CLEANER PRODUCTION OPPORTUNITIES

IN

SUGAR MANUFACTURING SECTOR
Indian Scenario of Sugar Industries:

There are over 575 sugar mills spread over 9 states of India. All sugar mills produce bagasse during sugar production and use it for power and steam generation for internal use. Conventional use of bagasse for this purpose is inefficient. Indian sugar mills both in private and cooperative/joint sectors have started acknowledging the importance of high efficiency grid connected cogeneration power plants for generating exportable surplus after meeting their own demand of power and heat. By improving efficiency by steam production at higher pressure above 67 kg/cm² and temperature near about 500°C more power can be generated and steam required for the process also can be met.

Indian Sugar Industries Highlights:

- 2nd largest producer and largest consumer of sugar in the world
- Around 5 million hectares of land
- Producing about 350 million tons of sugarcane
- Cane payment of Rs.55,000 crore annually received directly to farmers, without middlemen.
- 50 million cane farmers and dependants
- Rs.80,000 crore sugar industry
- Estimated cane price payment for 2011-12 is Rs 55,000 crores
- Paid to farmers directly without involvement of any middlemen
- Located in rural heartland, directly contributes to rural economic development and employment
- 65% of sugar consumed by bulk consumers viz. beverage, biscuit, confectionery etc. manufacturers

General Description of Industry Activities

Sugar manufacturing facilities process beet and cane into crystalline sugar and other by-products (e.g. ethanol and other organic chemicals). In excess of 70 percent of the world’s sugar production is based on sugar cane, with the remainder based on sugar beet. Typical cane processing facilities may process between 500 to 10,000 tons of cane per day. Beet processing facilities may process between 2,000 tons beet/24 hrs to 15,000 tons beet/24 hrs.

The modern sugar mill may use bagasse (waste fiber) to provide for its own electrical energy needs while supplying excess power to the local grid. Separate facilities process the beet and cane into other sucrose products (e.g. liquid sugar, organic sugar, and organic syrup) for distribution to other industry applications or to consumers.
Sugar cane contains 70 percent water, 14 percent fiber, 13.3 percent saccarose (about 10 to 15 percent sucrose), and 2.7 percent soluble impurities. Sugar beet has a water content of 75 percent, and the saccarose concentration is approximately 17 percent.

**Production Process**

Beet and cane sugar production processes are similar. Both involve reception, cleaning, extraction, juice clarification, evaporation, crystallization centrifugation, drying, storing, and packing stages as illustrated in figures 1 and 2. Beet and cane sugar manufacturing are typically located adjacent to the sources of raw materials to reduce costs and transportation time, and to ensure fresh raw material. Reception of Beet and Cane. Sugar beet and cane are unloaded from the transportation vehicles after a sample has been taken for assessment of sugar and dirt content. The beet production line runs continuously at full capacity, whereas the sugar cane production line usually has to stop every approximately 14 days to facilitate removal of encrustations on heating surfaces. Cane and beet processing facilities typically have substantial areas to stockpile enough raw materials to facilitate continuous production.

**Washing and Extraction of Cane**

Traditionally, cane has been burned in the field before transport to processing facilities to remove any leaves from the cane stalk. The current trend is to harvest green unburned cane, returning leaves to the field where the crop residue promotes soil conservation. Cane factories may have washing operations followed by disaggregation of the raw material using knives and hammer mills.

Extraction of the sugar juice is achieved with roller mills which press out the juice. The remains of the cane stalk are called “bagasse,” which contains cellulose fiber. This is mostly used in the process facility as fuel for energy supply. Where fuel is available from another source, the bagasse may be used for further processing in the cellulose industry. Cane juice extraction may also be achieved by a diffusion leaching process, which can result in higher rates of extraction with 50 percent less energy consumption than a mechanical mill.

