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Environmental Pollution
Prevention Project

A Report of the
Office of Environment and Natural Resources
Bureau for Global Programs
United States Agency for International Development

POLLUTION PREVENTION DIAGNOSTIC STUDY
CURTIEMBRE CURSAN S.A.
SANTIAGO, CHILE

Final Report

Prepared for:

RCG/Hagler Bailly, Inc.
1530 Wilson Boulevard, Suite 900
Arlington, VA 22209-2406
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The pollution prevention audit/assessment reported on herein was conducted by a team of EP3 and industry representatives. The primary purpose was to assist industry or facility management in creating a sustainable pollution prevention and waste minimization program. This report presents information from the first step in the process; a base line survey and a definition of actions which can be taken to prevent pollution, improve efficiency and pay back any required investments.

The overall EP3 program in the countries in which EP3 has activities includes a wide range of activities including audits/assessments, information dissemination, training and small scale demonstrations. These country programs are all designed to create the conditions in the country which will assure the continuation of urban and industrial pollution prevention and establish locally sustainable pollution prevention programs.

This report was prepared for RCG/Hagler Bailly, Inc. by Thomas C. Thorstensen, T S G Inc., 35 Monadnock Drive Westford, MA 01886.

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This pollution prevention assessment was done under the direction of AMCHAM CHILE by RCG/Hager Bailly, Inc. under the US AID EP3 program. The study included plant visits, record and report review and extensive meetings with technical and executive personnel of the company.

The pollution loading of the company was calculated from the data in EPA studies of tanneries of similar production processes and by a material balance of the chemicals used in the production. Consideration was given to the abatement requirements applicable to this case.

It is recommended that the following steps be taken by the tannery:

1. The hides after washing should be fleshed before the hair pulp step. This will improve the quality of the production and will allow the disposal of over 1000- 1500 Kg of fleshings/day to a rendering facility.

2. The recycling of the spent chrome tanning solutions is recommended. This will result in an economic advantage to the tannery, decrease water use and prevent the pollution of the effluent by chromium. This step is necessarily to meet the pollution control requirements.

3. Some water washes are only slightly contaminated with process chemicals. These washes are compatible with some specific processes of the production. Recommendations were made on these specific recycling applications. The benefit of these applications are in water-use reduction.

4. Sulfide oxidation is recommended to remove toxic sulfides from the waste stream. This is required to meet the pollution prevention requirements. The system recommended is in common use in the industry and will effectively decrease the sulfide in the waste stream to > 3 mgl.

5. Primary treatment is required to meet the pollution prevention requirements. It is recommended that the separated waste streams, after sulfide oxidation and chromium removal, be mixed with pH control to co-precipitate the suspended solids and decrease the BOD.

6. With the system outlined the pollution prevention requirements can be met with the exception of the BOD requirement. It is recommended that the design of the secondary treatment system be delayed until the primary treatment system has been effectively optimized. Through this approach the most cost effective secondary treatment can be achieved.

TABLE 1
SUMMARY OF
POLLUTION PREVENTION OPPORTUNITIES

Material	Opportunity	Pollution Prevention Potential	Cost of Implementation	Action Required
Fleshings from Soaked Hides	Use fleshings for rendering	Decrease solid waste by 1000-1500 Kg/day	None	Production process change Negotiation with rendering facility at near-by slaughter house
Chrome Tanning	Recycle chromium tanning solutions	Decrease Cr in effluent to less than 3 mgl	$20,000 US cost $60,000 US savings/yr	Modify process. Install pumps, piping & tanks.
Water Usage	Recycle some wash water to compatible processes	Decrease water usage by 100-120 M^3/day	$10,000 USD cost of pumps, piping & tanks	
Water Usage	Recycle water on cooling water from vac dryers to process	Water decreased by 30 M^3/day	$10,000 USD cost of pipes, pumps & tank	Install equipment
Sodium Sulfide	Sulfide Oxidation	Decrease S in effluent to less than 3 mgl	$30,000 USD cost of pumps, tanks & piping	Install treatment system
Suspended Solids	Physico-chemical precipitation with spent unhairing waste	Decrease suspended solids by 60-80%. Decrease BOD by 40-60%.	$100,000 USD cost of pumps, tanks, cont'd.	Design, build treatment system
Sludge from Primary Treatment	Dry sludge for land applications	Solids disposal as fertilizer	$20,000 USD sand filters	Design & build systems. Check product with Forestry Service
Primary Treated Waste Stream	Secondary Treatment	Decrease BOD by 60-80% from primary	$50,000 USD trickling filters	Design & build secondary treatment system after the primary system
Solvent Usage	Change to water base lacquer finish	Decrease VOC discharge by 60-90%	None	Evaluate near finished available

CHAPTER 2: OBJECTIVE

This study was done under the Agency for International Development, Environmental Pollution Prevention Project (EP3) under the direction of AMCHAM-CHILE by RCG/Hagler Bailly, Inc. Dr. Thomas C. Thorstensen was the technical consultant to RCG/Hagler Bailly, Inc. for the project. The services of Geotechnica Consultores, represented by Solange Gantenbein were used to assist in the technical and operational aspects of the project. Mr. Gabriel Opazo of Curtidos CURSAN was most helpful in his cooperation.

The purpose of this study was to perform an environmental assessment of the tannery and to propose a program of pollution prevention.

The tannery Curtiembre Cursan S.A. is a cattlehide tannery producing chrome tanned and vegetable tanned leather from salted cattle hides. The tannery has grown over a period of time and some of the working areas are crowded. The equipment is good and the quality of the products is good.

Curtiembre Cursan S.A. has a nominal production capacity of five hundred hides a day. The hides average 23-24 Kg, with the total weight of hides for calculation purposes taken at 12,000 Kg/day.

The hides are domestic and imported from small slaughter house production. 10,640 Kg of hides/day are used in chrome/vegetable retan leather and 1,560 Kg of hides/day are used in vegetable tan leather.

