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Environmental Guidelines for Small-Scale Activities in Africa (EGSSAA)

Chapter 4.2:Food Processing: Cleaner Production Fact Sheet and Resource Guide

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Purpose

This fact sheet offers basic information on the important adverse environmental impacts of food 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 organizations seeking more information.[1]

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 other sections in Part III of the *Environmental Guidelines for Small-Scale Activities in Africa: Environmentally Sound Design for Planning and Implementing Development Activities*, which is USAID Africa Bureau's principal source of sector-specific environmental guidance.

[1] 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 workers' health: brick and tile production; leather processing; small-scale mining; food processing; metal finishing; wood processing and furniture production, and wet textile operations.

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Why Focus on Cleaner Production for Mitigation?

Cleaner production (CP) 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. CP methods may include:

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

In addition to environmental, health and safety benefits, many cleaner production techniques can substantially reduce operating costs and improve product quality. MSEs may profit from CP 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

Food processing is an area where many cleaner production opportunities can be found, from water usage to recycling.

return, sometimes with little or no investment. Many enterprises that change to CP methods may realize substantial financial and environmental benefits, indicating that CP 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 CP 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.

Adverse Environmental Impacts and Mitigation Opportunities

A wide variety of African MSEs engage in food-processing activities ranging from abbatoirs to cashew nut processing. Several key environmental issues associated with food processing are listed in the box at left 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 MSEs' costs.

Important Environmental Issues Addressed by This Fact Sheet

- Water pollution
- Working conditions
- Spoilage
- Solid waste
- Poorly maintained machinery

❑ *Water pollution*

Harmful wastes disposed of in pits or waterways can leach into groundwater and affect water quality for workers and the community. Contamination of water sources may not occur immediately, but can increase or accumulate over time, eventually damaging to product quality and affecting workers' health.

Key questions to consider:

- Is there any chance rain could transport elements of the firm's waste from its original site to community centers or water sources?
- How near is the waste site to the water table and/or groundwater sources, such as wells?
- How close is the waste site to streams, rivers, lakes or other surface water bodies?
- Is the enterprise mixing chemical and organic waste?

Selected mitigation strategies:

- Site small dumps or waste treatment sites far away from surface or groundwater water sources.
- Separate harmful chemical waste from organic waste, and use more care in handling chemical waste. Dispose of chemical waste in a way that prevents chemicals from leaching into ground or surface waters (such as clay- or concrete-lined pits). Check with an environmental expert to confirm the chosen disposal method is safe for the chemicals being disposed of.
- If the enterprise stores waste temporarily before transporting it to a treatment facility or landfill, make sure it is not leaking into the ground.

❑ *Working conditions*

Certain working conditions—excessive heat caused by operating machinery, lack of ventilation, skin-irritating acids from fruits—can damage workers' health. An unhealthy workforce may be unproductive, miss work too often and make costly mistakes.

Key questions to consider:

- Do workers and managers know safety measures well?
- Are there any by-products from production that cause skin, eye or breathing irritation, even occasionally?
- Is protective clothing (e.g., gloves, boots, face masks) available for workers?
- Is there enough light and air so workers do not have to strain to perform their work?

Selected mitigation strategies:

- Maintain safety equipment and reinforce safety training. Safety measures may already be in place, but workers should be reminded often; designate one person as the safety trainer and have that person train others. Check existing safety equipment regularly, and replace elements like dust filters frequently.
- Create a prevention strategy. Sometimes small changes such as buying a face mask or rubber gloves can dramatically reduce incidences of harm to workers. Find ways of preventing accidents.
- Find ways of reducing harmful byproducts. For example, clean the floors in between production cycles to get rid of excess dust, or install drip trays to catch acidic fruit juice.

❑ *Spoilage*

Certain structural features of the food-processing site may lead to spoilage or contamination of the products. Such site or building features include inadequate drainage or a lack of screens to keep out insects/rodents. Increased spoilage causes more waste and less profitability, while contamination may result in health problems for consumers.

Key questions to consider:

- Does the site experience substantial losses in raw materials during storage before production? If so, what causes these losses?
- How open are structures to the outside elements and pests? Can they be closed off more effectively while maintaining sufficient ventilation?
- What sanitation procedures are currently in place?

Selected mitigation strategies:

- Ensure that the building structure is secure not only from people but also from animals. Screens should be placed over drains and windows to keep out disease-carrying rodents and flies.

- Storage areas should be well-ventilated and large enough so that excessive heat and moisture do not spoil fruits and vegetables.

❑ *Solid Waste*

Food processing creates substantial amounts of organic and inorganic wastes. This can lead to increased costs for supplies, labor and sometimes fees for waste disposal. In addition, high volumes of burdensome waste, whether placed in a landfill or treated and disposed of, may place a serious strain on limited land resources. Minimizing waste can save on the cost of supplies and labor needed for waste disposal. Converting waste to productive uses can provide an extra source of income.

