
Chapter 4.3

Leather Processing: Cleaner Production Fact Sheet and Resource Guide

Purpose

This fact sheet offers basic information on important adverse environmental impacts of leather processing, as well as associated health and safety impacts. It also discusses opportunities for mitigating those impacts, with an emphasis upon “cleaner production” strategies that may also provide financial benefits to micro- and small enterprises (MSEs). In addition, each fact sheet offers a substantial, annotated list of resources for those organizations seeking more information.⁵

This fact sheet has been prepared for (1) **business development services (BDS) providers**, which offer services such as management training or marketing support to MSEs, and (2) **intermediate credit institutions (ICIs) and direct lenders** that provide financial credit to MSEs. It is intended to be used in concert with Part II of the *Environmental Guidelines for Small-Scale Activities in Africa: Environmentally Sound Design for Planning and Implementing Humanitarian and Development Activities*, USAID Africa Bureau's principal source of sector-specific environmental guidance.

Why Focus on Cleaner Production for Mitigation?

Cleaner production is a preventive business strategy designed to conserve resources, mitigate risks to humans and the environment, and promote greater overall efficiency through improved production techniques and technologies. Cleaner production methods may include:

- substituting different materials
- modifying processes
- upgrading equipment
- redesigning products

⁵ At the time of writing, USAID cleaner production fact sheets are available for the following subsectors that are likely to have substantial adverse impacts on the environment and/or worker health: brick and tile production; leather processing; small-scale mining; food processing; metalworking; wood processing and furniture production, and wet textile operations.

In addition to environmental, health and safety benefits, many cleaner production techniques provide opportunities to substantially reduce operating costs and improve product quality. MSEs can profit from cleaner production through more efficient use of inputs and machinery, higher quality goods that can command higher prices, and reduced waste disposal costs. Improved safety measures can also help MSEs avoid costly accidents and worker absences.

Experience has demonstrated that, with assistance, MSEs can frequently identify cleaner production opportunities that produce a positive financial return, sometimes with little or no investment. Many enterprises that change to cleaner production methods may realize substantial financial and environmental benefits, indicating that cleaner production should be the first option considered in addressing MSEs' environmental problems.

Yet, although this approach can offer tremendous advantages, readers should also recognize that cleaner production options showing clear financial benefit will only be available to varying degrees among different enterprises and often may not completely mitigate environmental problems. In some cases, even when pursuing cleaner production techniques, some businesses may need to use solutions that offer no measurable financial return—if such solutions are required by USAID's Regulation 216 or local regulations or desired for other reasons, such as community goodwill.

Important Environmental Issues Addressed by This Fact Sheet

- Chemicals
- Water use
- Worker health hazards
- Odor
- Excess waste

Adverse Environmental Impacts and Mitigation Opportunities

Several key environmental impacts associated with leather processing are listed in the box at right and discussed below. For each environmental impact, the fact sheet provides a list of questions to aid in the assessment of individual MSEs. These questions are followed by a number of mitigation strategies that can be considered, with an emphasis on cleaner production strategies where possible. The strategies presented typically represent a range of available options, from profitable activities that require no investment to other activities that may increase MSE costs.

□ Chemicals

Leather processing requires extensive use of chemicals to treat and soften hides. These chemicals are present in the firm's wastewater and can contaminate community water sources. When chemicals are improperly or inefficiently used in production, costs rise and pollution increases. More efficient chemical use can both lower production costs and reduce pollution.

Key questions to consider:

- What kind of chemicals are used?
- Which of these chemicals are the most harmful?
- Which production stages use the most chemicals? In what quantities?
- Where are chemicals stored?

