

PROCESS DESCRIPTION

Fruit and vegetables can be processed in many different ways depending on the type of raw material and the end product. There are two major sub-sectors:

- Fresh packed products;
- Processed products.

The techniques most frequently used for processing are: canning or bottling accompanied by heat treatment; refrigeration or freezing; fermentation; drying; pickling; and chemical preservation. In most cases the aim is to lengthen the shelf life (reduce the perishability) of the product, but there are often secondary objectives such as to make the product more convenient to use; to improve the packaging and presentation; improve the eating quality; or to produce an entirely new product such as juices, purees, jams, or wine.

The main activities are:

- **Receipt of raw materials:** the fruit and vegetables typically arrive in bulk by truck; Solid raw materials are usually conveyed around the site by belts and elevators, liquid raw materials are conveyed by pumping from storage tanks or by containers on pallets;
- **Primary grading:** Sorting and grading of the crop and an assessment of the overall quality of the crop. Ideally this is carried out at the farm to minimise the movement of waste material;
- **Intermediary storage:** At various stages in the process the product will need to be stored pending the next stage in the process. The storage conditions will be dependent on the product;

- **Primary cleaning:** Removal of all off-specification material, debris, metals, pesticides and other surface contaminants. Methods used are product dependent and may include use of both wet and dry methods;
- **Sorting, grading and inspection:** sorting by shape, size and colour to ensure uniformity;
- **Product preparation:** Removal of inedible parts, e.g. trimming, peeling; size reduction; mixing; forming; separation and concentration;
- **Product processing:** Processing is a combination of one or more separate operations, e.g. heating (baking, cooking in oils, blanching, pasteurisation, sterilisation, evaporation and dehydration), cooling (chilling, controlled or modified storage, freezing and freeze-drying) and packaging to reduce respiration;
- **Packaging:** Processed products are packed to provide containment, protection, convenience and communication.

KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Solid Wastes

Large volumes of fruit and vegetable waste will be generated in the form of the removed inedible parts and items rejected from the sorting, grading and various production processes. The majority of this waste can be diverted from disposal by being manufactured into other products, e.g. jams, biofuels, animal feed or composting for use as a soil improver.

Solid and liquid wastes should be separated e.g. by screening, sedimentation, flotation etc.

Packaging materials typically used include flexible polymer materials, paper, cardboard, glass, cans, and wooden or polymer boxes. Companies operating with the European Union (either as a manufacturer or as a supplier into European Union countries) will be subject to the European Union Packaging and Packaging Waste Directive (94/62/EC), which aims to reduce the amount of packing that is being introduced into waste streams.

Product Contamination

Fruit and vegetable products can become contaminated through:

- Contaminated raw products having been received from the farm, chemical residues, and from contamination of other raw ingredients e.g. dioxins, pesticides;
- Poor food hygiene standards within the processing operations, e.g. unclean machines, unhygienic handling;
- Failure in the processing operation, e.g. under cooking, failure to maintain chilled conditions, sterilisation failure, and poor seals on vacuum packs etc.

A system of food traceability may be a legal requirement or is good practice so as to enable product recall if required.

The Company's operations should be designed to internationally recognized food safety standards consistent with the principles and

practice of Hazard Analysis Critical Control Points (HACCP)¹ and Codex Alimentarius².

Water Supply

Fruit and vegetable processing operations can use large quantities of fresh water for cleaning process areas and equipment, cleaning raw fruit and vegetables, and as process water in peeling, sorting, transporting and canning operations. Much of this water is wasted when it could be treated and reused in the process.

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. Whenever changes take place in product volumes, this should be reflected in the permit.

Effluent treatment

Large volumes of effluent (wastewater) containing high organic loads, cleansing and blanching agents and suspended solids may be produced. The effluent may also be contaminated with pesticide residues.

Discharge of the effluent directly to water bodies is discouraged as it can pollute them causing damage to wildlife.

