European Bank
for Reconstruction and Development

Sub-sectoral Environmental and Social Guidelines: Sugar Production

PROCESS DESCRIPTION

Sugar is produced from sugarcane and sugar beet and the production process can be broken down into three distinct phases:

- Growing;
- Processing; and
- Refining.

This guideline deals with the environmental and social issues associated with sugar processing and refining.

- Sugar processing is generally located as close as possible to the growing areas. Processed sugar is then usually sent to refineries for further refining;

- During processing, the sugar is extracted by a process known as diffusion using hot water with the resulting liquor being purified using materials such as lime and carbon dioxide;

- The filtered juice is then boiled and tiny sugar crystals are added ('seeding') to encourage the crystallisation process;

- The mixture of syrup and crystals is centrifuged to separate the crystals which are then dried, cooled and stored in silos prior to distribution for packaging or bulk delivery;

- The syrup is returned to the process for further crystallisation and the final syrup is retained as molasses;

- By products may be produced such as high energy animal feed (spent cossettes and molasses), molasses for fermentation, and waste may be used as an energy source, such as boiler fuel for the factory;

- In the case of sugar beet, the factories are usually operational for the seasonal harvest until all the beet has been processed;

- For sugar cane factories, much of the primary processing is undertaken at the plantation before being sent for refining;

- During sugar refining, the raw crystalline sugar is melted, clarified, decolourised, recrystallised and packaged for dispatch.

KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Effluent Discharges

One of the main environmental problems associated with sugar processing is the management of effluent. All stages in sugar processing and refining produce wastes that have a high organic content, they have a high level of suspended solids and may also be coloured.

Wastewater will need to be treated on-site before release to sewer or surface water. Many facilities have on site wastewater treatment plants, which may utilise mechanical and chemical means of treatment. A permit with specific discharge parameters from the regulatory authorities will normally be required whether discharge is from an onsite wastewater treatment plant or discharge is to a municipal wastewater treatment plant.

Direct release of untreated wastewaters to surface waters will cause pollution and damage to the environment.

Product Contamination

The raw materials may be contaminated by pesticides from crop spraying or rotation. Sampling needs to be conducted on a regular basis.

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 Alimentarius[2].

Temperature

- High temperatures can lead to collapse through heat exhaustion and contact burns and scalds.
- Refrigeration systems will result in very cold temperatures, which can result in frostbite and contact burns.

Manual Handling & 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 and carrying of boxes and manoeuvring wheeled racks within the plant.

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.

Fire and Explosion

Powder-based raw materials (in particular, the actual sugar) represent a fire or explosion risk if inadequately stored and handled. As does the inadequate storing and handling of carbon dioxide. Storage areas should be fitted with explosion and fireproof equipment, where necessary.

OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Hygiene and Product Standards

Factory hygiene standards should be addressed both in sourcing and handling of raw materials (sugar cane and sugar beet) and at all stages of the production process. Quality of raw materials and procedures for identifying possible contamination may be driven by product quality standards particularly where product is for export.

Some territories may require that a food traceability system be in place.

Waste Disposal

Typical wastes from sugar processing include:

- Stones from receipt of raw materials and cleaning;
- Waste raw materials, beet and cane remnants termed bagasse;

[1] ISO 2005

[2] FAO and WHO (1962–2009).

- Empty containers;
- Waste oils;
- Sludges (if a wastewater treatment plant is present);
- Solid wastes (drums, cartons, packaging, domestic);
- Lime based filter cake (often used by growers to improve the soil);
- Sugar dust;
- Waste tops (these can be sold as fertiliser or animal feed).

Typical wastes from refining of sugar cane are more restricted to lime based filter cake, sugar dust and chemical and physical impurities in the sugar. The bulk of solid waste can be re-used as fertilizer, animal feed or for biogas production.

Solid wastes include packaging arising from raw materials delivery i.e. sacking, paper, and cardboard.

Hazardous wastes include waste oil and solvents from maintenance and operation of equipment or on-site generation of power or steam.

