Module 5

Module -5
Applications: Applications of EMS, Waste Audits and Pollution Prevention Control: Textile, Sugar, Pulp & Paper, Electroplating, , Tanning industry. Hazardous Wastes - Classification, characteristics Treatment and Disposal Methods, Transboundary movement, disposal.

Questions

1. Briefly discuss the applications of EMS and Waste Audit. (10 Marks)

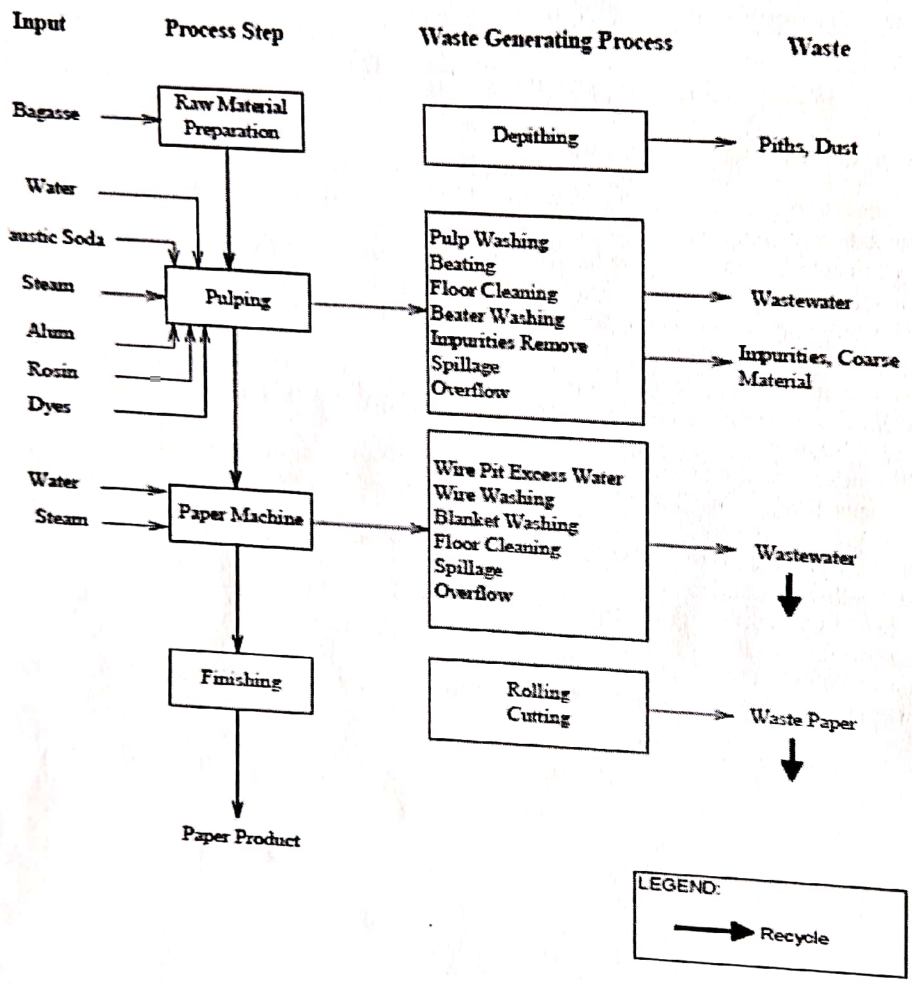
Application of ems and waste audit

- Environmental Management Systems can help to minimize environmental effects of an organization or company.
- They can help to amplify the productive use of assets that the company has.
- They are shown to help to reduce the amount of waste that a company produces.
- EMS's can help to give the public a good picture of the organization that you have and that you want to be.
- They can play a very large role in constructing the consciousness of environmental concern among people within your organization and that utilize what your organization has to offer them.
- Gain a superior understanding of the environmental effects of business exercises.
- Expansion benefits and enhancement of environmental plan execution, through more productive operations.
- Waste audits can determine the effectiveness of your operations
- Waste audit reduce the cost
- Waste audit measures the success
- Waste audit will verify and have access to more accurate data
- Waste audit meet certificate standards
- Waste audit are required for certain regulatory compliance and reporting purposes