**Washing and Extraction of Beet**

Washing of sugar beet is water intensive and wash water is typically recirculated. During washing, soil, stone and leaves are separated from the beet. Separated stone can be used, for example, as gravel for the construction industry. Disintegration of the beet is accomplished by cutting into slices (cossettes). The juice is extracted by a diffuser, where the slices are mixed with hot extraction water to form a sugar solution, known as ‘diffusion juice’. The spent beet cossettes in the beet pulp are then pressed and dried to produce animal feed.
Clarification, Evaporation, and Crystallization

The juice resulting from the extraction process is clarified by mixing it with milk of lime, after which it is filtered to remove the mud. In beet-based sugar production, the lime is produced from limestone, which is combusted in a specially designed lime kiln. The main outputs are burnt limestone and carbon dioxide (CO2).

The burnt limestone is used to generate milk of lime and the CO2 is also added to the liquid in a process called carbonation. Because large quantities of milk of lime and gas are needed, this is a continuous process. These substances are added to the juice and, in the process of carbonation, bind other components, such as protein, to the lime particles. The lime is then filtered, resulting in lime sludge, and dried for use as a soil conditioning agent in agriculture. The resultant clear solution of juice is called “thin juice.”

Although the carbonation process gives good results, it is rarely used in the cane industry because of the investment required and a general lack of the main raw material, limestone. Cane processing facilities typically purchase ready-made burnt limestone powder and use this to generate milk of lime. After clarification, the thin juice has a sugar content of approximately 15 percent. Concentrations greater than 68 percent are needed to allow sugar crystallization, and this is achieved through evaporation. Water is removed from the thin juice in a series of evaporating vessels until a syrup with a dry matter content of 68–72 percent is obtained. This thick juice is further evaporated until sugar crystals form, and the crystals and the accompanying syrup are then centrifuged to separate the two components. The final syrup, which contains 50 percent sugar, is called molasses. Sugar crystals are then dried and stored (e.g. in silos).

Molasses is the most important by-product of the sugar production. Molasses can be used as cattle fodder or as raw material in the fermentation industry. To facilitate the use of the molasses, which is generated in relatively high volumes, sugar factories may be combined with distillation plants (see below). The basis for the distillery can be sugar juice, molasses, or a combination of these products.

Sugar Refining

The refining of sugar involves affination (mingling and centrifugation), melting, clarification, decolorization, evaporation, crystallization, and finishing. Decolorization methods use granular activated carbon, powdered activated carbon, ion exchange resins, and other materials.

Distillery

An associated distillery may employ batch or continuous fermentation, followed by distillation, to produce ethanol with a purity of 95 percent. This ethanol can be used in other industries or further processed and blended with gasoline. Waste from the distillation process is known as vinasse or spent wash. Anaerobic digestion of this waste is used to produce biogas, which can be utilized for the production of boiler fuel for the
distillery or to fuel CHP engines. Remaining waste can be returned to agricultural fields and / or used in the composting of organic solids emanating from processing.

Figure 1: Sugar Manufacture from Beet
Figure 2: Sugar Manufacture from Cane
Environmental issues in Sugar Industries:

A. Solid waste and by-products
B. Wastewater
C. Emissions to air

A. Solid Waste and By-Products

Sugar industry activities generate large quantities of organic solid waste and by-products (e.g. leaves from cane or beet, molasses from the final crystallization, press mud or cachaza, bagasse fiber from the cane, mud and soil arriving at the plant with the raw material, and lime solids from the juice clarification).

Generated mainly from the primary treatment of raw materials, these waste materials may also present a risk from pesticide residues. The amount of waste generated depends on the quality of the raw materials themselves and on the initial cleaning in the field.

The generation of higher quality waste can provide opportunities for reprocessing of otherwise discarded raw materials into commercially viable by-products (e.g. paper making and particle board manufacturing). Other solid wastes from the sugar manufacturing process include spent filter material (e.g. active carbon, resins from the ion exchange process, acids from chemical cleaning of equipment, vinasse or spent wash from the distillation of fermented molasses-sugar juice, and ashes from the steam boiler plant).

