European Bank
for Reconstruction and Development

Sub-sectoral Environmental and Social Guidelines: Dairy Processing

PROCESS DESCRIPTION

Dairy processing covers the conversion of raw milk into safe products for human consumption. This guideline includes reception, storage, and industrial processing of raw milk and the handling and storage of processed milk and dairy products. Products include pasteurised and ultra high temperature processing (UHT) milk, liquid milk butter, condensed whey, cottage cheese, ice cream, condensed milk, milk powder, whey powder, fluid and cultured products, natural and processed cheese. Dairy processing plants can be divided into two main types:

- Fluid milk processing involving the pasteurisation and processing of raw milk into liquid milk, cream, flavoured milk, and a second process producing cultured products such as yoghurt.
- Pasteurisation and processing of raw milk into value-added products such as cheese and casein, butter, milk powder and condensed milk, whey powder and ice cream. The figure below summarises the principal aspects of dairy processing.

A recent trend has been for those plants producing long life products such as cheese, UHT and milk powders to be located close to the raw milk supply and those plants producing products with short shelf life such as milk, cream, yoghurt and soft cheeses to be situated close to consumer markets, on the edge of urban centres. There has also been a trend towards rationalisation with larger processing specialising in a limited range of products enabling the use of more automated and efficient equipment operated by fewer people.

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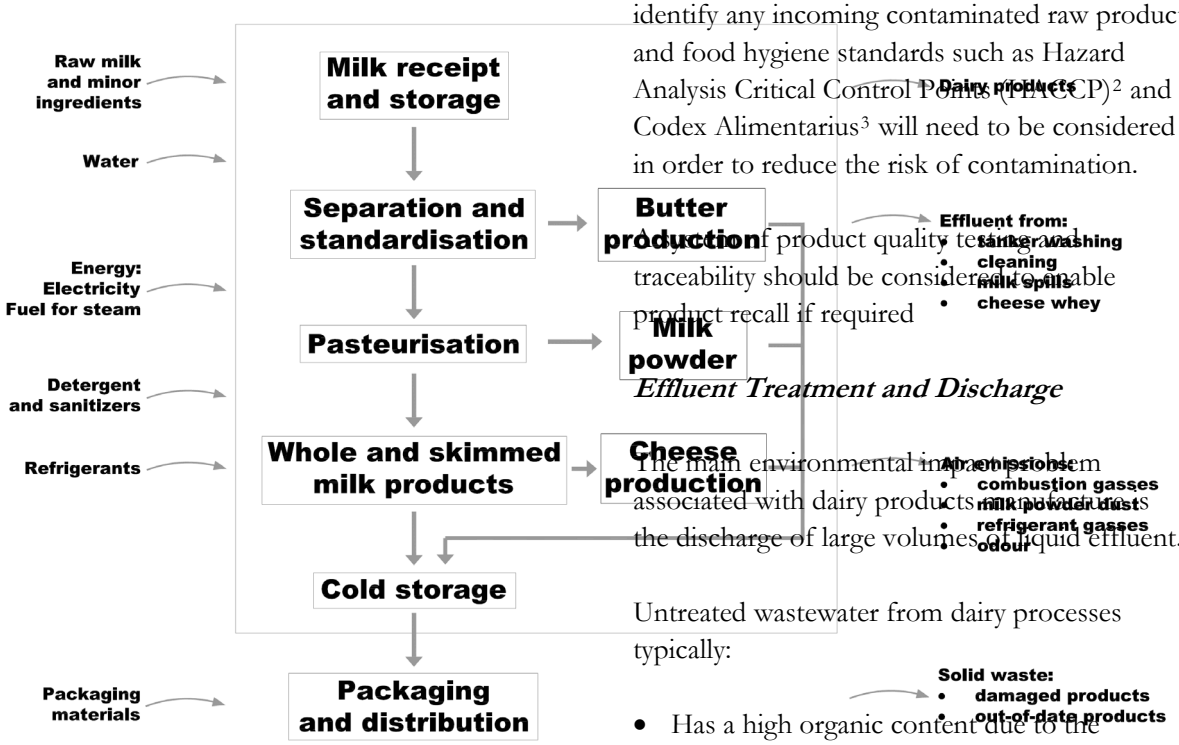

Figure 1: Dairy Processing (Adapted from UNEP (2000))

KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Product Contamination

Dairy products can become contaminated as a result of contamination of the vegetable matter consumed by the grazing species (e.g. radioactive isotopes, dioxins, and other fat soluble pesticides) through a process known as bio-accumulation[1] and during processing, packaging and transport. Screening of raw materials will identify any incoming contaminated raw product and food hygiene standards such as Hazard Analysis Critical Control Points (HACCP)[2] and Codex Alimentarius[3] will need to be considered in order to reduce the risk of contamination.

