0.5-1	
Chrome total		2.0		3.0		2.0	5.0-50			
Chloride				600						
Sulphate					400	300		300	1000-1200	
Ammonia					200					
TKN										
Oil/grease	100			250	60				50-500	10

Table 6.4 Comparison of Discharge Standards for Sewer Systems for Several Countries (source: ICT/Leather)

into rivers and therefore have direct responsibility for maintaining environmental quality levels. In UK practically all tannery effluents are discharged into sewers. The municipal authorities therefore have the ultimate responsibility for treatment and pollution levels and set the overall parameters for what they will accept, which they may change from company to company and area to area, varying the overall charges for effluents that keep within the agreed limits and the special charges for any effluents that exceed the limits. This more flexible approach explains why the UK appears not to have developed an 'eco-industry plan' as in Germany and Italy or even a set of national standards as in France and other European countries, beyond a number of absolute prohibitions which are common to all countries.

The empirical approach seems resource-efficient but may need greater supervision and in consequence added cost. The absolute approach caters for every contingency and can, in theory at least, deal with the danger that even acceptable levels of pollution can in time build up to a hazardous and irreversible level.

Anti-pollution strategies

The potentiality of pollution in leather-making is considerable, since only about 57% of the raw hide or skin stock is converted into leather and the remaining 43% enters the tanner's waste stream. Also the tanner's basic production technique is to treat the stock with increasing concentrations of process chemicals using water as a carrier in order to ensure full penetration of the thickest part of the thickest hide or skin in the batch. These concentrations are well in excess of what is needed and the non-absorbed chemicals are discharged in the effluent.

Dealing with these two extensive and varied potential pollution loads, tanners can or have to adopt a number of avoidance or remedial strategies.

1. Wet blueing

The first of these is to side-step the problem by having the tanning done elsewhere by buying in wet-blue or crust. A tanner in an environmentally senstive area thus avoids the main pollutant load. Although this is often given as a reason for the growth in Europe of leather production from the blue or from crust, economies of scale or marketing or political policies by resource-rich countries seeking to add value to their raw hide or skin assets are the real reasons and probably no tanner wanting to stay in business has deliberately abandoned tanning simply to avoid pollution.

2. Zoning

The second strategy is zoning. As has been mentioned, zoning was and is still in certain countries primarily directed at controlling the social nuisance of odours, which arise from damp, untanned protein waste decomposing or being attacked by bacteria or from untanned sulphide-bearing residues from the beamhouse operation. The object of zoning in such instances is not to eliminate or remedy the problem but to quarantine it. Good housekeeping is normally all that is necessary to solve this problem, which a great many tanners seem to be notoriously bad at, even though such material can readily be utilised on agricultural land as a fertiliser and conditioner.

Today the incentive to locate tanneries in special zones comes from the need to manage end-of-pipe effluent treatment and solid waste disposal economically and effectively. This is the logic of discharging effluent to the public owned treatment works (POTW) where industrial and domestic effluent can be mixed together with some degree of mutual neutralisation. Large tanneries such as the big wet-blue units in the US have the necessary economies of scale, but even so the capital cost of plant can be relatively high. A large specialist wet-blue tannery in Kansas, supplying both its associated finishing plant in New England and selling wet-blue internationally has now built three effluent plants each more expensive than the one before and the last costing more than the tannery itself. Despite these capital costs and high US labour rates, this tanner is able to provide a guaranteed year-round standard selection at prices well below or equal to wet-blue from South America or South Asia.

Italy provides the most advanced and most comprehensive example of this zoning strategy focussed on the central treatment plants at Turbigo, Robecchetto con Induno, Arzignano, Montebello - Zermeghedo, Santa Croce sull Arno, Castelfranco di Sotto, Ponte a Egola, Ponte a Cappiano, Solofra.