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<tr>
<th>Source</th>
<th>Cleaner Production Measures</th>
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| Solid Waste: leaves from cane or beet, molasses from the final crystallization, press mud or cachaza, bagasse fiber from the cane, mud and soil arriving at the plant with the raw material, and lime solids from the juice clarification | • Avoid burning cane leaves in the field before harvest. The trimmings from the sugar cane should be spread in the field to biodegrade;  
• Use bagasse (waste fiber) from the cane as fuel for steam and power generation. Depending on production capacity and raw material input volumes, using bagasse as a fuel can meet the plant energy demand and may generate excess electrical energy for sale;  
• Use molasses beneficially as a feedstock for:  
  o Fermentation and organic chemical manufacturing  
  o Production of citric acid and yeast  
  o Distillation industries  
  o Organic chemical manufacturing (e.g. ethanol)  
• Use beet leaves and roots (which enter the facility as part
- Collect waste products, (e.g. beet tops from the washing process) for use in by-products or as animal feed;
- Convert beet pulp into feed (e.g. for cattle). During the processing season it can be sent as return loads on empty beet lorries;
- Separate stones from the beet during the washing process and reuse in other industrial applications (e.g. road building and construction industries);
- Remove soil and earth from the beet while in the field and before transport to reduce the risk of spreading pesticide residues;
- Use organic material in the wastewater and the spent wash from distillation to produce biogas;
- Use filter and dry lime from the juice clarification process to make a soil-conditioning product for agricultural land;
- Compost organic solids from press mud (cane laundry) to make high-quality organic manure for agricultural production

| sludge from wastewater treatment | Aerobic stabilization or anaerobic digestion. Anaerobic stabilization improves the sludge applicability to agriculture;
Gravity thickening;
Sludge dewatering on drying beds for small-scale facilities and dewatering using belt presses and decanter centrifuges for medium- and large-scale facilities;
Using sludge from concentrated sugar juice prior to evaporation and crystallization (known as cane mud or cachaza) to produce organic manure and soil amendment for agricultural applications. |
B. Wastewater

Industrial process Wastewater

Sugar processing wastewater has a high content of organic material and subsequently a high biochemical oxygen demand (BOD), particularly because of the presence of sugars and organic material arriving with the beet or cane. Wastewater resulting from the washing of incoming raw materials may also contain crop pests, pesticide residues, and pathogens.

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| Waste Water: Washing of incoming raw materials containing crop pests, pesticide residues, and pathogens | - Segregate non-contaminated wastewater streams from contaminated streams;  
- Reduce the organic load of wastewater by preventing the entry of solid wastes and concentrated liquids into the wastewater stream;  
- Implement dry precleaning of raw material, equipment, and production areas before wet cleaning  
  o Allow beet to dry on field if possible, and reduce breakage during collection and transport through use of rubber mats and lined containers.  
  o Use dry techniques to unload beet  
  o Fit and use floor drains and collection channels with grids and screens or traps to reduce the amount of solids (e.g. beet parts) entering the wastewater  
  o Prevent direct runoff to watercourses, especially from tank overflows |

Process Wastewater Treatment

Techniques for treating industrial process wastewater in this sector include preliminary filtration for separation of filterable solids; flow and load equalization; sedimentation for suspended solids reduction using clarifiers; biological treatment, typically anaerobic followed by aerobic treatment, for reduction of soluble organic matter (BOD); biological nutrient removal for reduction in nitrogen and phosphorus; chlorination of effluent when disinfection is required; dewatering and disposal of residuals; in some instances composting or land application of wastewater treatment residuals of acceptable quality may be possible. Additional engineering controls may be required to contain and neutralize nuisance odors.

Other Wastewater Streams & Water Consumption Guidance on the management of non-contaminated wastewater from utility operations, non-contaminated stormwater, and sanitary sewage is provided in the General EHS Guidelines. Contaminated streams should
be routed to the treatment system for industrial process wastewater.

Sugar manufacturing requires considerable quantities of high-quality water for raw material cleaning, sugar extraction, final sugar washing, and cooling and cleaning equipment. Steam is essential to the evaporation and heating of the various process steps in sugar processing. Beet and cane raw materials also contain high percentages of water, which can be recovered and reused during processing. Additional industry-specific measures applicable to sugar manufacturing include:

- Recycle process water and apply to the washing of incoming raw material;
- Use closed loops for intensive solid generating washings, (e.g. cane and beet wash) and flue gas scrubbers.