Analysis of product quality testing and traceability should be considered to enable product recall if required

Effluent Treatment and Discharge

The main environmental impact/problem associated with dairy products manufacture is the discharge of large volumes of liquid effluent.

Untreated wastewater from dairy processes typically:

- Has a high organic content due to the presence of milk solids, and in some instances whey, a by-product of dairy production, which depletes oxygen levels and reduces water quality. Such discharges can cause pollution of water courses and damage to wildlife;
- May contain salts from cheese making activities, acids, alkalis and detergents, disinfectants, including chlorine compounds, hydrogen peroxide and bleach;
- May contain pathogenic viruses and bacteria;
- May cause fluctuations in temperature in the receiving waters causing harm to wildlife.

Typically, authorities require treatment of such wastewater before it is allowed to enter natural watercourses. For plants located near urban areas, the effluent is either treated at the plant or

[1] Bioaccumulation occurs when an animal absorbs a toxic substance at a rate greater than that at which the substance is lost (excreted). The toxin can then become increasingly concentrated in the organism or in the food chain over time.

[2] ISO 2005

[3] FAO and WHO (1962–2009).

discharged to municipal waste water treatment systems. In rural areas the effluent may be irrigated to land and inappropriate application adversely affect the environment. In addition, contaminants in the effluent may impact groundwater quality.

Large dairy facilities are likely to have been issued with a permit from the local regulatory authority, which specifies limits for various contaminants. These permits may apply to effluent discharges to sewer and to surface water.

Water Supply

Large volumes of water are needed for cleaning process equipment and work areas to maintain hygiene standards, for cooling and for production purposes. The amount of effluent generated is closely related to the volume of water consumed for these processes.

Where water abstraction takes place it is typical for abstraction or water use permits to detail volumes of water abstraction allowed as over abstraction can impact local communities. Where ever changes take place in product volumes this should be reflected in the permit.

Energy Consumption

Dairy plants consume large quantities of energy (gas, electric or diesel) for running electric motors on process equipment, for heating, evaporating and drying, for cooling and refrigeration and for the generation of compressed air. Approximately 80% of the energy demand is to generate hot water and steam for process applications and is met by the combustion of fossil fuel (oil, gas, etc)[4].

Energy usage has a direct correlation to the operating costs of the company and energy generation and consumption may be regulated or taxes/levies applied to reduce energy use and associated emissions of gases such as carbon dioxide. Investment in technology may be required where targets have been set by regulators to reduce energy or carbon emissions.

Solid Wastes

Solid wastes arise from:

- Non-conforming products and product losses;
- Sludge from wastewater treatment;
- Filter residues and some packaging wastes.

Dairy products are packaged in a wide range of materials ranging from plastic-lined paperboard cartons, plastic bottles, glass bottles, foil, wax, plastic film and cans. Solid waste will arise from the packaging process in the form of discarded packaging offcuts and improperly packaged dairy products. The products themselves can often be returned for reprocessing but the packaging is generally consigned as waste.

Solid wastes should be stored in adequate containers and segregated to encourage recycling. Solid wastes will need to be disposed of regularly to avoid odour, litter, fly and rodent problems.

Packaging

Companies operating within the European Union (either as a manufacturer or as a supplier into European Union countries) will be subject to the European Union Packaging & Packaging Waste Directive (94/62/EC), which aims to

[4] IFC 2007

reduce the amount of packaging that is being introduced into the waste streams.

Emissions to Air

- The pasteurisation/sterilisation process requires significant heat generation capacity. Many large dairy facilities have on-site boilers to meet these high temperature requirements. The exhaust gas emissions from the boilers will be dependent on the fuel used (coal, oil or gas).

- Fine milk powder residues from the exhausts of spray drying and bagging equipment can be deposited on surrounding surfaces. The presence of hot air and fine dust creates fire and explosion impacts. When wet these deposits become acidic and can cause corrosion in extreme cases.

Slips, Trips and Falls

- The high volume of water and other liquid substances used within dairy processing lead to a high risk of slips, trips and falls where leaks and spills have not been cleaned up or where cleaning of process areas is taking place.