2. Discuss Pollution Prevention Opportunities in Pulp Paper and Sugar mills. (10 Marks)

PULP AND PAPER MILL/ INDUSTRY

Production Process



5.3.3.1 SOURCES OF POLLUTANTS AND ITS CHARACTERISTICS

Source	Major Pollutants
Chemical Pulping Process	VOCs (terpenes, alcohols, phenols, methanol, acetone, chloroform, methyl ethyl ketone [MEK])
	Reduced sulfur compounds (TRS)
	Organo-chlorine compounds
Bleaching	VOCs (acetone, methylene chloride, chloroform, MEK, chloromethane, trichloroethane)
Wastewater Treatment Plant	VOCs (terpenes, alcohols, phenols, methanol, acetone, chloroform, MEK)
Power Boiler	SO2, Nox, fly ash, coarse particulates
Evaporator	Evaporator noncondensibles (TRS, volatile organic compounds: alcohols, terpenes, phenols)
Recovery Furnace	Fine particulates, TRS, SO2, Nox
Calcining (Lime Kiln)	Fine and coarse particulates

5.3.3.2 POLLUTION PREVENTION AND CONTROL

- Prefer dry debarking processes.
- Prevent and control spills of black liquor.
- Prefer total chlorine-free processes, but at a minimum, use elemental chlorine-free bleaching systems.
- Reduce the use of hazardous bleaching chemicals by extended cooking and oxygen delignification.
- Aim for zero-effluent discharge where feasible. Reduce wastewater discharges to the extent feasible.
- Incinerate liquid effluents from the pulping and bleaching processes.
- Reduce the odor from reduced sulfur emissions by collection and incineration and by using modern, low-odor recovery boilers fired at over 75% concentration of black liquor.
- Dewater and properly manage sludges.
- Where wood is used as a raw material to the process, encourage plantation of trees to ensure sustainability of forest

5.3.3.4.2 Cleaner Production

Good housekeeping

1. Installation of a screen to separate fine piths and dust in the depithed bagasse.
2. Repairing the belt conveyor to prevent the bagasse spillage.
3. Replacing another type of water tap to avoid water leaking.
4. Installation of self-closing valves for the pressurized raw water to minimize water wastage
5. Insulation of the steam pipeline
6. Insulation of the digestors.
7. Cleaning the roll in the paper machines to avoid broke paper

Better Process Control

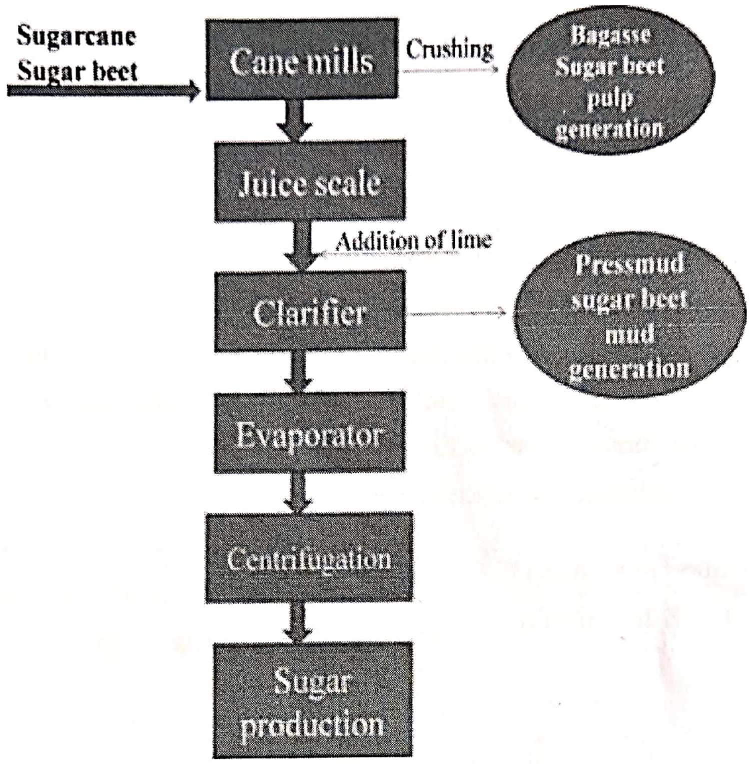
1. Segregation of initial concentrated black liquor
2. Installation of consistency indicator.
3. Adjustment of edge cutter to reduce side trimming loss
4. Use of soft water as boiler feed water.
5. Installation fiber recovery unit (saveall) for whitewater from paper machines.
6. Reduce beating time
7. Multiple loading of digestor

Recycling

- Recovery of concentrated black liquor for use as construction material additive.