C. Emissions to Air

Air emissions in sugar manufacturing are primarily related to particulate matter generated from bagasse-fired steam boilers, dust from unpaved access roads and areas, and sugar drying or packing activities. In addition, odor emissions are generated from beet processing activities and storage facilities. Beet actory juice clarification produces a sweet odor, which can be irritating. Inadequate cleaning of the raw material may result in fermented juice, which will also create a foul smell.

Exhaust gases

Exhaust gas emissions produced by the combustion of organic materials in boilers for power and heat generation can be the most significant source of air emissions in sugar processing activities. Air emission specifications should be considered during all equipment selection and procurement.

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| Particulate Matter and Dust | • Operate bagasse-fired steam boilers while targeting emissions guidelines applicable to the combustion of solid fuels presented in the General EHS Guidelines. Typical control methods include boiler modifications or add-on controls, (e.g. flue gas cyclones, fabric filters, or electrostatic precipitators, wet scrubbers and local recirculation systems) to capture the ash and recycle the water to prevent the emission of particulate;  
• Use wet scrubbers to remove dust from drying and cooling of sugar;  
• Reduce fugitive dust from roads and areas by cleaning and maintaining a sufficient level of humidity;  
• Install ventilation systems with filters on transport systems for dry sugar and on sugar packing equipment. |
Odor

- Keep beet processing and storage facilities clean to avoid the accumulation and fermentation of juice;
- Use wet scrubbers to remove odors with a high affinity to water (e.g. the ammonia emitted from the drying of beet pulp);
- Consider use of bio-treatments;
- Ensure that vapor from the carbonation section is emitted from a stack of sufficient height.

**Energy Consumption and Management**

Sugar manufacturing facilities use energy to heat water and produce steam for process applications and cleaning purposes. Reducing energy consumption will have a positive effect on air emissions. Some industry specific recommendations include:

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<th>Sr. No</th>
<th>Energy Conservation measures</th>
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<tr>
<td>1</td>
<td>Install steam turbine-based combined heat and power technology, enabling the facility to generate its own process steam and electricity requirements and sell excess electricity;</td>
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<td>2</td>
<td>Use waste fiber or bagasse from the cane as fuel for steam and power generation. Ensure that the bagasse moisture level is below 50 percent before it is used as boiler fuel to improve its calorific value and overall efficiency for steam generation and avoid the need for supplemental fuels.;</td>
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<td>3</td>
<td>Anaerobically digest high-strength organic wastes (e.g. vinasse or spent wash from distillery and organic chemical manufacturing) to produce biogas. Use biogas to fire distillery boilers or to operate combined heat and power systems generating electric energy and hot water/steam;</td>
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<td>4</td>
<td>Keep heating surfaces clean by adding chemicals to prevent incrustations. Incrustations are generated by mineral salts that are not removed during clarification and may be prevented or reduced by adding special polymers to the thin juice;</td>
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<td>5</td>
<td>Ensure even energy consumption by management of batch processes (e.g. centrifuges, vacuum pans) to schedule energy demand and equalize steam demand on the boilers;</td>
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<td>6</td>
<td>Reuse vapor from vacuum pans for heating juice or water;</td>
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<td>7</td>
<td>Use an evaporator with at least five effects; • Combine drying of beet pulp with the main energy system in the facility.</td>
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<td>8</td>
<td>Select the operating conditions of the boiler and steam turbine system to match the heat-power ratio of the utility system to that of the facility. If, despite selection of a high pressure boiler, the facility needs to pass more steam through the turbine than it uses in the process to generate sufficient electricity, then it should condense rather than vent this steam.</td>
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**General Good Housekeeping Practices:**