Air emissions

Combustion plant emissions from on-site boilers may generate dust and gaseous emissions. The emissions from the boilers will be dependent on the fuel used (coal, oil or gas). Coal fired boilers may emit high concentrations of sulphur dioxide (SO_2), nitrous oxide (NOx), carbon monoxide and dioxide (CO and CO_2) and particulates (soot and dust from combustion). Emissions to air may be subject to a permit.

Water supply

Large volumes of water are likely to be required during sugar processing where sugar is extracted by diffusion using hot water. Sources of water are either from mains or water is abstracted from ground or surface water. 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.

Handling and storage of materials

- Storage facilities may include bulk storage of raw materials (sugarcane and sugar beet) in tanks and drums, silos, sacks and bags;
- Pollution risks to watercourses and land may arise from spillages of raw materials i.e. sugarcane and sugar beet, lime and oils and fuels.

Packaging

Within sugar production, packaging is widely used for protection of the quality of the product, marketing and for transport purposes. Typically, this is plastic, cardboard, shrinkwrap and film.

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 reduce the

amount of packaging that is being introduced into the waste streams

Polychlorinated Biphenyls (PCBs) & 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 1980s.

Noise

Noise levels, both internal and external can also constitute a nuisance. Noise generated by the movement of traffic to and from the plant, particularly during the night, may be an issue in populated areas.

Energy

Processing operations consume high amounts of energy as:

- Thermal energy for boiling and drying the product and to produce hot water for cleaning and sterilising;

- Electricity for machinery operation, dust extraction, ventilation, 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.

Confined Spaces

Storage silos are dangerous confined spaces and entry to them must be strictly controlled and avoided wherever possible. There is a risk from engulfment, lack of breathable atmosphere and mechanical hazards.

Noise

Noise induced hearing loss can occur from working in noisy areas;

Machinery & Sharp Edges

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, wrapping machinery.

Slips, Trips and Falls

- Vats for mixing raw materials provide hazards in the form of working at height which could result in falls and asphyxiation;

- Slippery floors and surfaces present a high risk of slips, trips and falls where

spills have not been cleared up or effective cleaning has not taken place;

- 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 to employees, inhalation of harmful/toxic fumes or ingestion of harmful substances.

Forklift truck Operation Injury

Forklift trucks are a potential danger to their operators and to other people in the vicinity if not operated with great care. Risks include being struck by a moving truck, crushed by an overturning vehicle, becoming trapped between a truck and an object or, being crushed by a falling load.

KEY SOCIAL, LABOUR AND COMMUNITY ENVIRONMENT, ISSUES

Product Contamination

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 and should be consistent with the principles and practice of HACCP and Codex Alimentarius.

OTHER SOCIAL, LABOUR AND COMMUNITY ENVIRONMENT, ISSUES

Noise Nuisance

Operations may cause noise which is a nuisance to neighbours;

Transport

Transport of raw materials and chemicals to site could result in a road traffic accident which involves the general public;

Odour

Odour from the waste lagoons and from processing may result in local nuisance complaints. In some cases where the odour is regarded as a nuisance by the authorities, mitigation measures may need to be implemented though these usually relate to housekeeping measures.

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 may be required to facilitate product recall. In some territories this is a mandatory requirement.

- 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;

- Replacement of refrigerant gas or equipment may be required to meet international standards;
- Where large quantities of energy are used this can result in high operating costs to the business;
- Income may be generated through sale of by-products, for example 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 & safety regulations.

IMPROVEMENTS

Environmental Improvements

- Adopt recycling and reuse of steam, vapours and water in process;
- The processing of sugar is energy intensive and there are often opportunities for reduction in energy consumption, such as:
  - Preheating of incoming cold pipes by hot effluent streams;
  - Consider combined heat and power generator schemes with steam turbines;
  - Change to cleaner fuel sources and more efficient fuel types;
- Investing in environmentally sound technologies which generate less waste and residues, reduce operating inefficiencies and lead to lower emissions of environmental contaminants. The continued use of inefficient technologies can represent increased operating costs for organisations;
- Re-use of waste products in the process, e.g. as an energy source;
- Recovery raw materials, products, particularly the filter cake which contains impurities and sugar residues to provide high nutrient content animal feed;
- Minimise dust production through extraction systems;
- Improving the integrity of drainage systems, for example, sealing or removing abandoned drains to avoid undetected leakages;
- Monitoring of all materials held on site and clear procedures for their handling and treatment in the event of spillage, particularly where these materials may impact on human health or the local environment;

- Secondary containment of tanks to contain spills;

- Regular integrity testing of bulk storage tanks and drums. Secure valves on oil and fuel supplies.