5.3.2 SUGAR INDUSTRY

Production Process



5.3.2.1 SOURCES OF POLLUTANTS AND ITS CHARACTERISTICS

- The main air emissions from sugar processing and refining result primarily from the combustion of bagasse (the fiber residue of sugar cane), fuel oil, or coal.
- Other air emission sources include juice fermentation units, evaporators, and sulfidation units.
- Approximately 5.5 kilograms of fly ash per metric ton (kg/t) of cane processed (or 4,500 mg/m3 of fly ash) are present in the flue gases from the combustion of bagasse.
- Sugar manufacturing effluents typically have biochemical oxygen demand (BOD) of 1,700– 6,600 milligrams per liter (mg/l) in untreated effluent from cane processing and 4,000–7,000 mg/l from beet processing; chemical oxygen demand (COD) of 2,300–8,000 mg/l from cane processing and up to 10,000 mg/l from beet processing; total suspended solids of up to 5,000 mg/l; and high ammonium content.

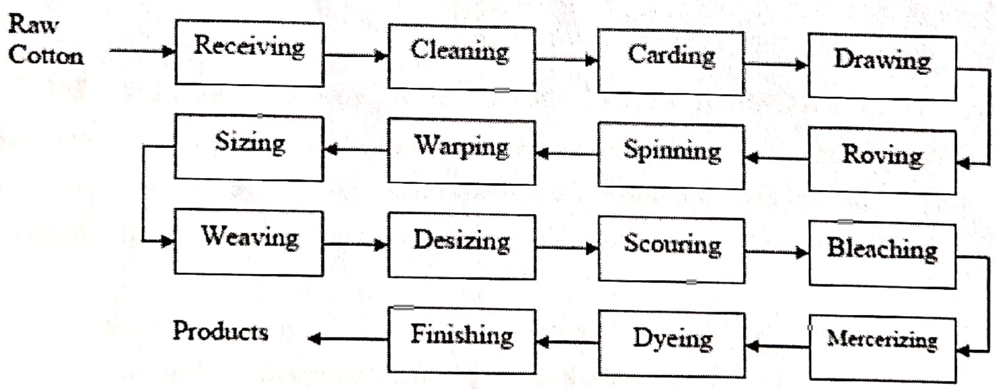
5.3.2.2 POLLUTION PREVENTION AND CONTROL

- Reduce product losses to less than 10% by better production control. Perform sugar auditing.
- Discourage spraying of molasses on the ground for disposal.
- Minimize storage time for juice and other intermediate products to reduce product losses and discharge of product into the wastewater stream.
- Give preference to less polluting clarification processes such as those using bentonite instead of sulfite for the manufacture of white sugar
- Collect waste product for use in other industries—for example, bagasse for use in paper mills and as fuel. Cogeneration systems for large sugar mills generate electricity for sale. Beet chips can be used as animal feed.
- Optimize the use of water and cleaning chemicals. Procure cane washed in the field. Prefer the use of dry cleaning methods.
- Recirculate cooling waters.

3. Explain Pollution prevention in Textile Industry

5.3.1 TEXTILE INDUSTRY

Production Process



5.3.1.1 SOURCES OF WASTEWATER AND ITS CHARACTERISTICS

1. Sizing wastewater results from the cleaning of sizing boxes, rolls, size mixer, sizing area and the drainage of sizing solution. Its volume is low but, depending on the recipe used, can contain high levels of BOD, COD and TSS.
2. Desizing effluent results from additives used in the size technique, surfactants, enzymes, and acids or alkaline as well as the sizes themselves. The generated wastewater can be the largest contributor to the BOD and TSS.
3. Scouring wastewater characteristic is an organic and alkaline, contain fabric fragment starch and sizing materials, caustic soda and chemicals used. It generates very high BOD concentrations.
4. Bleaching wastewater usually has high solids content with low to moderate BOD levels include alkaline and contain bleaching agents.
5. Mercerizing wastewater has low BOD and total solids levels but are highly alkaline prior to neutralization. The low BOD content arises from surfactants and penetrating agents used as auxiliary chemicals.
6. Dyeing wastewater depend upon the dyes used. It contributes high volume, color, low BOD, high COD, high temperature and is sometimes toxic.

