PD-ABL-085

WORLD ENVIRONMENT CENTER

WASTE MINIMIZATION IMPACT PROJECT

NAKRO TANNERY
NARVA, ESTONIA

MARCH 27-29, 1995

World Environment Center
419 Park Avenue South, 18th Flr.
New York, N.Y. 10016

April 1995

DISTRIBUTION

Michael Kalinoski	Senior Environmental Specialist, Bureau for Europe and New Independent states, United states Agency International Development, Washington, D.C.
Patricia A. Swahn	Acquisitions Manager, Document Acquisition, United States Agency for International Development, Washington, D.C.
Adrian L. deGraffenreid	Representative, United States Agency for International Development, Tallinn, Estonia
Aleksander Brokk	Executive Director, Nakro Tannery (Plant Report)
Antony Marcil	WEC
George Carter	WEC
Thomas J. McGrath	WEC
Romuald Michalek	WEC
Thomas A. Pluta	WEC
Anne Randmer	In-country Coordinator, WEC
Marcel Siegler	Volunteer Expert

(2) Files

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I. INTRODUCTION AND BACKGROUND

BACKGROUND AND PURPOSE OF TRIP

From March 27-29, 1995 World Environment Center personnel, a volunteer expert, and local Estonian consultants visited the Nakro Tannery in Narva, Estonia to continue the Waste Minimization Impact Project.

The WEC team consisted of Mr. Thomas A. Pluta, Program Manager, WEC; Mr. Marcel Siegler, volunteer expert (Seton Leather Company, retired); and Ulle Radmagi and Tiit Gorelov, Estonian consultants.

This report was prepared by Thomas A. Pluta with input from Mr. Siegler and includes material and recommendations prepared and submitted by Mr. Siegler.

II. EXECUTIVE SUMMARY

This report describes the activities of the WEC team which visited the Nakro Tannery in Narva, Estonia from March 27-29, 1995. The plant has made substantial progress since the last visit in January, 1995, in organizing and carrying out a waste minimization program. The Waste Minimization Committee (WMC) has established three working committees dealing with maintenance, technology and production. The WMC set a preliminary goal of reducing water use by 10% and has begun projects which it estimates have reduced water use by 2-4% to date. Additional goals in reducing energy use and increasing product yield were also identified, with the need for setting specific objectives recognized. Fourteen projects have been completed or are in progress. Several new waste minimization opportunities were identified by the volunteer expert, Mr. Marcel Siegler, during a plant tour with key WMC personnel. Several equipment requests were also reviewed and discussed. The Director and various members of the WMC acknowledged the positive effects of the program in raising the awareness of employees on relationship between technology and production operations and personnel, the importance of cutting costs, and the connection of both ideas to waste minimization. Past practices and attitudes and the concentration on economic survival still influence the pace at which the program is being implemented. Copies of a Russian language translation of the USEPA Waste Minimization Manual were provided. This will assist in extending waste minimization principles, practices and forms to a broader spectrum of plant personnel. Strong management commitment and a cadre of interested and qualified personnel form a good foundation for continued progress.

March 27-28, 1995
Nakro Tannery, Narva, Estonia

Attendees

Aleksandr Brokk	Director
Galina Krylova	Chief Engineer
Aleksandr Knjazetski	Chief Power Engineer (Head of Waste Minimization Committee)
Helena Arsenyeva	Chief Technologist
Sergei Chapkin	Chief Liming, Chroming, Tanning Shop
Valeri Houstov	Chief Mechanic
Ludmilla Smirnova	Engineer Technologist, Water Treatment Plant
Anna Stepanenko	Chief of Laboratory
Ulle Radmagi	Consultant
Tiit Gorelov	Consultant
Anne Randmer	Director, Estonian Pollution Prevention Center
Marcel Siegler	Volunteer Expert, WEC
Thomas A. Pluta	Program Manager, WEC

All persons were not present at all meetings during the visit.

The purpose of this visit was to continue the waste minimization program at Nakro and provide the expert consultation of Mr. Siegler, a tannery expert with more than 40 years of experience. Previous visits by WEC and local Estonian consultants provided training and began the plant waste minimization organization, project identification and equipment selection steps. The first day involved presentations by plant personnel who described the progress made in implementing the program. A plant tour followed to observe plant operations and to provide a basis for detailed discussions regarding specific projects. On Tuesday, another tour with key plant personnel was made to identify additional waste minimization opportunities for consideration by the WMC. Equipment requests were identified for consideration by WEC for purchase or preparation of justifications by Nakro. The final activity involved the outline of specific actions items to be completed by WEC and Nakro to continue the waste minimization program. Possible loan sources including the Baltic American Enterprise Fund were discussed. The plant is still state owned and the privatization process is on hold.

Waste Minimization Committee Progress Report

The WMC is chaired by Mr. Knjazetski, with three main committees - maintenance, technology and production. Additional working groups under these three are formed as needed. He indicated that the previous training helped the members re-orient their thinking toward pollution prevention. This viewpoint was then passed on through training of other key employees. During the last visit in January, 1995, the WMC set a water use reduction goal of 10%. The WMC subsequently identified an additional goal of reducing energy use. Several projects to increase yield were described and were subsequently listed under a third goal, yield improvement. Energy and water use reduction and yield improvement were then finalized as the three main waste minimization goals of Nakro. These projects are briefly summarized below. The plant was requested to provide descriptions of all projects following the format provided.

A company waste minimization policy needs to be prepared and distributed to all employees. Sample policies in the waste minimization manual were reviewed. Russian translation versions of the manual were provided to each committee.

An annual profit sharing program is in effect. However, there are no incentives for suggesting waste minimization ideas. The value of such a system was discussed including the benefit of immediate small rewards to establish and maintain employee interest. These could include non-monetary rewards and could be for a limited period to encourage participation. For example, the company buys sugar in bulk and sells it at cost to employees. High cost commodities could be used as an award in an incentive system.

Director Brokk indicted that the waste minimization program was helpful in linking the idea that technology and production are integrally linked, contrary to the current view of most employees. Training and education, coupled with the program organization, helps develop new cooperative working relationships among employees. Committees made up of employees from several different areas can advance this objective. Worker responses to the waste minimization program were primarily related to "what's in it for me". Committee heads indicated that employees have an increased awareness of the importance of reducing costs and the benefits of waste minimization in reducing costs and improving profits. Program implementation, however, is still moving slowly. The program has raised awareness and resulted in the idea that the "more we look, the more we see what needs to be done." The importance of realistic expectations and "continuous improvement" was emphasized by WEC.

Project Summaries

The WMC estimates that the projects completed have accomplished a 2-4% reduction in total water use toward the goal of 10%. More detailed measurements are needed to determine the actual reduction. This should be possible with the installation of flowmeters. A list of projects follows.

1. Replacement of potable water in process and sanitary systems, where possible, with technical water to reduce the cost of higher priced potable water. This was accomplished by re-piping supply sources. Potable water use was reduced by 350-400 m^3/month or about a 12-15% reduction.

2. Elimination of one wash step in the hide washing cycle reduced water use by 15m^3/day.

3. Recycling of 100% of the cooling water for compressors which was previously discharged is expected to reduce water use by 200m^3/day. This will eliminate the need to purchase additional water and reduce discharge costs which are 1.50 EEK/m^3.

4. Drum water will be recycled instead of being discharged, reducing the need for make up water.

5. Dry clean up in advance of general wet cleaning operations has reduced overall water consumption.

6. Flowmeters will be installed at various points to monitor water use at specific process locations with the costs charged back to the user to encourage the reduction of water use.