Key questions to consider:

- Are there any other uses for organic waste generated by the production process? For instance, can organic waste be turned into fodder or compost?

- What contributes most to waste?

- How can production processes be changed to reduce waste?

Selected mitigation strategies:

- Re-use organic waste. Some organic waste such as vegetable peelings can be used as animal fodder; other waste, such as the fiber from palm kernel husks, can be used as fuel.

- Modify waste disposal to facilitate faster decomposition/breakdown of organic material. Add layers of dirt and dry organic material to waste pits, or spread waste over large areas of land. This type of composting and "land spreading" can speed up decomposition and quickly lowers waste volume. Ensure, however, that this material does not attract disease-carrying vectors including birds, rodents and insects.

- Minimize wastes by improving production processes. Identify and change elements of production that may be inefficient or produce excess waste. For example, improved techniques for cutting food produce can reduce waste and yield more product.

❑ *Poorly maintained machinery*

Machinery that leaks chemicals or fuel is wasting energy, can contaminate water supplies and may threaten workers' health. Repairing leaks lowers fuel costs and can prevent costly accidents such as fire. For dairy processors, who use more machinery and refrigeration systems than other food

processors, reducing leakage can save money spent on refrigerants and other chemicals.

Key questions to consider:

- How often is machinery checked?
- Are there any routines or technology in place to detect leakages?
- Do workers ever complain of nausea or dizziness on the job?

Selected mitigation strategies:

- Schedule regular machine maintenance checks and repairs. Ensure that workers have up-to-date training in operation and maintenance. Do not wait until machinery is broken before checking it; leaks can occur long before serious equipment breakdown and may be costing the business money. If possible and cost-effective, replace faulty machinery with more efficient machinery.
- If machinery is difficult to access, then monitor wastes or emissions to detect leaks. For example, check for puddles underneath machinery or chemical/fuel smells.
- Use wood shavings, drop cloths and/or oil-water separators to catch spills and leaks.
- If the business is disposing of organic and chemical wastes separately, ensure that chemical or fuel waste does not contaminate the organic waste.
- If it is not cost-effective to replace or to repair machinery, make sure that harmful effects are minimized. Increase ventilation around any machinery that has high gas or chemical emissions.

❑ *Water use*

Food processing workers sometimes use too much water, usually when they are cleaning equipment or food materials. This may not only cause others in the community to have less water, but also lessen the enterprise's own future access to water. It may also mean that water costs are unnecessarily high, even with use of a well. New wells may have to be drilled more frequently as groundwater levels drop.

Key questions to consider:

- Does the business primarily use water to clean machinery and floors?
- Is the source of water limited?
- Is water left running when it is not in use?

- How much money does the business pay for water, and how much could that cost be reduced through more careful usage?

Selected mitigation strategies:

- Decrease water usage through “dry cleanup.” Dry cleanup involves an initial cleaning without water (sweeping, wiping down) before washing. This method reduces the amount of water required to dislodge solid wastes from floors or machinery.

- Regulate water flow. Using high-pressure water hoses can ease cleaning and cut water use; usually this only involves adding a new nozzle to the end of a hose.

- Reuse water. Some food processors use steam to purify or clean packaging materials; a closed-loop system can cycle hot water back into the system. This process saves money on both water and energy costs.

❑ *Liquid waste*

Meat processing creates a good deal of liquid waste—wastewater with blood or animal fats in it—that may coagulate and clog pipes, or contaminate sources of water. Liquid wastes can also gather in stagnant pools, creating breeding grounds for insects. These conditions may cause costly losses in labor and meat from the spread of disease among workers and animals.

Key questions to consider:

- How large is the volume of liquid wastes that is produced?

- Do liquid wastes gather in pools, serving as a breeding grounds for mosquitoes and other insects?

- What waste treatment systems are in place?

Selected mitigation strategies:

- Practice water reduction strategies mentioned above, including "dry cleanup," to minimize the amount of wastewater created and the amount of waste materials in the wastewater.

- Separate fats, grease and solids from wastewater. Oil separators or oil traps can be purchased or made at relatively low cost and can dramatically reduce the amount oil in wastewater. Drain stagnant pools of liquid or water away from holding pens and working areas.

- Consider constructing waste treatment ponds. Both solid and liquid waste can be treated in these ponds, which can aid decomposition and reduce disposal costs. Since they may attract mosquitoes and other insects, site such ponds away from animals and places of human activity.

❑ *Noises and odors*

Food processing may result in noises or odors that affect the quality of life surrounding the production site. Community members may be unwilling to tolerate continued production or may block plans to expand production in the future. Loud noises may also damage the ears of workers and managers.

Key questions to consider:

- Are there some aspects of the production process that are much louder than others?
- Is your waste disposal or treatment site located near human settlements?
- What smells are produced in the production process?