3.1 Methodology

Visits were made to the tannery over a five day period. During these visits Dr. Thorstensen was accompanied by Mrs. Gantenbein and, at times, Dr. Mauricio Roldan. The program was outlined by Edwardo Maal and the daily coordination was under the guidance of Dr. Roldan.

The cooperation of the tannery personnel was very good. Mr. Armando Leon Besnier, Executive Director, supplied quantitative business data and Mr. Gabriel Opazo, Technical Director, cooperated with constant personal attention, and technical discussions during the visits. A copy of the report Tratamiento de los Effluentes Liquidos Proyecto Basico by Jorge Castillo G. dated 1993 was made available to the project as a resource. The Castillo report was particularly useful in the detailed description of the processes and the water use in each step of the production.

TABLE 2

Environmental Protection Agency
Hair Pulp, Cr Tan, Retan, Wet Finish

Parameter	Load Data Kg/1000 Kg Hides
BOD	62.3
TSS	92.3
COD	178
Oil & Grease	15.4
Nitrogen (TKN)	12.6
Total Cr	2.9
Sulfide	2.5

TABLE 3

Chemical Used in 20 Days (*)

Chemical Product	Consum Kg
Salt from hides (12%)	27000
Salt from process	14000
Lime ($CaOH_2O$)	10000
Sulfides ($Na2_S$, NaSH)	7200
Ammonium Sulfate	5500
Sulfuric Acid	3700
Formic Acid	2500
Chrome Tan (25% Cr_2O_3)	15500
Sodium Bicarbonate	1360
Magnesium Oxide	3100
Vegetable Tanning Materials	15000
Leather Oils	10000
Dyes and Synthetics	15000

* 450 hides per day, 25 kg/hide, total = 12000 kg hides/day
water consum 1.5 m^3/hide, total consum 700 m^3 water/day

To determine the pollution load of the tannery, direct analysis of the widely fluctuating streams was not practical in the time available. The data from the Castillo report was useful but was not conclusive for the calculations we desired. To obtain quantitative estimates of the pollution load of the tannery the data of the averages of many similar tanneries in the United States, as reported in the EPA Development Document for Effluent Limitations Guidelines and Standards, 1979, was used. This document reported the pollution generated in Kgs/1000 Kg of hides processed. The data included all significant parameters that are of interest to this study.

In addition, the tannery supplied the data of the chemicals used in the leather production for a continuous month of production. The pollution generated from the hides, such as BOD and TSS, were taken from the EPA data. The estimates of the chemical pollution was calculated from the chemicals used. Calculation of the chemicals fixed was based on the estimated percent fixation of the specific material.

For example the salt from the hides was taken as 12% of the weight of the hides. The salt used in the process was taken from the data supplied by the tannery.

3.2 Findings

The production process is conventional for Chrome tan leather tanneries using the Hair Pulp, Chrome Tan, Retan, Wet Finish system. This corresponds to the EPA category I in the Development Document.

The salted hides are inspected, resalted if needed, then weighed into production lots. The hides are placed in a conventional drum and soaked in cold water. Some minor chemicals may be added to assist in the soaking. The water used is about two l water for one Kg of hide. After the desired soaking time the hides are washed in additional water. The total water used in this operation is 140 M^3/day, or about 12 M^3/1000 Kg of hides.

The hair pulp process is done in the same drums as the soak. The hides are treated with lime ($CaOH_2$) and sulfides (Na SH & Na_2S). The hair pulping is done with additional lime followed by washing in cold water in the rotating drum. The total water used in the hair pulp system is about 200 M^3/day or about 18 M^3/1000 Kg of hides.

The washed, limed hides are removed from the drum, wrung then placed in a drum for deliming and bating. This process involves the use of ammonium salts and enzymes then remove most of the lime from the hide. Clean the hide and adjust the pH. The water use in this step is about 22 M^3/day or about 2 M^3/1000 Kg of hides.

TABLE 4

Chemicals from Tannery Use and Skins Calculated After Estimated Take Up by the Hides

Parameter	Load Data kg/1000 kg Hides	Estimated mg/l
BOD	62.3	1068
TSS	92.3	1582
Oil & Grease	15.4	264
Nitrogen (TKN)	12.6	216
Salt	170.8	2928
Lime	42	720
Ammonium Sulfate	23	102.5 (NH_3) 292 (SO_4)
Sulfuric Acid	15.4	264
Formic Acid	10.4	178
Chrome Tan (1)	65	47.4 (Cri) [illegible]23 (SO_4)
Leather Oils (2)	42	72
Veg Tans (3)	62.5	268
Bicarbonate (Soda)	6	103
Dyes & Syntans (4)	62.5	107

(1) 75% take up
(2) 90% take up
(3) 75% take up
(4) 90% take up

TABLE 5

Water Used in Each Process and General Characteristic of the Wastes Generated

Process	Volume M^3/1000 kg hides	Pollutants
Hide Soak	12	Salt pH = 6 - 8
Unhairing	18	High BOD, TSS, Lime, S pH = 12 - 13
Fleshing Bate & Delime	2	BOD $(NH_4)SO_4$ pH = 7 - 8
Cr Tan	11	Cr, SO_4, Salt pH = 3,5 - 4
Retan	7	low BOD, SS pH = 4 - 6
Other	6	Weak Wastes pH = 6 - 8

