



Waste Minimization

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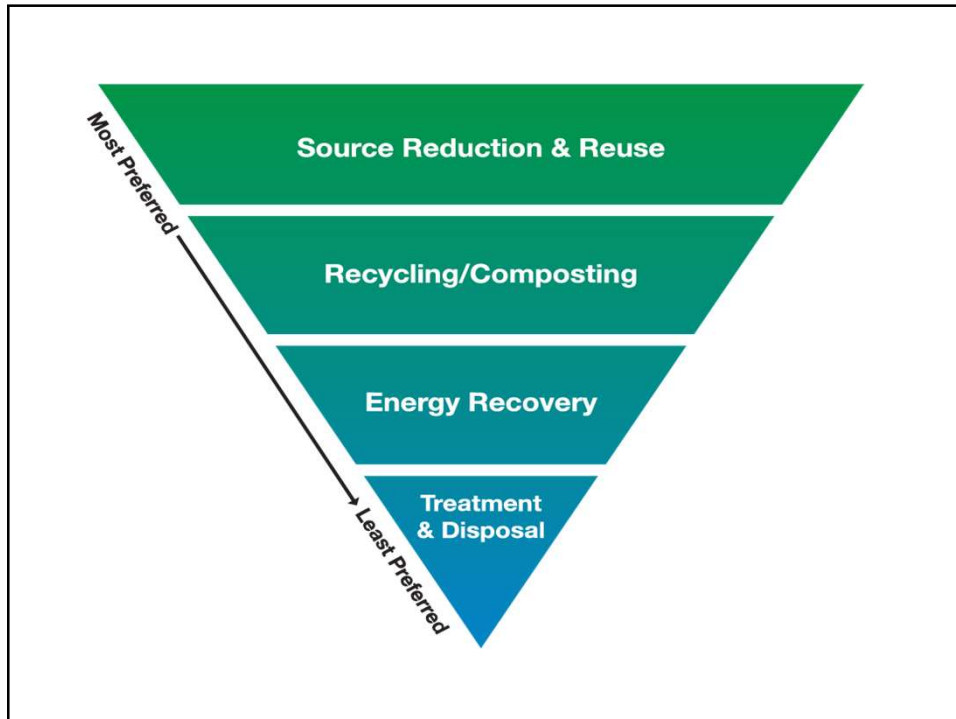
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Why We need Waste Minimization?



Environmental Conservation:
The best solution to get rid of the wastes and their ill effects is "not producing them"



What is a waste?

- Traditionally, waste is viewed as an unnecessary element arising from the activities of any industry.
- **In reality, waste is a misplaced resource, existing at a wrong place at a wrong time.**
- Waste is also the inefficient use of utilities such as electricity, water, and fuel, which are often considered unavoidable overheads.
- **The costs of these wastes are generally underestimated by managers.**