7. The chrome float has been recycled and then used as make up for the pickle float. This will reduce chemical costs and water supply requirements.

8. One drum has been automated to reduce handling of hides, increase productivity, and reduce energy costs. A second drum is scheduled for upgrading.

9. Liming drums will be re-fitted to increase capacity, reduce handling of hides, increase productivity and reduce energy costs.

10. Reduction of excess water used in liming and tanning drums from 150% to 125% is being researched. This is expected to reduce water and chemical consumption.

11. Increased frequency of pH monitoring using portable pH meters to minimize chemical use through better control of tanning process conditions. Estimated savings are $7600/year on an investment of about $600 for five meters.

12. Increase the use of moisture measurements at various steps in the tanning process using portable moisture meters to reduce drying times and reduce energy costs, reduce hide defects and the rework. Estimated savings are about $4000 with an investment of $750 for three meters.

13. Reduce the use of wastewater treatment chemicals and discharge fees by faster analysis of wastewater using a COD analyzer. Estimates savings are $4300 on an investment of about $2000.

14. Reduction of solid waste in leather production will be evaluated by better monitoring of trimming, splitting, samming (wringing) and shaving operations.

The last discussions on Monday afternoon focused on the importance of setting realistic goals (see goal sheets in appendix) and measurable objectives, and developing standardized approaches to the identification and evaluation of projects. The use of "brainstorming" techniques to identify problems, causes, and solutions was emphasized. The key elements of success (management commitment, worker involvement and good organization and cost accounting) were reviewed along with the four steps of a good waste minimization program (organization, assessment, evaluation and implementation). Finally, the need to begin with low cost, no cost opportunities was stressed. Possible funding for more costly projects was discussed in light of the various loan opportunities through such organizations as the Baltic American Enterprise Fund, the Baltic Fund and the various international financing institutions.

Tuesday, March 29, 1995

Mr. Siegler toured the plant with committee representatives. The purposes of the tour were: (1) to identify waste minimization opportunities to reduce by-products throughout the tanning process; (2) to discuss appropriate measurement methods related to reduction of by-products; (3) to identify solid waste reduction opportunities; (4) and to discuss chrome shavings utilization.

The primary focus was on increasing the yield from each hide since 50% of the cost of production is in hide purchase. Careful grading and minimizing trimming are key to increasing hide yields. Immediate correction of worker practices and equipment deficiencies, worker awareness of daily outputs and the percentage of hide defects is essential to instilling a sense of personal responsibility and the ability to directly influence quality. Mr. Siegler pointed out specific examples of both worker and machine induced defects. In some cases, equipment defects are primarily the result of outdated equipment. For example, the samming (wringing) machine is an old Czechoslovakian made machine which cannot be repaired. In addition, the damaged felt mat results in high numbers of damaged splits which lowers leather quality and increases trimming wastes.

Daily supervisory and employee meetings to examine a representative sample of daily production analyzed by the laboratory for quality control purposes can immediately identify defects. This procedure can quickly address problems, reduce high defect rates and avoid or reduce the need to rework hides. The moisture meter presented to Nakro on Monday was used to demonstrate its usefulness in to make timely process adjustments to increase yield. These are screening measurements to detect variances from the established moisture parameters. More accurate laboratory analyses must still be used for quality control purposes.

This accompanied tour was a very effective and practical exercise which clearly demonstrated the benefits of early problem identification, operator and supevisor awareness, timely corective actions, and continuous waste minimization improvements.

Possible waste minimization improvements discussed during the tour included the following:

1. Establish specific defect and productivity criteria, where measurement is possible, and graphically report the results on a daily basis. This provides immediate feedback to employees.

2. Add a conveyor immediately after the setting out machine and sort and grade hides at this location.

3. Minimize trimming by measuring trimming wastes and tracking reductions in waste against total hide weight processed.

4. Conduct periodic maintenance checks when the plant is shut down and advise employees of deficiencies to let them know that proper cleaning and maintenance procedures will be checked.

5. Identify operator related defects and inform operators of each machine of the effect of uncorrected defects, e.g. increased solid waste, lower leather quality and decreased yield.

6. Identify equipment related defects and immediately inform supervisors to ensure timely corrective action to minimize wastes and improve product quality.

Other possible actions to minimize waste include:

1. Cover hides throughout processing to minimize drying of hides and dirt accumulation which result in additional trimming wastes, lower product quality and lower sales price for leather.

2. Increase monitoring of hide moisture content before and after the vacuum drying operation to minimize drying time and energy use.

3. Maintain proper moisture levels at the Dynavac step to minimize hide shrinkage after stretching.

Chrome use reduction and elimination of chrome was discussed, especially in regard to the "wet white" method and chrome free tanning. The advantages and disadvantages of these methods were described by Mr. Siegler. Further study of these procedures are recommended since they can reduce chrome use, eliminate chrome shavings and trimmings and thus reduce the costs for solid wastes disposal and wastewater treatment.

Solid waste reduction is another area of concern in the plant. Several measures have already been implemented including the use of scrap leather in the manufacture of clothing and the sale of various by-products. Nakro generates about 40 tons/month of fleshing, 24 tons/month of chrome shavings, 20 tons/month of chrome trimmings and about 30 tons/month of lime trimmings. WEC will inquire whether the Rakvere Meat Processing plant may be interested in processing some of the organic wastes in its rendering plant to recover saleable by-products.

Equipment Requests

Equipment requests for a COD analyzer, moisture meter and pH meter were briefly reviewed. A request for flow meters will be prepared. More detailed justifications of benefits were requested. The estimated cost of all equipment requests is $7350, which exceeds the amount of funding available. Nakro was asked to prioritize the requests. The possibility of sharing part of the cost was discussed. The individual equipment costs are as follows:

1. COD analyzer with reactor and chemicals ($4000)

2. Five pH meters ($600)

3. Four moisture meters - 3 for 0-30% range, 1 for 0-70% range; $750.

4. Twenty flowmeters - specify metric measures ($2000).

The final activity on Wednesday was to review the elements of a successful waste minimization program (management commitment, worker involvement, cost accounting and organizational system). The four key steps of a good waste minimization program (organization, assessment, feasibility, implementation) were discussed. Specific references for information on several items below were identified in the waste minimization manual. A plan of action and dates to complete and send the following to WEC were agreed on.

1. Prepare a company waste minimization policy by April 17, 1995.

2. Set specific percentage reduction objectives for the three key goals by April 17, 1995.

3. Prepare a waste minimization project list by April 17, 1995.

4. Prepare revised equipment justifications for COD and moisture meters.

5. Prepare an equipment justification for the flowmeters.
(Items 4 and 5 will be sent as soon as possible since the purchase and delivery is related to approval of a satisfactory request).