5.3.1.2 POLLUTION PREVENTION

Pollution prevention programs should focus on reduction of water use and on more efficient use of process chemicals. Process changes might include the following:

- Match process variables to type and weight of fabric (reduces wastes by 10–20%).
- Manage batches to minimize waste at the end of cycles.
- Avoid nondegradable or less degradable surfactants (for washing and scouring) and spinning oils.

- Avoid the use, or at least the discharge, of alkylphenol ethoxylates. Ozone-depleting substances should not be used, and the use of organic solvents should be minimized.
- Use transfer printing for synthetics (reduces water consumption from 250 l/kg to 2 l/kg of material and also reduces dye consumption).
- Use water-based printing pastes, when feasible.
- Use pad batch dyeing (saves up to 80% of energy requirements and 90% of water consumption and reduces dye and salt usage). For knitted goods, exhaust dyeing is preferred.
- Use jet dyers, with a liquid-to-fabric ratio of 4:1 to 8:1, instead of winch dyers, with a ratio of 15:1, where feasible.
- Avoid benzidine-based azo dyes and dyes containing cadmium and other heavy metals. Do not use chlorine-based dyes.

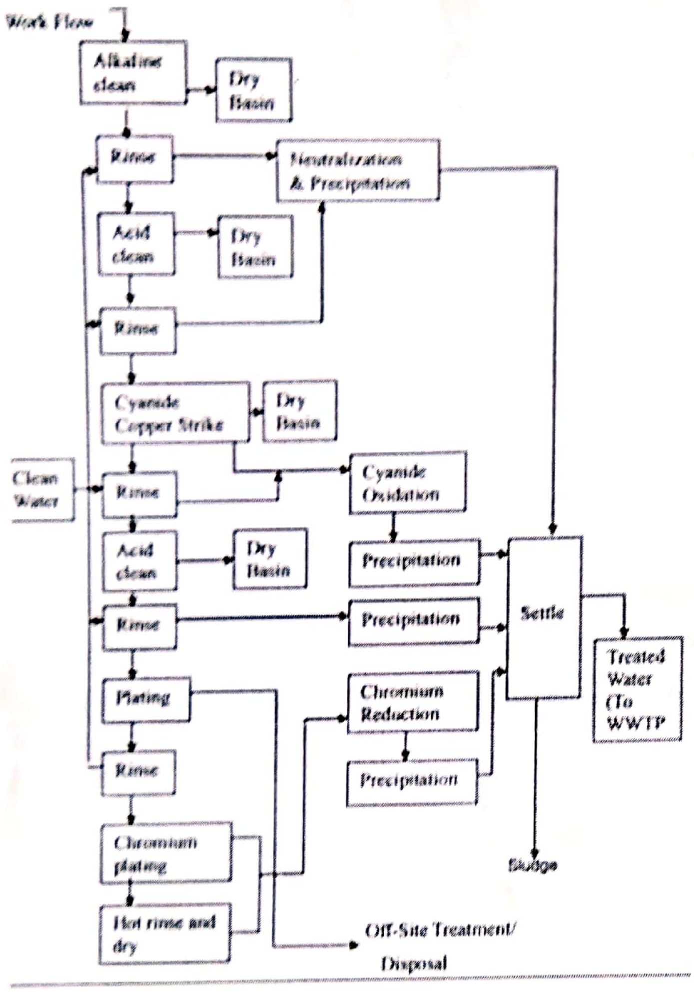
4. Explain pollution control in Electroplating & Tanning industry

5.3.4 ELECTROPLATING INDUSTRY

- Electroplating involves the deposition of a thin protective layer (usually metallic) onto a prepared metal surface, using electrochemical processes.
- The process involves pretreatment (cleaning, degreasing, and other preparation steps), plating, rinsing, passivating, and drying

The cleaning and pretreatment stages involve a variety of solvents (often chlorinated hydrocarbons, whose use is discouraged) and surface stripping agents, including caustic soda and a range of strong acids, depending on the metal surface to be plated. The use of halogenated hydrocarbons for degreasing is not necessary, as water-based systems are available. In the plating process, the object to be plated is usually used as the cathode in an electrolytic bath. Plating solutions are acid or alkaline and may contain complexing agents such as cyanides.

