



**TOGETHER**  
*for a sustainable future*

## OCCASION

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



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

## FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

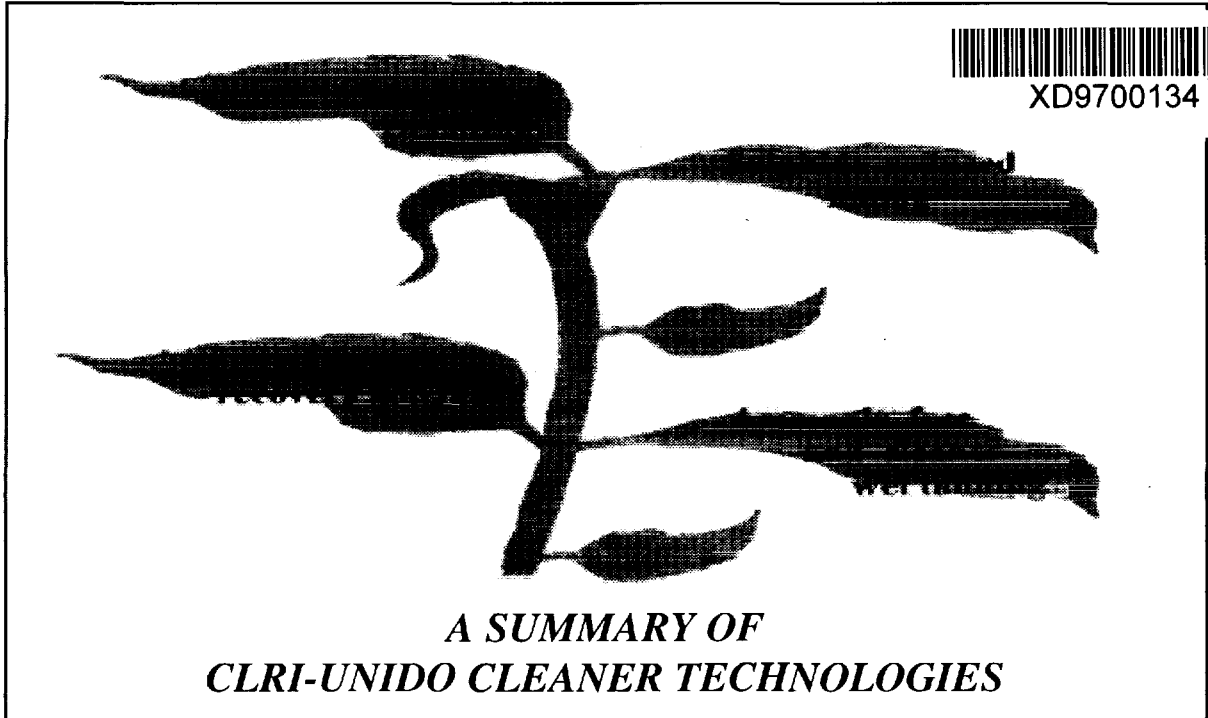
For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)

# 21578 IMPLEMENTATION OF ENVIRONMENTALLY CLEANER TECHNOLOGIES (UNIDO PROJECT : US/IND/90/244/2) TERMINAL REPORT

22 p.  
tables  
diagram



XD9700134



*A SUMMARY OF  
CLRI-UNIDO CLEANER TECHNOLOGIES*



*A PROJECT ASSIGNED BY*  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION



*IMPLEMENTED BY*  
**CENTRAL LEATHER RESEARCH INSTITUTE**  
(Council of Scientific & Industrial Research)  
ADYAR, MADRAS - 600 020, INDIA  
FEBRUARY, 1996

R

# CONTENTS

---

1. Preamble
  2. Choice of Cleaner Technologies and Cooperating Tanners
  3. Contractual Obligations
    - 3.1 Ammonia free deliming and cleaner wet tanning operations
    - 3.2 Chrome recovery and reuse system
    - 3.3 Sulfide reduced liming system
    - 3.4 Mechanical desalting
  4. Compliance to Contractual Obligations
    - 4.1 Overall strategy adopted for the invitation of local competitive bids
    - 4.2 Placing of orders
    - 4.3 Performance of the equipment and other units
    - 4.4 Costing Equipments/services
    - 4.5 Contractual Obligations Compiled: Technical
    - 4.6 Services rendered under Amendment-A of contract
  5. Overall achievements, failures and lessons learnt
    - 5.1 Ammonia free and cleaner wet tanning
      - 5.1.1 Achievements
      - 5.1.2 Drawbacks and unachievable targets
    - 5.2 Chrome recovery and reuse
      - 5.2.1 Achievements
      - 5.2.2 Drawbacks and unachievable targets
    - 5.3 Mechanical desalting
      - 5.3.1 Achievements
      - 5.3.2 Unachieved objectives
    - 5.4 Reduced sulphide liming
      - 5.4.1 Achievements
      - 5.4.2 Unachieved objective
  6. Conclusions
-