Total =56 M^3/1000 Kg hides 670 M^3/day

FIGURE 1: Process Flow Sheet for the Curtidos Cursan Tannery

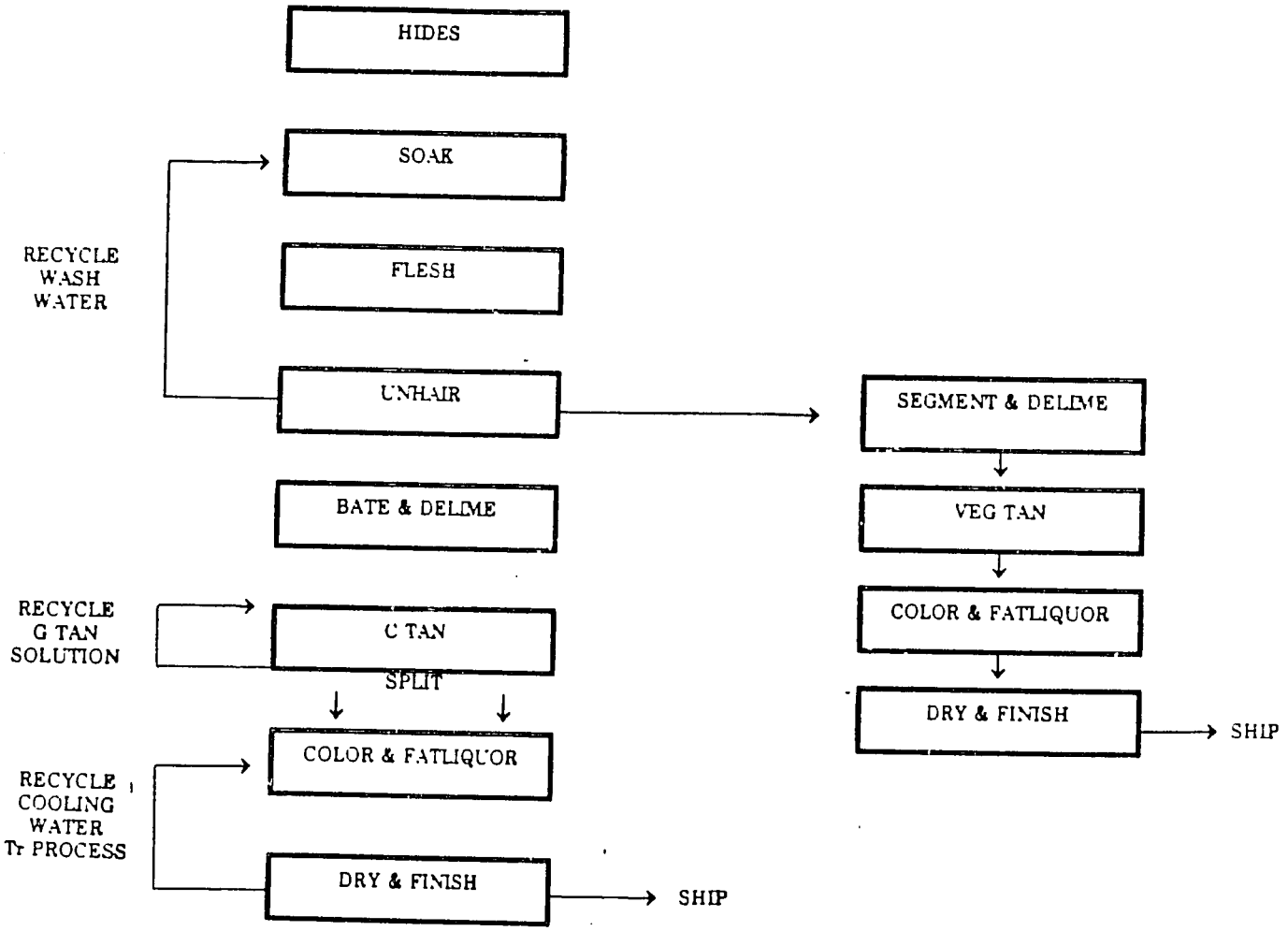

TABLE 6

Parameter	Discharge without Treatment mg/l	Treated Waste mg/l (1)	Provisional Requirements mg/l (2)
pH	12 - 4	6 - 8	5,5 - 9
TSS	1582	100 - 200	300
Set Solids	N.D	N.D	20 ml/l
Oil & Grease	264	50 - 100	150
Hydrocarbons	N.D	N.D	20
BOD	1068	500 - 600	300
CR^{+3}	47.4	< 3	3
SO_4	815	< 800	1000
Sulfide	514	< 5	5
Nitrogen	N.D	N.D	80

(1) The waste effluent will be colorless, odorless, pass on CR & $S^{=}$, only BOD is high. Secondary treatment can be added later if needed.

(2) Norma Provisoria de la Superintendencia de Servicios Sanitarios SISS, Chile.

The chrome tanning is done in drums as a conventional process. The hides are placed in a solution of salt and acid followed by the chrome tanning agent. The chrome tanning material is a basic chromium sulfate. During the pH of the solution is adjusted by the addition of magnesium oxide. When the chrome tannage is complete, the leather is washed with running water and then the surface cleaned by the addition of a small quantity of acid. The tanned leather is removed from the drum and wrung. The total water use in the chrome tanning is about 130 M^3/day or 11 M^3/1000 kg of hides.

The volume of solution dumped containing the spent chrome solution is about 25 M^3/day or 2 M^3/1000 Kg of hides.

The hides to be vegetable tanned are separated from the other hides after the liming. These hides are cut into sections for bellies, shoulders and bends. This segmenting is done to assure the most efficient use of the expensive vegetable tanning materials. The practice is common in the industry.

The vegetable tannages are done without the use of chromium. Since the retan system for the chrome tanned leather is also a vegetable tannage, in most of the leathers made, the effluent from the vegetable tannages has been combined with the other effluents from the retan step.

The chrome tanned leather, after wringing, is split to the desired thickness. This results in two layers of leather: the grain and the split. The grain layer is the larger and the more valuable. The split is trimmed and further processed in the same manner as the grain leather. Following splitting the leather is precision cut to the desired thickness by shaving. The shaving machine has a high speed rotating blade that removes some leather in small shavings about 1 mm x 3 mm. These shavings are sold to be used in reconstituted leather products.

The chrome tanned leather is retanned in small batches to color and lubricate the leather as desired. The retan formulations vary widely depending on the leather desired. In most of the leather made in this tannery, vegetable tanning materials are used. In addition, dyes, specialty chemicals and leather lubricating oils are applied. The retanning process produces large quantities of effluent with relatively low pollutants.

The balance of the processes in this tannery are dry operations with little polluting water except for equipment washing.