- Vats and tanks used for mixing raw materials and storage provide hazards in the form of working at height, which could result in falls and asphyxiation (immersion).

Collision

In a busy manufacturing environment, it is common to have injuries where people are struck by moving or falling objects and vehicles.

Manual Handling

Workers may be involved in heavy manual lifting, carrying and repetitive work including the operation of slicing and vacuum packing machines and poor working postures.

Exposure to Biological Hazards

Inhalation of dust and aerosols can expose workers to biological hazards this is particularly true of milk powder operations. Skin irritations and other allergic reactions may arise from dust and high levels of humidity.

Exposure to Chemical Hazards

Workers may be exposed to hazardous substances (liquids and gases) typically during cleaning and disinfecting of process areas and in the maintenance of heating and cooling systems.

Refrigerants

Dairy processing plants rely heavily on chilling facilities to preserve the products. The refrigerants used may be ozone depleting chemicals, such as Chlorofluorocarbons (CFCs) and Hydro chlorofluorocarbons (HCFCs), the production of which are being phased out under the Montreal Protocol. Use of these types of refrigerant gases should be avoided. Ammonia is becoming a more commonly used alternative refrigerant, which has no such restriction but does have health and safety issues. It is toxic if inhaled at high concentrations and can cause frostbite when released to the atmosphere.

Facilities using ammonia refrigeration should be aware of the potential hazards of ammonia releases and of the steps that can be taken to prevent such releases. They should be prepared to respond appropriately if releases do occur.

OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Noise and Vibration

Noise induced hearing loss can result from prolonged exposure to grinding or steam injection operations which may reach levels in excess of those regarded as healthy. Noise issues can arise depending on plant location and the processes conducted.

Machinery

All equipment should have safety guarding and workers should be issued with appropriate personal protective equipment to protect against unavoidable sharp items and edges.

Odour

Depending upon the location of the facility, odour can be a significant nuisance issue for neighbouring facilities and residential areas. In the most serious cases odour control equipment may need to be installed. Odour problems are mainly due to poor housekeeping and inadequately operated wastewater treatment plants. The installation of odour control equipment may incur significant expenditure depending upon the location of the facility. Odour reduction and prevention is much more cost effective than end of pipe control.

Storage Issues

Finished product, raw ingredients, chemicals for cleaning and fuel oil may all be stored on site in bulk storage tanks, caustic and acid tanks, fuel oil tanks; tank farm (multiple tanks) containing finished product; and drums of assorted additives, caustics, disinfectants, detergents and cleaning agents.

These storage facilities should be provided with satisfactory containment (concrete walls/bunds, recessed drainage gullies connected to effluent treatment areas) to ensure that spillages do not enter the surface water drainage systems or leak direct to the ground. Alarms may be fitted on equipment to detect leakages of gas or oil.

Polychlorinated Biphenyls (PCBs) and Asbestos

- PCBs are a group of substances which are good electrical insulators. Typically, PCBs may be present in hydraulic oils or dielectric fluids in electrical switchgear and transformers.

- Asbestos has been used on a large scale for many years as a fire proofing and insulation material and may be encountered in a wide range of forms including asbestos cement boards, as fire retardant gaskets in pipework and as fire retardant insulation around boilers and furnaces.

Though the presence of PCBs and asbestos are not likely to be a principal issue of concern in relation to the main bakey production process, they may be present in factories constructed prior to the 1980s and present both an environmental and health and safety hazard.

Permitting

Dairy processing operations within the EU receiving on average more than 200 tonnes of milk per day will be subject to national regulations under the Integrated Pollution Prevention and Control Directive (2008/1/EC), which requires the use of the best available techniques and a programme of continuous environmental improvement. Other smaller facilities within the EU and operations outside the EU will still be subject to local regulation but

this will generally set less stringent requirements on the techniques to be adopted.

Temperature

- Fluctuating internal climatic conditions ranging from refrigeration areas to scalding operations. Refrigeration systems will result in very cold temperatures, which can result in frostbite and contact burns. High temperatures can lead to collapse through heat exhaustion and contact burns;

- Ill health can also arise from prolonged working at low temperatures.

KEY SOCIAL, LABOUR AND COMMUNITY RISKS/LIABILITY ISSUES

- Contamination of product could result in ill health in the general public and may result in product recall. Hygiene standards within process areas must be maintained to a high level to prevent product contamination. In accordance with international best practise, the Company's operations should be designed to internationally recognized food safety standards consistent with the principles and practice of HACCP[5] and Codex Alimentarius[6].