Production Process



5.3.4.2 POLLUTION PREVENTION AND CONTROL

1. Changes in Process

➢ Replace cadmium with high-quality, corrosion-resistant zinc plating. Use cyanide-free systems for zinc plating where appropriate. Where cadmium plating is necessary, use bright chloride, high-alkaline baths, or other alternatives. Note, however, that use of some alternatives to cyanides may lead to the release of heavy metals and cause problems in wastewater treatment.

2. **Reduction in Dragout and Wastage**

- Minimize dragout through effective draining of bath solutions from the plated part, by, for example, making drain holes in bucket-type pieces, if necessary
- Allow dripping time of at least 10 to 20 seconds before rinsing.
- Use fog spraying of parts while dripping.

3. **Minimizing Water Consumption in Rinsing Systems**

- It is possible to design rinsing systems to achieve 50–99% reduction in traditional water usage. Testing is required to determine the optimum method for any specific process, but proven approaches include:
- Agitation of rinse water or work pieces to increase rinsing efficiency
- Multiple countercurrent rinses
- Spray rinses (especially for barrel loads).

4. **Management of Process Solutions**

- Recycle process baths after concentration and filtration. Spent bath solutions should be sent for recovery and regeneration of plating chemicals, not discharged into wastewater treatment units.
- Recycle rinse waters (after filtration).
- Regularly analyze and regenerate process solutions to maximize useful life.

5.3.5 TANNING INDUSTRY

Tanneries and The Environment

- When auditing an industrial site or tannery, it is important first to know the quality and quantity of pollutants being released into the environment and second the type and proximity of receptors, in order to established a pollution prevention strategy to lower or eliminate the impact on them.

Environmental Impact

- Environmental impact of tanneries might vary depending on the quality and quantity of generated pollution and the proximity of contaminant effluents to "receptors" (humans, plants, animals or ecosystems exposed to pollutants).

Water Consumption

- Water consumption in the tanning sector includes process water, and also technical water which is needed for cleaning, energy use, waste water treatment, and sanitary purposes.

Impact on waste management systems

- By-products and waste generated during leather production might include trimmings from raw hides, lime fleshing, lime split and pelt trimmings, chromium shavings, chromium split, chromium leather trimmings, buffing dust, finishing chemicals, sludge from wastewater treatment, packaging, salt, organic solvents, residues of process chemicals and auxiliaries, fats from degreasing, finishing sludge, residues from air abatement other than buffing dust, such as activated carbon filters and sludge from wet scrubbers, and residues from waste treatment.

5.3.5.1 POLLUTION PREVENTION AND CONTROL

1. **Removal of Salt**

- ➢ Desalting of raw stock reduces TDS level in the composite tannery wastewater by about 15%.

3. **Enzymatic Unhairing**

- Separation of the hair from the epidermis by the addition of enzymatic products, avoiding the use of sulphide.

Environmental benefits

- Lower environmental impact in the wastewater given that sulphides are not used
- Hair is removed in solid form so the level of wastewater pollution (COD) is reduced
- Reduction of the consumption of water (less washes than using sulphide)
- Toxicity of wastewater is reduced.

3. **Increasing the Efficiency of Chromium Tanning**

- It is relevant to optimize the parameters of the process to increase the proportion of the conventional chrome-tanning agent taken up by the hides or skins.

4. Substitution Of Nitrogenous Compounds In Post- Tanning

- • Substitution of amino resins in the retanning stage (urea-formaldehyde and melamine formaldehyde) and ammonia, used as a dye penetrator

5. **Non-Spraying Curtain or Roller Coating**

- The leather to be finished is fed into the machine through a curtain of liquid or by impregnated rollers.

6. Mechanical and Physio-Chemical Treatment

These operations include several operations as screening of gross solids, skimming of fats, oils, and greases and removal of solids by sedimentation, sulphide oxidation and suspended solids, chromium and COD removal by coagulation/ flocculation and precipitation.

- Pollutants contained in effluents are converted into sludge which is easier to dispose of.

7. **Water-Based Chemicals for Coating**

- Use of finishing products which are dispersed in water rather than in solvent

8. **Organic Waste Fractions and By-Products**

- The reduction of waste production inside installations is essential for an optimized waste treatment system

9. **Process Water Management**

- A good process water management reduces the global environmental impact

5. Write a note on Hazardous Waste classification and characteristics. **(10 Marks)**

5.4.1 WHAT IS A HAZARDOUS WASTE?

Hazardous Waste substance is a solid, semi solid or non-aqueous liquid which because of its quality, concentration, or characteristics in terms of physical, chemical, infectious quality:

- Can cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitate reversible illness, or
- Pose a substantial present or potential hazard to humans or the Environment when it is improperly treated, stored, transported, disposed of or otherwise managed.