**EXECUTIVE SUMMARY**

The United Nations Industrial Development Organization awarded a sub contract to the Central Leather Research Institute, Madras to serve as a consultant for the implementation of environmental friendly technologies in select Indian tanneries. With the help of chief technical advisor of UNIDO, a special task force of CLRI identified four tanneries in India to implement an environmentally cleaner technology in each one of the tanneries. The technologies chosen for implementation are ammonia free deliming and cleaner wet tanning operation, chrome recovery/reuse, mechanical desalting and sulfide reduced liming. These technologies have been implemented as per contractual obligations. Among the four technologies, chrome recovery and reuse has made both environment and economic impact. This technology has been received by tanners with interest. The ammonia free deliming and wet tanning operation technology has aimed at both cleaner production and improved inplant ecology through modernisation. The improvements in terms of cleaner production could be established through credible scale technical trials. The demonstration plant has attracted interests of other potential clients for implementation. Follow-up on this technology through Leather Technology Mission, launched by the Government of India has now been possible. The full scale implementation of this technology needs to await technology absorption by a group of tanners, who have evinced interests in modernisation. Mechanical desalting is a relatively simple technology to implement. Although this has been implemented in one tannery, due to lack of adequate motivating factors, the wide spread adoption of the technology has not been forthcoming so far. However in recent times, the Supreme court of India has taken a serious note of the high Total Dissolved Solids content in treated tannery effluents. Under the changed circumstances, mechanical desalting may attain higher significance. The seeding of this technology by UNIDO in India, is therefore, likely to lead to significant environmental benefits in the leather sector in recent future. The technology for sulfide reduced liming implemented under the program has met only with partial success, partly because of the non-availability of commercially proven enzymic products for dehairing in the market. There have been also other non-technical reasons for the constraints in the implementation of cleaner technologies in the Indian tannery sector. However, the project

supported by UNIDO has made valuable contributions in identifying specific challenges in referencing cleaner production technologies in the social context of a highly dispersed and small scale tanning sector in India. As a result of the experience gained through the UNIDO program, many important initiatives to implement cleaner technologies with linkages to the Leather Technology Mission of India have been undertaken. An awareness of cleaner production methods and recognition of the importance of training of man power has now been gained. With increasing social awareness of environmental problems associated with the tanning sector and the Supreme court of India enforcing legal measures, cleaner production methods developed and implemented in commercial tanneries with UNIDO support are likely to be a timely technological help to the Indian tanners.

## 1. Preamble

The leather and leather products sector has figured among the top five foreign exchange earners for India during the last three decades. The Government of India has recognised the economic and employment potential of the leather industry and has classified leather among the thrust sectors and footwear as extreme focus area. The Government has launched a number of promotional measures for the leather sector with the objective of enhancing the Indian share of the Global leather trade from the current 3.5% to 10% by 2000 AD. However, the environmental problems emanating from leather processing practices are threatening to stifle the growth of the Indian leather industry. This problem is further aggravated by the complex structural grid of the Indian leather processing industry.

In India, there are as many as 1083 registered units of which 1008 and 75 units are classified under small and medium scale sectors, respectively. In addition to the 1083 registered units, there are approximately 2000 tiny and cottage level units engaged in leather processing. Leather processing is concentrated in three regions of the country with nearly 60% activity in Tamil Nadu, 20% in West Bengal (Calcutta) and 15% in Uttar Pradesh (Kanpur).

The environmental preparedness of the industry is widely varying and technology absorption in the sector is relatively slow. The investment potential of several Indian tanners for establishing waste water treatment measures is somewhat low.

Some tanneries with higher investment potential and environmental preparedness have established individual effluent treatment plants and many tanneries have enrolled themselves as members of common effluent treatment systems.