<table>
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<tr>
<th>Waste origin/ Sections</th>
<th>Waste type</th>
<th>Pollution prevention measures mainly from the point of ‘Good Housekeeping’</th>
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| Before milling i.e. cane receiving cane yard, can unloading cane carrier section | Inadvertent spills, can pieces (small) and wastage, cow dung | • Use just in time ordering system  
• Maintain a clean, even surface in yard area  
• Inspect material (cane) for quality, quantity etc., before unloading  
• Concrete road for vehicles/ carts to stand and automatic unloading of can will reduce spillage  
• Set up written procedure for loading/ unloading  
• Remove cane trash and cow dung then and there  
• Failing out cane pieces/powder must be removed from below the cane carrier. |
| Mill Section | Effluent continuous gland cooling and intermittent floor washings, leakage of oil, grease and spill over, leakage of juice, leakage of bearing cooling water, spillage of bagasse and can juice from rollers, whirling tanks, pipelines, overflow of juice from whirling tanks | • Prevent concrete ‘sweating’ by raising the drum of storage tank pads  
• Construct concrete drains closed with steel jellies having lids at intermittent places for inspection and maintenance  
• Drains leading to the effluent collection pit in the mill house should have proper slope and drain time of liquid should be adequate.  
• Inspect regularly glands, valves and pumps for leakage and attend repairs immediately.  
• Use lubricants judiciously and properly  
• Schedule production rate to achieve maximum efficiency.  
• As a precautionary measure keep trays of proper design and shape to collect oil and grease spillages/wastes.  
• Install overflow alarms for tanks/vessels  
• For bagasse, use closed transfer system (hous)  
• Provide system with guards/guides for bearing cooling water  
• Dry clean at places wherever possible  
• Separate oil, grease and bagasse from effluents using proper grits  
• Use disinfectants judiciously |
| Juice Dilution and Chemical areas of work | Tank bottoms: off spec and excess material; spill residues leaking vessels, pumps, valves, tanks, pipes, damaged containers, dirt accumulation, floor | • Use seal less pumps or pumps with metallic seals.  
• Instruct operators not to bypass alarms, signs or significantly alter set points without authorization.  
• Document all spillage  
• Set up control points to dispense chemicals and wastes  
• Store containers/vessels/tanks in such a way as to allow for visual inspection for corrosion and leaks. |
| Clarification (Sedimentation) Section and Vacuum filters | Leakage from pump gland, overflows. Leakage from pipe, tanks etc | • Provide adequate light and ventilation in the storage area.  
• Maintain distance between different types of chemicals to prevent cross contamination.  
• Follow manufacturer’s suggestions in storage and handling of chemicals.  
• Use mechanical wipers on mixing tanks.  
• Use closed storage and transfer system.  
• Use clean-in place systems.  
• Improve cleaning efficiency.  
• If possible, use large containers with height to diameter ratio equal to one (1)  
• Install secondary containment areas.  
• Segregation of effluents will reduce pollution loading.  
• PH controller, temperature gauges and overflow indicator and water meter at appropriate places will help in control of overdoses, identification of leakage spots i.e. increase use of instrumentation.  
• Use closed storage and transfer system.  
• Use cleaning systems those avoid or minimize solvents and clean only when needed. If possible use high pressure water cleaning or dry cleaning or dry  
• Adhere to regular preventive maintenance and monitoring  
• Have some pacca tank/ pit to collect effluents with oil and grease.  
• Install overflow alarms for all tanks/vessels  
• Maintain physical integrity of all tanks and vessels  
• Clean drains at regular intervals |
| Boiler house | Waste with inorganic salt concentration boiler blow down contaminant, boiler dust from flue gases, boiler ash | • Boiler blow down can be recycled for use in lower pressure boiler as make up water. If needed, some segregation may be required.  
• Regular inspection and preventive maintenance of boiler and its accessories for leakages, corrosion, scaling must be done.  
• Cleaning of boiler should be done properly and on the basis of deposit thickness, so as to reduce frequent waste generation.  
• Improve equipment seals to prevent air and cooling water leaks into the boiler.  
• Use wet scrubbers, fly ash arrestors properly and effectively.  
• Use modern multicycle type dust collectors. Use of ESP can also be considered.  
• Regularly inspect for choking etc.  
• Allow adequate quantity of air for proper combustion.  
• Remove boiler ash to designated locations in closed conveyors/ transportation systems. |
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<th>Gujarat Cleaner Production Centre - ENVIS Centre</th>
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### Sulphitation (Bleaching)
- **Possible SO₂ leakage, overflow of juice from tanks, spillage etc.**
  - Use properly designed tanks and vessels (juice receiving and reaction tanks) for their intended purposes.
  - Install overflow alarms for all tanks/vessels.
  - Document all spillage.
  - Place tanks/vessels in such a way as to allow for visual inspections.
  - Use adequate scrubbing arrangements in sulphitation tank to absorb sulphur dioxide (SO₂) to gas.
  - Chimney from sulphitation vessels should extend above roof to an adequate height.
  - Adequate lighting and ventilation around the sulphitation area is must.
  - Use steel pipes of good quality and proper seals for collar positions.
  - Improve cleaning efficiency.
  - Install SO₂ detectors at possible leakage points/sources
  - Adequate open area/ventilation must be provided to avoid any accident due to SO₂ leakage (if any)

