



# Sub-sectoral Environmental and Social Guidelines: Grain Mill Products

## PROCESS DESCRIPTION

Grain is defined here as cereals (wheat, rice, barley, oats, rye, maize etc.), and pulses (various varieties of dry beans, peas and other non-cereal grains). Oilseed and oil extraction processes are excluded (see Vegetable Oil Processing guideline). Grain can be processed in many different ways depending on the type of raw material and the end product. The techniques most frequently used are:

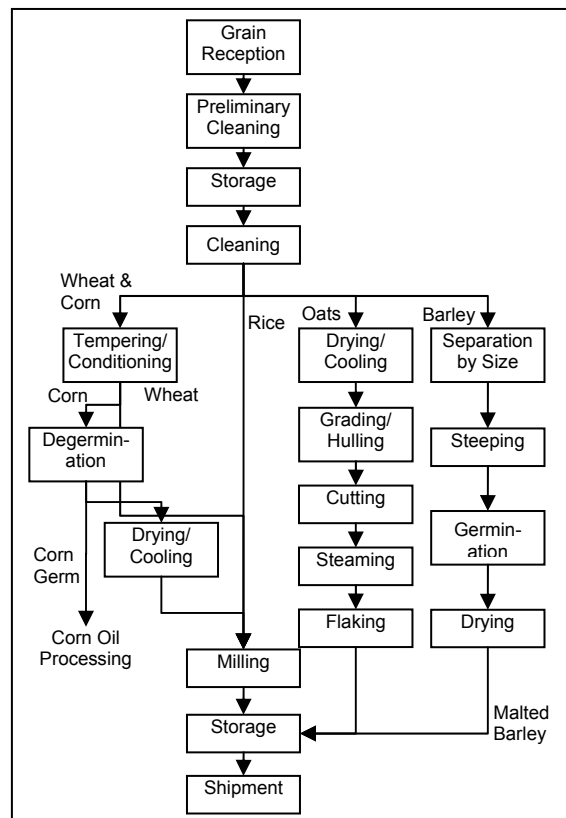
- Milling to reduce grain to smaller particles including flour;
- Malting by germinating seeds; and
- Extracting soluble carbohydrates for brewing.

Most by-products are dry and environmentally benign. The mixing of milled products to produce animal feeds is described in detail in the Animal Feed Processing Guideline.

The manufacturing steps include some or all of the following: receipt and weighing of raw materials, usually in bulk form; storage in silos or warehouses; drying to reduce the moisture content to allow safe storage; grading; cleaning to remove weed seeds, soil, and other foreign matter including stones and metallic objects; milling (grinding, cracking, hammering, crushing etc.); bagging or bulk storage; and outloading to road transport.

The malting process involves wetting the grain and allowing germination to take place. This converts insoluble starch contained in the seed into a soluble and fermentable form (maltose). The germinated seeds are coarsely ground to produce the “grist” from which the maltose is extracted by hot water solution. The residue is

known as brewer's waste which can be sold as animal feed.



Common examples of processed grain products include: flour and its by-products (bran, pollard etc.); polished rice and its by-products (rice bran, rice hulls); malt, malt extract and brewer's waste; animal feed ingredients (e.g. maize meal). Most products are outloaded in bagged or bulk form, usually by truck. Flour is sometimes handled in drums.

Reference should also be made to the sub sector guideline on warehouse receipts and commodities.



### **KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES**

#### ***Product Contamination***

Grain products can become contaminated through:

- Receipt of contaminated raw materials e.g. chemical residues, pesticides and debris such as metal, wood, or stones;
- Poor storage conditions e.g. raised moisture levels promoting insect, mould and bacterial growth;
- Poor hygiene standards within the processing operations, e.g. unclean machines, unhygienic handling.

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)<sup>1</sup> and Codex Alimentarius<sup>2</sup>.

A system of product traceability is good practice and may be mandatory in some territories.

#### ***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 biological and microbial hazards presenting a risk of occupational lung disease. When combined

with high levels of humidity they may give rise to skin irritation or allergic reactions.

- A dust cloud of any flammable material (such as grain) will explode where:
  - The concentration of dust in air falls within the explosive limits; and
  - A source of ignition exists.