Table 6.5 - Central treatment plants in Italy

Centre	No of tanneries	Effluent throughput m^3/day Civil	Tannery	Sludge disposal
Turbigo	45	2000	2000	18 tons
Robecchetto	42 + (2 textile 3 chemical)	2600	2400	
Arzignano	270 (180 piped rest trucks)	11000	22000	320 m^3
Montebello	34	10000	24000	
Santa Croce	461	5000	25000	
Ponte a Egola	164	2500	9300	180/200 tons
Ponte a Cappiano	45	2000	3500	50/60 tons
Castelfranco	14	1800	1600	
Solofra		projected 2000 (10360	7000 - 20730)	22 tons

Source - UNIC

The success of zonal strategies depends on a favourable industrial infrastructure as well as the importance the national or regional authority attaches to the industry. In all the nine areas above, large numbers of small tanneries had long been established and such a concentration is essential to stimulate either the financing of a purely industrial service operation or the setting up of an industrial/municipal or state joint venture. Most of these nine operations were joint ventures where sometimes the industry and sometimes the municipality took the initiative but both were involved in the management. Ponte e Egola was an industry cooperative but open to treat civil effluent. The Arzignano complex was a planned double operation involving the out-of-town relocation of the tanneries in new open-plan factories and the building of a new treatment plant which could also handle the civil effluent. In Santa Croce the new plant was built by the municipality but financed by the industry to handle both tannery and civil effluent. The tannery units consisted of many small independent specialist operators collectively capable of the complete range of leather manufacturing from raw, crust, wet-blue or ready-to-finish starting stock to finished leather rather than integrated tanneries. They originally all discharged effluent into the river basically without treatment. Although there were traditional concentrations of tanners in other countries, similar developments did not occur partly because a well-ordered POTW structure was willing to accept tannery effluents straight or after some pre-treatment and partly because the concentrations were dispersed as a result of closures, mergers, consolidations, financial restructuring or transfer of operations to low-cost areas. The exceptions are France (one complex in Normandy), Spain, Portugal, Greece and Turkey, where they are projected.

3. End-of-pipe treatment strategies

Whether or not they discharge effluent to a common facility or to public sewage works, individual tanners may be obliged or voluntarily decide to carry out end-of-pipe treatment of waste liquids and solids.

Strategies to avoid or reduce the cost of end-of-pipe treatment include

- substitution
- cleaner or low waste or no waste technologies
- increased efficiency and higher exhaustion of chemicals
- recovery and recycling of materials
- low float processing.

Specific pollutant problems

Pollutants enter the tanning chain in, basically, three forms:-

- as preservatives or pesticides added by the farmer, butcher or market to the raw hide or by the first tanner to simply tanned leather,
- as unwanted, untanned or tanned protein residues such as fleshings, fat, blood, trimmings, shavings and buffing dust,
- as unfixed process chemicals from the beamhouse, tanning or finishing operations.

Diagram 6.6 schematically shows the potential chemical and biological pollutants produced at each of the leather-making stages.