There are vacuum dryers that have non-contact cooling water. These dryers use about

3.3 Pollution Loading

The normal water usage in this tannery is 670 M^3/day or about 56 M^3/1000 Kg of hides. Of this water, the largest amount of pollutants are from the hide degredation products. The

soaking and hair pulp systems release very high BOD and Suspended solids. The hair pulp system also contains sulfides and strong alkali as calcium hydroxide. The presence of sulfides is a danger to the health and safety of the community. Sulfides are deadly toxic materials and treatment is required in the discharge regulations for the destruction of this sulfides to essentially zero. The decrease in the sulfide used in the tannery cannot be done within any practical system. The sulfides must be destroyed chemically. The normal treatment system in the industry is to collect all the sulfide containing wastes then oxidize the sulfides with air with a manganese sulfate catalyst. The lime solution, free of sulfide, can be used to neutralize the acid wastes to adjust the pH to the acceptable range.

The chrome tanning wastes contain valuable chrome tanning materials. These spent solutions should be recycled to remove the chromium from the effluent and also save on processing costs. Detailed discussions of the recycling system for the tannery resulted in a practical demonstration of the system. The recycling is further reported in greater detail in this document.

The mixing of the acid and alkaline wastes at a controlled pH will result in a coagulation of the suspended solids. The removal of the coagulated materials by primary treatment will result in the decrease in the suspended solids by about 80%. The primary treatment of tannery wastes by coagulation and settling will also decrease the BOD by 50-70%. This approach has been successfully used in the industry in many tanneries.

The coagulation of the wastes and primary treatment with the removal of sulfides and chromium to acceptable limits should bring this tannery into compliance with the regulations. There will remain a problem of decreasing the BOD by about 50% of that expected after primary treatment. It is recommended that secondary treatment be delayed until the primary system has been optimized. At that time the most cost effective method for BOD reduction can be determined.

The expected results of this system on the effluent from this tannery are given in Table 5. The flow diagram for the system is given in Figure 1.

4.1 Solid Wastes

4.1.1. Chrome Leather Shavings

The shaving of the leather to the desired thickness creates leather scrap in the form of leather fibers of about 1-2 mm in diameter. These shavings (100-200 Kg/day) are collected and sold for the production of reconstituted leather. The disposal of the scrap by this means is fortunate. As long as there is a demand for the shavings there is no problem. If market or other conditions change and the demand is lost, there would be a problem. In that event, the tanners could consider the formation of a by-product cooperative.

4.1.2 Fleshings

The flesh, as now being removed in the limed condition, contains lime and sulfides. The presence of these chemicals precludes the use of the fleshings as a material for rendering. With the change in the process to fleshing of the hides before the hair pulp process, the flesh will be removed in a clean condition free of the objectionable chemicals. The local slaughter house has an operating rendering plant that could accept the fleshings. An agreement with the slaughter house should be made as the change to the new fleshing system is introduced. If an agreement cannot be made, the fleshings could be disposed in land application with less objection than the present fleshings containing lime and sulfides.

4.1.3 Sludge

The primary treatment system will generate sludge to the extent of about 1000-2000 Kg/day dry weight. This tannery sludge is high in organic nitrogen and has been accepted as a fertilizer and soil conditioner. When sludge is available and air dried, samples should be submitted to determine the most beneficial land application for the product. The sludge, from the system proposed, will be free of objectionable amounts of chromium and sulfide and could be used for application in land renewal or forest areas.

4.2 Water Conservation

The recommended changes in the initial hide washing and the chrome tanning changes will decrease the process water use by 110-200 M^3/day. The advantage of this to the tannery is not only a saving in operating costs but will also make the treatment of the effluents more efficient and at less capital expense.

4.3 Chemical Controls

The recycling of the chrome tanning solutions is definitely both desirable from a pollution prevention point of view but also is an economic advantage for the company. The test and

discussions with the technical director revealed the changing to the recycle system is this tannery would involve significant process changes. The recycling of chrome tanning solutions requires close chemical control. It is the experience of the industry that the chemical control of the tannage will result in a consistently better quality leather. It is recommended that the tannery hire a chemist full time to assist the technical director in problems of chemical quality control, pollution prevention and treatment, and process development.

The implementation of the recommendations in this report will be required for the meeting of the pollution abatement requirements of the regulations. The recommendations are made with the purpose of achieving the cost effective results. The system is based on the regulations as presently written and cannot be directly compared with any system designed to meet the requirements of another governing body.

The projected schedule of implementation is an estimate based on the conditions and priorities as observed in this tannery.

5.1 Wash Water

The change in the washing of the hides to produce better hair pulping and cleaner flesh is a simple matter for the production. There is no quality risk in this change and it is recommended that this step be taken as soon as possible.

5.2 Chrome Recovery

The recycling of the chrome tanning solutions has technical benefits for the tanner in addition to pollution prevention. It is recognized that this step is not simple and will require some process adjustments. The chrome recycling is important and will eventually be required. The recommended personnel should be hired and the project started as soon as possible.

5.3 Sulfide Oxidation

Sulfide oxidation is required under the pollution control regulations. There is no way that this step can be avoided. The engineering of the sulfide oxidation system should be started and the project implemented as soon as possible.

5.4 Primary Treatment

The primary treatment system is the most extensive project recommended in this report. The requirement of suspended solids makes the primary treatment system essential. The design of the system should begin immediately and construction started when the planning is completed.

TABLE 7

Pollution Prevention Opportunities
Estimated Schedule of Implementation

Opportunity	Months	Comment
	0 3 6 9 12 15 18 21 24	
Fleshing Soaked Hides		Will improve quality
Chrome Tanning Recycling		Will save on chemicals
Wash Water Recycling		Wash water from lime wash to soak
Cooling Water Recovery		Hot water used in color and fatliquoring
Sulfider Oxidation		Needed for health and safety
Primary Treatment		Required for discharge resolution
Sludge Users		Decrease land disposal and provide a valuable byproduct
Secondary Treatment		Design and construct based on primary data
VOC Rad		Decrease emission by 60-90%

APPENDIX A

Statement of Work

AMCHAM-CHILE
ENVIRONMENT COMMITTEE

EP3 CHILE PROGRAM.