The volume of effluent flow may vary substantially by season, and as the quality of the effluent, after primary treatment to remove solids, is usually suitable for discharge to a municipal wastewater treatment system, it is not unusual for further treatment to be carried out on site, unless the peak volumes would cause a problem.

¹ ISO 2005

² FAO and WHO (1962–2009).

Energy

Processing operations may consume energy as:

- Thermal energy in the form of steam and hot water used for processing, cleaning, sterilising;
- Thermal energy for direct heating and cooling the product;
- Electricity for machinery operation, refrigeration, lighting and production of compressed air. Minimum refrigeration requirements are normally determined by regulation.

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.

Refrigerants

Chilling facilities may be used to preserve and store 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. Releases 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.

Odour

Odour can be released through heat-based activities such as steam peeling, blanching and dehydrating and in the storage of solid waste.

Manual Handling and Repetitive Work

Lifting, repetitive work and posture injuries occur as a result of lifting and carrying heavy or awkward shaped items, lifting of boxes and manoeuvring carts/manual forklifts within the plant. Repetitive tasks such as the operation of slicing and vacuum-packing machines can lead to musculoskeletal injuries.

Collision

In a busy manufacturing environment, it is common to have injuries where people are struck by moving or falling objects such as crates, boxes, equipment, conveyors and forklift trucks.

Dust and Aerosols

Dust may arise from storage, handling and drying activities; aerosols typically arise from the use of compressed air and high-pressure water for cleaning. Workers may inhale or ingest the dust and aerosols exposing them to health hazards. When combined with high levels of humidity they may give rise to skin irritation or allergic reactions.

Noise

Noise induced hearing loss can occur from working in noisy areas, e.g. blast freezers/chillers, bowl choppers, packing machinery;

OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Storage Issues

Bulk storage facilities will be used for the storage of fruit, vegetables, and other raw ingredients, chemicals used in the production process and for cleansing and disinfection, and fuel oils for energy production. These storage facilities should be provided with satisfactory containment (concrete walls/bunds, recessed drainage gullies connected to effluent treatment areas to prevent spills reaching the wider environment. Alarms may be fitted to detect leakages.

Permitting

Large fruit and vegetable processing plants in the EU capable of producing more than 300 tonnes per day of finished product are subject to national regulations under the Integrated Pollution Prevention and Control Directive (2008/1/EC), which requires facilities to hold an environmental authorisation and follow potentially stringent operating requirements. 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 environmental practices to be adopted.

Sharp Edges and Machinery

Sharp tools are used to process fruit and vegetables including knives, mixers and packaging equipment. All equipment should have safety guarding and workers should be issued with appropriate personal protective equipment to protect against unavoidable sharp items and edges.

Slips, Trips and Falls

Slippery floors and surfaces caused by water, juices or remains/pieces of fruit and vegetables present a high risk of slips, trips and falls where spills have not been cleared up or effective cleaning has not taken place.

Hazardous Substances

- The cleaning and disinfecting of process areas and some food preservation processes use materials that if inappropriately used and stored could result in chemical contact burns, inhalation of harmful/toxic fumes or ingestion of harmful substances;
- Exposure to ammonia from leakage from refrigeration equipment; Ammonia, which is commonly used as a replacement for Chlorofluorocarbons (CFCs) in refrigeration systems, is toxic if inhaled at high concentrations and can cause frostbite when released to the atmosphere. The dense mixture tends to travel along the ground rather than rapidly rising. This behaviour may increase the potential for exposure of workers and the public. 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.

Temperature (Heat and Cold)

- 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 and scalds;

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

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, they may be present in factories constructed prior to the 1980s and present both an environmental and health and safety hazard.

Radiation

Occupational exposure to radiation can occur from irradiation dosing to extend the shelf-life of fruits and vegetables.

KEY SOCIAL, LABOUR AND COMMUNITY RISKS/LIABILITY ISSUES

Hygiene

Contamination of product could result in ill health in the general public and may result in product recall. Operations and hygiene standards within process areas must be maintained to a high level to prevent product

contamination and consistent with the principles and practice of HACCP and Codex Alimentarius.