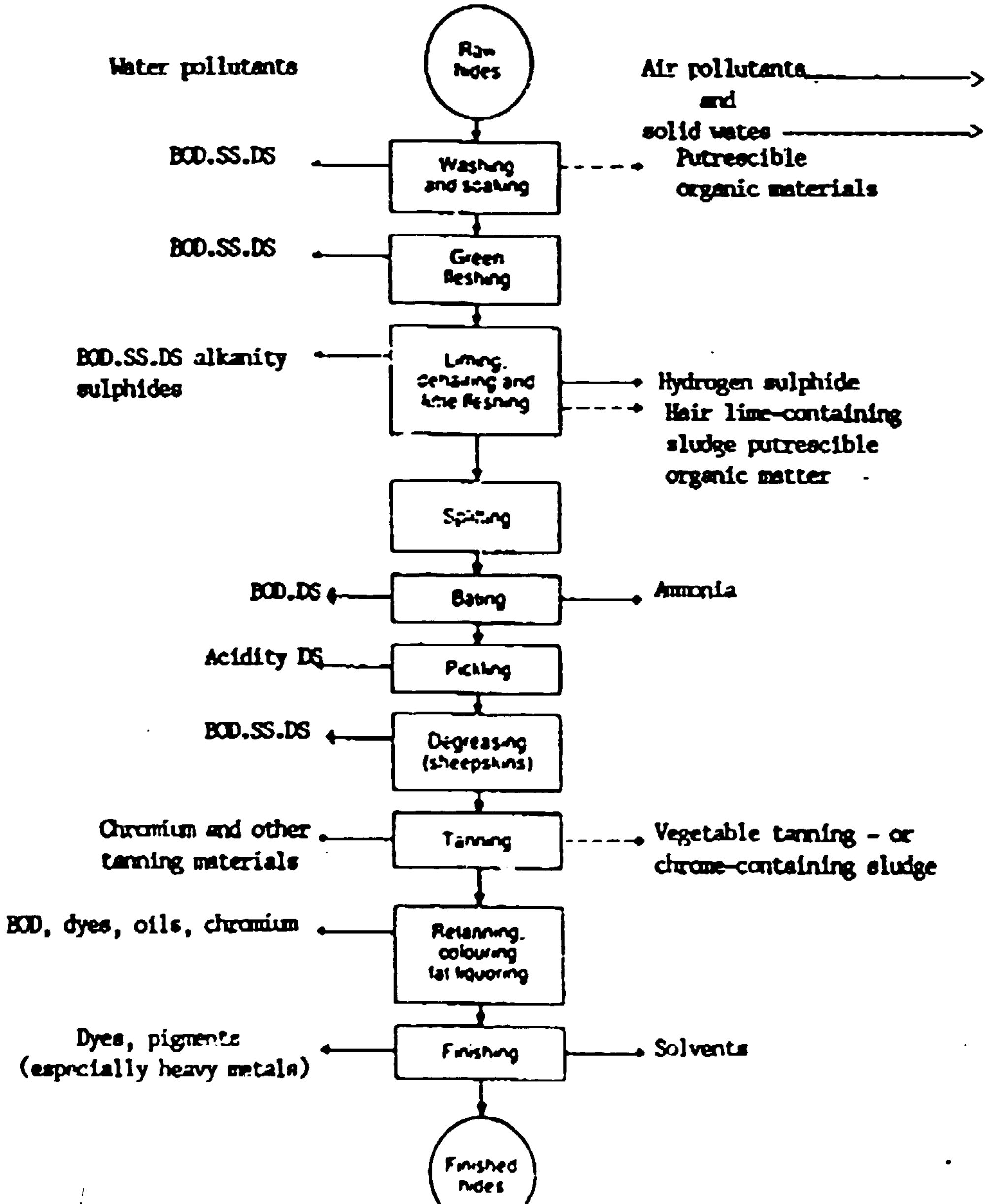

Diagram 6.6 - Pollutant/process flow-chart
Source UNEP

Pesticides, salt, sulphides, BCD and COD, chrome, solvents, excessive water consumption and the disposal of solid waste are the main environmental problems:

a-Salt

New German legislation requires the avoidance in waste waters of any substance used in the preservation of hides and skins. This is directed at both pesticides, most of which are specifically prohibited, and at salt. It reflects the hardening attitudes all regulatory authorities are taking towards the latter and has put further pressure on the industry to adopt alternative methods of curing. Biocides have so far not been deeply investigated but may simply substitute one hazard for another. The most favoured solution is to work the hide or skin as soon as possible after take-off or to keep it in the green state as long as possible.

In the USA working green hides has led to the location of tanneries next door to slaughterhouses and packing stations and to the expansion of wet-blueing. The probability is that hides and skins from the USA, the world's largest supplier of hides, will be marketed internationally in the blue. Already one US company, IBP, is wet-blueing 35% of its throughput, equal to 2% of the world trade.