TANNERIES INDUSTRIES.
TECHNICAL ASSISTANCE REQUISITION.

BACKGROUND.

The Environmental Steering Committee of AMCHAM has approved two Tanneries to participate in EP3 projects, technically assisted by the Prime Contractor.

The plan is to perform Environmental Industrial Pollution Prevention Diagnostic studies in the two Plants selected.

In order to do the job, the Prime Contractor will provide its assistance through US.experts,Probono consultants and local chilean consultants, contracted and paid by the Contractor.

All the Consultants should posses proven technical capabilities in PP for the Tannery industrial processes, as well as expertise in dealing with gaseous emission, liquid discharge and solid waste situations in these industries.

US.CONSULTANT WORK TASK.

To technically assist the Plant Team in the identification of changes/ modifications to the processes, in order to reduce or abate the generation of contaminants, resulting in increased productivity and improved profitability to the operations.

SPECIFIC TASKS.

To assist and/ or work with the plant Team, the EP3 Coordinator and the local consultant to achieve the listed objectives.

.-Diagnostic Study of the Plant processes.
.-P2 opportunities identification and analyses.
.-Determination of the effluent base line .
.-Technical recommendations and Reports.
.-Implementation of P2 recommendations and options.
.-Monitoring of changes and follow up of results.
.-Evaluation of results.
.-Exchange and transfer of technical information.
.-Identification of possible capital investment solutions.
.-Recommendations for ongoing environmental improvement.
.-Participation in Seminars and workshops on P2.
.-Education and training to Plant personnel.

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AMCHAM-CHILE
ENVIRONMENT COMMITTEE

QUALIFICATIONS OF THE US.CONSULTANT.

.-Proven expertise and know-how in P2 measures and procedures.
.-Experience in developing and supervising tanneries P2 projects. (Assessment, implementation, monitoring, evaluation and reporting).
.-Capability to specify and recommend technical solutions.
.-Ability to train plant personnel.

REQUIREMENTS FOR THE US.CONSULTANT.

.-Provide a biodata sheet for each proposed consultant.
.-Computer data/ info. processing (Wordperfect, Lotus).
.-Bilingual spanish-english desired.

CONDITIONS FOR THE US.CONSULTANT.

.-Should be selected and contracted by the Prime Contractor.
.-Will belong to the Plant team.
.-Will supply his own computer, printer and software.
.-Will coordinate activities with EP3 Coordinator.
.-Will report to the Prime Contractor.

DATES FOR IMPLEMENTATION.

1st.VISIT: NOVEMBER 15 through DECEMBER 03.
(or earlier if Technical Assistance Agreements signed out by Plant Board/ Managers in advance).

BEST AVAILABLE DOCUMENT

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AMCHAM-CHILE
ENVIRONMENT COMMITTEE

EDW

EP3 WORK PLAN FOR TANNERIES.

BACKGROUND.
The AMCHAM Steering Committee has approved two TANNERIES as candidates to initiate individual Plant projects.

These Projects should start right after signature of a Private Agreement with each candidate plant.

INDUSTRIES SELECTED.

CURTIEMBRE JORGE DE CAMINO Y CIA. LTDA.(Mid size plant).
CURTIDOS BAS SA.(Mid size plant).

POLLUTION SITUATION.
Both industries work in batch and semi-continuos processes, producing mostly semifinished leather from row hides,sold to the finishing manufacturers : JORDEC treats only goat hides and BAS specializes in cow hides.

Main concern here is the water pollution from extensive usage of a variety of chemicals to treat, dye and finish the hides; waste water containing salt, sulphides, chromiun,etc. flows directly into the sewage system or an open cannal.

The gaseous emissions come from their boilers and some treatment processes, whereas the solid waste is restricted to trimmings, hair, fat, skin and residues left behind in the vessels and tanks, after washing or cleaning.

WORK PLANS.
The Prime Contractor should conduct a Diagnostic Study in each of these Plants in order to identify Pollution Prevention opportunities, aimed at reduction/ abatement of pollution through low cost changes and modifications to their processes.

In order to perform the Study, the Contractor must develop a specific Execution Work Plan for every Industry Sector (and/ or plant) already approved by AMCHAM Steering Committee.
The Execution Work Plans should be submitted to the Steering Committee for approval, right after the first plant visit as per the Work sequence to follow.

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TASKS AND ACTIVITIES-WORK SEQUENCE.

The Contractor Execution Plans for each Plant will include tasks and activities following the sequence below.

.-Orientation meeting with EP3 Coordinator upon arrival of Prime Contractor team to Chile (1st.visit of Experts).
.-Meeting with Plant Board and/or Managers.
.-Diagnosis Study of plant and processes.(Plant tour assessment).
.-Develop Execution Work Plan (Copy to Steering Committee and Plant Board).
.-Effluent base line: recommendations and determination.
.-Plant data/ information collection:cost, processes,functions.
.-Pollution prevention opportunities analyses /identification.
.-Draft report on recommendations with strategies and actions, incorporating the Execution Work Plan.
.-Review of draft Report with Plant Managers.
.-Team formation and task definitions.
.-List of criteria to analyze/ select P2 options.
.-Exit meeting with Steering Committee.
.-Final report on Recommendations to Plant Board with confirmatory analyses and suplemental information for best preferred option to implement in plant.
.-Implementation of best option in plant (2nd.visit of Experts)
.-Monitoring/ follow-up.
.-Information transfer and control.
.-Periodical reports on progress.
.-Evaluation of results (3rd.visit of Experts).
.-Final report of results.
.-PLAN II assessment after evaluation (Capital intensive solutions).
.-Report recommendations for PLAN II capital intensive solutions.

During the visits of P.C.team, time should be spent in seminars, workshops and training sesions to members of the Plants involved.