Selected mitigation strategies:

- Improve production methods to increase efficiency. Using higher temperatures in chrome baths helps chrome adhere to hides and reduces the amount of chemicals in wastewater. Instruct workers in correct chemical ratios to use in tanning and finishing baths. Use measuring equipment to minimize overuse.
- Improve chemical storage to reduce waste and spills. Store chemicals in sturdy, waterproof containers. Instruct employees to seal containers after use to avoid spills.
- Consider using alternative chemicals that are less hazardous. For instance, vegetable-based tanning solutions can be substituted for chrome. Take into consideration, though, that switching to low-polluting chemicals may involve a tradeoff in quality. For example, vegetable dyes may produce unpredictable colors.
- Recycle chrome and tanning bath solutions. Chrome and lime effluent can be reused in future production stages without loss of effectiveness; use filters to screen out solid wastes and then set aside the to use it again. Assess the cost-effectiveness of such strategies before proceeding, however. For example, some chrome-recycling strategies may not be cost-effective for smaller operations.

□ ***Water use***

Leather processing requires water in almost every stage of production, but certain production methods or machinery can lead to overuse. If well or pump water is used, excessive water use can deplete water sources for future production or community use. Energy costs for pumping, as well as environmental impacts from energy consumption, will also be higher than necessary. Excessive groundwater use may lower the water table and require frequent redrilling of wells. Also, untreated wastewater from processing operations may contain organic wastes which can pollute both local water sources and degrade water quality for downstream communities.

Using water more efficiently guarantees less costly production and ensures against water shortages that could interrupt production. If the enterprise pays

by volume for the water it uses, reducing water usage can be expected to provide substantial savings.

Key questions to consider:

- Is water left running between production stages?
- Is fresh water used in every new bath? Could some water be reused?
- Are hides pre-cleaned before they are washed?

Selected mitigation strategies:

- Reuse water from "cleaner" stages of production in "dirtier" stages of the next production cycle. For example, use rinse water from the final stage of production for initial soaking or washing of the next batch of hides.
- Conserve water by improving production methods. Turn off water between batches or while transferring hides between baths. Install nozzles on hoses to increase the effectiveness of spraying while decreasing water use. Prevent baths from overflowing by monitoring water levels closely or installing an automatic shut-off mechanism.
- Use dry cleanup methods. Wipe down spills with dry material; use brooms or cloth to remove as much solid or semi-solid waste as possible from floors or machinery before rinsing down with water.
- Divert organic effluent away from water bodies (see below for production mitigation strategies for tannery effluent).

□ ***Worker health hazards***

Certain working conditions in leather processing—such as exposure to chemicals in the air or in solution baths—can be hazardous to workers. Symptoms can include skin irritations, dizziness and breathing problems. An unhealthy workforce can lower productivity, cause excessive absences and contribute to potentially costly mistakes.

Key questions to consider:

- What safety measures are currently in place?
- How often are workers exposed to chemicals?
- Is the tannery structure well ventilated?

Selected mitigation strategies:

- Provide safety equipment such as facemasks, rubber gloves and boots for workers. Small improvements can increase worker safety dramatically and improve long-run productivity.

- Ventilate the production sites well. Organic solvents, in particular, are harmful when inhaled. Minor exposure can cause long-term harm over time.
- Train workers in proper chemical handling. Minimize chemical spills and accidental exposure by educating workers in preventive safety measures. For example, sealing chemical containers when not in use can prevent both spillage and evaporation and consequently reduce input costs.

□ **Odor**

Tannery effluent often contains highly odorous waste. Strong smells can affect quality of life around the tannery site and may reduce or destroy community support for further production or expansion. Controlling odor through improved waste treatment techniques, or even recycling, can improve community relations and may reduce costs.

Key questions to consider:

- Which wastes smell the worst?
- Can wastes or trimmings be separated before chemical treatment?
- Where are solid wastes disposed of?