OTHER SOCIAL, LABOUR AND COMMUNITY RISKS/LIABILITY ISSUES

Noise

The noise generated by equipment such as saws, steam, condensers, ventilation, banging equipment, canning and bottling lines and pressurised air equipment as well as manoeuvring trucks can be a nuisance if the site is located close to residential areas and other sensitive receptors.

Transport

During peak seasons trucks delivering bulky raw materials may cause traffic congestion or excessive noise;

Urban Water Treatment Systems

During peak seasons, excessive demands may be placed on municipal wastewater treatment systems;

FINANCIAL IMPLICATIONS

- Product recall can have a significant impact, e.g. compensation claims, loss of reputation, loss of contracts and in terms of export markets. 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 and international food hygiene standards. A system of product traceability is required to facilitate product recall;

- Many countries are signatories to the Kyoto Protocol and have adopted targets for the reduction of CO₂ emissions. Where Governments have set up carbon emission reduction programmes industrial processes have been required to reduce their CO₂ 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;
 - Replacement of refrigerant gas or equipment may be required to meet international standards;
 - Where large quantities of energy are used then this can result in high operating costs to the business;
 - Income may be generated through sale of waste products e.g. for use in animal feed;
 - Injuries 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 and safety regulations.
- methods such as vibration with sieving and sifting devices; improved washing techniques;
- Consider use of continuous/batch stream or dry caustic processes for peeling activities;
 - Adopt tank and equipment cleaning-in-place (CIP)³ procedures to reduce chemical, water and energy consumption;
 - Use taps with automatic shut-off valves and use high water pressure and optimised nozzles;
 - Separate cooling water from process water to enable recycling of wastewater and recirculation of cooling waters;
 - Check wastewater holding tanks and treatment facilities for potential overflows and leakage;
 - Implement procedures to ensure solid waste is removed from transport equipment and surface areas before rinsing and washing, e.g. using scrapers, brooms and vacuum cleaners;
 - Installation (or upgrade) of wastewater treatment plant;
 - Install grids to reduce or avoid introduction of solid materials into the wastewater drainage system;

IMPROVEMENTS

Environmental Improvements

- Improve product conveying systems to reduce or eliminate wet transportation of products and waste, and to minimise risks of spills of raw materials and water;
- Reduce water usage for primary product cleaning where appropriate by using dry

³ CIP is a method of cleaning the interior surfaces of pipes, vessels, process equipment, and associated fittings, without disassembly using approved chemicals and/or detergents with minimal environmental impact and compatible with subsequent wastewater treatment processes.

- Minimise storage time for raw materials to reduce losses from decay and consider use of enclosed/covered storage to prevent damage to materials stored outdoors and emissions of dust and odour;
- Minimise dust transport by the use of sprays, sprinklers, windbreaks and stockpile management;
- Consider on farm cleaning, sorting and grading of fruit and vegetables to reduce transport requirements and quantity of waste materials produced at the processing facility;
- Ensure organic waste is collected and stored separately from other waste to enable composting and/or use for soil amendment, or use in energy production;
- Improve waste storage containment to prevent ingress of water and leakage;
- Regular inspection should be carried out of all bulk containment and refrigeration facilities on site to prevent leakage and product loss;
- Select cleaning materials that do not have an adverse affect on the environment or on the use of effluent and sludge for agricultural use;
- Implement changes to non-CFC coolants and/or sealing of leakages in the refrigeration system;
- Reduce energy consumption by designing plant layout to minimise pumping and conveyor distances;
- Pre-cool products before refrigeration and freezing;
- Where climate conditions and plant design allows, consider increased use of outside storage in appropriate containers (particularly for materials destined for animal feed) to minimise the need for refrigeration;
- Install controls to maximise the efficiency of cooling plants;
- Install insulation in refrigeration areas; consider automatic door closures, airlocks and alarms to prevent chill room doors being left open;
- Recover energy from thermal processes, e.g. heat from condensed steam, ovens, dryers;
- Good housekeeping should be maintained at all times all areas. The adoption of good cleaning and working practises as a routine will reduce odour emissions and improve hygiene standards;
- Recirculate exhaust gas from frying and other cooking processes to the burner. Upgrade exhaust stack heights from cooking processes to minimise air pollution and nuisance to the local community;
- Consider operating facilities under partial vacuum to prevent odour emission.
- 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;