In Europe, the slaughtering infrastructure is of relatively small scale and more dispersed units, although new hygiene rules and economic pressures are pushing it towards fewer and larger units, and chilling rather than wet-blueing or wet-whiting is likely to become the preferred solution to marketing green hides. Packing hides in ice in the slaughterhouse, rapid chilling in the hide market and delivery to tanneries in refrigerated trucks effectively enable green hides to be marketed to any tannery in Europe from any European slaughterhouse. Tanners using green hides report improved grain and improved yields.

b-Pesticides

Identifying pesticides and measuring quantities used on raw and simply tanned hides and skins is often a problem and can present difficulties for the tanner. For example, although arsenic has long been internationally banned, it was still until recently on the list of chemicals recommended for use as a preservative in Africa. In December 1989 Germany placed a limit of 5mg/kg dry weight on pento-chloro-phenol (PCP) and a year later the rest of the European Community adopted a modified version of the prohibition. The German ban caused consternation in hot-climate, high-humidity countries like India where it is extensively used in crust, wet-blue and finished leather and also problems for tanners using Indian and similar leather stock as a base for finished leather because of the difficulty in measuring the PCP content. Alternatives to PCP are five times as expensive and less effective.

c-Sulphides, BOD and COD

With hides, removing the hair has seldom been cost effective as with sheep and goatskins, where the wool or hair is valuable. The normal practice is to remove it by a hair-burn process in liming and discharge it as sludge, where it constitutes 80% of the BOD and COD load of the tannery sludge and the source of much of the sulphide content. Simple recycling of lime/sulphide liquors combined with screening to remove solids can save 20%-50% of sulphide and 40-60% of lime and related costs. A new Sirolime process enables the hair to be readily separated and saved, reduces the BOD, COD and hydrogen sulphide in the effluent by three quarters.

Bating with liquid enzymes allows automatic dosing which shields workers from exposure to toxic hydrogen sulphide and inhaling enzyme dusts.

d-Chrome

About 90% of the world leather production is chrome tanned and initially because of fears about the supply of chrome oxide and later because of strictures on chrome in effluent and solid waste the industry has looked for alternative tanning materials which would perform as well. Despite the low levels of fixation in the chrome bath, the additional leachates in subsequent processing and the subsequent high chrome content in the waste stream, there seems to be little likelihood of the situation changing. Alternative tannages - aluminium, titanium, zirconium, di-aldehyde and vegetable tanning - do not match the qualities of chrome tanned leather in softness, fullness, water and perspiration resistance, colour, handle, flexibility and stability to light and heat. The original enthusiasm for aluminium tannages has waned because of the toxic effect on fish and plant life, the connection with Alzheimer's disease and the capacity under certain circumstances to reverse. Health and safety regulations in certain countries limit the utilisation of aldehydes. Vegetable tanned leather's poor light fastness hampers its use in many modern applications. Vegetable tanning in combination with chrome gives some of the advantages and performance of both tannages but cannot be regarded as a substitute for chrome tanning. Titanium perhaps holds out the best prospect for a total substitution for chrome but its lower toxicity has still to be proved. Wet-white pre-tannage with aluminium, titanium or zirconium allows usable chrome-free shavings and a later full tannage with reduced quantities of chrome. This achieves partial substitution but so far has made very little market penetration.

Instead of substitution, the industry is concentrating on reducing the amount of chrome getting into the liquid and solid waste streams. These efforts include

- high chrome fixation
- recycling

- chrome precipitation and recovery
- forced injection of tanning floats.

Recycling chrome liquors to tannage can achieve an 80% recycle and to pickle a 60% recycle. Precipitating the chrome as hydroxide enables virtually chrome-free supernatant to be drawn off and discharged to the effluent system and the remaining settled hydroxide sludge to be redissolved and reused. In Italy the Consorzio Recupero Cromo in Tuscany is the first ever central chrome recovery plant recycling 21000kg/day of basic chrome sulphate to the 172 cooperative tanneries which invested 7 billion lira in the project.