Similarly, the participation of experts in open seminars dealing with general P2 topics, waste minimization techniques and procedures, clean technologies and related subjects directed towards Academia, Industry Associations and University students may be considered if time permits.

PRIME CONTRACTOR RESPONSIBILITIES.
The Contractor will have to select and contract US.experts and Probono consultants, as well as hiring local chilean consultants in order to provide in-plant assistance to the projects.

TIMEFRAME.
First visit of US.Team experts should be programmed and take place inmediately after Contractor receives written fax notice from EP3 Coordinator, of the signature of Technical Assistance Agreement by the Plant Board/ Managers.

It is expected that the entire process of Diagnostic Study to the stage of Exit meeting with the Steering Committee, will not extend beyond 5-6 working days for every one of the Projects, during the first visit of the team of experts.

On return to the US. the experts will review their preliminary analyses and recommend the most attractive P2 options to address waste reduction opportunities; a Final Report sent to the EP3 coordinator for review of the Plant Board, will allow the Plant to choose the option which would best fit its capabilities and undertake its action plans.

The implementation of the best option selected by the Plant will take place inmediately after Plant Board approval, during the second visit of the Team of experts. This step may not take more than 2-3 working days.

Time for monitoring/ follow-up will vary for every particular project and plan.

A third final visit of experts has been programmed for the Evaluation of results, Final Project Report and PLAN II Capital intensive recommendations. It is expected to complete this stage in 5 working days.

It is important to stress that, to the extent possible, experts in such disciplines as Water treatment and Boiler/ burner operations should be used in several plant visits during their trip to Chile.

BEST AVAILABLE DOCUMENT

APPENDIX B

Industry Agreement

Contratos Santiago
Tomo - N.º
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CONTRATO DE MUTUA COOPERACION
ENTRE
El Programa EP3 Y (EMPRESA)

Se celebra el presente Contrato con fecha 11 de Mayo de 1994, por y entre El Programa de Prevención de Contaminación (en lo sucesivo denominado "El Programa EP3") financiado por la Agencia de los Estados Unidos para el Desarrollo Internacional, (en lo sucesivo denominado como "USAID") en Chile, y que cuenta con el respaldo de la Cámara Chilena Norteamericana de Comercio A.G. (en lo sucesivo denominado como "AMCHAM"), y que recibirá asistencia técnica de RCG/Hagler, Bailly, Inc. como Contratista Principal (en lo sucesivo denominado como "EP3-HBI"), con sus oficinas situadas en la Cámara Chilena Norteamericana de Comercio A.G., Avenida Américo Vespucio Sur 80, piso 9, Casilla 82, Santiago 34, Chile, por una parte; y por la otra parte Cortiembre Santiago, Soc. Inversiones del Carmen SA. (en lo sucesivo denominado "EMPRESA"); domiciliada en Camino Melipilla 2185, Cerrillos, Santiago, Chile;

Y

POR CUANTO "EP3-HBI" ha sido contratado por la Agencia de los Estados Unidos para el Desarrollo Internacional para que le proporcione al Programa EP3 servicios de administración y apoyo técnico;

Y

POR CUANTO la EMPRESA manifestó su deseo de participar en El Programa EP3, de ejecutar un Estudio de Diagnóstico de Prevención de Contaminación y de implementar sus recomendaciones;

LAS PARTES VIENEN, EN VIRTUD DE LO EXPUESTO, A CONVENIR LO SIGUIENTE:

1.0 <u>RESPONSABILIDADES DEL PROGRAMA EP3</u>

1.1 El Programa EP3 y EP3-HBI ejecutarán directamente y/o contratarán (sin costo para la EMPRESA) un análisis diagnostico de prevención de contaminación que será hecho por técnicos/expertos Chilenos asistidos por técnicos/expertos extranjeros, cuando sea necesario. Entre la primeras actividades del estudio diagnostico será establecer una base de referencia de las composiciones actuales de los efluentes de la EMPRESA.

1.2 El Programa EP3 y EP3-HBI le enviarán a la EMPRESA, para su respectiva aprobación y consentimiento, un Alcance de trabajo recomendado para la EMPRESA.

1.9 El Programa EP3 designa aquí al señor Mauricio Roldán como Coordinador del Proyecto, quien asume una responsabilidad contractual y operativa directa en virtud del presente Contrato.

El señor Roldán será también responsable de verificar el cumplimiento de las condiciones del presente Contrato.

2.0 RESPONSABILIDADES DE LA EMPRESA

2.1 La EMPRESA cooperará con los técnicos del Programa EP3, suministrará las informaciones técnicas, administrativas y contables, relacionadas a los procesos de fabricación necesarias para analizar los sistemas de producción. El objetivo de esto es identificar posibles cambios en ellos, en las materias primas (si es posible), en los productos químicos, en los controles de producción, y en otros variables para reducir la emisión de contaminantes, y que incidirá en el mejoramiento de la productividad y la rentabilidad operacional.

2.2 La EMPRESA también proveerá a los técnicos del Programa EP3 las informaciones, mediciones o datos relacionados a las actuales composiciones de los efluentes de nuestra EMPRESA y sobre proyectos de mejoramiento ambiental en ejecución o en planificación. En caso que no tengamos datos cuantitativos sobre la composición actual de efluentes, permitiremos que El Programa EP3 directamente o usando sub-contratistas de USA o Chilenos tome mediciones cuantitativas sobre la composición de los efluentes como parte del estudio diagnostico de prevención de contaminación.

2.3 La EMPRESA requiere que todos los datos confidenciales de procesos de propiedad de la EMPRESA, o datos relacionados a composición de efluentes que suministre, o cualquier información operacional o comercial que obtengan los técnicos del Programa EP3 en la EMPRESA, serán tratados con **máxima confidencialidad**, y que no serán divulgados a ninguna entidad Publica o Privada sin previa aprobación por escrito por parte de la EMPRESA.

2.4 La EMPRESA tendrá la última decisión y aprobación de cualquiera recomendación que haga el programa EP3, y por ende, la EMPRESA releva al Programa EP3 de toda responsabilidad legal relacionada a la implementación de las recomendaciones del Programa EP3 o de sus resultados.