Cost of wastes

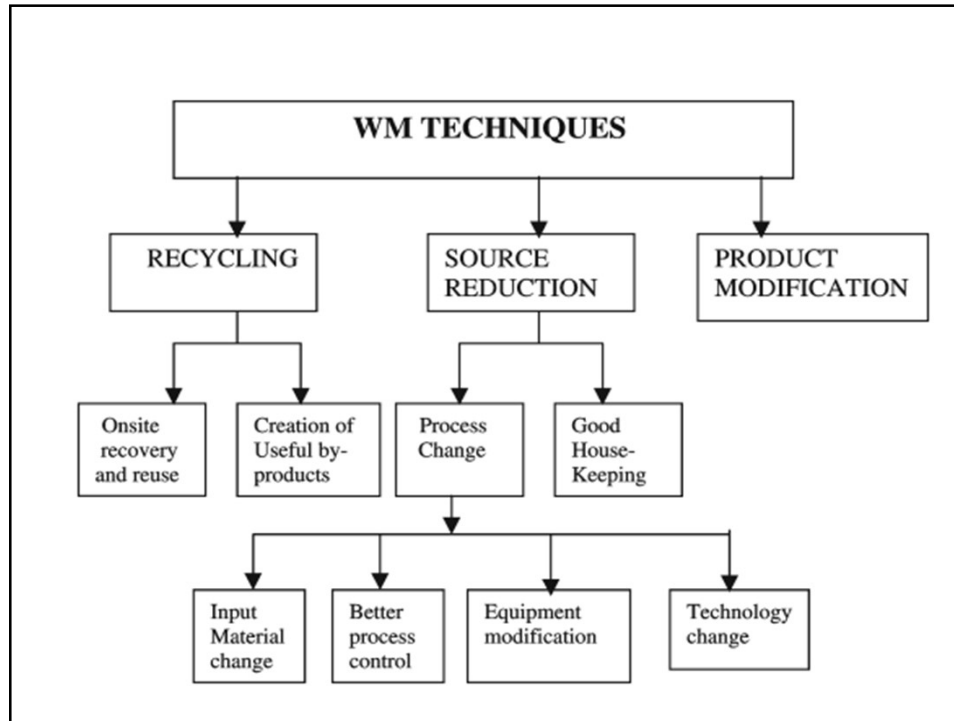
- Disposal cost
- **Inefficient energy use cost**
- Purchase cost of wasted raw material
- **Production cost for the waste material**
- Management time spent on waste material
- **Lost revenue for what could have been a product instead of waste**
- Potential liabilities due to waste

What is waste minimization?

- Waste minimization can be defined as systematically reducing waste at source".
- It means:
 - Prevention and/or reduction of waste generated
 - **Efficient use of raw materials and packaging**
 - Efficient use of fuel, electricity and water
 - **Improving the quality of waste generated to facilitate recycling and/or reduce hazard**
 - Encouraging re-use, recycling and recovery.

- **Waste minimization is also known by other terms such as waste reduction, pollution prevention, source reduction and cleaner technology.**
- **It makes use of managerial and/or technical interventions to make industrial operations inherently pollution free.**
- **It should be also clearly understood that waste minimization, however attractive, is not a panacea for all environmental problems and may have to be supported by conventional treatment/disposal solutions.**

- **After exhausting the source reduction opportunities, attempts should be made to recycle the waste within the unit.**
- **Finally, modification or reformulation of products so as to manufacture it with least waste generation should be considered.**



Source Reduction

- ***Good Housekeeping:***
 - Systems to prevent leakages & spillages through preventive maintenance schedules and routine equipment inspections.
 - Well-written working instructions
 - Supervision
 - awareness
 - regular training of workforce

Source Reduction

- **Process Change**
 - **Input Material Change**
 - Substitution of input materials by eco-friendly (nontoxic or less toxic than existing and renewable)
 - Material preferably having longer service time.
 - **Better Process Control**
 - Modifications of the working procedures machine-operating instructions.
 - Process record keeping in order to run the processes at higher efficiency and with lower waste generation and emissions.