Nevertheless, recovery is considered to be the least effective of the strategies and the most cost-effective high fixation. By means of alternatives in the composition and concentration of the chrome offer, size of float and increases in temperature and time, fixation rates of up to 80/85% have been achieved.

Two operational developments could also help - more precise sorting and levelling of the hides before tanning and individual injection of the tanning liquors into each hide singly. Reducing the variations in hide substance both within the hide and across the batch allows the tanner to reduce the deliberate excess of chrome offer needed to ensure complete penetration. Injecting individual hides separately could ensure the optimum penetration with the minimum chrome concentrate and the highest exhaustion, together with total recycling of the liquor, the lowest float, the avoidance of any residual tanning liquors and the possibility of chrome tanning without prior pickling with a consequent reduction of salt in the effluent.

e-Solvent emissions

Some years ago the Swiss tanners reported that effluent was no longer a problem and their main concern was over solvent air emissions on which stricter limits or even complete prohibitions were coming out. In Europe solvent based finishes are increasingly requiring waste air treatment systems involving expensive capital and operating costs. Water based colorants present no problem in the base coats but with top coats there are difficulties over poor film spreading, colour fastness and adhesion to the base coat. Process techniques such as roller coating as well as improvements in pigment and dyestuff technology will resolve these problems.

f- Water

The need to conserve drinking water, the cost and the growing water shortages both in developing and developed countries place a premium on the efficient management of process waters. Water consumption in tanneries varies between 20 l/kg and 100 l/kg for apparently similar productions and technologies and only about half of what is used is actually needed for the process. With central computer or individually micro-electronically controlled dosing and rinsing systems the tanner can now precisely monitor water floats, inputs, recycling and discharges and avoid the considerable operational wastage that occurs in traditional tanning and housekeeping practices. Operator training and simple control valves can reduce free-running over-use of water in less advanced tanneries. Batch washes in place of running water washes and low float techniques can save 70% of the water traditionally used and further savings are possible by recycling run and wash waters to other processes where low concentrations of chemicals in such waters will be beneficial or do no harm.

g - Solid waste

Tanners tend to regard disposal of solid waste as their main environmental problem. The danger they are seeking to avoid is that all such waste must be specially dumped in a limited number of secure sites proofed against contamination of ground waters and guarded against intruders, expensive to use and expensive to reach. In the USA in the eighties such sites numbered only twenty-four for the whole country.

The tactics tanners are using are:

1) to try to ensure that any solid waste is non-hazardous and can be disposed of easily or even at a profit;

2) to put political pressure on regulatory authorities to accept tri-valent chrome as non-toxic or hazardous.

Since potentially nearly half of the weight of the raw material is not converted into leather and constitutes the solid waste load, the tanner should aim at not processing any hide or skin into leather he finds difficult to sell and not processing any part of the hide or skin that he cannot market profitably as a by-product. In both of these the tanner is now able to rely on new technology. Newly-developed ultra-sonic equipment could make it possible for him to sort and pre-select his starting stock before unhairing and more precise splitting machines could allow him to level hides by splitting before tanning rather than by shaving after tanning. The hair-save liming mentioned earlier will provide a marketable by-product and greatly reduce the load that has to be dumped. Wet-white pre-tanning will also enable him to remove a considerable portion of the potential solid waste whilst it still can be readily disposed of profitably as fertiliser or animal feed.

