

FOOD PROCESSING

1. Food processing projects involve the processing and packaging of meat and meat products, fish and shellfish, dairy products, fruits and vegetables, and grains. Food processing may include refinement, preservation, product improvement, storage and handling, packaging or canning.
2. The objective of this industry is to enhance food and extend the shelf life of raw materials using various methods of conservation. In WAEMU, there are three (3) types of major changes in agricultural products for food:
 - Small-scale processing is the oldest and is practiced in all sectors of the African food industry.
 - Semi-industrial processing, straddling the artisanal and industrial, with the use of more sophisticated means of transformation (semi-mechanized machine for the most important operations of the manufacturing process). Labor used is low skilled, the transformation processes are operated with an average level of technology. Production is steady and generally suited to a wider market (proximity, city, region, and nation).
 - Modern/industrial processing, which is distinct from a high technological level (string fully mechanized and automated processing), a skilled, very significant investments work and greater production capacity, a modern distribution system and products of superior quality.
3. The food industry is certainly a vital sector for agricultural development and food security, but leaves an imprint on the environment, because it uses

water, energy and raw materials and produce wastes or effluents that are found in the natural environment. The West African Development Bank in its policy of funding for food industry projects also ensures to minimize the impact of this sector on the environment and human health.

Potential impacts on the environment

4. These plants generate large volumes of wastewater and solid waste can also cause air pollution. The wastewater comes mainly from leaks, spills and rinsing equipment. The washing fruits and vegetables, which are to rid the earth of pesticides and their skin, also generate large amounts of waste water.

The industry uses a lot of the sorting method for removing solid waste. The latter, with a market value are generally recovered and converted into animal feed. If air emissions are not a problem, against the exhalation odor is an issue.

5. Screening is extensively employed in the industry to remove solids. The recovered solids have market value and are normally processed for animal feed. Although air emission is not a problem, odor problems can be significant. (See Table at the end of this section for further discussion.): impacts of the pipeline processing of dairy products. The dairy industry manufacture some types of dairy products , among others , pasteurized milk , condensed milk, evaporated milk , butter, cheese , ice cream , whey and fermented products. While some dairy facilities can manufacture several products, others cannot make one or two.

Impacts of the pipeline processing of dairy products

6. The dairy industry generally uses equipment and following manufacturing processes:
 - reception areas and storage of raw materials, equipment and transfer large refrigerated storage rooms ;
 - clarification processes which removes suspended particles and separation for skimming milk operations generally performed by specific patterns of large centrifugal ;
 - processes churning, homogenization , fermentation and dehydration necessary for the production of butter , ice cream , cheese , buttermilk , etc. .;
 - Packaging and storage prior to transport operations.

7. The wash water and rinse by-products not recovered, products damaged or advanced particles and training of water droplets from the evaporators belong to the main waste and wastewater engendered processing industry milk.

8. Operations receiving and storage of raw materials is not a major source of waste as long as they are carried out according to the standard and maintenance conditions acceptable. Solid waste is a minor problem that can be discharged into a landfill.

9. Wastes emitted by all dairy industries are characterized by marked changes in the amounts of biochemical oxygen demand (DBO₅), temperature and PH. In a dairy, milk, dairy products and other edible products contribute nearly 94 percent. 100 of biochemical oxygen demand (DBO). The disposal of waste generated by the production of whey is compared with other wastes, the most difficult problem to solve.

The most common methods involve the use in animal feed, in the sprinkler in the discharge into municipal systems, to concentrate or dehydrate.

10. Major accident risks faced by the staff of a dairy industry come from bottles bursting of projected glass and fall due to slippery floors. Among the most common diseases to which it is exposed, there are livestock diseases such as brucellosis, bovine tuberculosis, anthrax, etc... Employees are also at risk of occupational dermatitis cheese makers.

Impacts of Industries of fruit and vegetables

11. Canning and preservation of raw materials means extend their shelf life. These methods include methods for canning, freezing, dehydration and placing in brine. The conservation of fruits and vegetables usually involves cleaning, sorting, peeling calibration operations and stabilization and transformation processes. Fruits and vegetables, before be machined, are washed and rinsed with large quantities of water and detergents sometimes. The washed products are then sorted and calibrated using mechanical or hydraulic means and methods manual and optical sometimes. It separates mature products using a brined solution of controlled density. Once the triage operation completed, products are then mechanically trimmed and peeled.