6. Prepare project descriptions for completed projects (begin immediately and send as completed).

7. Brief progress reports will be faxed monthly.

APPENDICES

NAKRO BROCHURE

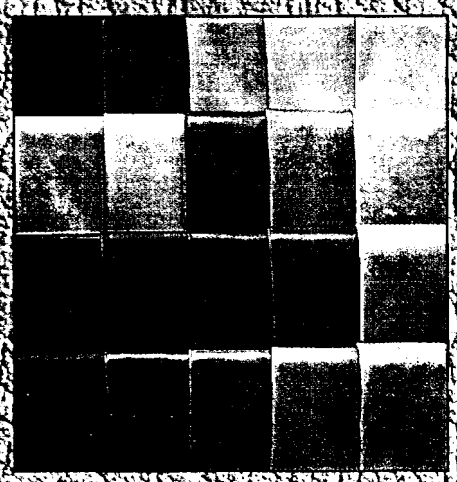
TYPICAL TANNERY FLOW DIAGRAM

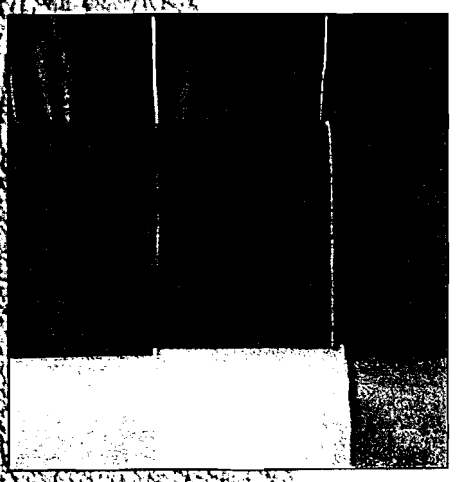
EQUIPMENT JUSTIFICATIONS

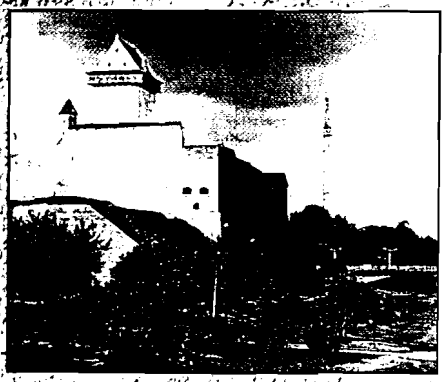
TANNERY WASTE MINIMIZATION CASE STUDIES

GOAL SHEETS

NAKRO







The state owned joint-stock company NAKRO is one of the biggest leather processing factories in Estonia and it was founded in 1984. During this period it has displayed the ability to produce high quality production.

The main production involve chrome-tanned leather for lining and shoeuppers. In small quantities leather for garments, gloves and handbags as well as other leather articles are produced.

Factory occupies the territory of 14 hectars where the main departments and shpos are situated. They comprise the unified technological chain with the total capacity of 187 million dm^2 of finished production per year.

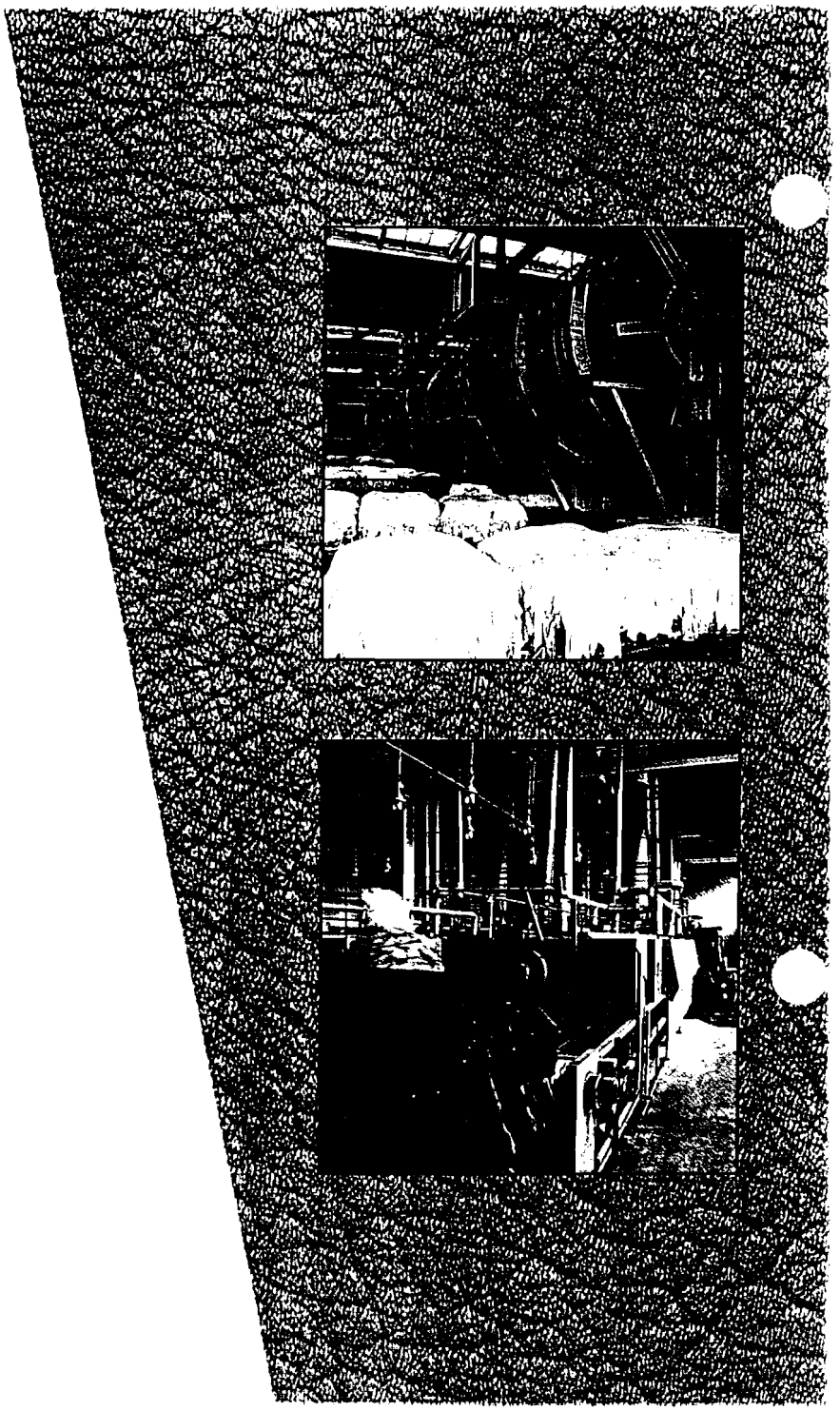
Subsidiary departments are as follows:

- shop for the primary processing of row hides;
- shop for sheepskin processing;
- shop for manufacturing slippers;
- shop for sewing leather and fur garments;
- shop for manufacturing leather goods.

The high quality is achieved by using chemicals and machinery, purchased from Germany, Italy, France, Switzerland as well as from Czechia and Slovakia.

Formerly the majority of production was meant for domestic market in Estonia. Now the leather processed by NAKRO is exported to Russia, Finland, Italy, partly to Sweden and Germany. This is mainly a kind of CRUST and WET-BLUE leather as well as raw hides and leather residues.

NAKRO has a good experience in co-operation with western companies in the field of technology and chemicals for the production and sewing leather and fur articles according to customers' designs.
The factory owns three shops in Narva with the area of 110m^2. We sell 15,000 articles per year. Leather jackets, especially for men, handbags and slippers are favourite selling articles.
About 800 people are employed by the factory. They are well-experienced and highly qualified.
We would like to give variety to our products and improve their design. And we offer our production for sale, being interested in co-operation with all the interested parties in this field.