Although many of the effluent treatment plants established in India are being operated with best of efforts, experience has shown that it is difficult to comply with the

current environmental standards for the discharge of treated tannery waste water through end-of-pipe treatments alone.

The necessity to tackle the problem at source through the implementation of cleaner production methods is being increasingly felt. The need for replacement of traditional technologies which lead to generation of considerable amounts of wastes by cleaner technologies has been recognised also by tanners. However, one of the important steps in the propagation of such emerging cleaner technologies among Indian tanneries involves the demonstration of economic viability and environmental benefits at credible scales. Seeding such cleaner technologies which are commercially viable in Indian tanning clusters is a vital need.

The United Nations Industrial Development Organization (UNIDO) had launched an innovative programme of seeding environmentally cleaner production technologies in selected tanneries in India. The main objective of the project is to demonstrate the potential of viable cleaner technologies.

The Central Leather Research Institute, Madras has been contracted by UNIDO to implement a selected blend of cleaner production methods in selected Indian tanneries.

## **2. Choice of Cleaner Technologies and Cooperating Tanners.**

UNIDO awarded a sub-contact (92/107) of the project US/IND/90-244/2 to the Central Leather Research Institute (CLRI) to function as consultant for **“Implementation of Environmentally Cleaner Technologies”** in select Indian tanneries which could function as demonstration centers.

A choice of proven technologies from established sources has been made by UNIDO for implementation. CLRI assisted UNIDO in the choice and implementation.

The technology elements chosen for implementation are

- i. Ammonia free and cleaner wet tanning operations
- ii. Chrome recovery and reuse
- iii. Mechanical desalting
- iv. Sulfide reduced liming

CLRI formed a special task force for helping the implementation of cleaner technologies with UNIDO support. The CLRI task force members visited several tanneries in Tamil Nadu along with Chief Technical Adviser of UNIDO with the objective of choosing suitable tanners for siting the project elements. The criteria employed for the selection of the tanneries were

- a) Technical competence to absorb the technology
- b) Willingness to demonstrate the implemented system to other tanners
- c) Willingness to participate financially in the project and absorb part of the project cost

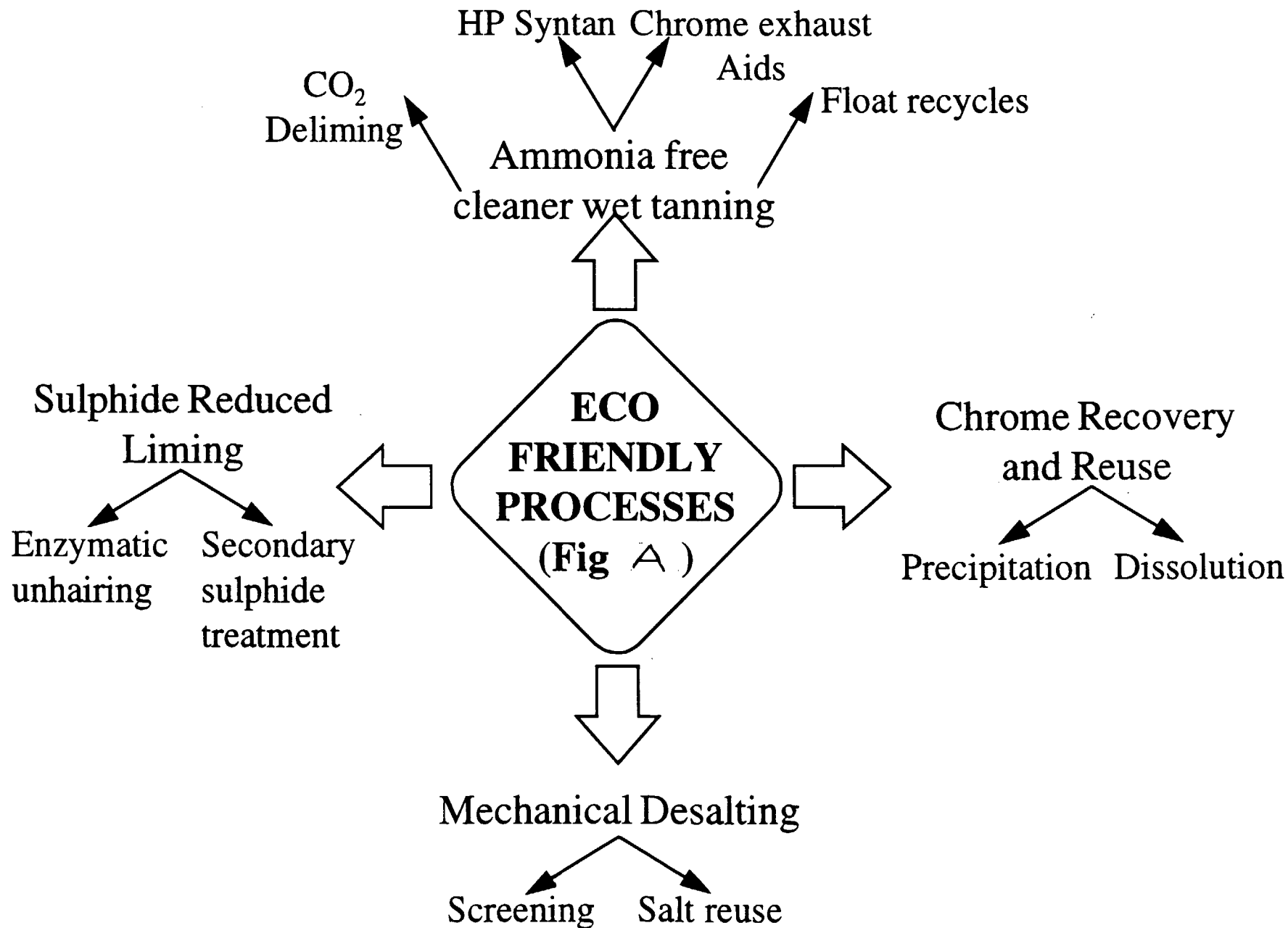
Several commercial tanneries were visited and discussions held with decision makers in tanneries. The search team, including the UNIDO representative, identified the following four tanneries for siting the cleaner technology demonstration centers.