12. Many fruits and vegetables are peeled to remove the residual Earth, pesticides and thick, ruffled or leathery skins. This process can be done in a way mechanical, thermal or chemical. Coring operations dump, cutting into slices or cubes are performed mechanically without water. Some fruits are mashed and squeezed to get juices. Vegetables, on the other hand, are laundered and canned. Finally, and according to the type of

operation, certain products are dried or dehydrated, others are cooked or freeze-dried any fruits and vegetables are eluted.

13. Fruit and vegetable processing plants are large consumers of water and from large generators of waste. Washing and rinsing operations, yard, transport on the premises, as well as processes which consist to peel, bleach, canned, mixing, baking products, in the same way as the clean-up activities generate significant amounts of wastewater and solid waste. If the emissions are insignificant, fragrant fumes can, in some cases, be non-negligible.
14. The main parameters which must be considered in wastewater are the BOD₅, the MES and PH. While it is true that fecal coli forms may be a problem, good maintenance practices and the constant maintenance of hygiene conditions satisfactory to remedy. It is essential, due to large variations in flow and concentration (BOD₅) of wastewater treatment facilities are designed so that they can cope temporarily with huge volumes of wastewater. Waste to which citrus fruits give birth contain pectin which impede the precipitation of suspended solids
15. Serious accidents that occur in the canning of fruits and vegetables are due to the lifting of weight, burns from steam, acids and alkalis as well as cuts caused by glass shards and sharp metals. Dermatitis or other skin inflammation is the main problem encountered health due to exposure to chemicals and handling of fruit and vegetables. In some factories, excessive noise, oppressive temperatures and high humidity can also cause health problems.

Meat industry

16. The meat industry is the purchase of carcasses, cuts of meat and other products. It manufactures sausages and casings of sausages, performs cooking, salting, smoking, and canning of meat, preparing cuts of meat, fresh or frozen. These operations may be carried out separately or in conjunction with the Packers.
17. The plant receives carcasses are thawing by dry or wet, or one axe. In contrast to the method of defrosting dry, wet method has large volumes of wastewater. The hash requires equipment to manipulate frozen meat. A factory type can have one or the following:
- Cut meat to prepare standardized products for hotels, restaurants, institutions, fast food shops, etc..
 - curing ham in brine solutions followed by operations of cooking, smoking, cooling, slice and packaging;
 - Production of sausages and meat which manufacture blocks requires an important method for reduction, mixing and formatting of the finished product;
 - Canned hams, pasta and food for animals.
18. Meat processing is a process whose day-to-day operations are intermittent. As a general rule, factories stop daily work to carry out a thorough cleaning. This industry produces large volumes of wastewater varying quantities of suspended solids. Solid waste mainly from sorting and maintenance operations are generally recovered and sent to treatment plants. If the gaseous emissions are low, the fragrant emanations are a problem. They are formed from the cooking materials and animal residues as well as the decomposition of organic substances.

19. The essential parameters for the meat processing industry to consider are the DBO₅, the MES, oils and fats, pH and fecal coliforms. Phosphorus and ammonia can also represent a problem. Among the methods that come to be described, putting canned meat and ham are the two biggest causes of flows of wastewater, DBO₅, of MES and oils and fats, but less important operations.

20. It is possible to reduce to desired levels loads of waste discharged by the meat industry by using an effective water management, on-site waste checks, changing processing and wastewater-treatment systems using. The main risk of accidents encountered in this industry are caused by slippery floors, Burns, cuts and scratches caused by sharp metal, shards of glass and cutting machines. The chemicals are at the source of the major health problems such as dermatitis or skin infections. Diseases transmitted by animals, anthrax, actinomycosis, erysipeloid and tuberculosis from cattle, also represent a potential source of danger to health. With respect to noise levels, heat and humidity, they are no less problems for the health of the staff.

The fish and shellfish industry

21. Industry canning and the conservation of fish and seafood products gradually transformed from the methods of drying and smoking techniques of conservation, canning, freezing and processing of fishery products. The length of the season in this industry varies according to the period of fishing and the quantities of industrialized products.

22. Processing of this industry include the capture of fish, their availability and storage, evisceration, pre-cooking, sorting, or cleaning activities, conservation and packaging. Once captured fish are unloaded from ships,

weighed and transported to the processing area to be immediately machined or stored in cold rooms. There are modes of operation where is done at sea to the removal of the heads of shrimp, the evisceration of fish and emptying of crustaceans. Waste are preserved in dried form or even obtained by filtering wastewater to be subsequently converted into byproduct.