OTHER SOCIAL, LABOUR AND COMMUNITY RISKS/LIABILITY ISSUES

Hazardous chemicals

- Dairy processing uses chemicals and substances, for example, ammonia or caustics, which if incorrectly used could release into the surrounding environment resulting in inhalation of harmful fumes by the general public;

Traffic

- A substantial traffic load will occur near a large dairy plant due to the delivery of raw materials and the shipment of products.

Noise

- Operations such as hammer mills to grind the product and the use of steam injection for heat treatment of milk and for the creation of reduced pressure in evaporation processes can cause high noise levels which is a nuisance to neighbours;

Sludge Spreading

- Spreading of sludge to land may cause degradation of soil and groundwater quality having implications for the local community or indigenous populations.

FINANCIAL IMPLICATIONS

- Milk products may be contaminated at source, during processing or after packaging. This could have serious consequences for the company in terms of compensation claims, loss of reputation, loss of contracts and market share. Significant upgrades in hygiene standards may be required at the production facility in order to reduce the risk of contamination during processing and to satisfy national or international hygiene standards. The company may need to invest in a sophisticated system to assist in tracing its products;

[5] ISO 2005
[6] FAO and WHO (1962–2009).

- Expenditure relating to effluent discharge may be incurred for a number of different reasons. These include:
  - The need to pay fines for contamination of nearby surface water courses;
  - There may be pressures from regulatory authorities to install or upgrade a wastewater treatment plant, which would incur significant costs. Drainage systems may also need to be inspected, upgraded, replaced or re-routed;
  - Capital expenditure may be required to meet new environmental, hygiene and health and safety standards;
- In some countries, the costs of water and effluent disposal are rising to reflect environmental costs. Considerable reductions in water consumption, and therefore cost, can be achieved through investment in advanced equipment, good housekeeping and awareness among both employees and management;
- The consumption of large quantities of energy will result in high operating costs, which could be reduced by capital investment in energy efficiency measures;
- Many countries are signatories to the Kyoto Protocol and have adopted targets for the reduction of CO_2 emissions. Where Governments have set up carbon emission reduction programmes industrial processes have been required to reduce their CO_2 emissions through the setting of targets. This can result in a need for substantial investment in new/clean technologies to achieve the emission targets. These targets may be reflected in environmental permits;
- Injures may lead to increased payroll costs to replace skilled workers and lost production time;
- Fines, penalties and third party claims may be incurred for non-compliance with environment, health & safety regulations.

IMPROVEMENTS

Environmental, Health and Safety Improvements

- Ensure that packaging is either recovered or capable of being recycled;
- Increased monitoring and control of effluent discharges;
- Collection of waste product for use in lower-grade products such as animal feed;
- Installation or upgrade of effluent treatment plant;
- Optimisation of use of water and cleaning chemicals; recirculation of cooling waters;
- Segregation of process, cooling and sanitary effluent to enable recycling of waste water;
- Use taps with automatic shutoff valves and use high pressure hoses to minimise water usage;
- Recover energy using heat exchangers for cooling and condensing;
- Insulate refrigeration rooms; consider automatic door closures and alarms to prevent chill room doors being left open;
- Implement procedures which ensure regular inspections of surface and foul drainage

systems, soakaways, fat traps and interceptors etc.;

- Implement waste management systems which are safe, hygienic, secure from scavenging and minimise manual handling;
- Have robust waste management procedures to maintain hygiene standards;
- Consider changes to non-CFC coolants and /or sealing of leakages in the refrigeration system;
- Undertake continuous sampling and monitoring of key production parameters to enable identification and reduction of production loses, thereby reducing waste arisings, energy and water consumption.
- Provision of personal protective equipment (PPE) that is fit for the task to prevent injury and maintain hygiene standards. Staff should be trained in the correct selection, use and maintenance of PPE; the training should include the reasons for its use and the dangers of not using it. PPE should be inspected regularly and maintained or replaced as necessary;
- Take measures to avoid spillages and leakages onto floors and walkways, ensure there is a system for cleaning spillages;
- Walking and working surfaces should be kept clean and dry and workers provided with anti-slip footwear. Restrict access to areas being cleaned or where spillages have occurred. Floor cleaning should be scheduled for a time when work is not in progress or has finished for the day and the floor should be dried as much as possible;
- Handrails should be fitted on platforms, ladders and stairs;
- Eliminate the need to work at height or at the top of tanks, e.g. install automatic tank sampling. Ensure correct fall arrest systems are in place, e.g. guarding and harnesses;
- Redesign manual processes to avoid heavy lifting/repetitive activities. Where this is not possible install mechanical lifting aids and rotate work tasks to avoid repetitive tasks;
- Separate work and welfare facilities should be provided to maintain worker personal hygiene;
- Direct contact with non-conforming dairy products should be avoided;
- Separate people from moving equipment:
    - Redesign process layout to reduce crossing paths to avoid collisions and falls;
    - Use of separate transport corridors and working areas to reduce risk of collision;
    - Install correct guarding of machinery to reduce risk of entrapment;
- Improve signage to give clear warnings and instructions e.g. health and safety, waste segregation and minimisation; fire exits.