### Crystallization and Pan Boiling
- **Leakage from pumps**
- **Leakage/spills from gutters**
- **Inlet and outlet vents losses**
- **Oil and grease from equipment cleaning and maintenance**
  - Arrange layout such that visual inspection for leakage and spills must be possible.
  - Maintain pumps, tanks, wheel and gear arrangements as per preventive maintenance plan/schedule.
  - Segregate effluents as per loading.
  - Water leaving crystallizers and sulphur burners can be sent to condenser water cooling system (injection water).
  - Inlet and outlet vents must be checked for leakage/losses.
  - Check cooling elements regularly for the leak proof working.
  - Maintain physical integrity of crystallizers, centrifuges and pans.
  - Isolate equipment or process lines, pipes etc. those leak or not in service. Use seal less pumps or metallic seals.
  - Use clean in place systems.
  - Adopt 'dry cleaning' using bagasse.
  - Use mechanical wipers on mixing tanks.
  - Use improved seals for pipes, valves, pumps etc.

### Spray pond overflow
- **Overflow water form spray ponds, oil & grease from equipment cleaning/ poor maintenance**
  - This can be reused for irrigation through segregation of streams in lined drains/channels.
  - Regular inspection and preventive maintenance is essential.
  - Water channels/drainage must be leak proof. Inspect for leakage, stagnation and take immediate measures (cleaning, disinfectant etc)
  - Check for the minimum depth of water in spray pond.

### Evaporation Section and Pan Boiling
- **Sugar loss in the condensates through entrainment, thus pollutes cooling water.**
- **Leaking pumps, valves & vessels and pipes.**
- **Poor operating & maintenance conditions.**
- **Caustic soda scrap scales**
- **Oil and grease from equipment cleaning/ operation and maintenance**
  - Continuous automatic recording and indication of brix of syrup will be useful for supervisory staff.
  - Use sealless pumps.
  - Use good quality seals and valves
  - Provide adequate lighting and ventilation near storage area
  - Provide segregation drains and collection pits for water wastes from evaporators and pans.
  - Inspect regularly pumps, gauges, valves, vessels, pipes for choking leakage, spillage and splash etc.
  - Preventive maintenance schedule must be adhered to.
  - Check the 'catch all' in evaporator and pans frequently.

### Evaporator, Pans & Juice heater cleaning
- **The wastewater from cleaning of scales increases pollution load of effluent streams**
  - Reduce frequency of cleaning of evaporator using desalts.
  - Cleaning of scales by electric driven flexible shafts using compressed air.
  - Improve cleaning efficiency
  - Segregate and collect the wastewater in lined drains.
  - Explore alternative cleaning methods without using chemicals.
  - Holding tank used for avoiding shock loadings in ETP should be leak proof with overflow alarms.
  - Establish spill prevention, control & countermeasures (SPCC/plans).
  - Maintain physical integrity of all tanks vessels.
  - Document all spillage
  - Preferably use seal less pumps for all purposes or use quality seals.
  - Keep aisles clear of obstructions
  - Scales can be partially softened/ or partially dissolved before high pressure cleaning