23. Depending on the destination of the final product, may that fish and seafood products are packaged for immediate consumption or cooked to make peeling and cleaning operations where skin, bones, shells, gills, etc. will be removed. The peeling operation can succeed those freezing, canning, pasteurization and refrigeration.
24. The quantities of water used and waste generated vary greatly from one factory to another. In general, the waste produced by this industry contain DBO5, of DCO, of MES, oils and fats and may have more or less high levels of PH. These waste waters contain often not toxic or hazardous substances. Sometimes, on the other hand, waters with high concentrations of sodium chloride are discharged.
25. The gas emissions that emerges a factory operating normally represent no particular problem. On the other hand, solid waste that is not recovered could be a problem for treatment and evacuation. Fortunately, most recent installations have means of filtering or collecting dry to recover most of the solid waste. They are then processed into fishmeal, soluble protein concentrates, liquid, granular fertilizer to the supply of fish, animal feed, etc.

26. Major accidents incurred in the industry of canning of fish are due to the uprising of weight, the handling and the fall of materials. Falls caused by slippery floors as well as burns and cuts caused by machinery and sharp objects are part of secondary causes. Major health problems come in the form of due warts viruses and viscous humors that cover the fish and are caused by the chemicals responsible for dermatitis or other skin infections.

Issues related to natural resources

Water Quality

27. The food industry uses large quantities of water and most of the uses are employed for washing and rinsing, the transport of the products in the plant and cleaning activities.

28. It has been common in the industry of fruits and vegetables, for example, to use water as a means of transportation of raw materials inside the factory and to consider such use as being both economic and hygienic. It remains no less, however, than the leaching of soluble elements present in the products (e.g. sugars and acids from cut fruits and sugars and starch issued by cut vegetables) has led to other means of transport of fluids, such as osmotic pressure systems. There, moreover, that efficient washing after harvest is necessary due to pesticides or other pollutants to which it has recourse and mechanical techniques for the crops where the remains of Earth are maintained on the fruits and vegetables.

29. The dairy industry, meat, fish and shellfish also uses large volumes of freshwater used to processing activities as well as cleaning equipment and

processing areas. The water serves also as a solvent for products and is a way of cooking and cleaning. For all these reasons, it is essential that food facilities are located in places where the quality and adequate quantities of water are available.

30. The wastewaters generated by the food industry vary depending on the type and size of the processing operations. In General, the effluents contain significant BOD₅, DCO, rates high of oils and fats, coliforms and suspended solids and dissolved. These effluents may, moreover, contain pollutants such as pesticide residues, complex oils, compounds of alkali or acid, as well as other organic constituents. The guidelines for the environment, health and safety of the BOAD offer standards of safety for employees and ensure the quality of effluents from food industries.

31. Accidental spills of no treated wastewater and chemicals processing, even that insufficient control of surface runoff or non-point sources, can heavily affect the water resources of the region. If chemicals are used, should be put in place procedures for handling and storage, as well as measures for spill control in order to reduce the risk of accidents that may damage the environment.

Air quality

32. If atmospheric emissions from food industries are minor, they can, however, contain particles, sulphur oxides, nitrogen, hydrocarbons or other organic compounds. The nauseating odors of food industries represent a major problem... Industries must comply with the standards of the air quality with

respect to particulate matter, oxides of sulphur and for a number of organic compounds in each country.

Use of land

33. The location of food plants may affect land resources if it leads to the development of land of ecological, agricultural or economic importance. Land resources could also be compromised by waste disposal on-site. It is important to acquire enough land to implement according to a logical schema and without constraint, processing and storage facilities.

34. Local regulations, if they exist, should be applied. It should, moreover, a review of measures to reduce the risk of pollution by solid waste and to integrate them into the development plan ("Collection and disposal of solid waste" section gives more information on this subject.)

Socio-cultural issues

35. Processing plants and food production well designed and operating properly, provide local employment and opportunities for local products with minimal environmental impact possibilities. On the other hand, poor design and inadequate implementation process may have adverse effects on local cultural resources, cause discomfort and health problems from hazardous and noxious emissions, lower property values and degrade air resources, land and water. The damage done to the environment may limit the potential for further development.

36. There should be an assessment of the proposed site is performed during the evaluation of the project (phase feasibility study) taking into account the

factors just mentioned , access to social services, the availability of skilled labor and the tertiary sector. It would be important, moreover, to make the assessment of noise and odor emissions from processing facilities to the extent that they may affect the health of employees and affect local communities.

Specific issues

Environmental Law and Land Use

37. The choice of a location is an extremely complex and lengthy process that involves developers, special interest groups, politicians and local and national authorities. The time and costs involved in obtaining an establishment of a food industry permits should be taken into account when establishing the schedule and cost of the entire project. All WAEMU countries are increasingly experienced in locating an industry and have the regulations for the environment and land use. It is therefore essential to consider the operation of the plant in the choice of its location.