Source Reduction

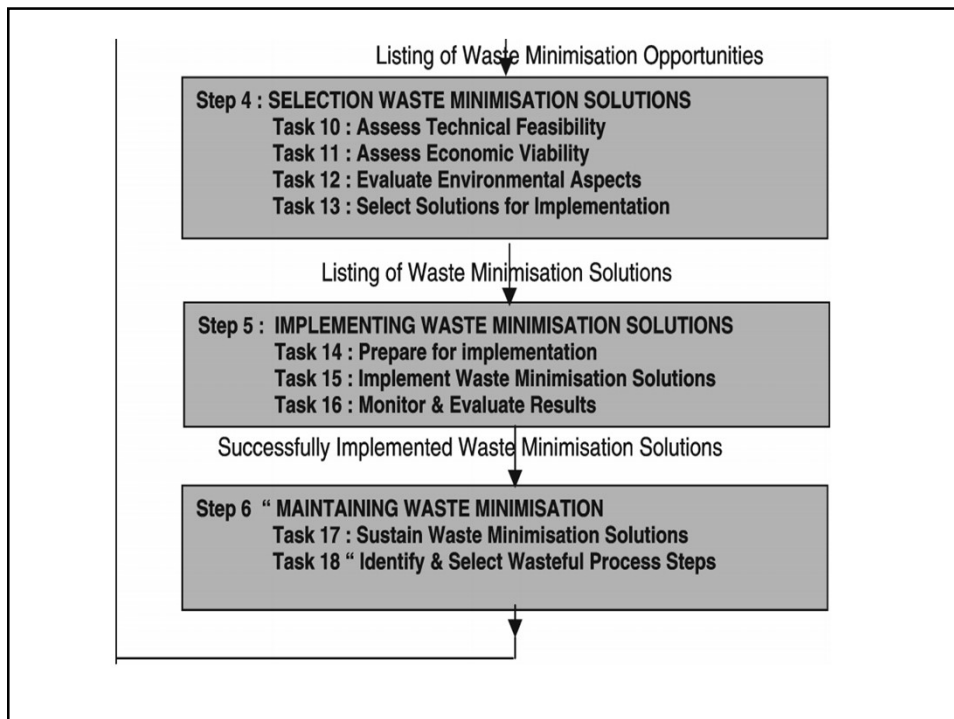
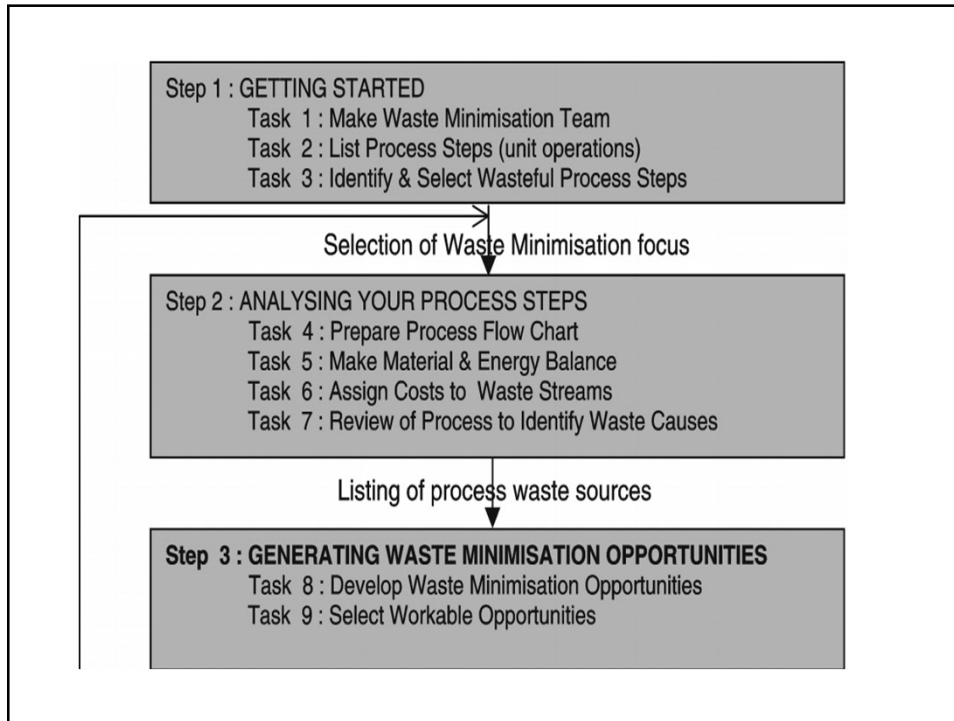
- **Equipment Modification**
 - Modification of existing production equipment and utilities.
 - for instance, by the addition of measuring and controlling devices, in order to run the processes at higher efficiency and lower waste and emission generation rates.
- **Technology change**
 - Replacement of the technology
 - processing sequence
 - synthesis route, in order to minimize waste and emission generation during production .