The political battle is to have chrome-tanned wastes de-classified so that they too can be deposited on agricultural land unequivocably. At present various countries allow these deposits to a limited extent (table 6.7) and the European Commission is considering a proposal for uniform maximum values for tri-valent chromium in soils and sludges as follows:

Parameter	Denmark	France	Germany	Holland	Belgium	Norway	Sweden	Switzerland	USA	Engl. & Wales
Maximum permissible soil concentration (mg/kg)	100	150	100	100*	150					600
Maximum permissible sludge concentration (mg/kg DS)	100	2000	1200	500	500	200	150	1000	1000	
Suggested annual loading limit for Cr (kg/ha/yr)		6.0	2.0	1.0	2.0	0.4	1.0	2.5	20-120	
Maximum recommended metal loading (kg/ha)		360	210	100		4			100-600	1000
Maximum sludge solids loading (t/ha)			167	200		20	5 in 5 yrs			
Suggested maximum annual sludge solids application (t/ha)	1.5	3.0	1.7	2 (arable) 1 (grass)		2	1	2.5		
Minimal application period (yrs)	20		100	100		10	5			30
Minimal soil pH		6.0							6.0	6.5**

* Varies according to clay content, eg 50 + (2 x % clay) = max. permissible soil Cr concentration

** The pH quoted is for arable land - for grassland, minimal pH is 6.0

Table 6.7 Comparison of Sludge Re-use Standards for Several Countries (source:

Table 6.8 - Proposed EC maximum values for trivalent chrome in soils and sludges

Soil concentration (mg/kg in air - dry soil)	150-250
Sludge concentration (mg/kg in sludge dry matter)	1000-1500
Total metal addition to agricultural land (kg/ha/	300-600 a)c)
Annual addition to agricultural land (kg/ha/yr)	45 b)c)d)

a) for a background concentration of 50 mg/kg the additon is based on an allowable increase of 100 to 200 mg/kg assuming 25 cm depth of cultivation and a field density of dry soil of 1.20
b) based on a mean total metal addition of 450 kg/ha and an enrichment period of 100 years
c) all additions are subject to the soil concentration limit not being exceeded
d) based on 10-year average

Source UNEP

Tanners argue however that tri-valent chrome is not harmful, is inert and in no danger of converting to toxic hexa-valent chrome, is a valuable source of slow-release nitrogen in agricultural land and even essential to the healthy diet of man and other mammals. Professor Silva of Piacenza University maintains that the 400,000 tons of sludge produced by the Italian leather industry yearly, which costs the industry billions of lira to dispose of, could instead save farmers 2 billion lira from a yearly recovery of 3500 tonnes of nitrogen and by renewing the cycle of organic matter could help to reverse the steady loss of the already low organic content of Italy's soil. An earlier British government report concluded that the risks of adding tri-valent chromium to soil would appear to be groundless and that sewage sludge containing 1000 kg/ha of chromium could be applied over 30 years or more without harmful effect on crop growth.

Opportunities also exist for converting solid waste into an energy source. Incineration needs careful control and may not be practical except on a large scale but the French research centre claims that volatile tannery waste could provide enough biogas to supply 4,5% of the total power consumption of, for example, the French tanning industry.

h - Conclusion

The management of waste waters and their quality control, whether in-house, discharged to rivers, discharged to sewers or discharged to central tannery or joint tannery/civil authority plants seem to have brought liquid waste under control in countries with advanced tannery operations. The possibility for doing the same for solid wastes seems also to be there but is less tractable. In developing countries, shortage of water and the greater availability of land for dumping make liquid waste management more of a problem than solid waste disposal.

The inter-regional impact and comparative advantages

Assessing how far the cost of protecting the environment affects the competitive position of tanners across the world is not straightforward. It depends not only on what limits are laid down but on how far these limits are enforced, on whether the costs of treatment are the real costs or whether they are overtly or covertly subsidised, on whether water treatment is tannery exclusive or of a mixture of tannery and civil effluents, on whether plants are subsidised or not and on whether the return on marketing waste by-products is relatively above or below the marginal cost of disposal.