Use of solid waste and residues

38. Most solid wastes generated by food industry consist of products of meat, fruit residues and vegetable waste and by-products of fish. Products derived from meat and fish representing a suspected outbreak of disease vectors (rats, insects, etc...) should not be dumped in a landfill. These materials are valuable resources that should be recovered. The by-products of the meat should be collected and sent to a processing plant to turn them into lard, tallow, oil, protein substances, bone meal, etc... Regarding the fruit peels and cores and crushed fruits of lower quality, they can use in the manufacture of juice or vinegar. Citrus peels can be

processed to extract the essences. Peelings potatoes may be treated to extract the raw starch. Some waste can be used in livestock feed, processed into compost or dumped in a landfill.

39. Solid waste processing operations of small seafood are usually discharged into water courses nearby facilities. Should avoid this practice if it is important facilities, if they are not adjacent to large bodies of water or the force of the current does not allow spoofing the waste to the sea in such cases, the solids will settle and decompose, creating an anaerobic phenomenon that can lead to harmful fumes noxious odors for people. It is possible to recover the solid waste from the processing of fish-derived products that can be used in the production of fishmeal, soluble protein concentrates, oils, liquid fertilizer pellets for fish and other products restored.

Technical requirements for manufacturing processes

40. It would be important that food plants implement the technical requirements to reduce the risk of poor preparation of foodstuffs that may cause food poisoning (e.g. botulism). These requirements should combine the following aspects:

- improving controls and management measures to reduce waste, to maintain equipment and to develop techniques of recovery of waste;
- develop the engineering and processing equipment to increase the efficiency of production and reduce the burden of waste; and
- improving hygiene conditions so as to eliminate the risk of bacterial contamination, according to the cooking time, using appropriate equipment and following the rules of cleaning.

Alternatives to projects

41. Even though there are various ways to design and implement a project, the technologies and materials available as well as opportunities for manufactured products offered restrict the type of treatment facilities food and manufactured goods. The solutions listed below provide a framework that could be used in the preparation and review of the environmental assessment, the estimation of specific projects and would help the team responsible for developing the project.

The choice of a location

42. The choice of a location for the establishment of a food industry and manufacturing facilities is dependent on a number of economic, ecological and socio-political factors. The ideal situation for the environment, regardless of the product treated or manufactured, is one that meets the following criteria:

- availability of spaces for the development program and extensive storage facilities for raw materials, processing, manufacturing and waste disposal;
- minimum movement of persons and measures of compensation for travel and housing.
- few conflicts with the more profitable uses of land, such as agriculture, especially when it comes to marginal lands, there where land good for agriculture are much sought after.
- close proximity to an outlet capable of receiving the discharges of effluent without causing serious damage to the biophysical environment and aquatic...
- ease of access to physical and social infrastructure: qualified personnel, service logistics, means of transportation, energy, raw materials and market opportunities for potential products;

- reasonable distance tourist areas and recreation areas, areas of homes and offices so as to mitigate the effects caused by odours, noises and other pollutants; and finally,
- minimum impact construction and production activities on the species rare, threatened or endangered and their habitats.
- reforestation to mitigate air pollution due to the discharge of CO₂ by industry

Raw materials supply

43. It is essential that the raw materials used in processing and the production of foodstuffs are environmentally sound and delivered with all necessary hygienic precautions and the least possible on other areas, habitats and resources. It should, for example, do not capture the seafood in areas where fish populations are disrupted or in places where the catches are likely to be contaminated. In the same way, which could be contaminated by pesticides or other chemicals or products which were not the subject of an adequate storage should not be processed for human consumption. Industries must promote the rational use of pesticides.

Operationalization of the plant

44. The food industry uses various manufacturing processes. The product type and size of operation determine the type of equipment required, the nature and quantities of waste products, which in turn dictate the pollution control equipment. It is impossible to specify the type of facilities required for all possible food products industries; treatment measures generally used however include:

(a) To fight against water pollution:

- activated sludge treatment

- aerated lagoon
- filtration
- sedimentation, flocculation, neutralization, clarification
- sprinkler irrigation
- filtration percolation
- stabilization lagoon
- oxidation
- stripping the ammonia
- ion exchange
- carbon adsorption
- electro dialysis

(b) To fight against air pollution:

- electrostatic precipitators and bag filters
- Active carbon filtration
- scrubbers sodium hypochlorite (for odor)

Management and Training

45. The need for good management and appropriate training is more important than processing techniques are becoming increasingly sophisticated. The development of technical capacities of industry personnel and representatives of the governments of countries allowing them to exercise monitoring measures to reduce pollution continues to grow in importance. The number of national consultants whose qualifications can prepare detailed environmental assessments is insufficient and many of them are academics who lack experience in projects in the industrial sector.