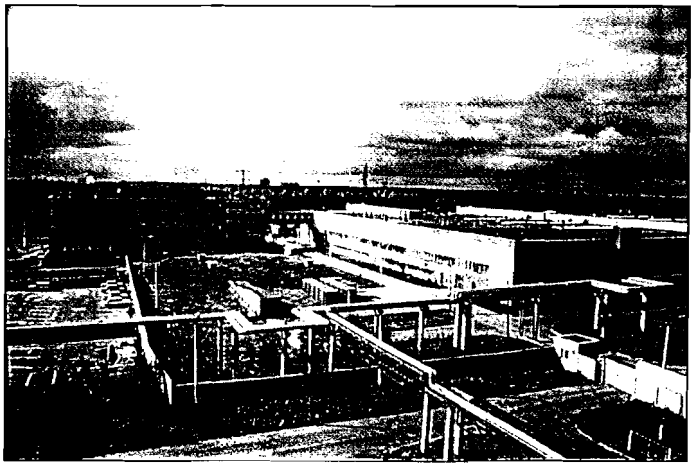


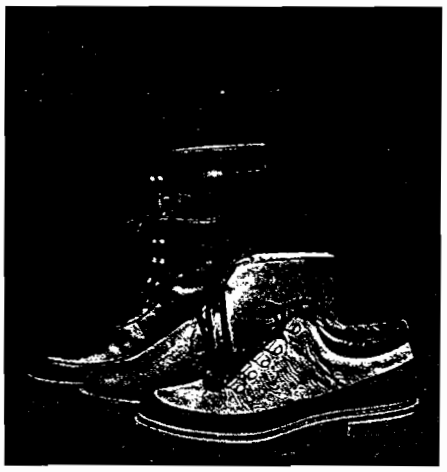
You are welcome !

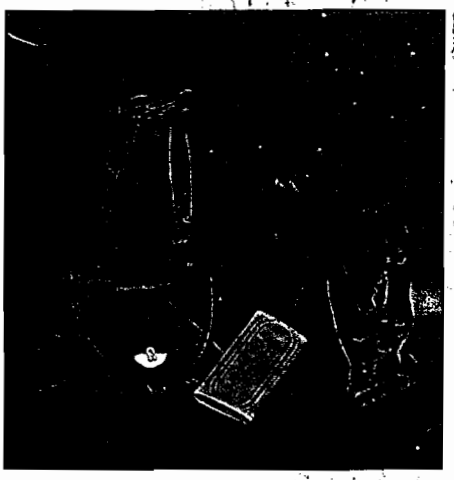
NAKRO Ltd.
P.O.BOX 17, EE 2000 Narva, ESTONIA

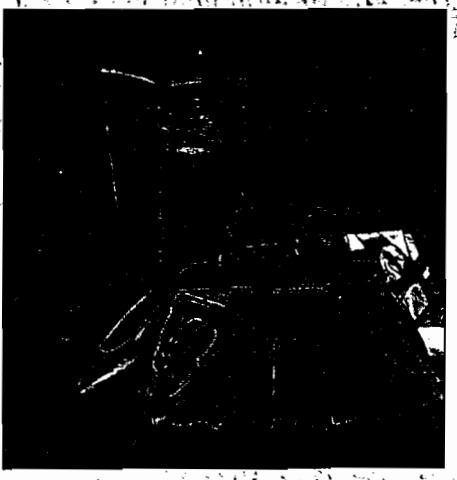
Aleksander Brokk, General Director
Phone (372 35) 49686
Fax (372 35) 49686

Ljubov Smirnova
Manager on Foreign Relations
Phone (372 35) 42756
Fax (372 35) 43498









RIIKLIK AKTSIASELTS

NAKRO

STATE JOINT - STOCK COMPANY

ГОСУДАРСТВЕННОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО

P R O J E C T W E C No 3.

1.Project description and nature of the problem.

There are reduction of quality production and additional expenditure of chemicals,as it is not possibility quickly and exactly to determine concentration of Hydrogen ions in leather on stuffing.

2. Project goal.

Reduction of expenditure chemicals and improvement of quality products.
Reduction of content stuffing chemicals in wastewater.

3.Method of solving the problem.

At present time concentration of Hydrogen ions in leather determines the aid of indicator paper.This method is not exact,there are the additional expenditure of chemicals,as part of stuffing chemicals does not assimilate in leather and flows together wastewater, what leads to additional expenditure at wastewater treatment.
It is necessary to have the modern equipment for measuring of concentration Hydrogen ions in leather.

4.Economic calculation.

Output volume in year is	250000 sq m
Losses of stuffing chemicals are	1,7/100 sq m
Total	1,7 x 2500= 4250 kg
Price pur 1 kg of stuffing chemicals	20,05 EK
Losses are	20,05 x 4250 = 85213 EK ($ 7589)

Payback 1 month

Using the equipment for measuring of concentration Hydrogen ions in leather, we will can to save this amount in every year.

E. Arseneva,
Technolog

28.03.1995.

p/k 17, EE2000 Narva, Eesti vabariik
Box 17, EE2000 Narva, Estonian Republic

Tel.: 49686, 49993
Fax: (01435) 43498
Teletype: 308 025 ХОЛМ

1.Project description and nature of the problem.

There are the large expenditures of labor in the time of definition moisture of leather.It is possibility to determine the moisture only 30% of manufacturing leather.Product quality reduces owing to drying-out,the price of leather reduces.There are the losses of raw hides owing to necessity of reprocessing finished leather

2.Project goal.

Reduction of time moisture measurements.It will be possibility to check moisture 100% of manufacturing leather.Price of finished leather will increase owing to improvement of product quality,it will be a saving of raw hides.

3.Method of solving the problem.

Now time of carrying out analysis of moisture leather composes 1,5-2hours. It is necessary to have the modern equipment for moisture measurements. More accurate measurements reduces the time, required to dry leather to the optimum moisture, this improves the product quality and reduces the quantity of leather,which must be reprocessed owing to drying-out, what results in raw hides savings and electrical energy savings.

4. Economic calculation.

Volume of manufacturing leather in year is 250000sq.m
Reduction of price of finished leather composes for 1sq.m 9EK
Quantity of finished leather of falling quality 1% 2500sq.m

Losses are 2500 x 9 = 22500EK

Quantity of finished leather drying-out is 10% 25000sq.m
The area loss is 0,5% 125sq.m
The price of finished leather 190EK\sq.m
Losses are 190 x 125 = 23750EK

Using the moisture meter, we will can to save this amount in every year.

$ 4130

Payback 22 days

RIIKLIK AKTSIASELTS

STATE JOINT-STOCK COMPANY

NARO

ГОСУДАРСТВЕННОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО

Date: March 14, 1995

To: Mr. Thomas A. Fluta, Program Manager.

FAX: 0-10-1-212-683-4745.

From: Alexander Erokk

Dear Mr. Thomas A. Fluta,

Thank you for your faxes, we received the equipment specification on the moisture meter and on the cleaning equipment to reduce water use.

We have prepared a justification for the purchase equipment for measuring of concentration of BKO 7(Biological Requirement of Oxygen 7),but a justification for the purchase the moisture meter we will send you on Thursday ,March 16.

Best regards,

Alexander Erokk
Director

p/k 17, EE9000 Narva, Eesti vabariik Tel.: 49686, 49993

1. Project description and nature of the problem.

There is the large concentration of BKO 7 in wastewater and therfore there is the high level of tax for the wastewater.

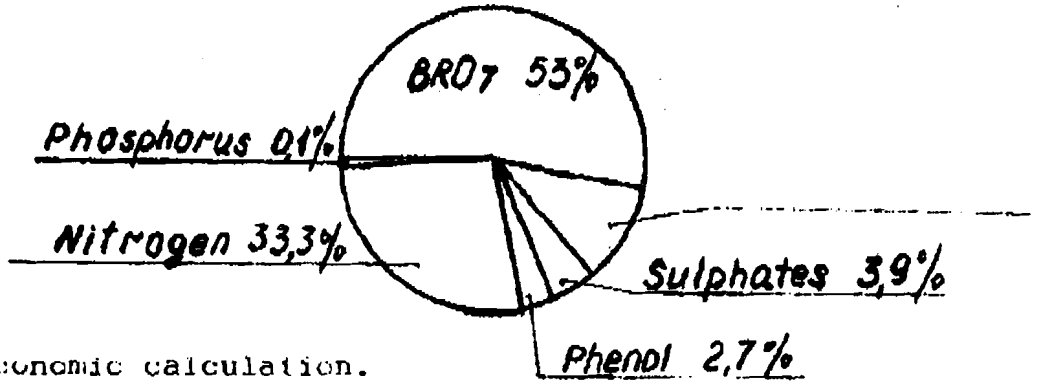
2. Project goal.