5.4.2 HAZARDOUS WASTE CHARACTERISTICS

Any waste is hazardous if it exhibits whether alone or when in contact with other wastes or substances, any of the identified characteristics below:

1. Corrosivity
2. Reactivity
3. Ignitability
4. Acute toxicity
5. Infectious property.

CORROSIVITY

A waste exhibits the characteristics of corrosivity if a representative sample of the waste has either of the following properties:

- Any liquid which has pH less or equal to 4 or greater than or equal to 12.5 as determined by the standard test procedure, or
- A waste, which can corrode steel at a rate greater than 6.35 mm per year at a temperature of 55 degree C as determined by standard testing procedures.

REACTIVITY

- Unstable and undergoes violent change without detonation
- Violent reaction with water
- Potential explosive mixture with water
- Toxic gases, vapors or fumes generation of CN or S wastes
- Explosive

min temp @ which liquid gives off vapr

IGNITABILITY <60°C

- Waste with flash point < 60 degree C

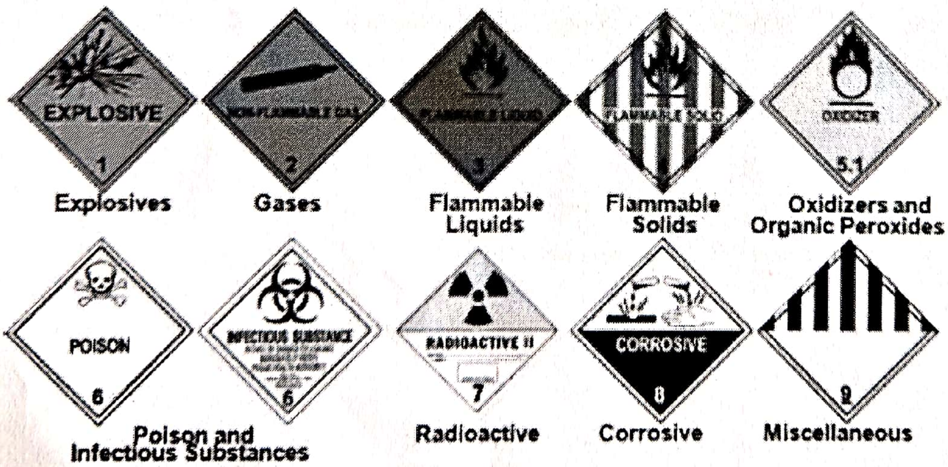
TOXICITY

- A solid waste exhibits the characteristics of toxicity if the leachate from the representative sample.

EPA-Designated Hazardous Wastes

- The EPA lists contain numerous examples of hazardous wastes that require careful handling and treatment in a cradle-to-grave management system. Three lists of specific hazardous wastes have been promulgated by EPA

1. Nonspecific source wastes: These are generic wastes, commonly produced by manufacturing and industrial processes. Examples from this list include spent halogenated solvents used in degreasing and wastewater treatment sludge from electroplating processes.
2. Specific source wastes: this list consists of wastes from specifically identified industries such as wood preserving, petroleum refining, and organic chemical manufacturing. These wastes typically include sludge, still bottoms, wastewaters, spent catalysts, and residues, e.g., wastewater treatment sludge from the production of pigments.
3. Commercial chemical products: the third list consists of specific commercial products or manufacturing chemical intermediates. This list includes chemicals such as chloroform and creosote, acids such as sulfuric acid and hydrochloric acid, and pesticides such as DDT and Kepone.



5.4.4 TREATMENT OF HAZARDOUS WASTE

The various treatment procedures can be classified as:

1. Physical.
2. Chemical.
3. Biological.
4. Thermal.
5. Incineration

5.4.4.1 PHYSICAL TREATMENT PROCESS

- Physical treatment of hazardous waste includes a number of separation processes commonly used in industry.
- It is of first importance where waste containing liquids and solids are separated to reduce cost.