The most common locations for fire and explosion are in driers, mills and hot work on plant. The grinding operation may generate considerable quantities of heat and dust and the temperatures of raw materials may rise by 10 - 20°C.

Care should be taken at all stages of the process, notably at bulk storage areas for raw materials (during milling and at bulk product storage areas) to minimise risk of fire or explosion.

Dust emissions can be controlled by enclosing processing and transport equipment, which also reduces product losses, and the installation of extraction and antistatic equipment.

#### ***Wastewater discharge***

Major sources of wastewater within grain mills are cleaning water and surface water run off. These may present a significant risk of pollution if allowed to enter a river without treatment. Pollution may arise from:

- flour or grain product;
- high alkalinity, depending on the type of cleaning materials used;
- solvent and oils used in equipment operation;

<sup>1</sup> ISO 2005

<sup>2</sup> FAO and WHO (1962–2009).



- oils, fats or molasses which may be used in blended products.

Grain mills normally discharge to the municipal wastewater treatment system but some onsite pre-treatment may also be required.

Wastewater discharge from grain processing will typically require a permit.

### ***Storage***

Bulk storage facilities will be used for the storage of raw grain, finished product, 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. The storage facilities should be secure to prevent pest invasion, be waterproof and well ventilated. Alarms may be fitted to detect leakages. All outdoor bulk storage of dusty, or potentially dusty materials should be in silos and ventilation/extraction equipment used to minimise dust generation. Bulk storage facilities should be fitted with alarms to prevent overfilling.

### ***Energy***

Processing operations may consume energy as:

- Thermal energy in the form of steam and hot water used for processing, cleaning, sterilising;
- Electricity for machinery operation, lighting and production of compressed air.

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.

### ***Manual Handling and Repetitive Work***

Lifting, repetitive work and posture injuries occur as a result of lifting and carrying heavy or awkward shaped items such as sacks, lifting of boxes and manoeuvring carts/manual forklifts within the plant. Repetitive tasks such as the operation of 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.

### ***Slips, Trips and Falls***

Slippery floors and surfaces caused by oil deposits present a high risk of slips, trips and falls where spills have not been cleared up or effective cleaning has not taken place;

## ***OTHER POTENTIAL ENVIRONMENTAL RISKS***

### ***Solid Waste***

The amount of waste produced is minimal as all parts of the seed have some economic value. Low value by-products such as rice husks can be used as a source of fuel. All other by-products can be used for human or animal consumption. The only true waste is foreign material removed from incoming grain, and some packaging materials. Occasionally if high moisture content grain is received and drying facilities are not



available, the grain may begin to germinate making it unusable.

### ***Packaging***

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.

### ***Polychlorinated Biphenyls (PCBs) and Asbestos***

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

Particular attention should be given to buildings constructed before the 1980's.

### ***OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES***

#### ***Noise***

Noise induced hearing loss can occur from working in noisy areas, e.g. hammer mills, grinders.

#### ***Confined Spaces***

Storage silos are dangerous confined spaces and entry to them must be strictly controlled and avoided wherever possible.

#### ***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. Particular attention should be paid to conveyors, mills, mixers, rotary valves, pelleting presses and packaging machinery.

#### ***Hazardous materials***

Cleaning and disinfecting 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.

### ***KEY SOCIAL, LABOUR AND COMMUNITY RISK/LIABILITY ISSUES***

#### ***Product Contamination***

Contamination of product could result in ill health in the general public and may result in product recall. Grain mill products can become contaminated as a result of contamination of the raw materials, 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)<sup>3</sup> and

<sup>3</sup> ISO 2005



Codex Alimentarius<sup>4</sup> will need to be considered in order to reduce the risk of contamination.

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

## ***OTHER SOCIAL, LABOUR AND COMMUNITY RISK/LIABILITY ISSUES***

### ***Dust***

Grain mills may present a significant source of air pollution both on site and in the surrounding locality. Release of dust to the atmosphere from storage handling or processing of grain products, may generate a health risk to employees or a local nuisance.

