Environmental Guidelines for Small-Scale Activities in Africa (EGSSAA)
Chapter 4.1: Brick and Tile Production: 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 brick and tile production, 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.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 making; and wet textile operations.

This EGSSAA Chapter was prepared by The Cadmus Group, Inc. for International Resources Group, Ltd. (IRG) under USAID Africa Bureau's Environmental Compliance and Management Support (ENCAP) Program, Contract Number EPP-I-00-03-00013-00, Task Order No. 11. Its contents are the sole responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government.
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. Cleaner production methods may include:

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

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 CP through more efficient use of inputs and machinery, higher-quality goods that 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 CP methods may reap 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

Several key environmental issues associated with brick and tile production are listed in the box at left and discussed below. For each 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.

**Inefficient use of fuel**

Traditional brick and tile production requires a great deal of fuel during firing. Inefficient production technologies and techniques and excessive fuel consumption are typical. High fuel use increases air pollution, worsening respiratory illnesses. It also increases deforestation and associated environmental impacts, leaving less wood for future use. Reducing consumption reduces costs, conserves resources and lowers pollution levels.

**Key questions to consider:**

- What type of fuel is used in production? Where does it come from?
- What other types of fuel are available?
- Are there leaks or openings in the kiln structure?
- How close are settlements to the (proposed) kiln site?
- How much exposure to smoke and ash do workers have?
- How much bending and lifting do workers do?

**Selected Mitigation Strategies:**

- Use alternative fuel types. Organic wastes such as rice husks or sugar bagasse can supplement scarce fuel sources, such as wood, without sacrificing efficiency.

- Raise kiln temperature using improved firing techniques. Adding combustible material around the bricks or between clamps can increase temperatures and lower traditional fuel needs.

- Maintain kiln structure and repair cracks or leaks. Even small leaks can substantially increase fuel costs over time. Monitor structure and machinery to identify potential leaks.

- If traditional brick-making technology is used (brick clamps), ensure adequate insulation of the clamp and orient it at a 90° angle to prevailing wind direction to reduce underfiring or overfiring of bricks. See

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**Important Environmental Issues Addressed by This Fact Sheet**

- Inefficient use of fuel
- Resource extraction and depletion
- Inefficient use of non-fuel inputs
- Dust
- Chemical pollution
• Increase efficiency and reduce emissions by using kiln structures that require less fuel. Ventilated-shaft brick kilns (VSBKs) or bull trench kilns (BTKs) are effective in reducing smoke and lowering the amount of fuel required for firing.

• Install filters in chimneys. One small-scale brick producer used broken brick pieces to absorb carbon dioxide (CO$_2$) and reduced emissions substantially.\(^2\)

• Prepare a safety and health plan to minimize adverse respiratory effects and physical stress on kiln workers.

**Resource extraction and depletion**

Brick and tile production can alter the landscape in ways that are harmful to the environment and may hamper future business plans. Production can deplete local sources of fuelwood, eventually raising the cost of labor for acquiring fuel. It can also create clay pits or “borrow” areas, which, if improperly managed, can become safety hazards. They may also accumulate rainwater and become habitat for mosquitoes. These effects, with associated soil erosion, may make land unusable for farming. For all these reasons, landowners or communities may resist further expansion.

**Key questions to consider:**

• How is the landscape expected to change (from tree-cutting, borrow pits, etc.) over the course of production?

**Selected mitigation strategies:**

• Consider planting fast-growing tree species that can be coppiced easily, such as *Leucaena* or *Albizia*, to maintain a source of fuel. Tree planting also helps to prevent soil erosion, reduce siltation of water bodies and maintain soil fertility. If trees are planted, make sure it is clear who owns them to encourage better long-term management.

Return land to a usable state. Set topsoil aside before removing clay and replace it after production ends. If topsoil has been lost or dispersed, fill the borrow pit with soil to avoid creating pools of water that attract mosquitoes.

**Inefficient use of non-fuel inputs**

Inefficient production techniques reduce productivity and create excessive waste. Improper brick and tile formation and low-quality inputs result in a high number of bricks or tiles that crack or break during firing and must be

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\(^2\) For more information, see “Remediation of Airborne Polyaromatic Hydrocarbons (PAHs)” in the reference section of this document.
discarded. This decreases output and increases waste disposal costs. Brick or tile wastes require significant amounts of space, leaving less land available for other uses. Better use of technology and training will increase productivity and efficiency while reducing costs and waste.