5.4.4.2 CHEMICAL TREATMENT

- Chemical treatment transforms waste into less hazardous substances using such techniques as pH neutralization, oxidation or reduction, and precipitation.
- These procedures involve the use of chemical reactions with the help of various chemicals to convert hazardous waste into less hazardous substances.

5.4.4.3 BIOLOGICAL TREATMENT

- Biological treatment uses microorganisms to degrade organic compounds in the waste stream
- It is an effective, efficient and cost-effective way to treat remove hazardous substances from wastewater through biological agents.

5.4.4.4 THERMAL TREATMENT

- These are the treatment processes which involve the application of heat to convert the waste into less hazardous forms.
- It also reduces the volume and allows opportunities for the recovery of energy from the waste.

5.4.4.5 INCINERATION

- In incineration, in general, waste is destroyed or reduced to CO2 , H2O and other inorganic substances and these substances are harmless.
- The only limitation with this treatment process is generation of effluent or emission which is rather secondary pollution.
- Incineration is the controlled combustion process which can be used to degrade organic substances. In practice, complete combustion is difficult if not impossible to achieve but for hazardous waste 99.99% or greater destruction or removal is required for the process to be generally acceptable

6. Explain the concept of Transboundary of Pollutants. (10 Marks)

5.5 TRANSBOUNDARY MOVEMENT

- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted in 1989 and it came into force in 1992.
- It is the most comprehensive global environmental agreement on hazardous wastes and other wastes. With 175 Parties (as at 31 March 2011), it has nearly universal membership. The Convention aims to protect human health and the environment against the adverse effects resulting from the generation, transboundary movements and management of hazardous wastes and other wastes.
- **Transboundary Movement means** any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one State to or through an area under the national jurisdiction of another state or to or through an area not under the national jurisdiction of any state, provided at least two states are involved in the movement.

5.5.1 CONDITIONS FOR TRANSBOUNDARY MOVEMENT

Parties are under an obligation to take the appropriate measures to ensure that TBM of hazardous wastes and other wastes are only allowed if one of the three following conditions is met:

- The State of export does not have the technical capacity and the necessary facilities, capacity or suitable disposal sites in order to dispose of the wastes in an "environmentally sound manner"; or the wastes are required as raw material for recycling or recovery industries in the State of import; or
- the TBM in question is in accordance with other criteria decided by the Parties (such criteria will normally be found in the decisions adopted by the Conference of the Parties).
- In all cases, the Convention requires that the standard of "Environmentally sound management" (ESM) of hazardous wastes or other wastes is met.

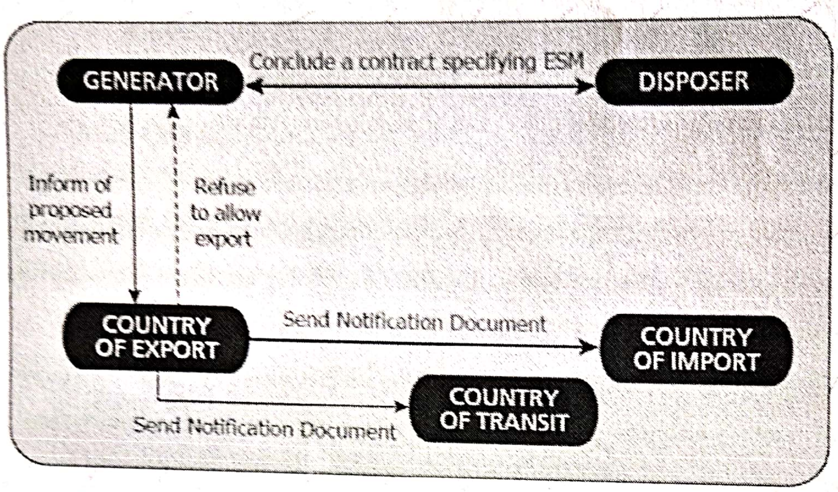
ESM means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes.