- i. M/s Tejoomal Industries Limited, Pernambut, North Arcot District, Tamil Nadu for ammonia free and cleaner wet tanning operations.
- ii. M/s Arafath Tanneries, Chrompet, Madras for Chrome recovery and reuse.
- iii. M/s General Industrial Leathers, Chrompet, Madras for mechanical desalting.
- iv. M/s Haarty Leathers, Chrompet, Madras for sulphide liming.

### **3. Contractual Obligations**

The basic features of the above projects are schematically represented in **Fig.A**. CLRI submitted Flash Report-1 in December 1992 to UNIDO highlighting the profiles of the above projects after the first level assessment of technical and financial aspects. Based on the cost projections made by CLRI, UNIDO invited CLRI in March 1993 to submit a





Fixed Price Proposal as Amendment-A to the sub-contract 92/107 for undertaking turnkey responsibility for the above programs. Based on the proposal submitted by CLRI, UNIDO awarded sub-contract-2 of the Project US/TND/90/244/2 to CLRI for undertaking implementation of cleaner technologies in some selected tanneries.

The major activities involved in this assignment according to the contractual obligations of CLRI include

- Execution of agreement with user tanneries.
- Preparation of basic/detailed engineering
- Equipment procurement.
- Selection of appropriate sub contractors for sub tasks.
- Technical expertise and supervision during erection of equipment.
- Testing, trial run and commissioning of the project.
- Training of user tannery personnel.
- Techno-economic evaluation of the implemented technologies.
- Preparation of completion report.

The contractual obligations can be grouped as

- (a) Preoperational
- (b) Technical, and
- (c) Reporting

The technical obligations have been detailed in the subsequent sections of this report.

### 3.1. Ammonia free delimiting and cleaner wet tanning operations

The contract envisages a) setting up of a commercial scale demonstration facility for the carbon di-oxide delimiting process at one of the tanneries in the state of Tamil Nadu, India, b) demonstrate the techno-economic potential, c) establish the environment friendliness of the option, d) disseminate information on these technologies, e) train tannery personnel, and f) submit a complete know-how package.

The project plan involves a financial participation to an extent of 30% of the total equipment and service costs by the host or user tannery. The technical objectives and the description of the processes to be implemented under this program are described in Sections 1.2 and 1.3 of the Flash Report of UNIDO Project (US/IND/90/244/2). The proposal submitted by CLRI has been approved by UNIDO.

The work plan for the project as envisaged at the beginning of the programme is given in **Table A**.