Selected mitigation strategies:

- Separate and sell non-contaminated wastes to farmers. Untanned collagen wastes and fats produce odors, but they can be reused as agricultural fertilizer if not contaminated by chemical wastes.
- Implement a waste disposal or treatment system. Avoid dumping solid wastes; instead, use a proper landfill or dig an appropriately sized pit. Bury waste to minimize odors. Wherever solid waste is disposed of, make sure it is away from water sources and cannot be washed away.
- Control sludge to decrease odors. Do not let sludge stagnate in or around the tannery site. Place in a landfill or treatment area. Drain standing pools of liquid to eliminate odor and potential breeding grounds for insects, particularly mosquitoes.

□ **Excess waste**

Inefficient or poor production methods contribute to excessive waste and costly product loss. Tanneries with low-quality production processes may have to discard or rework an unnecessarily high proportion of product. Improving production through maintenance and training can save costly reworking, reduce product loss, and thereby save money while reducing environmental impacts.

Key questions to consider:

- How much and what kind of product is lost in the production process?
- Which production processes are most prone to mistakes and wasted product?
- Which production processes are easiest to modify in order to reduce waste?

Selected mitigation strategies:

- Ensure that regular maintenance schedules for machinery are followed. For example, to reduce spoilage or losses, workers should regularly clean filters and screens of machinery used in dehairing and hide-shaving.
- Use appropriate equipment and train workers in proper machine operation and maintenance.
- Optimize production. For example, do not overfill or underfill tanning baths with hides. Overfilling reduces efficiency, while underfilling wastes valuable inputs.

References and Other Resources

- Biller, Dan and Juan David Quintero (1995). *Policy Options to Address Informal Sector Contamination in Urban Latin America: The Case of Leather Tanneries in Bogotá, Colombia*. LATEN Dissemination Note # 14 December, World Bank.
[http://wbln0018.worldbank.org/lac/lacinfoclient.nsf/6968dd46d8c5c4d88525695d007235c8/b/bb2e6b3d6030f2852567ef006dcf7b/\\$FILE/Dn-14.doc](http://wbln0018.worldbank.org/lac/lacinfoclient.nsf/6968dd46d8c5c4d88525695d007235c8/b/bb2e6b3d6030f2852567ef006dcf7b/$FILE/Dn-14.doc). This report is a case study of informal leather tanneries in the San Benito neighborhood of Bogotá, Colombia. It includes proposals and policy options for addressing the industry's pollution problems.
- "Tanning and Leather Finishing" (1998) in *Pollution Prevention and Abatement Handbook*. World Bank July.
[http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/\\$File/80_tan.pdf](http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/80_tan.pdf) This chapter from the World Bank's pollution prevention handbook provides minimum pollution standards for tanneries and leather finishers.
- *Sectoral Profile of the Leather Industry*. United Nations Industry Development Organization (UNIDO)
<http://www.unido.org/ssites/env/sectors/sectors401.html>. A very good overview of tannery production processes; includes lengthy discussion of all stages of production, from hide processing to leather finishing. Includes possible strategies for cleaner production and improved production efficiency.
- *Re-Use of Chromium in Leather Tanning*. United Nations Environment Program (UNEP) Cleaner Production Case Studies.
http://www.emcentre.com/unepweb/tec_case/leather_19/recovery/r3.htm.
EP3—Pollution Prevention Audit for a Sheep Hide Tannery. United Nations Environment Program (UNEP) Cleaner Production Case Studies.
http://www.emcentre.com/unepweb/tec_case/leather_19/material/m5.htm.
EP3—Cleaner Production Audit for a Cattle Hide Tannery. United Nations Environment Program (UNEP) Cleaner Production Case Studies.
http://www.emcentre.com/unepweb/tec_case/leather_19/material/m7.htm
Three short case studies of cleaner production in a medium-scale sheep and cattle hide tanneries. These provide a useful overview of cleaner production opportunities. Included are cost estimates of cleaner production methods. The studies also focus on re-use of chemical effluents.
- Covington, Anthony D. (1999) *Innovations in Processing*. International Union of Leather Technologists and Chemists Societies (IULTCS) Congress held in Chennai, India, January 1999.
<http://leather.webindia.com/innovation.html>. This paper includes a useful overview of hide processing and presents new or alternative production methods that increase efficiency and/or reduce chemical use.
- Sahasranaman, A. (1999) *Occupational Safety and Health in the Tanning Industry—Emerging Challenges*. International Union of Leather Technologists and Chemists Societies (IULTCS) Congress held in Chennai, India, January 1999.