5.5. PROCEDURES FOR TRANSBOUNDARY MOVEMENT

The Basel Convention contains a detailed Prior Informed Consent (PIC) procedure with strict requirements for TBM of hazardous wastes and other wastes. The procedures form the heart of the Basel Convention control system and are based on four key stages

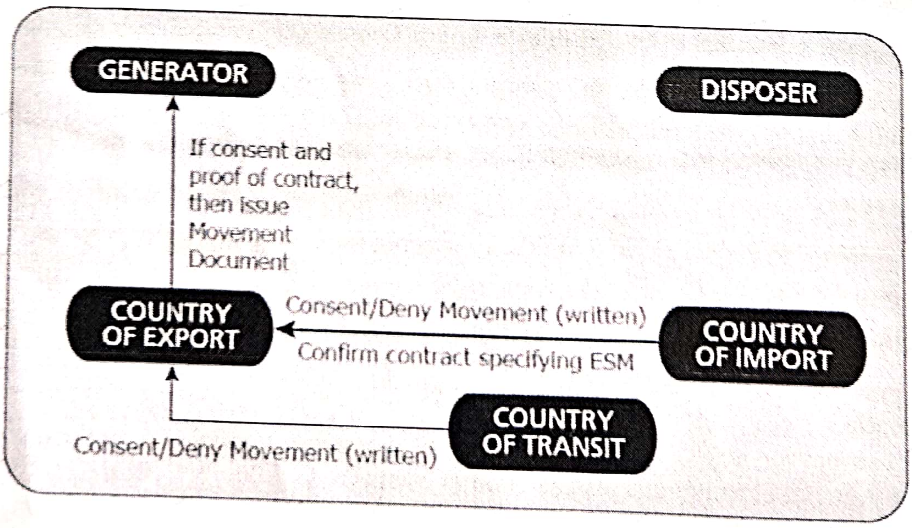
i. Notification
ii. Consent and issuance of movement document
iii. Transboundary movement
iv. Confirmation of disposal.

Stage 1: Notification
• The purpose of notification is for the exporter to properly inform the importer of a proposed transboundary movement of hazardous wastes or other wastes.
• The exporter/generator of the wastes must inform the Competent Authority (CA) of the State of export of a proposed shipment of hazardous or other wastes.



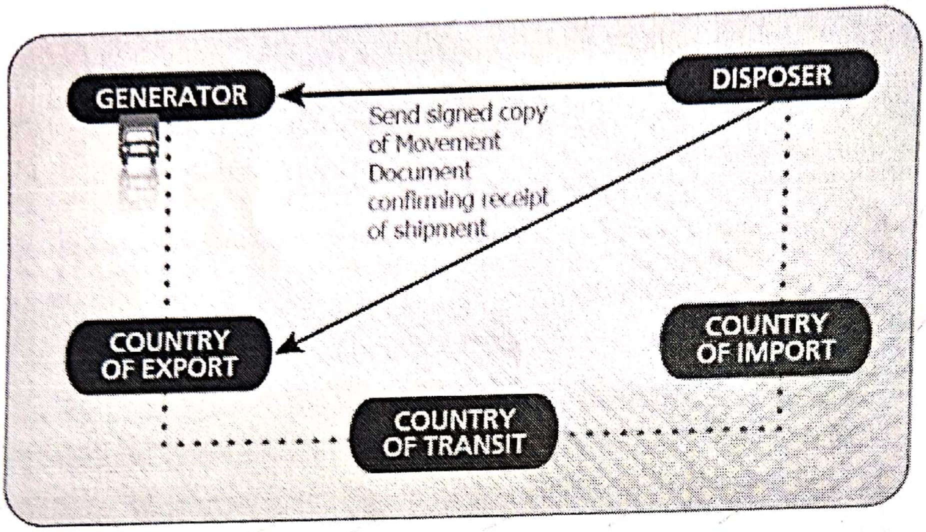
Stage 2: Consent & Issuance of Movement Document

- The purpose of stage 2 is to ensure that the importer agrees to the proposed transboundary movement and accompanies the shipment of hazardous wastes or other wastes.
- On receipt of the notification document, the CA of the country of import must provide its written consent or denial.
- The CA of any country of transit must acknowledge promptly receipt and may provide its written consent to the country of export or denial within 60 days.



Stage 3: Transboundary Movement

- Stage 3 illustrates the various steps that need to be followed once the transboundary movement has been initiated and until the wastes have been received by the disposer.
- The movement document provides relevant information on a particular consignment, for example, on all carriers of the consignment, which customs officers it has to pass through, the type of waste and how it is packaged. It should also provide accurate information on the authorizations by the CAs for the proposed movements of wastes.



Stage 4: Confirmation of Disposal

- The purpose of stage 4, the final stage in the TBM procedure, is for the generator and country of export to receive confirmation that the wastes moved across borders have been disposed of by the disposer as planned and in an environmentally sound manner.