46. It is essential that the government as well as the industry acquire the skills to select contractors and consultants involved in the evaluation of environmental impacts which are able to provide competent and effective services cost during the phases of planning, design, construction, commissioning operation and maintenance of the project and related facilities. Sometimes consultants retired, having established a reputation in one or other of the areas of assessment, may, as independent consultants, provide assistance to governments and industries and to ensure that the components of training on environmental protection are optimized in development projects.

47. To improve the quality of projects with environmental management methods, several types of institution building activities can be considered:

- Training of government staff in the field of impact assessments on the environment, in the analysis and interpretation of data on pollution and the implementation of laws, regulations and standards.
- Training of employees in the industry to raise awareness and make them able to judge government regulations, data on pollution, possible treatment options and operational data.
- Training of local independent specialists of the government or the industry to be able to provide consulting services or an independent review of impact assessments on the environment and measures to reduce pollution.

48. The technical details of the framework should provide consultants the possibility of some flexibility to shape the training component from the skills of local trainers and experience level in force in a country or region.

49. Strategies for effective measures against pollution and waste reduction require institutional support. The plant staff should receive training to enable

them to keep abreast of technology fight against air pollution and water and become familiar with the equipment used in the plant. The manufacturers and suppliers of means of pollution control ensure, often training on how to operate and maintain the equipment. It is also recommended to provide on-site training program, to explain the procedures relating to health and safety within the plant and maintenance practices that respect the environment.

50. If local regulations do not exist, it would be that employees receive training informing them of "codes of practice" approach to occupational health and safety. This program should emphasize the need to handle and process food in accordance with rules of hygiene and sterile conditions in order to minimize the transmission of diseases. Information on the risks posed by the use of chemicals and manufacturing equipment should also be part of the training program.

51. It may, moreover, that the staff of local or national environmental agencies also needs to have training programs should cover, on the one hand, the risks to the environment and human health posed by food industries and secondly, measures to mitigate them. Those responsible for the regulation should also receive training in collecting and evaluating data on the environment and health as well as the control of safety conditions.

Monitoring

Monitoring of the plant to its start-up and during operation

52. The control of pollution caused by food industry projects requires, as a general rule, monitoring air quality, liquid effluent and solid waste. The development and implementation of an environmental monitoring plan

brings specific ways to determine if the project or one of its components comply with standards and practices for the environmental regulations.

53. The monitoring plan should state on the one hand, the institutional and administrative capacity, and secondly, to provide program oversight and monitoring of environmental components (measures to reduce pollution, for example) to a project. It may, moreover, we should make use of monitoring data for the environmental specialists from other countries or locally occur at critical moments of the project. One could, for example, set up workshops that would analyze the data environment monitoring, clarify the objectives of the project and develop guidelines for more appropriate management.

54. The following aspects are part of initiatives that should be included in a program of monitoring food plants:

- Monitoring of waste streams and emissions based on the selected parameters.

Corrective actions if specific releases routinely exceed the national limit emissions or the standards set by the industry measures.

- Alteration, improvement of processes or equipment modification and maintenance practices can be part of the corrective action.
- Monitoring the quality of the receiving water and air quality in the direction of prevailing winds.
- Monitoring of the effects caused by the methods of solid waste disposal on land, groundwater and surface water and groundwater.
- Implementation of awareness programs to promote respect for the environment among employees.
- Periodic review of technologies in order to adopt, to the extent possible, means of reducing pollution that are both more efficient and more profitable.

- Encouragement of the plant management and engineers to consider the impact that the plant may have on the environment.
- Establishing and maintaining a system of odor control to be considered in conjunction with the leaders and communities.
- Implementation plans for health and safety and regular site inspections to ensure that protocols for training and protective equipment workers are in use in the workplace.
- Compliance with industry codes of practice.
- The documentation and statistics should correspond to periodic review and adjustment of business activities.

55. Simultaneous strengthening of the capacity of the plant and the Government to monitor the implementation of laws and regulations is a major factor in the reduction of pollution. Similarly, it is essential that the technical capacity complies with the standards governing the discharge of effluent. If we want to ensure the success of a follow-up program, it may be necessary to provide equipment for sampling and laboratory (analytical laboratory) protocols to the host country and to provide for the needs of training from the conception of the project.