<http://leather.webindia.com/safety.html>. This short reports lists worker safety issues associated with tanneries production and provides policy strategies for addressing safety issues in tanneries.

- *Sources, Detection and Avoidance of Hexavalent Chromium in Leather and Leather Products* (2000). Regional Programme for Pollution Control in the Tanning Industry in South-East Asia, United Nations Industrial Development Organization (UNIDO).

<http://www.unido.org/userfiles/PuffK/hexavalent.pdf>. This document evaluates a variety of tanning production methods to see which produce dangerous levels of chromium IV, a by-product of chromium III usage. Technical in some sections, but the general discussion on which methods produce the most danger is quite accessible.

- *Hair-Save Unhairing Methods in Leather Processing* (2000). Regional Programme for Pollution Control in the Tanning Industry in South-East Asia, United Nations Industrial Development Organization (UNIDO).

http://www.unido.org/userfiles/PuffK/L_hairsave_unhairing.pdf. This report discusses methods of unhairing that result in lower levels of contaminated wastewater, compared to traditional chemical unhairing procedures.

- Money, Catherine A. (1999) *Clean Technology Challenges*. International Union of Leather Technologists and Chemists Societies (IULTCS) Congress held in Chennai, India, January 1999.

<http://www.tft.csiro.au/leather/cleantech.html#tzw>. A very useful overview of cleaner production strategies in leather production. Contains checklists for cleaner production technologies. Compares advantages and disadvantages of certain methods. Also includes diagrams for filtering technology.

- Cranston, R.W., R.W. Gleisner, et al. (1997) *The Total Recycling of Chromium and Salts in Tanning Liquors*. Australia: CSIRO Leather Research Centre.

<http://www.tft.csiro.au/leather/totrecycling.html>. A how-to paper on chromium recycling. Includes diagrams and cost-benefit analyses.

Other Resources:

- Davis, M.H. and J. G. Scroggie. (1980) *Theory and Practice of Direct Chrome Liquor Recycling*. Australia: CSIRO Leather Research Centre.

<http://www.tft.csiro.au/leather/dclr.html>. Examples and strategies to reuse chrome solution during hide processing.

- Money, Catherine A. *Curing of Hides and Skins: Alternative Methods*. Australia: CSIRO Leather Research Centre. <http://www.tft.csiro.au/leather/curinghides.html>.

Money, Catherine A. *Unhairing and Dewooling—Requirements for Quality and the Environment: Procter Memorial Lecture*. Australia: CSIRO Leather Research Centre. <http://www.tft.csiro.au/leather/procter.html>.

These two papers present alternative methods of hide preparation and unhairing. There is short discussion of current methods and alternative methods that can improve quality.

- Pojer, Peter M and Chi P Huynh. *A Salt-Free Pickling Regime for Hides and Skins*. Australia: CSIRO Leather Research Centre.

- <http://www.tft.csiro.au/leather/saltfreepickling.html>. Provides information on eliminating the salt pickle method for preparing hides for tanning.
- *Tanneries and the Environment: A Technical Guide to Reducing the Environmental Impact of Tannery Operations* (1991). Technical Report Series No. 4. United Nations Environment Program (UNEP).
<http://www.ecoethics.net/bib/tl-021-a.htm>. Extensive discussion of environmental issues associated with tanneries and possible solutions. Ordered from the above Web site for \$25.
 - *Trainers Workbook on Cleaner Production in Leather Tanning* (1996). United Nations Environment Program (UNEP).
<http://www.unepie.org/publi/lists/cp/listpub.html>. Available from UNEP for around US\$120.