**Key questions to consider:**

- What kind of machinery is used in the production process?
- What kinds of raw materials are used in production and how are they identified?
- What quality control processes are used to evaluate raw materials?
- What waste will be left after production is finished?

**Selected mitigation strategies:**

- If little or no machinery is used, consider low-cost technology improvements. Decrease losses during firing by improving brick preparation: use an extruder to process clay, or form bricks with manual presses.
- Improve input quality. Bricks that crack during firing may have too much organic material in them or too much topsoil mixed in with clay. Train workers and monitor quality regularly.
- Consolidate or remove brick and tile waste once production ends. This waste may be scattered over a large area and make it hard to farm the land in the future. Investigate possible uses of broken or burnt brick for construction and other processes.

**Dust**

Dust, a byproduct of brick and tile production, may cause serious health problems. Dust is most prevalent and most dangerous when clay is extracted and when finished bricks are transported following the firing process. Inhaling rock dust can lead to silicosis, a disease that affects lungs and breathing. Silicosis lowers the productivity of workers and can have long-term and even fatal effects on the health of workers, owners and people who live close by (including the families of workers and owners).

**Key questions to consider:**

- When is dust most prevalent in the production process?
- What safety measures are available to workers?

**Selected mitigation strategies:**
• Provide workers with face masks and instruct them to use masks in high-dust operations.

• Dampen bricks and tiles to keep dust down. In particular, if bricks or tiles are made and then broken for use in construction, make sure to dampen them first. However, try not to use excessive water.

Chemical pollution

Adding pigment to bricks or glazing roofing tiles produces chemical wastes that could harm workers, pollute the air and contaminate water supplies. Glazing and enameling require materials that contain acids or metals, and improper handling or excessive contact can lead to metal poisoning, skin irritations or lung disease. Unhealthy workers can lower productivity, miss work too often and contribute to costly mistakes. Poor housekeeping practices can waste materials, raising input costs.

Key questions to consider:

• What types of glaze or enamels are used in production?

• What safety and housekeeping measures do workers practice?

• Are chemical wastes disposed of away from water sources?

Selected mitigation strategies:

• If possible, use water-based acrylic glazes to minimize environmental problems.

• Improve storage practices. Close containers containing glazing or enameling material to prevent loss of the material through evaporation, spoilage or spills, and to minimize workers’ exposure to fumes.

• Require workers to wear masks when they are using glazing or enameling chemicals.

• Require workers to wash their hands after working with glazes. Many glazes have traces of metal that can cause metal poisoning when ingested. Provide gloves made of rubber, vinyl or other impermeable materials for workers who are handling glazes and glazed material.

• Ventilate kilns after firing. Dangerous gases and fumes escape during the firing process and can sicken workers removing bricks or tile.

• Prevent water contamination. Apply glazes away from water sources and dispose of chemical wastes properly. Do not clean spilled glazes with water. Sprinkle them with absorbent material such as straw, clay or dirt, and sweep up the spill into a separate container. To prevent metals from leaching out of the glazes into water supply, they should be disposed of safely (for example, in clay- or concrete-lined pits). Check
with an environmental expert to confirm the chosen disposal method is safe for the chemicals used.
References and Resources


  This case study discusses the development of technology for improving polluting emissions among small-scale brickmakers in Mexico.


  Direct links to online guides for cleaner production in clay brick making.


  A series of technical briefs dealing with the drying of clay for brick- and tile making, the preparation of clay, and the molding and firing of clay bricks and tiles. The brief describes basic drying processes, different drying methods, surface treatment, drying tests, choice of drying methods, economics and flexibility. A table explains drying faults, their causes and remedies.


  This report discusses improvements in the brick, tile and lime industry in Indonesia. Particular attention is paid to better ways to prepare clay and keep tiles from breaking in the kiln.


  A general discussion of improving energy efficiency in the brick industry. This is not a very technical document but includes useful starting strategies for dealing with energy issues.


  A comprehensive description of brick production and alternative technologies that improve production. Specific reference to kiln types and different methods of input extraction.

This report analyzes technical and economically feasible means for improving energy efficiency in brick and tile production in Uganda. Specific discussion of fuelwood conservation.

Other Resources

  
  Description of the Bull's Trench Brick Kiln technology. Discusses advantages and disadvantages of the technology, with specific reference to lowering fuel use and improving productivity. Includes diagrams and figures.

  
  This report covers the broader ceramics industry, including pottery, but contains a useful detailed discussion of how to improve energy efficiency in kilns.

  
  This is a larger document on environmental assessment of microenterprises, but includes a case study of brickmakers in Zimbabwe.