Waste volume Reduction

❖ First step in minimizing effect of industrial wastes.

This is accomplished by

[1] Classification of waste,
[2] Conservation of wastewater,
[3] Changing production to decrease wastes,
[4] Reusing both industrial and municipal effluents for raw water supplies.

(1) Classification of wastes:

By classifying the waste the unpolluted waste stream can be segregated from the polluted, thus reducing total volume of wastewater.

Three general classes of waste from industry are:

a) Wastes from manufacturing processes:

e.g. waste from milk can washing, discarded plating solution, spent wash from distilleries, etc.

b) Wastes used as cooling agents in industrial processes:
   - Volume varies from industry to industry
     e.g., large refinery discharges 150 MGD of waste out of which only 5 MGD (3.33%) is process waste, remaining cooling water with slight contamination due to small leaks, corrosion products, and little organic matter.

c) Waste from sanitary uses:
   - Range from 100 to 200L per person per day.
   - Depends on size of plant, amount of waste product washed from floors

In most plant all these waste are mixed together.

(2) Conservation of wastewater: conserved means saved,

- Reducing volume of process water is conservation.
- e.g., recycling white water (water passing through wire screen for wet chipping where paper is formed); reusing pickling liquid in tanneries, etc.
- Concentrated waste streams are treated after usefulness of recycling.
- Two fold saving: water costs and wastewater treatment cost.
- During water storage industries are reducing water consumption however; after storage is over they are consuming more water in spite of high water charges.
- Need change in mind set.

(3) ***Changing production to decrease waste***:

- Effective method of controlling the volume of wastes.
- Difficult to convince production people to change process.
- The entire unit including production and treatment of wastewater should be considered to evaluate cost.
  e.g., replacement of crome tanning with vegetable tanning.
  e.g. balancing quantities of acids & alkalis used in process in cost of chemicals for neutralization, and time.

(4) Reusing both industrial and municipal effluents for raw water supplies:

- Practiced in water scare area, it is popular and economical method of conservation.
- Not having social acceptance, technical problem such as high TDS, hardness, aesthetic reluctance, negotiating contract.
  e.g., RCF, Bombay.

Waste Strength Reduction

- It is a second major objective for an industry.
- Reduction in strength will achieve saving in treatment cost. (Sometimes due to limitations of hydraulic loading it may not save cost).

The strength of waste may be reduced by

1. Process changes
2. Equipment modification
3. Segregation of wastes
4. Equalization of wastes
5. By-product recovery

1. **Process change**: The waste problem of industry can be resolved by process change.

   e.g. In textile finishing⟶ starch is traditionally used as sizing agents before weaving. Replacing starch with carboxy- methyl cellulose can considerably reduce pollution (about 50% BOD reduction is possible).

   e.g. In metal plating to reduce cyanide pollution.

   - Change from copper- cyanide plating to acid-copper solution.
   - Replacing soluble oils and other short-term rust-preservative oils by cold cleaners.

2. **Equipment modification**

   Changes in equipment can effect a reduction in the strength of the waste by reducing waste- quantity.

   e.g., dairy milk cans ⟶ by eliminating sharp corners and also installing drip pans to collect milk which drains from the cans after they have been emptied.

e.g., placing traps on the discharge pipelines in poultry plants to prevent emission of feathers and pieces of fats.

3. Segregation of wastes:

- Segregation reduces strength of waste and difficulty of treating.
- Small volume of strong waste can be handled with methods specific to the problem it present. (e.g. InoTech Pharma, Bromine wastewater separation)
- Segregation results in two wastes
    (1) One strong with small volume.
    (2) Other weaker with similar volume as non-segregated waste.

- Segregation of cooling waters from process waste will reduce size of the final treatment plant.
- Some waste like dye can be effectively treated when concentrated.

Examples: separation of kiering (scouring) waste from other waste stream in textile industry is effective.

In metal plating producing chromium and cyanide waste segregation is effective.

- For cyanide waste $\longrightarrow$ make alkaline and oxidize
- For chromium waste $\longrightarrow$ acidified and reduced
- Then it can be combined and precipitated in alkaline solution to remove metal.

Segregation may not always work- some time combining will be effective e.g. for neutralization/ equalization.

4. Equalization of wastes:

- Holding of wastes for certain period of time to equalize when many products using different processes are produced.

- The detention time of equalization basin will be for complete cycle time of process.
- The effluent from equalization basin is much more consistent in its characteristics, than separate influent to the same basin. Stabilization of pH, BOD, SS and heavy metals can be achieved.

- Sometimes no treatment may be required after equalization, e.g. when acidic and alkaline waste is a problem from the same industry.

5. by- product recovery:

- The use of waste material for by- product will reduce pollution load and generate revenue through byproducts.

  e.g. paper mills → recovery of caustic soda from cooking liquors, methane recovery, sludge digestion and drying and fertilizer, etc.

- Black strap molasses from sugar → to alcohol production
- sulphite waste → liquor byproduct from paper mills used as fuel, road binder, insulating compound.
- Waste yeast from brewery as poultry food.
- Dried and evaporated butter milk from milk plant used as chicken food.
- In dairies materials collected on Oil and grease trap → soap manufacturing.