2.5 La EMPRESA está de acuerdo con que el Programa EP3 inicialmente, tratará de identificar modificaciones que no impliquen mayores inversiones o costos.

2.6 La EMPRESA implementará las modificaciones identificadas y recomendadas por El Programa EP3, siempre y cuando estas, según evaluación de la EMPRESA, no sean perjudiciales a los productos, a los sistemas de producción, ni a las prácticas comerciales y de ventas.

2.7 La EMPRESA permitirá que El Programa EP3 le de publicidad a los resultados de las innovaciones recomendadas por el Programa EP3, y permitirá que otras industrias con procesos similares se beneficien de las experiencias de nuestra EMPRESA, siempre y cuando esto no involucre procesos de propiedad de la EMPRESA, y que se puedan transferir a otras industrias del sector. Los resultados no serán divulgados a ninguna entidad Publica o Privada sin previa aprobación por escrito por parte de la EMPRESA. Esta divulgación de resultados se podrá hacer durante los dos (2) primeros años siguientes a la puesta en marcha e iniciación operativa de las modificaciones o aplicaciones, de forma que otras empresas puedan observar las tecnologías en operación. Estas visitas serán aprobadas por el Gerente de Proyecto de la EMPRESA, y se programarán de forma tal de minimizar perturbaciones en las operaciones de la EMPRESA.

2.8 La EMPRESA obtendrá también las licencias, permisos y otros documentos oficiales que puedan requerirse. La EMPRESA se encargará del pago de cargos locales. La EMPRESA será responsable del almacenamiento y de la seguridad de todos los instrumentos y/o equipos de los técnicos del Programa EP3 desde su llegada a ésta.

2.9 La EMPRESA se compromete a pagar los costos de implementación de la recomendaciones del Programa EP3 que sean aceptadas por la EMPRESA.

2.10 La EMPRESA accede a proporcionar personal operativo y de mantenimiento que esté capacitado para recibir entrenamiento para la Operación y Mantenimiento de los equipos, instrumentos o recomendaciones operacionales según lo soliciten El Programa EP3 y EP3-HBI o el consultor/contratista local que contrate El Programa EP3 para el Programa EP3. La EMPRESA tambien se compromete a promocionar una ética de Prevención de Contaminación que adoptará e implementará la siguiente politica ambiental formalizada, que incluirá a todo su personal:

> "Para la EMPRESA, la protección del medio ambiente tendrá máxima prioridad. Nuestro compromiso será eliminar o reducir la utilización de sustancias tóxicas y reducir al mínimo el uso de la energía y la generación de todo tipo de desechos, siempre que sea posible. Preferimos prevenir la contaminación en la fuente que controlarla y/o tratarla al final del proceso industrial. En los casos que no se puede evitar que haya desechos, trataremos de reciclar, de tratar o eliminar desechos por medios que reduzcan al mínimo los efectos nocivos para la atmósfera, las aguas y la tierra."

2.12 La EMPRESA proporcionará personal con capacidades técnicas suficientes para ejecutar las funciones de verificación o implementación que identifique El Programa EP3. Se le proporcionará toda la información disponible a Programa EP3 que sea necesaria para formular sus recomendaciones.

2.13 Luego de la ejecución del presente Contrato, el personal técnico de la EMPRESA y del Programa EP3 realizarán conjuntamente el seguimiento de los resultados. Se registrarán toda medida y parámetros necesarios, como ser las emisiones y los efluentes, para verificar la reducción de los efluentes y de las emisiones.

2.14 La EMPRESA designa al Señor Gabriel Opazo como su Gerente de Proyecto, quien asumirá las responsabilidades de revisión técnica de la EMPRESA en relación a la implementación del Programa EP3. El Gerente de Proyecto actuará también como enlace entre la EMPRESA y El Programa EP3/EP3-HBI y/o con los consultores/contratistas extranjeros o Chileno, que contrate El Programa EP3 para este Proyecto.

2.15 La EMPRESA le proporcionará espacio de trabajo a los representantes del Programa EP3 cuando éstos se hallen en la EMPRESA durante las fases de medición, implementación de las recomendaciones, y puesta en marcha de operaciones, y también durante el seguimiento de las implementaciones de las recomendaciones y las evaluaciones y/o mediciones de los resultados.

2.16 La EMPRESA conviene en participar, con otras firmas y con El Programa EP3, en la promoción de la "aplicación de tecnologías de prevención de contaminación", asistiendo a seminarios y talleres.

2.17 La EMPRESA declara que ni El Programa EP3 ni USAID ni EP3-HBI ni sus respectivos contratistas y sub-contratistas, serán responsables por ningún daño directo o indirecto, especial o consecuencial; incluyendo, sin que esta enumeración sea limitante, pérdida de energía, costo de reponer energía, imposibilidad de uso o pérdida de ganancias que pudiesen resultar de la implementación de recomendaciones emanadas de los Estudios Diagnósticos de Prevención de Contaminación o de cualesquier otros servicios prestados por El Programa EP3, por USAID o por EP3-HBI o por sus respectivos contratistas y sub-contratistas en virtud de este Contrato.

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2.18 La EMPRESA declara que ni El Programa EP3 ni USAID ni EP3-HBI ni sus respectivos contratistas y sub-contratistas, serán responsable por daños personales, pérdidas o daños a la propiedad que pudiesen resultar de la Aplicaciones Técnicas descritas en este documento. La EMPRESA se compromete a indemnizar, a defender y a mantener libre de perjuicio al Programa EP3, a USAID y a EP3-HBI y a sus respectivos contratistas y sub-contratista por y ante cualesquier demandas, juicios o procedimientos provocadas por o relacionadas con cualquier acto o emisión en relación con la ejecución de los servicios objeto del presente Contrato.