### ***Noise***

The noise generated by equipment such as hammer mills, grinders, ventilation, banging equipment, and manoeuvring trucks can be a nuisance if the site is located close to residential areas and other sensitive receptors.

## ***FINANCIAL IMPLICATIONS***

- Product recall can have a significant impact, e.g. compensation claims, loss of reputation, loss of contracts and market share. Significant upgrades in quality control 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;

<sup>4</sup> FAO and WHO (1962–2009).

- Many countries are signatories to the Kyoto Protocol and have adopted targets for the reduction of CO<sub>2</sub> emissions. Where Governments have set up carbon emission reduction programmes industrial processes have been required to reduce their CO<sub>2</sub> 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.
- Where large quantities of energy are used then this can result in high operating costs to the business;
- Injuries may lead to increased payroll costs to replace skilled workers and lost production time;
- Capital investment may be required to comply with new environmental, health, safety and hygiene requirements;
- Fines, penalties and third party claims may be incurred for non-compliance with environment, health and safety regulations.

## ***IMPROVEMENTS***

### ***Environmental Improvements***

- Reduce dust emissions by:
  - Enclosing and sealing plant and equipment to prevent escape and accumulation of dust;
  - Use of doors/plastic strip curtains on building access points.
  - Redesigning processes to reduce free-fall distances and speed of movement for grain and other dry products



- Installing windbreaks and covers in outside handling areas;
- Replace any external bulk storage areas with silos, fitted with alarms to prevent overfilling;
- Install a centralised piped vacuum cleaning systems;
- Installation of dust extractors e.g. cyclones and fabric filters
- Improving ventilation within buildings;
- Maintaining a slight negative pressure within storage vessels such as bins and silos;
- Install dust monitoring equipment at the most sensitive points;
- Reduce the risk of fire and explosion by:
  - Reducing dust emissions as above;
  - Improved removal of metal, stones and glass which can cause sparking;
  - Locate equipment within a lightweight building so that the roof and wall cladding panels can act as explosion relief;
  - Fit silos and bins with explosion relief;
- Reduce spoil and loss by
  - Weather proofing windows, doors and other openings against pests and water;
  - Controlling moisture content in grain storage;
- Monitor product losses during processing operations;
- 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;
- Regular inspection should be carried out of all bulk containment on site to prevent leakage and product loss;
- Provision of secondary spill containment for storage and process vessels;
- Select cleaning materials that do not have an adverse affect on the environment;
- 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;
- 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;
- Train workers in correct use of machinery and safety devices;
- Redesign manual processes to avoid heavy lifting/repetitive activities;
- Install mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities;
- Separation of people from moving equipment:



- Ensure that the process layout reduces opportunities for process activities to cross paths;
- Installation of safeguards on 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 safe and regularly maintained;
- Redesign processes where practicable to remove dust and aerosol generating activities.
- Records and samples of the ingredients used and of each product batch;
- Potentially implement product traceability systems that facilitate tracing of products once released for sale;

### ***GUIDE TO INITIAL DUE DILIGENCE SITE VISITS***

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

- Check the condition and efficiency of any wastewater treatment plant present and location of discharge points. Note the colour and appearance of adjacent watercourses;
  - Note whether the plant discharges to a local watercourse or the municipal wastewater treatment works;
  - Check the condition of storage facilities for chemicals;
  - Discuss procedures to check the source of raw materials and screening for contamination, in particular, check 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 dust 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;
- Implement a quality control plan including
    - Sampling procedures and frequencies;
    - Analysis methods;
    - Destination of non-compliant product;

### ***Social, Labour and Community Improvements***



- Are staff wearing Personal Protective Equipment?
- Is there a quality control system? Is there a food traceability system;
- Check signage around the site:
  - Does it convey the health and safety risks?
  - Are fire exits clearly marked?
  - Are there demarcated 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 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;
- 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, 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;

### ***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, 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;
  - Emergency plans for environment, health and safety accidents or hygiene non-compliance;
  - Management review/demonstrated involvement in environment, health, safety and hygiene management.



**European Bank**  
for Reconstruction and Development

## **Sub-sectoral Environmental and Social Guidelines: Grain Mill Products**

### **REFERENCES AND ADDITIONAL SOURCES**

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