Limits in Europe are generally stricter than the US Federal limits but not necessarily than State limits such as in California. South American are comparable in cities like Buenos Aires and Sao Paolo but not outside. In traditional leather producing countries like India and Pakistan, the treatment of waste has not matched the industry's development. In countries like South Korea and Taiwan, where the rapid growth of the shoe and other product manufacture has attracted a parallel growth in brand new tanning capacity, an effluent treatment infrastructure has often been built in.

One of the reasons advanced in the seventies and still being echoed for the transfer of leather-making to the developing countries was that tanners in Europe and America were facing problems over effluent and waste disposal. Exporting these problems to the developing countries does not solve them but merely transfers them. Governments in developing countries are now having to adopt similar legislation and the same standards and the tanners in these countries are having to take the same action and incur the same order of expense as tanners in the developed countries. The costs could be proportionately higher (because their labour costs are lower and total production costs correspondingly less) and absolutely higher (because in general chemicals and equipment cost more than in western countries). This will go some way towards equalising discrepancies between leather production costs in developed and developing countries.

The industry stance towards the environment

The United Nations World Conservation Strategy stressed the interdependence of conservation and sustainable development, arguing that every aspect of human activity benefits from conservation and therefore must contribute towards it. The UN Environmental Programme pointed out that pollution crosses national boundaries and has international repercussions, that discharges of industrial residues are a waste of resources and a cost that diverts finance from positive development and that in practical terms it costs less to avoid pollution than to treat it. These moral and practical arguments favour a positive industry approach to environmental protection since every industry needs more and more to be seen to be concerned to ensure continuing customer confidence in its product.

Few industries do any more to protect the environment or to avoid pollution than they have to and tanners have been no exception. Without the pressure of regulations, external treatment charges imposed on them and political and public opinion, tanners would probably have done very little to clean up their image. In those countries where these pressures do not exist, they have done nothing. Where the industry has taken action, it has clearly moved a long way from being a polluter. The world picture is therefore a varied one. In 1990 under the banner of the International Council of Tanners, the world leather industry acknowledged its responsibility towards the environment, its need to maintain quality of effluent, emissions to air, solid waste disposal, handling, storage and use of chemicals and a safe and healthy environment at work and in general (below).

STATEMENT OF THE INTERNATIONAL LEATHER INDUSTRY PRINCIPLES FOR IMPROVED ENVIRONMENTAL, HEALTH AND SAFETY PERFORMANCE

The leather industry accepts responsibility for taking its own initiatives to safeguard the environment, health and safety in addition to compliance with the law. It recognises that such initiatives are a civic obligation as well as good business and marketing practice.

The International Council of Tanners has prepared the following statement of principle in order to encourage the industry in the development and implementation of performance improvement programs.

Associations and companies should:-

1. be sensitive and responsive to public concern about pollution and the environmental impact of leather-making processes;
2. promote an individual commitment to protect health, safety and the environment amongst all levels of management and employees;
3. assess adequately the environmental, health and safety implications of new and monitor the effects of existing products, processes and operations at all stages of supply, production and marketing;
4. adopt, use and encourage the supply of processes, operations, chemicals and materials which have low-risk environmental, health and safety impacts;
5. advise all levels of staff on the safe use, storage, handling, transportation and disposal of chemicals and other potentially harmful products;
6. foster cooperation between appropriate trade sectors (hide, skin and leather suppliers and producers at all stages of the supply and production chain, equipment, chemical and other manufacturers and ancillary groups) in order to initiate action on environmental matters where a joint approach may be effective or necessary;
7. conduct and support research to reduce possible damage to people and the environment from leather industry products, processes and waste materials;
8. encourage technological training and education in low waste techniques which are environmentally-friendly and reduce the risk of harm to workers, customers and the public;
9. provide information to enable authorities, employees, customers and the public to understand any potential health, safety and environmental effects of tannery operations and processes;
10. cooperate with authorities and others to encourage the development of soundly based practical laws and regulations to safeguard the public, workers and the environment.

6 June 1990