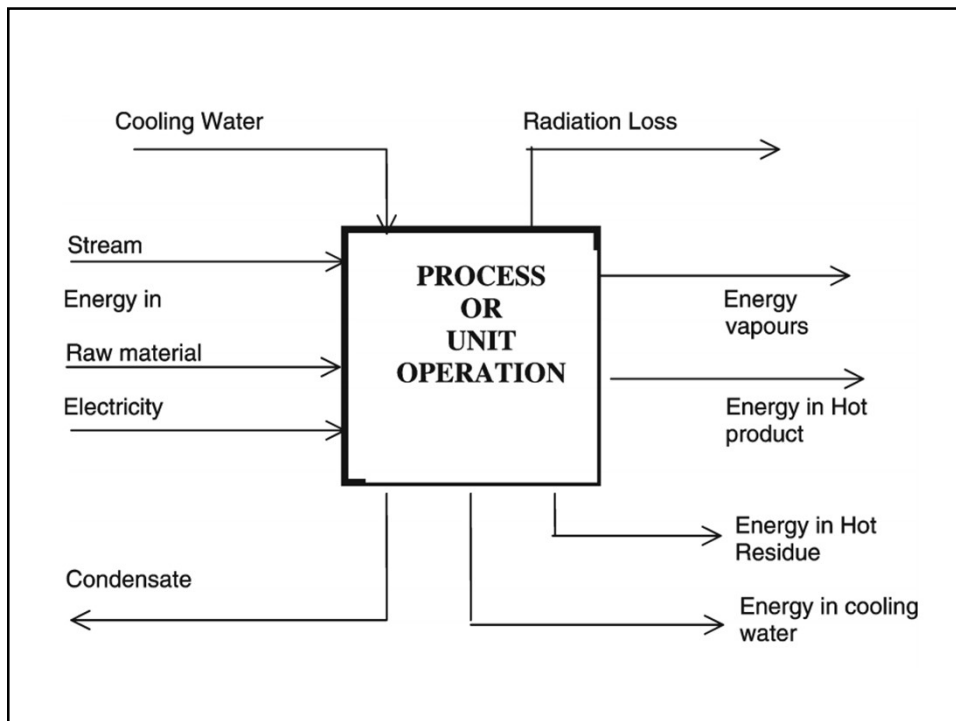
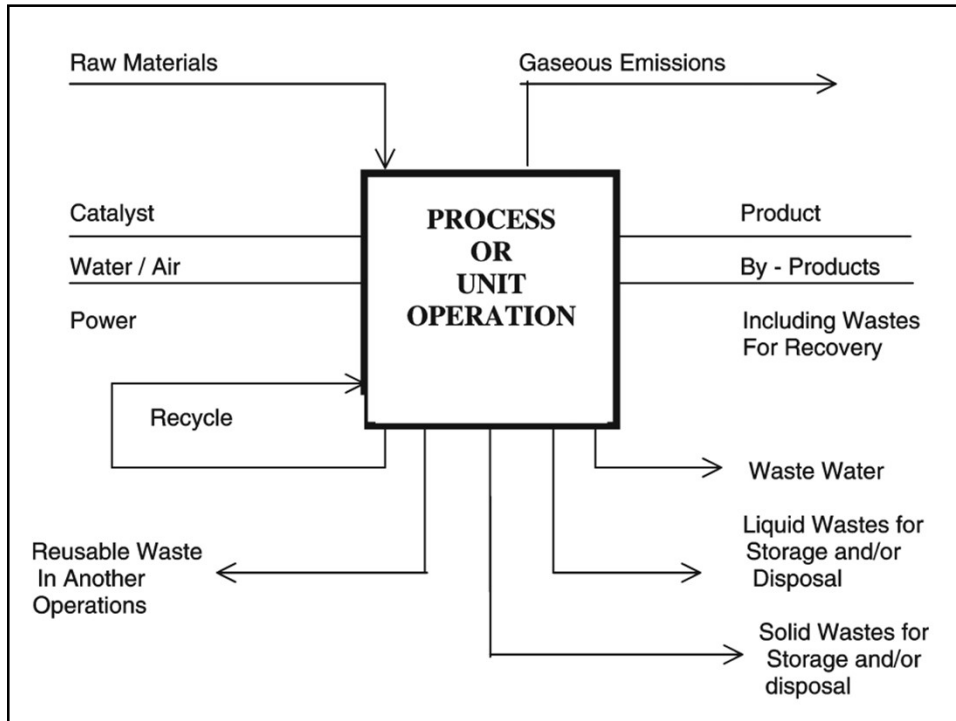
Recycling

- ***On-site Recovery and Reuse***
 - Reuse of wasted materials in the same process or for another useful application within the industry.
- ***Production of Useful by-product***
 - Modification of the waste generation process in order to transform the wasted material into a material that can be reused for another application within or outside the company.