- Sugar dust can be explosive. Install anti-static devices to minimise risk of sparks and explosions in the presence of high levels of sugar dust;

To safeguard against the dangers posed by forklift trucks, companies must ensure they assess the risks involved in any use of these vehicles and take appropriate steps to counter those risks.

- Use of licensed/certified forklift truck operators is mandatory in some countries

- Vehicle routes and movements need to be planned to ensure segregation from pedestrians. Ideally areas where vehicles are manoeuvring should be made pedestrian free.

- All operators of machines need to be competent and trained on the individual characteristics of machines they are expected to operate.

- Separate people from moving equipment:

    - Redesign process layout to reduce crossing paths to avoid collisions and falls;

    - Separate transport corridors and working areas to reduce risk of collision;

    - Provide appropriate signage for segregating people and vehicles

- Install correct guarding of machinery to reduce risk of entrapment;

- Prevent spillage and maintain walking areas to ensure they are clean and dry;

- Ensure correct clean up programmes are in place for liquids: restrict access to areas being cleaned down or where spillages have occurred;

- Install mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities;

- To reduce the risk of noise exposure, isolate noisy equipment, 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;

- Restrict access to working at height or around the top of vats. Ensure correct fall arrest systems are in place, such as, (guarding and harnesses);

- 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.

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GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

With regard to sugar beet, as the factories are usually operational for the seasonal harvest until the beet has been processed, visits should be timed accordingly.

When visiting the sites of potential borrowers, invested companies or during loan supervision use the following as a practical guide to due diligence.

Environment, Health and Safety

- Confirm organisational responsibilities and systems for environment, health and safety;
- Perform a complete tour of the works, accompanied by someone knowledgeable about all the activities at the works;
- Look for signs of poor housekeeping, such as signs of spillages and high numbers of empty drums, and dust/sugar accumulation. Particularly note any recent spills or releases of raw materials;
- Check the condition of any assets, facilities, equipment, production areas – look for wear and tear, and poor maintenance;
- Check whether fuel storage tanks are tested regularly for leakages;
- Discuss emergency response to fires, major spills etc;
- Check measures and equipment in place to prevent explosions/fires;
- Identify neighbour activities and determine whether there could be an impact;
- Check for quality testing of product;
- Check the source of raw materials and screening for contamination, in particular, which contamination parameters are analysed (e.g. pesticides, herbicides, radioactivity, heavy metals, and industrial pollutants);
- Check food hygiene standards at the facility and the results of previous food hygiene inspections, procedures used to ensure food hygiene and the condition and cleanliness of food processing and handling areas;
- Observe food hygiene standards at the facility and the results of previous food hygiene inspections, e.g. Separate welfare areas for workers; Are staff wearing PPE? Does the organisation have food traceability systems in place;
- 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;
- Find out whether drainage systems lead to wastewater treatment systems or discharge directly to surface waters and note the colour and appearance of adjacent water courses;
- Enquire about waste disposal options used by the site;
- Assess the level of health and safety awareness at the works, for example the presence of safety notices and the general appearance of the site;
- Find out what insurances are in place (health, hygiene, fire etc). Identify number and type of claims against insurance;'
- Note the location and integrity of oil and chemical storage areas. These should be located away from operational areas and have measures to contain spillages;
- Note the levels of noise at works and whether measures are in place to limit noise generation and to control ambient noise levels;
- 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 for controlling potential odours from the plant during the operation in the slaughterhouse or transportation;
- Check for automatic safeguards on machinery to prevent accidental injury;
- Have there been any recent (within the last three years) incidents on site such as fatalities, fires/explosions, spills?
- 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 and Hygiene 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.
- 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?

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

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 & 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.

REFERENCES AND ADDITIONAL SOURCES

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