### 3.2. Chrome recovery and reuse system

The contract is to implement a fully operational and appropriate chrome recovery and reuse system in a selected tannery at Pallavaram, near Madras city (India), which could serve as a central facility for a group of tanners and prove the cost effectiveness of the cleaner chrome tanning option under typical Indian tannery conditions. The basic strategy of the project has been to demonstrate the technical feasibility, and appropriateness to the local conditions of relatively low preparedness for supporting environmental technologies. The basic technical objectives and description of the proposed system are highlighted in Sections 2.3 to 2.6 of the Flash Report of UNIDO Project (US/IND/90/244/2). The work plan of the project as envisaged at the beginning of the contract is given in **Table A**.

### 3.3. Sulfide reduced liming system

The contract specifies the implementation of a sulfide-reduced liming process in one of the commercial tanneries in Pallavaram area near Madras city (India). (Haarty Leathers, Chrompet). The technical objectives and broad details of the process technology are highlighted in Sections 3.2 to 3.4 of the Flash Report of UNIDO Project (US/IND/90/244/2). The work plan of the project as envisaged at the beginning of the UNIDO contract is given in **Table A**.

### 3.4 Mechanical desalting

The contract specifies the demonstration of the technical benefits of implementation of mechanical desalting of salted hides and skins. The technical objectives and brief description of the process are given in Sections 4.2 and 4.3 of Flash Report of UNIDO Project (US/IND/90/244/2). The work plan of the project as envisaged at the beginning of the UNIDO contract is given in **Table A**.

**Table A**

Starting Date : 1st October 1992

**MONTHS**

Activities	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Ammonia Free and Cleaner Wet Training Operations																
1 Contract with User Tannery		xxxx	xxxx													
2 Finalization of cost estimates to be sent to UNIDO		xxxx	xx													
3 Equipment specifications finalisation to be sent to UNIDO			xxxx													
4 Ordering of Equipments				xxxx	xxxx	xxxx	xxxx	xxxx								
5 Receipt/fabrication of equip.						xxxx	xxxx	xxxx	xxxx	xxxx						
6 Design package preparation				xxxx												
7 Selection of implementing agency					xxxx	xxxx										
8. Civil works									xxxx	xxxx	xxxx					
9 Installation of equipments												xxxx	xxxx	xxxx		
10 Testing, Commissioning														xxxx	xxxx	xxxx
11 Demonstration & Training														xxxx	xxxx	xxxx

II	Chrome Recovery & Reuse																		
1	Field Study			xxxx															
2	Field Improvement				xxxx	xxxx	xxxx												
3	Inplant layout preparation				xxxx	xxxx	xxxx												
4	Execution of Civil Works						xxxx	xxxx											
5	Specifications to UNIDO	xxxx	xxxx																
6	Design package preparation			xxxx	xxxx	xxxx													
7	Ordering of equipment				xxxx	xxxx	xxxx	xxxx											
8	Implementation through contract agency					xx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx						
9	Standardization/training												xxxx	xxxx	xxxx	xxxx			
III	Mechanical Desalting																		
1	Field Study							xxxx											
2	Specifications to UNIDO							xxxx											
3	Equipment ordering								xxxx										
4	Installation									xxxx									
5	Commissioning										xxxx	xxxx							
6	Demonstration & Training												xxxx	xxxx					
IV	Sulfide Reduced Liming																		
1	Field Study							xxxx											
2	Specifications to UNIDO							xxxx											
3	Equipment ordering								xxxx	xxxx									
4	Installation										xxxx	xxxx							
5	Commissioning												xxxx	xxxx					
6	Demonstration & Training														xxxx	xxxx			

#### 4.0 Compliance to contractual obligations

The preoperative obligations of CLRI as per the contract include a)the execution of agreement with user agencies, b)preparation of basic/detailed engineering package, c)equipment procurement, d)selection of subcontractors, and e)providing technical expertise and supervision during the erection of the equipment.