- Train workers in correct use of machinery and safety devices;
 - Improve signage around the site, e.g. emergency exits, mandatory PPE;
 - Is fire fighting and first aid equipment available?
 - Redesign manual processes to avoid heavy lifting/repetitive activities;
 - Install mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities and exposure to biological hazards;
 - Separation of people from moving equipment:
 - Ensure that the process layout reduces opportunities for process activities to cross paths;
 - Installation of safeguards on peelers, moving parts of conveyor belts and packaging machinery to reduce risk of entrapment of employees;
 - Install walkways to separate people from vehicle movements to reduce risk of collision;
 - Walking and working surfaces should be kept clean and dry. 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;
 - To reduce the risk of noise exposure isolate noisy equipment and rotate tasks to minimise time spent in a noisy area over an eight hour period and provide personal protective equipment where people have to enter noisy areas;
 - Ensure all electrical equipment in wet areas is grounded;
 - Redesign processes where practicable to remove dust and aerosol generating activities; or provide adequate ventilation of enclosed and semi-enclosed areas;
 - If irradiation is used as preserving method, implement a system to monitor worker exposure to ionising radiation.
- Community Health and Safety Improvements***
- Implement a food safety programme to improve food hygiene standards in accordance with HACCP prerequisites and the Codex Alimentarius;
 - Implement a Customer complaints mechanism;
 - Consider implementing product traceability systems that facilitate tracing of products once released for sale;
 - Implement a system of food labelling to enable food traceability and recall and to inform the consumer of correct storage and cooking requirements.
 - Redesign plant processes to minimise risk of contamination, i.e. ensure products move from dirty to clean zones and that employees move in the opposite direction i.e. from clean to dirty zones.

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

During the initial site visit, the issues will vary according to the type of 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:

Environment, Health and Safety

- Confirm organisational responsibilities and systems for environment, health and safety;
- Check the condition of wastewater treatment plant and location of discharge points for wastewater from the facility. Note the colour and appearance of adjacent watercourses;
- Note whether the wastewater treatment plant discharges to a local watercourse or the municipal wastewater treatment works;
- Check the condition of storage facilities for chemicals;
- Discuss the procedures and controls around screening of raw materials and products for potential 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 build up of fruit and vegetable debris on floors and surfaces, 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 PPE?; Does the organisation have a food traceability system;
- Check signage around the site:
 - Does it convey the health and safety risks?
 - Are fire exits clearly marked?
 - Are there separate routes for pedestrians and vehicles painted on floor?
- 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 clean of debris and that are skips covered to prevent waste escaping, for example, check that waste containers have lids or are stored in an area with a roof;
- Have the premises been inspected recently (within the past 2 years) by the regulatory authorities for health, hygiene and environment? What were their findings?
- Review measures of controlling the odour coming out from the plant;

- Check for automatic safeguards on machinery to prevent accidental injury;
- Have there been any recent (within last three years) incidents on site such as fatalities, injuries, 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?
- Does the business plan have line items for Environment, Health and Safety improvements?
- Check the conditions and duration of validity for all permits;
- 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.

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?

ACTION PLANS

Dependent on the individual business, select appropriate improvements 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 and 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;



European Bank
for Reconstruction and Development

Sub-sectoral Environmental and Social Guidelines: Fruit and Vegetable Processing

- Emergency plans for environment, health and safety accidents;
- Management review/demonstrated involvement in environment, health and safety management.

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