Reduction of concentration BKO7 in wastewater by means of second treatment. Reduction of payment for the wastewater.

3. Method of solving the problem.

Now there is the possibility of second treatment wastewater in our tannery. But the equipment of chemical laboratory does not allow to carry out the analysis of concentration BKO 7 in wastewater quickly and qualitatily. One analyse has carryed out for 7 days.
It is necessary to have the modern equipment for measuring of concentration BKO 7 in wastewater.

We offer your attention the diagram of distribution amount of tax for different soiling pollution of wastewater.



4. Economic calculation.

The using of equipment for measurig of concentration BKO 7 allows to make the second treatment of wastewater in quantity till 500 m^3/day.

The middle concentration of BKO 7	327 milligram/liter
After second treatment the middle concentration of BKO 7will be	200 milligram/liter
	127 milligram/liter
The quantity of workdays for year is	254
Volume of second treatment wastewater for year will be	$500 * 254 = 127000 m^3$

Volume of BKO 7 ,which will reduce the quantity of BKO 7 for year
$127000 * 127,2 = 16,15\ 10^9$ mg = 16,15ton

Reduction of amount tax for BKO 7 without registration of expenditures for equipment purchase: 16,15tons*3000BK/t = 48463BK for year

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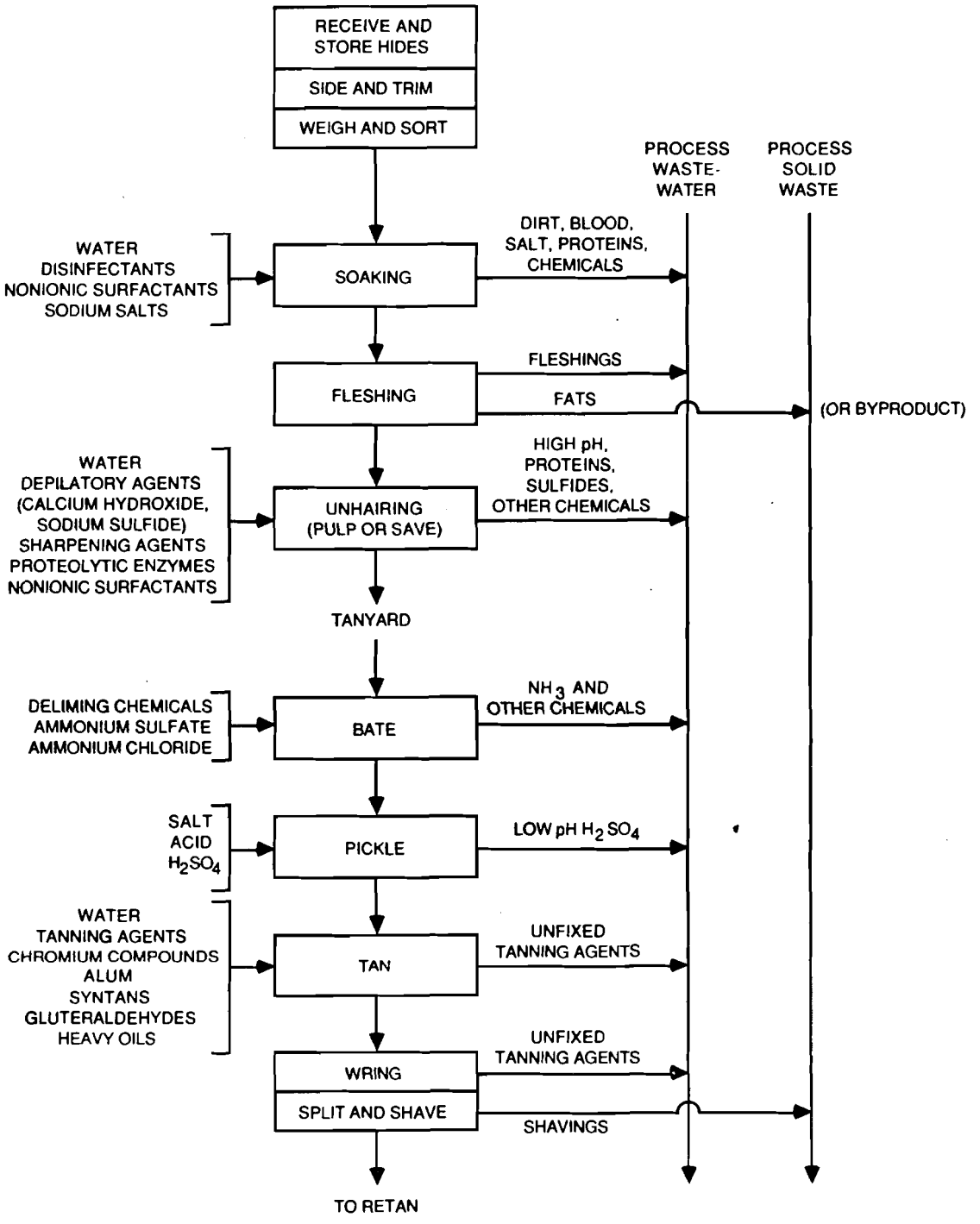
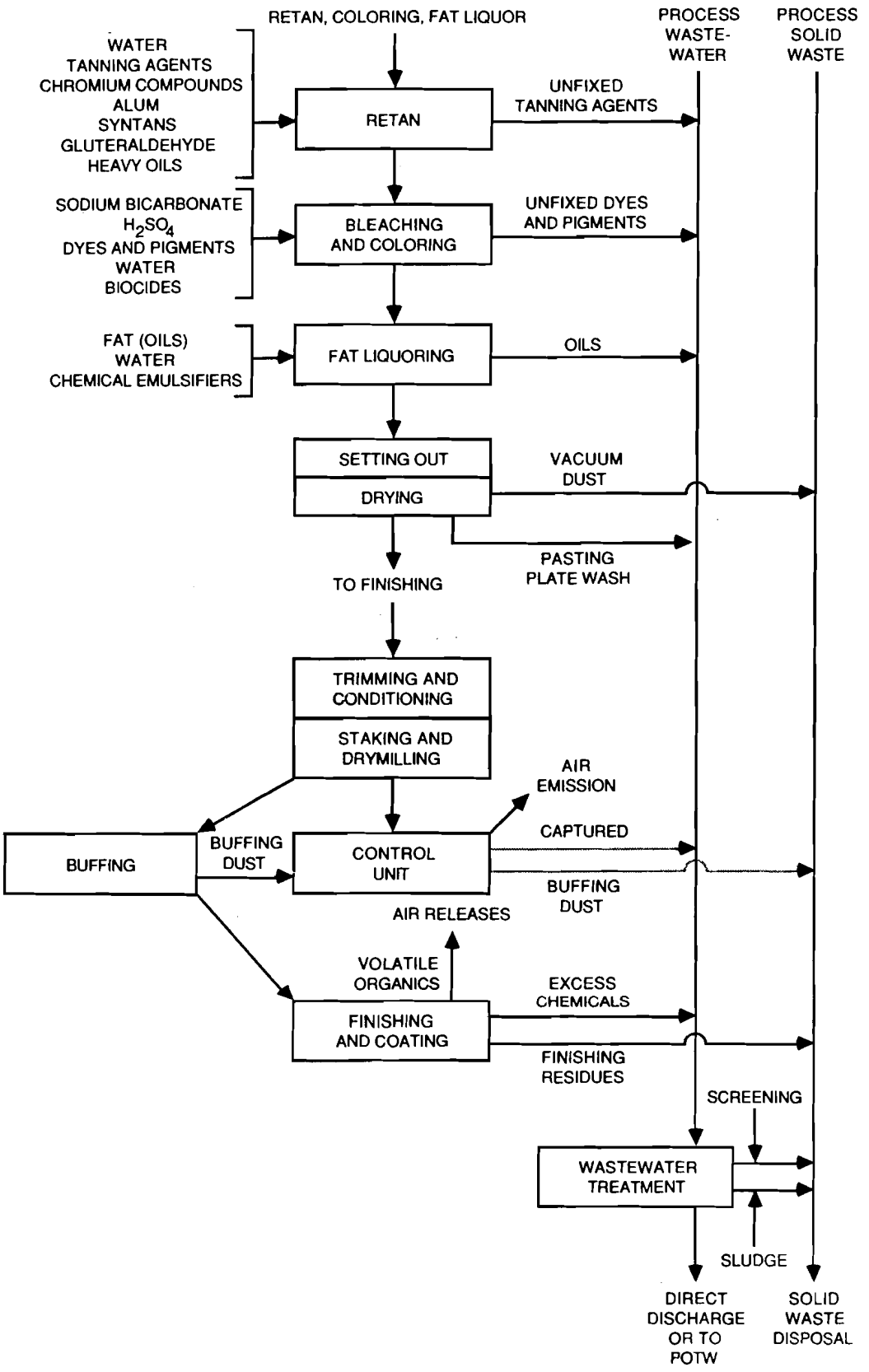