2.19 Queda convenido que la EMPRESA procurará sus propios seguros como única medida paliativa ante daños personales, pérdidas o daños a la propiedad o ante cualquier otra pérdida o daño resultantes de o relacionados con la prestación de los servicios ejecutados por El Programa EP3, por USAID y por EP3-HBI y por sus respectivos contratistas y sub-contratistas en el cumplimiento del presente Contrato. La EMPRESA acepta liberar, por el presente instrumento, al Programa EP3, a USAID y a EP3-HBI y a sus respectivos contratistas y sub-contratistas, de responsabilidad por cualesquier pérdidas o daños que pudiese sufrir la EMPRESA por razones de cualquier clase que sean, en este respecto.

2.20 Se espera que la EMPRESA proporcione indemnización o cobertura a su propio sub-contratista, si lo hubiese, sobre cualquier equipo o instalación de instrumentos en el transcurso de sus prácticas normales de contratación, y que tales medidas puedan incluir cualesquier fuerzas mayores, retrasos, daños liquidados o garantías de cumplimiento que la EMPRESA pueda desear, pero se entiende también que tales medidas no involucrarán en forma alguna los resultados de cualesquier actos u omisiones del Programa EP3 ni de EP3-HBI ni de ninguno de sus contratistas y sub-contratistas.

3.0 <u>OBLIGACIONES FINANCIERAS DE AMBAS PARTES</u>

3.1 El Programa EP3/EP3-HBI o el consultor/contratistas extranjeros o Chilenos contratados por El Programa EP3 para este Proyecto, no tienen obligación financiera alguna para con la EMPRESA. En igual forma, la EMPRESA no tiene obligación financiera alguna para con el Programa EP3/EP3-HBI o el consultor/contratistas extranjeros o Chilenos contratados por El Programa EP3 para este Proyecto.

4.0 DURACION DE ESTE CONTRATO

4.1 Este contrato tendrá una duracion suficiente para efectuar los estudios diagnósticos descritos anteriormente, y para implementar las recomendaciones del Programa EP3, pero en ningún caso será mayor de un (1) año a partir de la fecha de la firma de este contrato. El período de duracion solamente podrá ser modificado por medio de un acuerdo formal por escrito, entre las dos partes.

5.0 DISPOSICIONES GENERALES

5.1 Honorarios Eventuales

A) La EMPRESA garantiza que no ha empleado ni le ha pagado a ninguna persona ni agente de ventas para que solicite u obtenga este Contrato en base a un contrato de entendimiento por comisión, porcentaje, corretaje u honorarios anticipados; a excepción de empleados de buena fe o de agencias comerciales o de venta establecidas que la EMPRESA mantenga para efectos de procurar negocios.

B) En caso de infringimiento o violación del presente Contrato, El Programa EP3 tendrá el derecho de detener todas las actividades sin contraer responsabilidad por ello.

5.2 Efecto Legal de la Aprobación y Decisión de USAID

Las Partes suscritas manifiestan entender que el presente Contrato reserva ciertos derechos para USAID, tales como (pero no limitándose a): el derecho de aprobar las condiciones del presente Contrato, y también la EMPRESA y cualesquier otras industrias, los informes, las especificaciones, los sub-contratos, los documentos de licitación, los planos u otros documentos relacionados con el presente Contrato, como también el Proyecto del que este Contrato forma parte. Las partes suscritas declaran también entender y aceptar que USAID, al reservarse cualesquiera o todos los derechos de aprobación mencionados, actúa únicamente como una entidad financiera para asegurar el uso adecuado de los fondos del gobierno de los Estados Unidos, y que cualquier decisión que USAID tome de ejercer o de abstenerse de ejercer tales derechos de aprobación, será en cuanto parte financiante en el curso del financiamiento de este Proyecto, no significando que USAID entre a ser una parte del presente Contrato.

Las Partes suscritas declaran entender y aceptar que USAID puede, de vez en cuando, ejercer los derechos de aprobación mencionados, o bien discutir materias relacionadas con tales derechos y con el Proyecto, ya sea con las partes en conjunto o separadamente, sin que por ello incurra en responsabilidad alguna ante las partes, ni en conjunto ni en forma separada. Cualquier aprobación (u omisión de aprobar) por parte de USAID no privará al Programa EP3 ni a EP3-HBI ni a USAID de ejercer sus derechos, ni liberará a la EMPRESA de ninguna responsabilidad que ésta pudiese tener, de no haber mediado tal ejercicio, ante El Programa EP3, ante EP3-HBI o ante USAID.

5.3 Inspección

La EMPRESA consiente en permitir acceso a los representantes autorizados del Programa EP3 y de USAID, en cualquier momento razonable, para que inspeccionen las instalaciones, las actividades y el trabajo relacionado con este Contrato, y también para que adopten medidas de trabajo y realicen pruebas durante la vigencia del presente Contrato.

5.4 Notificaciones

Cualquier notificación que entregue al Programa EP3/EP3-HBI tendrá validez y efectividad solamente si se emite por escrito y se entrega al coordinador del Programa EP3 o a la EMPRESA en las direcciones consignadas en este Contrato. Las notificaciones entrarán en vigencia al momento de su entrega o a la fecha consignada como efectiva, lo que ocurra primero.

5.5 Ley que Regirá

El presente Contrato se interpretará de acuerdo con las leyes de la República de Chile, y en caso de litigio, este se tramitará en la ciudad de Santiago.

6.0 <u>COPIAS DE ESTE CONTRATO</u>

6.1 Este documento se hará en cuatro originales, uno para el Programa EP3, uno para la EMPRESA, uno para AMCHAM y uno para EP3-HBI.

Se declara que las partes, por medio de sus representantes debidamente autorizados, están de acuerdo con las cláusulas de este contrato.

<u>Por la EMPRESA</u>	<u>Por el Programa EP3</u>
Nombre: FELIPE LEON DELANO	Nombre: Eduardo S. Maal
Cargo: SUB-GERENTE DE INVERSIONES Y FINANZAS	Cargo: DEPUTY DIRECTOR
Firma:	Firma:
Fecha: 09/MARZO/1994	Fecha: 3/19/94

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