##### 4.1. Overall strategy adopted for the invitation of local competitive bids

Local competitive bidding was resorted to in all the cases with provision for a complete technical and financial evaluation of bids on the basis of itemized prices and services with appropriate warranties, delivery of spare parts, assembling, installation, test run, commissioning etc., as applicable for all the four projects highlighted above. The following strategy was adopted for financing of the four projects:

	Activities to be supported by financial inputs from	
	UNIDO Component	User tannery component
Ammonia free deliming cleaner wet tanning operations	i. Major equipments ii. Sub-contract for job execution	i. Civil works ii. Balancing equipment
Chrome recovery and reuse system	Sub-contract for job execution including equipment and field test kit procurement	a) Civil Works b) Balancing equipment c) Chrome liquor transportation and common processing
Sulfide reduced liming system	i. Major equipment ii. Process control lab accessories	i. Civil works ii. Balancing equipment iii. Subcontract for execution
Mechanical desalting	- do -	- do -
Miscellaneous	Unforeseen field work costs	

## 4.2 Placing of orders

Upon receipt of UNIDO's approval of the equipment procurement and/or subcontractor selection, CLRI had placed the orders with the selected agencies. It had also coordinated with user tanners inputs pertaining to civil construction to ensure smooth installation, commissioning, training and transfer of all units to users as stipulated in the original terms of references.

## 4.3 Performance of the equipment and other units

As authorized subcontractor of UNIDO, CLRI had undertaken the sole responsibility for ensuring the performance of all equipment and auxiliary facilities and meeting the project targets.

#### 4.4 Costing Equipment/services.

The total cost of equipment to be requisitioned by CLRI with UNIDO funds was originally estimated at US\$ 110,000. The cost break-up is given below:

	US \$
Ammonia free deliming and cleaner wet tanning operations	52,000
Chrome recovery and reuse system	46,000
Sulfide reduced liming system	7,000
Mechanical desalting	5,000
Total	<u>110,000</u>

In addition to the costing made by the CLRI originally an approximate of US \$ 50,000 has been incurred for the following services :

	US \$
1. Additional activities on training programme	6,000
2. Providing field analytical safety kits	7,000
3. Improvements in central chrome recovery & reuse system at Pallavaram	2,000
4. Additional expenditure towards ammonia free deliming process central system at Tejoomal's Tannery, Pernambut	17,000
5. Fellowship programme for five member team	18,000
Total	<u>50,000</u>

General conditions as agreed to between CLRI and UNIDO in contract No.92/107 were also applicable for the Amendment-A as highlighted in this document.

#### 4.5 Contractual Obligations Complied: Technical

Demonstration centres for technical evaluation of ammonia free deliming, chrome recovery/reuse and mechanical desalting have now been established in the premises of the counterpart tanners. The reduced sulphide dehairing has been demonstrated in commercial scale in the tannery. The cleaner technology options have been demonstrated and the possible environmental benefits presented to the tanners.

In the case of chrome recovery/reuse, the economic benefits have been direct. The tanners have been educated on the techno-commercial potential of the cleaner chrome tanning through chrome recovery/reuse.

The technical viability of ammonia free deliming through carbon di-oxide based process has been successfully demonstrated to the tanner, who has expressed satisfaction through written statements. The cleaner technology option has also been coupled to the process control system and a more regulated chemical addition system. Investments in process control systems are likely to help achieve product consistency. This benefit, however, can be realised only through continuous operation and constant monitoring and assessment of the product quality. Although through limited number of production cycles, indications of such improvements could be obtained; due to non technical reasons, the assessment had to be more qualitative than quantitative with respect to quality related benefits. However, the benefits accruing from reduction in the BOD and COD load through carbon di-oxide deliming in comparison to the traditional technologies practiced by the company have been demonstrated quantitatively. It is true that the facilities made available in the demonstration centre at Pernambut are being made limited use. The acceptance of the technology by other tanners in the country has been significant. The objective of seeding such new technologies seems to have been achieved partially.

The carbon di-oxide deliming technology appears to be limited to application in thinner hides and skins. Where lime splitting of thicker hides is not practiced, the



application of carbon di-oxide deliming process seems to be limited under Indian tannery conditions. Such technical features of the process have now been completely evaluated under Indian conditions. The range of application conditions where the deliming process is efficient has now been better understood and demonstrated to the cooperating tanner. The process can be used for processing skins and thinner hides with considerable advantage from the environmental stand point.

The mechanical desalting is a simple technology for the physical removal of salt. The technology has been satisfactorily demonstrated to the tanner. In the absence of commercial benefit and lack of adequate pressure from environment enforcement agencies regarding the discharge of salt bearing streams, the mechanical desalting process may receive only limited industrial compliance. However, if the recovered salt could be cleaned up and a recycling strategy evolved, the mechanical desalting can be made more attractive. The salt reuse has been outside the scope of the present contractual obligations of the tanner as well as CLRI.