### Molasses storage tanks (final molasses)
- **Poor handling, leakage, improper**
  - Provide collecting pits/chambers around the tank for collecting cold water used for spray and also any foam overflowing etc.
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<th>Topic</th>
<th>Details</th>
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<tr>
<td>Storage, overflows from tank</td>
<td>- Handling of molasses should be careful without spillage/losses.&lt;br&gt;  - Store molasses on storage tanks fitted with all accessories/fitting as prescribed including overflow alarm, inlet valve, washout valve, outlet for pump, temperature gauges, manhole vent.&lt;br&gt;  - Arrangement for spraying cold water spray coil, level indicator etc.&lt;br&gt;  - Properly label all tanks, containers.&lt;br&gt;  - Conduct periodic analysis of molasses.&lt;br&gt;  - Provide lids and vents on tanks (fixed roof type).&lt;br&gt;  - Thoroughly clean the tanks with water whenever they are emptied.&lt;br&gt;  - Use splash guards.&lt;br&gt;  - Inspect/check for losses, spills around tanks &amp; immediately attend it.&lt;br&gt;  - Immediately clean floors using dry cleaning or other appropriate cleaning system.&lt;br&gt;  - Regular lifting of molasses should be monitored.&lt;br&gt;  - Prefer intact and closed transportation/conveyance system.</td>
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<td>Solid Waste Bagasse</td>
<td>- Bagasse fibres find their way into waste streams.&lt;br&gt;  - Storage of bagasses in open area may create pollution problems.&lt;br&gt;  - Keeping segregated waste through streams/drains/channels closed having (inspection points open) proper slope and lining will prevent fall of bagasse fibres into streams (i.e. closed transfer system).&lt;br&gt;  - Use industrial vacuum cleaners/dry cleaners/clean in place system and these should be routine features of the mill.&lt;br&gt;  - Automatic transportation feeding of bagasse must be there as per required quantity.&lt;br&gt;  - Storage of bagasse (if any) should be in proper storage yards.&lt;br&gt;  - 5% of total bagasse can be used for other by products like paper and pulp, paperboard etc.&lt;br&gt;  - Keep wet while storage and use closed transportation systems and conveyors.&lt;br&gt;  - Clean the screens used on conveyors properly at regular intervals.&lt;br&gt;  - Clean bottom of blowers properly and regularly.</td>
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<td>Press mud or 'filter cake' (obtained at juice clarification station from rotary vacuum filters)</td>
<td>- Contains inorganic salts and organic materials.&lt;br&gt;  - Due to spillage (while transportation and collection) from conveyors, unloading etc.&lt;br&gt;  - Automatic and closed transfer systems/conveyors will reduce this problem.&lt;br&gt;  - Provide splashguards.&lt;br&gt;  - Automatic unloading through hopper bottom directly on to the trucks can help in keeping the floors and premises clean.&lt;br&gt;  - Clean equipment after use.&lt;br&gt;  - Maintain a clean, even surface (concreted) in transportation/movement areas.</td>
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<td>Air Pollution Sugar dust from sugar house and particulates from bagasse burning (boiler house)</td>
<td>- Sugar dust is explosive and pollutes inside atmosphere.&lt;br&gt;  - They fly ash particles are likely to escape out&lt;br&gt;  - Use closed conveyor and transportation system.&lt;br&gt;  - Use closed loading &amp; unloading system for sugar packing.&lt;br&gt;  - Vacuum cleaning/dry cleaning will keep the area neat and clean.&lt;br&gt;  - Proper handling of equipment, better operations and maintenance practices will reduce release of sugar dust.&lt;br&gt;  - Adequate light and ventilation near sugar packing area will not suffocate the environment inside the plant.&lt;br&gt;  - Efficient and effective air pollution control devices like dust collectors, fly ash collectors, cyclones/wet scrubber type fly ash arrestors and bag filters of required efficiency and effectiveness shall preferably be used appropriately.</td>
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