Social, Labour and Community Improvements

- Implement a food safety programme to improve food hygiene standards in accordance with HACCP prerequisites and the Codex Alimentarus;

- Implement a Customer complaints mechanism;

- Implement a system of food labelling to enable food traceability and recall and to inform the consumer of correct storage and cooking requirements.

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

During the initial site visit, the issues will vary according to the type of dairy product being produced and depending on the level of environment, health and safety management already introduced. While visiting the site it is important to discuss and review the following:

- Confirm organisational responsibilities and systems for environment, health and safety;

- Condition and efficiency of wastewater treatment plant and location of discharge points;

- Note whether the wastewater treatment plant discharges to a municipal water treatment plant or to a local watercourse;

- Check the condition of storage facilities for raw materials and chemicals to observe the integrity of the storage;

- The source of raw materials and screening for contamination, in particular, which contamination parameters are analysed (e.g. pesticides, herbicides, radioactivity, heavy metals, industrial pollutants);

- What is the standard of "housekeeping" on site? Do areas look clean and tidy? Look for evidence of any recent spills or releases of raw materials/product. Look for evidence that the walking and working surfaces are kept clean and dry;

- Observe food hygiene standards at the facility and the results of previous food hygiene inspections, e.g. separate welfare areas for workers; Are staff are wearing Personal Protective Equipment; food traceability systems;

- Check signage around the site:

  - Does it convey the health and safety risks?

  - Are fire exits clearly marked?

- Is fire fighting and first aid equipment available?

- Check the age and condition of equipment, look for signs of wear and tear, degradation, leaks and breaks;

- Check that solid waste storage and disposal (storage equipment) is in a good condition;

- Check that waste disposal takes place on a regular basis;

- Check that waste storage areas are clear of debris and that skips are covered to prevent waste escaping, for example, check that waste containers have lids or are stored in an area with a roof;

- Does the organisation have insurance in place to cover the recall of contaminated products? Have there been any recent product recall incidents?

- Have there been any recent (within the last three years) incidents on site such as

fatalities, fires/explosions, spills? Are there insurances in place to cover such incidents?.

- Is the facility subject to any audits by customers? What was the outcome of these audits?
- Have the premises been inspected recently (within the past 2 years) by the regulatory authorities for health, hygiene and environment? What were their findings?
- Does the business plan have line items for Environment, Health and Safety improvements?
- Check the conditions and duration of validity for all permits.

Social, Labour and Community

- Check that labour standards, contracting and remuneration are in line with national law and are consistent with the average for the sector;
- Check that hours worked, including overtime, are recorded and staff should receive written details of hours worked and payment received;
- Check that wages and working hours are consistent with the average for the sector and national standards;
- Has the Company received inspections from the local labour inspectorate in the previous three years? Have these resulted in any penalties, fines, major recommendations or corrective action plans?
- Does the organisation have a grievance mechanism which allows employees to raise workplace concerns?
- Are employees free to form, or join, a worker's organisation of their choosing?
- Consider installing product traceability systems that facilitate tracing and recall of products once released for sale.
- Does the organisation have insurance in place to cover the recall of contaminated products? Have there been any recent product recall incidents? What other insurances does the company have in place?

Take note/ask questions relating to any activities that address the improvements listed in the improvements section of this document.

ACTION PLANS

Dependent on the individual business, appropriate improvements should be selected from the list above to include in the action plan. As a minimum, any business should be required to have the following in place:

- Operational procedures to manage environmental, health & safety risks;
- Monitoring programmes;
- Improvement objectives, targets and project plans;
- Training for personnel;
- Regular inspections, checks and audits with records to demonstrate achievement of the required level of performance against legal requirements and improvement action;
- Emergency plans for environment, health & safety accidents;

- Management review/demonstrated involvement in environment, health & safety management.

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