The reduced sulfide dehairing has been successfully demonstrated using laboratory model dehairing enzyme samples. The commercial adoption of the process needs to await the easy availability of commercially viable and fail safe enzyme preparations from the chemical supply houses. The commercial sources of such enzyme preparation are emerging. The full range of benefits of the technology demonstrated already to the tanner could be exploited only after the commercial products of enzyme preparations are made available to the industry. The lack of easy availability of the commercial enzyme sample preparations has, however, not limited the compliance to technical contractual obligation of CLRI with respect to this technology element. CLRI, made available some samples of an enzyme preparation from bench scale trials for completing the contractual obligations. The continuous supply of the enzyme by CLRI is not in the scope of work envisaged. Due to non technical as well as technical limitations, the overall objective could not be realised in the time frame of the project.

#### **4.6 Services rendered under Amendment-A of contract**

The following services were provided by CLRI through its qualified scientific and technical personnel for implementation of the task highlighted in the Amendment-A of Contract No.92/107:

- i. Basic/detailed engineering of the four projects: delivered
- ii. Equipment procurement through local competitive bidding: completed
- iii. Selection of appropriate subcontractors for implementing of the various subtasks through local competition bidding: made
- iv. Execution of bilateral agreement with the user tanneries confirming their financial participation, willingness to cooperate in the project implementation and acceptance to demonstrate the environmentally friendly technologies to the other user tanneries as recommended by CLRI/UNIDO: completed
- v. Project engineering of all activities to be directly implemented by CLRI: completed
- vi. Technical expertise and supervision for implementation of all tasks to be executed by the various sub-contractors: provided
- vii. Technical expertise during testing, trial running and commissioning of the proposed project: provided
- viii. Training of user tannery personnel in the operation of new facilities: completed
- ix. Techno-economic evaluation of the implemented technologies: completed
- x. Preparation of a completion report of the project: individual reports submitted

### **Overall achievements, failures and lessons learnt**

An attempt is made in this section to highlight the achievements, failures and lessons learnt on implementation of the four technologies under this unique programme supported by UNIDO.

## **5.1 Ammonia Free and Cleaner Wet Tanning**

### **5.1.1 Achievements**

The following conclusions could be drawn from the completed project:

- i. Modernization of wet operations in small scale tanneries is a potential reality in India.
- ii. The personnel of the user tannery, who were not exposed earlier to control instrumentation and chemical handling and transportation equipment, have acquired knowledge and competence to operate the facilities. Their training under simulated conditions at the CLRI pilot tannery and at the actual working environment had helped them immensely.
- iii. The technical benefits of the cleaner technology objective arise from the reduction of BOD and COD. Product consistency is a potential benefit. The tanner would realize, if he evaluated the benefits over a large number of production cycles. Due to some technical reasons, these benefits could not be concretized in the specific user tannery; but the potential for such demonstration exists.
- iv. The following could be established during post demonstration phase:
  - a) Qualitative improvement in Inplant ecology and work culture of personnel after implementation of the project
  - b) Improved documentation of process data
  - c) Less direct exposure of operating personnel to chemicals
  - d) Minimization of process time and chemical wastages
- v. Techno-economic viability of ecofriendly processes can be enhanced by an appropriate grouping of technology packages.
- vi. Willingness of tanners to invest in modernization and ecofriendly cleaner wet processing options have been gained. The UNIDO project has seeded the change in the mind set of some tanners in India with respect to tannery modernisation.

The range of conditions where carbon di oxide deliming can be gainfully employed has been better understood. The economic benefits of CO<sub>2</sub> based deliming are more relative to price differentials between CO<sub>2</sub> and ammonium salts. The environmental benefit has been shown unambiguously.

### 5.1.2 Drawbacks and Unachievable Targets

**A) Time Over-run**

A significant time overrun (about 12 months) had taken place in this project for the following reasons:

- i. Structural changes in the user tannery leading to unforeseen circumstances
- ii. Time delay in locating a competent project engineering company to execute the programme.
- iii. Delays in equipment delivery by the manufacturing companies.
- iv. Teething troubles during installation and lack of local expertise in quick trouble shooting.
- v. Raw material shortages faced by the user industry.

**B) Unachieved Objectives/Targets**

- i. The total replacement of ammonium salts in deliming of thick hides could not be achieved due to lack of lime splitting facilities at the site.
- ii. Frequent changes in the rawstock type and quality has made the demonstration of benefits for quality consistency and controlled processes difficult.
- iii. Hot water control system could not be fully implemented due to lack of adequate steam generation capacity at the site.