Example Flow Diagram of Leather Tanning and Finishing



Example Flow Diagram of Leather Tanning and Finishing (continued)

NBI-94-003-01, Pub. 10/31/94

Pollution Prevention Assessment for a Cattle Hide Tannery CASE STUDY

What is EP3?

The amount of pollutants and waste generated by industrial facilities has become an increasingly costly problem for manufacturers and a significant stress on the environment. Companies, therefore, are looking for ways to reduce pollution at the source as a way of avoiding costly treatment and reducing environmental liability and compliance costs.

The United States Agency for International Development (USAID) is sponsoring the Environmental Pollution Prevention Project (EP3) to establish sustainable programs in developing countries, transfer urban and industrial pollution prevention expertise and information, and support efforts to improve environmental quality. These objectives are achieved through technical assistance to industry and urban institutions, development and delivery of training and outreach programs, and operation of an information clearinghouse.

EP3's Assessment Process

EP3 pollution prevention diagnostic assessments consist of three phases: *pre-assessment*, *assessment*, and *post-assessment*. During *pre-assessment*, EP3 in-country representatives determine a facility's suitability for a pollution prevention assessment, sign memoranda of agreement with each facility selected, and collect preliminary data. During *assessment*, a team comprised of U.S. and in-country experts in both pollution prevention and the facility's industrial processes gathers more detailed information on the sources of pollution, and identifies and analyzes opportunities for reducing this pollution. Finally, the team prepares a report for the facility's management detailing its findings and recommendations (including cost savings, implementation costs, and payback times). During *post-assessment*, the EP3 in-country representative works with the facility to implement the actions recommended in the report.

Summary

This assessment evaluated a facility that tans cattle hides. The objective of the assessment was to identify actions that would: (1) reduce the quantity of toxics, raw materials, and energy used in the manufacturing process, thereby reducing pollution and worker exposure, (2) demonstrate the environmental and economic value of pollution prevention methods to the tanning industry, and (3) improve operating efficiency and product quality.

The assessment was performed by an EP3 team comprised of a US expert in leather tanning and a pollution prevention specialist.

Overall, the assessment identified eight pollution prevention opportunities at this facility. Recommendations include recycling the spent chrome tanning wastes, oxidizing the sulfide containing wastes, decreasing the volatile organic discharge by changing finishing materials, decreasing water use by batch washing, and using solid wastes from the waste stream as fertilizer.

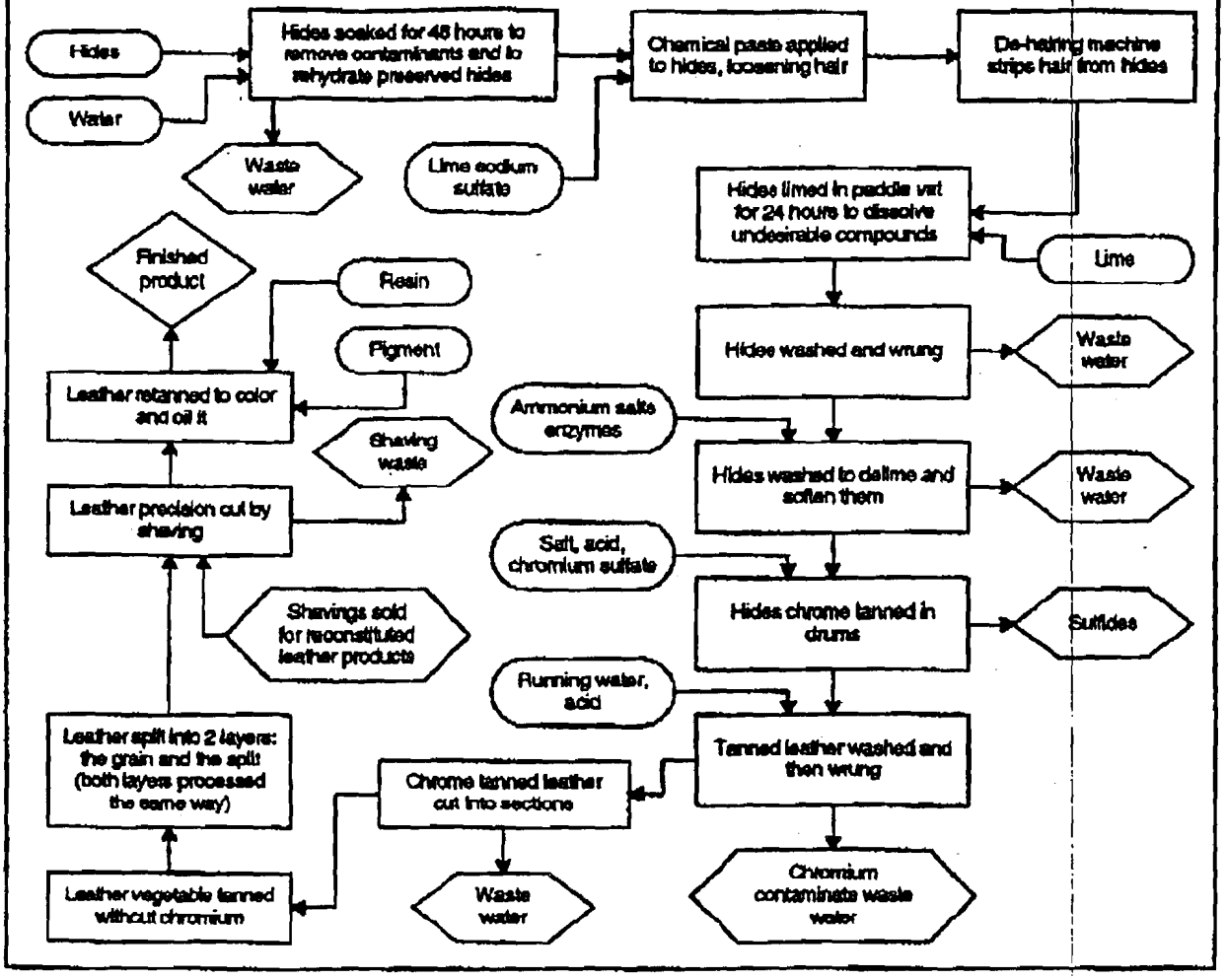
Facility Background

This facility is a cattle hide tannery producing chrome tanned shoe upper leather from salted cattle hides. The tannery has a nominal capacity of five hundred hides per day. Monthly production is 25 days at 400 hides per day, with an average hide weight of 23 kg. The total weight of hides processed per day is 9,200 kg.