Selected mitigation strategies:

- Locate waste disposal sites away from housing or town centers.
- Modify waste disposal or production practices to minimize odors. For example, if treating waste in lagoons or compost pits, make sure they are large enough to accommodate the volume of waste that is produced—if they are too small, the effectiveness of the treatment decreases and smell increases.
- Provide earplugs for workers.
- Repair and maintain machinery so that excessive grinding or squeaking is minimized. This may increase the machinery's efficiency and make it last longer

Resources and References:

- *Cleaner Production Assessment in Dairy Processing.* United Nations Environment Program, Division of Technology, Industry and Economics (UNEP-TIE). http://www.agrifood-forum.net/publications/guide/d_chp0.pdf

  A guide to the application of cleaner production in the dairy industry, with a focus on the processing of milk and milk products at dairy processing plants.

- *Cleaner Production Assessment in Meat Processing.* United Nations Environment Program, Division of Technology, Industry and Economics (UNEP-TIE). http://www.agrifood-forum.net/publications/guide/m_chp0.pdf

  This document is a guide to the application of cleaner production to the meat processing industry, with a focus on the slaughtering of cattle and pigs at abattoirs. Includes case studies, sample evaluation, and assessment forms.

- Crickenberger, Roger G. and Roy E. Carawan (1996). *Using Food Processing By-Products for Animal Feed.* North Carolina Cooperative Extension Service. http://www.bae.ncsu.edu/programs/extension/publicat/wqwm/cd37.html

  This paper gives information to help food processors prevent pollution and save money by recovering by-products for use as animal feed. It considers some by-products suitable for animal feeding and factors to consider when selecting by-products for feed, e.g., moisture content, waste stream, volume of material, and effects on feed consumption.

- Fellows, Peter. *Guidelines for Small-Scale Fruit and Vegetable Processors* (1997). Agricultural Services Bulletin 127. UN Food and Agriculture Organization (FAO). http://www.fao.org/docrep/w6864e/w6864e0g.htm. (see appendix).

  This document generally concerns the production process, but it does also include a good overview of health and safety issues for fruit and vegetable processors. Specifically discusses methods for avoiding dangers of hot liquids/jams, fruit acids and steam. Some mention of high volumes of solid organic waste and contamination of the product from workers.

- Fellows, P., B. Axtell, and M. Dillon (1995). *Quality Assurance for Small-Scale Rural Food Industries.* Agricultural Services Bulletin No. 117. UN Food and Agriculture Organization (FAO). http://www.fao.org/docrep/V5380E/V5380E00.htm.

  A good discussion of cleaner production building design. Specific mention of how to keep rodents and insects out of building structures in addition to sanitation and hygiene in production.

- *Food Processing Fact Sheets.* Minnesota Technical Assistance Program, University of Minnesota. http://wrrc.p2pays.org/indsectinfo.asp?INDSECT=50.

  Although this site gives examples of cleaner production strategies undertaken by some Minnesota food processors, it is relevant to developing country producers. Links to the following fact sheets:

- *Composting and Landspreading Food Processing By-Products.* http://www.mntap.umn.edu/food/78-CompLand.htm. A good discussion of how to compost commercial food processing wastes quickly through landspreading methods.

- *Dairy Waste Reduction Tips.* http://www.mntap.umn.edu/POTW/Dairywaste.htm. A discussion of what some Minnesota dairy companies are doing to reduce wastewater and product losses. Includes 10 water conservation strategies.

- *Feeding Food By-Products to Livestock.* http://www.p2pays.org/ref/02/01247_files/fs77-r.htm. This fact sheet explains the conditions under which non-meat uncooked food by-products can be used as animal feed.

- *"Fruit and Vegetable Processing" in Pollution Prevention Abatement Handbook* (1998). World Bank. http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_fruitveg_WB/$FILE/fruitandvg_PPAH.pdf.

  General guidelines on reducing pollution, noise and effluent, with specific recommendations on the recirculation of water in production, dry cleanup, and reuse of organic wastes. Also includes technical information on requirements affecting effluent and acceptable levels of waste for specific items.

- *A Guide to Cleaner Production in the Food Industry.* The United Nations Environmental Program (UNEP) Working Group Centre for Cleaner Production in the Food Industry. http://www.cleanerproduction.com/Directory/sectors/subsectors/FoodProc.html.

- *Information Resources on Industrial Pollution Prevention* (2000). United States Agency for International Development (USAID).

  Contains guides, case studies, and articles focused on pollution prevention in food processing and other sectors.

- *International Cleaner Production Information Clearinghouse* (1999). CD Version 1.0. United Nations Environment Program, Division of Technology, Industry and Economics (UNEP-TIE)

  Contains case studies, country profiles, and cleaner production strategies for food processing.