**5.2 Chrome Recovery and Reuse****5.2.1 Achievements**

This project has conclusively established following:

- i. Chrome recovery and reuse is financially and technically attractive and is easily adaptable in small scale tanneries.
- ii. The user tannery has established beyond doubt that the recovered chrome salt can be recycled for the leather processing.

- iii. The technology is simple enough for the existing tannery workers to operate efficiently after undergoing short term retraining and low technology preparedness of user is not a constraint for implementation of the technology.
- iv. The technology is eminently suited for wider scale implementation in small scale tanneries for achieving significant reduction of chrome content in waste water and in solid sludge obtained from the effluent treatment plants.

## 5.2.2 Drawbacks and unachievable targets

### A) Time over-run

The overall time over-run of the order of 7 months had taken place on account of following factors:

- i. Gestation time required for convincing the user agency about the viability of the technology.
- ii. Delays in entering into MOU and in obtaining financial commitment from the user agency for funding the counterpart activities.
- iii. Lack of local expertise available with the user tannery for implementing civil, mechanical and electrical supporting activities.
- iv. Unforeseen interruptions in civil work implementation during monsoon period due to flooding of the site.

### B) Unachieved Objective

The sharing of the chrome recovery facility by other tanneries is a partial success due to unforeseen delays in the implementation of the civil works at the respective sites and non-procurement of exhaust chrome liquor transport facility so far by the users. Lack of finances, hesitancy to share the facility and significant reduction in raw hide processing activities in Pallavaram area of the Madras City are the other factors responsible for the slowing down of the activity. The project team is keen to test full potential of common chrome recovery plant concept and will spare no efforts to implement this part of the scheme.

## **5.3 Mechanical Desalting**

### **5.3.1 Achievements**

- i. The programme is technologically successful and has greater potential for commercialization if more rigorous environmental standards come into vogue for dissolved solids
- ii. The user tannery selected for implementation of this technology has limitations in continuous use of this technology

There is scope for grouping this technology along with other technologies concerned with in-process control of the dissolved solids problem for enhanced environmental benefits

### **5.3.2 Unachieved Objectives**

Except from environmental considerations, this technology is not financially attractive to the user tanner for its application on a regular basis. The pressure to comply with the total dissolved solids standards in the treated wastewater is not strong. Accordingly the driving force to implement the technology is low for this option at this point of time in India. The situation is likely to change in the foreseeable future on account of emerging tighter groundwater regulations.

There are brighter prospects for adoption of this technology in places like Ranipet, Ambur and Vaniambadi in Tamil Nadu State which are already experiencing problems from serious groundwater pollution.

## **5.4 Reduced Sulphide Liming**

### 5.4.1 Achievements

The concept of sulphide free liming is technically successful for skin processing. However for hides, small quantities of sodium sulphide have to be supplemented for satisfactory performance. Larger number of field trials could not be conducted at the site since the user tannery had to suspend its production activities on account of financial and managerial problems.

### 5.4.2 Unachieved Objective

One of the contributing factors for the success of this technology is the availability of the unhairing enzyme samples developed and synthesized by the CLRI. Due to unavoidable reasons, the technology transfer could not take place in time. The establishment of a commercial facility to manufacture the dehairing enzyme has been delayed. The CLRI had to find a sponsoring agency to set up a demonstration plant, in its own premises, to produce semi-commercial quantities of enzyme samples. The plant has been commissioned during December 1995. Meanwhile, small quantities of the enzyme were produced in a sister institution at Mysore. This supply was hardly sufficient for CLRI's own pilot tannery trials on thick hides for development of suitable technology.

In the light of the above, this project could not achieve its full objective.

## 6.0 Conclusions

The four cleaner process technologies demonstrated by CLRI under the UNIDO project has been watched with keen interest by the tanning community in India. Chrome

recovery & reuse has become quite popular and tanners are adopting it voluntarily. Likewise there is a good deal of interest on ammonia free, CO<sub>2</sub> deliming as well as computerised process control system. It is foreseen that mechanical desalting will become attractive as soon as pressures build on tanners to effectively treat dissolved solids in the effluent. Likewise enzymatic dehairing too is likely to be adopted by the tanners in view of its environment friendliness, once the availability of the enzyme is ensured. CLRI is facilitating dissemination and propagation of these technologies in different parts of India through its parallel program for Leather Technology Mission.