The wastes generated by the tannery come from the hides and the chemicals used in the tanning process. Tannery wastes are discharged in a number of batches during the production day.

EP3 is sponsored by the U.S. Agency for International Development.

Figure 1: Overview of Facility's Cattle Hide Tanning Process



Manufacturing Process

Figure 1 outlines the process of leather production at the plant. In the production of leather from salted cattle hides, the hides must be thoroughly re-wet, and the dirt, salt and undesirable hide substances must be removed. Soaking and washing the skins is done in a series of steps to remove dirt, salt, and organic matter, and rinse the hides. The waste water is nearly neutral, and contains salt and some suspended solids.

Next, the skins are unhaired by treatment with lime and sulfides. The waste water is very alkaline, contains toxic sulfides, and is the main cause of the high BOD and suspended solids in the total waste stream.

The next step is de-liming to remove the lime in the skins and soften them by enzymatic action. The first dump of this process contains ammonium sulfate, enzymes, and some protein. The subsequent washes are very dilute, nearly neutral pH solutions.

The skins are then tanned. The chrome tanning process is standard for the industry: the solutions contain chromium as chromium sulfate salt and some free acid. About 75 percent of the chromium present combines with the hide.

Finally, the color and fatliquor steps are employed to color and oil the leather to make it as soft or firm as desired. A number of chemicals are used in these steps, and about 90 percent of the load is fixed to the leather. The spent solutions are mildly acidic, with a pH of between 4 and 6. BOD and suspended solids are relatively low.

Table 1: Summary of Recommended Pollution Prevention Opportunities

Unit Operation	Pollution Prevention Action and Environmental/ Product Quality Benefit	Cost	Payback Period
Chromium Tanning	Recycle chrome tanning - decreases Chromium to less than 3 mg/l	$20,000 (saves $60,000 per year)	4 months
Solvent Discharge	Change to water-based lacquer finish - decreases VOC discharge by 60-90 percent	None	To be determined
Water Use	Change to batch washes - decreases water usage by 20-40 percent	None	To be determined
Solid Waste	Save leather trimmings for reconstituted leather - decrease leather waste by 60-80 percent	10,000	To be determined
Sulfide Waste	Destroy sulfides by air oxidation - decreases sulfide waste by 95-98 percent	30,000	To be determined
Suspended Solids	Primary treatment - decreases suspended solids by 70-85 percent	100,000	To be determined
Sludge from Effluent	Dry sludge for land application - allows disposal of sludge as fertilizer	20,000	To be determined
Secondary Treatment	Treat primary waste - decreases BOD by 60-80 percent	$50,000 (trickling filters)	To be determined
TOTALS		$230,000 capital costs	

Existing Pollution Problems

At the time of the assessment, there were a number of pollution problems at the facility, including excessive (1) chromium discharge, (2) VOC discharge, (3) water usage, (4) leather waste, (5) sulfide waste, (6) suspended solids in effluent, (7) oil and grease in the effluent, and (8) BOD of effluent.

Pollution Prevention Opportunities

The assessment identified eight pollution prevention opportunities that could address the problems identified, with significant environmental and economic benefits to the facility (see **Table 1**). Two of the recommendations can be implemented with no capital investment.

The recommended actions are based on cost effective methods that have been proven in commercial applications:

Chromium recycling. This step allows the collection of the spent chrome tanning solutions, without dilution or contamination, for use in the pickle and tanning process. Since the tannery also tans splits, the spent chrome tanning solution can be used here as well. The tanning of splits results in very good fixation of chromium, so the concentration of chromium in the final effluent should meet effluent regulations. This system results in a saving of about 25 percent in the chromium chemicals used.

Solvents. The suppliers of finishing products have developed water-based lacquers with significantly lower volatile solvent contents. These materials are now widely accepted as quality products, and their use is strongly advised.

Process Water. In some hide wetting processes there is an opportunity to recycle the final rinses. The final rinse waste water in this process is compatible with fluids used for the first wetting of the hides.

Solid Waste. Elimination of solid leather waste discharges through the use of trimmings in reconstituted leather will ease the burden on landfills.

Capital Intensive Modifications. Eliminating sulfides from the effluent is very important, as they will corrode pipes, cause objectionable odors, and may cause fatal accidents. The sulfide-lime solution, and washes from this process, can be collected without contamination from other solutions. These collected wastes can be placed in a tank and the sulfides oxidized by air with a catalyst. This method is effective and can destroy the sulfide in 4-8 hours.

At this point the lime waste, with high BOD and suspended solids, can be used to neutralize the acid wastes that are being continuously discharged. The

acid and alkaline wastes from the tanning process will react to produce a co-precipitation of much of the suspended solids and BOD. This is done with a mixing tank and automatic pH control. Coagulants can also be added at this point.

The neutral streams can then flow to a primary clarifier for the removal of suspended solids as sludge. The sludge can be dewatered in a sand bed to more than 50 percent solids for disposal. Although this effluent is somewhat high in BOD, over 80 percent of the pollution load has been removed. The sludge is a good soil conditioner, and if used as such, will eliminate possible high disposal costs.

Secondary Treatment. In the future, a secondary treatment system can be added for BOD removal. The secondary system need only be as large as needed for the clarified wastes, and it may consist of a trickle filter, a secondary clarifier, and/or a filter press.

Effect on the Environment

Implementation of the suggestions will lead to a number of positive environmental benefits. Chromium recycling will decrease the chromium in the discharge by 80-90 percent. The reduction of volatile solvents will decrease VOC releases to the atmosphere by 60-75 percent. Changes to water usage patterns will decrease effluent volume by 30 percent. Elimination of solid leather waste discharges through the use of trimmings in reconstituted leather eases the burden on landfills. With primary and secondary treatment, the BOD can be reduced by 75 percent. In addition, the suspended solid reduction creates a useable by-product in the form of an organic fertilizer.

For Further Information

For further information on this assessment or other activities conducted by EPA, call the EPA Clearinghouse at (703) 364-1904, send a fax to (703) 231-1555, or on Internet at pollen@epamail.epa.gov.

Table 1: Summary of Recommended Pollution Prevention Opportunities

Unit Operation	Pollution Prevention Action and Environmental/Product Quality Benefit	Cost	Financial Benefits	Payback Period
Chromium Tanning	Recycle chrome tanning - decreases Chromium to less than 3 mg/l.	To be determined	$5,000 savings on chemicals used.	To be determined
Solvent Discharge	Change to water-based lacquer finish - decreases VOC discharge by 60-90 percent.	None	To be determined	To be determined
Water Use	Change to batch washes - decreases water usage by 20-40 percent.	None	To be determined	To be determined
Solid Waste	Save leather trimminge for reconstituted leather - decreases leather waste by 60-80 percent.	$5,000	To be determined	To be determined
Sulfide Waste	Destroy sulfides by air oxidation - decreases sulfide waste by 95-98 percent.	$20,000	To be determined	To be determined
Primary Treatment	Primary treatment - decreases suspended solids by 70-85 percent.	$50,000	To be determined	To be determined
Sludge from Effluent	Dry sludge for land application - allows for disposal of sludge as fertilizer.	$10,000	To be determined	To be determined
Secondary Treatment	Treat primary waste - decreases BOD by 60-80 percent.	$50,000 (trickling filters)	To be determined	To be determined
TOTALS		$135,000 capital costs	$5,000 plus 7 unquantified opportunities	

Pollution Prevention Opportunities

The assessment identified eight pollution prevention opportunities that could address the problems identified, with significant environmental and economic benefits to the facility. Table 1 lists the opportunities for pollution prevention recommended for the facility, and presents the environmental benefits and implementation costs for each. Two of the recommendations can be implemented with no capital investment.

Effect on the Environment

The recommended actions are based on cost effective methods that have been proven in commercial applications. These actions will have a number of positive environmental impacts.

1) Chromium recycling will decrease the chromium in the discharge by 80-90 percent. The spent chromium solutions contain about 25 percent of the total chromium used in the tannage. The loss of this valuable material can be decreased and the chromium concentration lowered by recycling. Some of the spent chromium solution can be directly used to make the pickle solution without affecting the quality of the leather. The remainder can be saved, and the chromium precipitated with the addition of an alkali. The recovered chromium can be dissolved in acid for use in the tannage.

2) The suppliers of finishing products have developed water-based lacquers with significantly lower volatile solvent contents. The reduction of volatile solvents will decrease VOC releases to the atmosphere by 60-75 percent.

3) In some hide wetting processes there is an opportunity to recycle the final rinses. In the goatskin process, extensive washing of the bated skin is common. The water from this wash could be used for rinse water in the original soaking, as the final rinse wastewater is compatible with fluids used for the first wetting of hides. The judicious recycling of rinse waters and automated systems in a tannery could result in savings of up to 50 percent of water consumed.

4) Elimination of solid leather waste discharges by using trimmings to make reconstituted leather will ease the burden on landfills.

5) Eliminating sulfide discharges is very important as sulfides can corrode pipes, cause objectionable odors, and cause fatal accidents. The sulfide-lime solution, and washes from this process can be easily collected, placed in a tank, and the sulfides oxidized by air with a manganese sulfate catalyst. This method is effective and can destroy the sulfide in 4-8 hours. The oxidized wastes are kept for use in controlling the pH of the effluent stream.

6) Decreasing by 80 percent the suspended solids discharged, and instituting secondary treatment will serve to decrease BOD. With primary and secondary treatment, the BOD can be reduced by 75 percent. In addition, the reduction of suspended solids creates a useable by-product in the form of an organic fertilizer, thus eliminating possible high disposal costs.

Implementation Plan

The schedule and timing of implementation of the recommendations will depend on the relative costs and benefits and the availability of personnel and capital. The recycling of the chrome tanning solutions is the most cost effective recommendation in that the company will have a large saving in material costs in addition to significant pollution prevention.

Chrome Recycling. The value of chrome recycling to the tannery and its low capital costs should make it an attractive option. Implementation may be accomplished in 2-6 months.

Solvents. The shift to low VOC finishes should occur between 6-12 months as the system is accepted by the company for each of the leathers it makes.

Process Water. The decrease in the volume of process water used can be accomplished without a capital investment. The batch washing of coloring and fatliquoring batches could result in savings of about 50 percent in these operations. With the recommended pretreatment system, a decrease in flow would decrease the capital and operating costs of the treatment system. The shift to lower water use should come gradually over the next 12 months.

Solid Wastes. At present, the tannery has useful disposal of most of its solid wastes in the form of fleshings, trimmings, and leather shavings. With the introduction of the pretreatment system, a new source of solid waste -- about 1000 kg of solid sludge containing 120-150 kg of nitrogen -- will be generated. This organic nitrogen and the other materials in the sludge have been proven to be very valuable as fertilizers and soil conditioners. The implementation of the primary treatment system over the next 6-18 months will not only clean the liquid tannery's wastes, but result in an environmental benefit to the community.

Pretreatment. The implementation of the pretreatment system will require design data and engineering and construction of the system. Total time to completion should be 12-15 months.

For Further Information

For further information on this assessment or other activities sponsored by EPS, call the EPS Clearinghouse at (703) 351-4004 or send a fax to (703) 351-6166.

WASTE MINIMIZATION COMMITTEE

MAINTENANCE	TECHNICAL	PRODUCTION	ADMINISTRATION
			FINANCE
			SALES
			PURCHASING

GOALS

1.	**INCREASE YIELD**
2.	**REDUCE WATER USE**
3.	**REDUCE ENERGY USE**

GOAL: IMPROVE YIELD AND QUALITY

PRODUCTION COMMITTEE
TECHNOLOGY COMMITTEE

OBJECTIVE: **INCREASE HIDE YIELD BY ___%**

STEPS:

1. **TRAIN SUPERVISORS & WORKERS REGARDING OBJECTIVE**

2. **REVIEW PROCESS WITH TECHNOLOGY/COLLECT DATA**

3. **ESTABLISH MEASURES**

4. **PREPARE PROJECT LIST**

    A. **EXISTING PROJECTS**
        1. **PREPARE PROJECT DESCRIPTION**
        2. **REPORT PROGRESS**

    B. **NEW PROJECTS**
        1. **BRAINSTORM**
        2. **PREPARE PROJECT LIST**
        3. **SUBMIT TO WMC FOR PRIORITY**

5. **ASSIGN RESPONSIBILITY**
   DEVELOP SCHEDULE

6. **BEGIN WORK**

7. **MONITOR WORK**

GOAL: REDUCE WATER USE

MAINTENANCE
TECHNOLOGY

OBJECTIVE: REDUCE WATER USE BY 10 %

STEPS:

1. TRAIN SUPERVISORS & WORKERS REGARDING OBJECTIVE

2. REVIEW PROCESS WITH TECHNOLOGY/COLLECT DATA

3. ESTABLISH MEASURES

4. PREPARE PROJECT LIST
   - A. EXISTING
     1. ELIMINATE ONE WASH STEP
     2. RECYCLE DRUM WATER
     3. AUTOMATE DRUMS
     4. RECYCLE CHROME FLOAT
     6. REDUCE WATER AMOUNT IN LIMING (150 → 120%)
     7. RECYCLE COOLING WATER
     8. REPLACE POTABLE WITH TECHNICAL WATER
     9. INSTALL FLOW METERS TO MONITOR USE
   - B. NEW PROJECTS
     1. BRAINSTORM
     2. PREPARE PROJECT LIST
     3. SUBMIT TO WMC FOR PRIORITY
5. ASSIGN RESPONSIBILITY
   DEVELOP SCHEDULE

6. BEGIN WORK

7. MONITOR WORK

GOAL: REDUCE ENERGY CONSUMPTION

MAINTENANCE COMMITTEE

OBJECTIVE: REDUCE ENERGY CONSUMPTION BY %

STEPS:

1. TRAIN SUPERVISORS & WORKERS REGARDING OBJECTIVE

2. REVIEW PROCESS WITH TECHNOLOGY/COLLECT DATA

3. ESTABLISH MEASURES

4. PREPARE PROJECT LIST

    A. EXISTING PROJECTS
        1. PREPARE PROJECT DESCRIPTION
        2. REPORT PROGRESS

    B. NEW PROJECTS
        1. BRAINSTORM
        2. PREPARE PROJECT LIST
        3. SUBMIT TO WMC FOR PRIORITY

5. ASSIGN RESPONSIBILITY
   DEVELOP SCHEDULE

6. BEGIN WORK

7. MONITOR WORK