Product Modification

- Characteristics of the product can be modified to minimize the environmental impacts of its production.
- The product itself during or after its use.
- There are three major ways of product modifications
 - Quality modifications
 - Functional modifications
 - Style modifications





Typical Causes of Waste

- **Poor housekeeping**

- Leaking taps / valves / flanges
- Spillages
- Overflowing tanks
- Worn out material transfer belts
- Unchecked water / air consumption
- Unnecessary running of equipment
- Sub optimal loading
- Lack of preventive maintenance
- Sub-optimal maintenance of process condition
- Ritualistic operation



Poor Raw Material Quality

- Use of substandard cheap raw material
- Lack of quality specification
- Improper purchase management system
- Improper storage

Poor Raw Material Quality

- Unplanned / adhoc expansion
- Poor space utilization plan
- Bad material movement plan

Poor process / Equipment design

- Mismatched capacity of equipment
- Wrong material selection
- Maintenance prone design
- Adoption of avoidable process steps
- Lack of information / design capability



Bad technology

- Continuation of obsolete technology, despite product / raw material change
- High cost of better technology
- Lack of availability of trained manpower
- Small plant size
- Lack of information



Inadequately Trained Personnel

- Increased dependence on casual / contract labour
- Lack of formalized training system
- Lack of training facilities
- Job insecurity
- Fear of losing trade secrets
- Lack of availability of personnel
- Understaffing hence work over pressure



Employee Demotivation

- Lack of recognition
- Absence of reward
- Emphasis only on production, not on people
- Lack of commitment and attention by top management



Generating Waste Minimization Opportunities

- Once the origin and causes of waste and emissions are known, the process enters the creative phase.
- The WM team should now start looking for possible opportunities for reducing waste.
- Finding potential options depends on the knowledge and creativity of the team members.

Where To Look?

- The potential sources of help in finding Waste Minimization Opportunities are:
 - Other personnel from the same or similar plant elsewhere
 - Trade associations
 - Consultancy organizations
 - Equipment suppliers
 - Consultants

The Waste Minimization opportunities developed should be screened and those, which are impractical, should be discarded.



Selecting Waste Minimization Solutions

- A typical checklist for technical evaluation could be as follows
 - Availability of equipment
 - Availability of operating skills
 - Space availability
 - Effect on production
 - Effect on product quality
 - Safety aspects
 - Maintenance requirements
 - Effect on operational flexibility
 - Shut down requirements for implementation

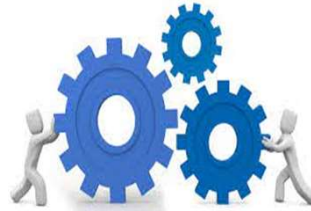


Implementing Waste Minimization Solutions

- The selected solutions could be taken for implementation.
- Apart from simple housekeeping measures several others would require a systematic plan of implementation.
- The Waste Minimization team should be well prepared to take up the job of implementation.
- The preparation would include arranging finances, establishing linkages in case of multidepartment solutions, technical preparations, etc.

Implement Solutions

- The task comprises layout and drawing preparation equipment fabrication / procurement, transportation to site, installation and commissioning.
- Whenever required, simultaneous training of manpower should be taken up as many excellent measures have failed miserably because of non-availability of adequately trained people.



Monitor and Evaluate Results

- The WM solutions should be monitored for performance.
- The results obtained should be matched with those estimated / worked out during technical evaluation to establish causes for deviation, if any.
- The implementation job is considered to be over, only after successful commissioning and sustained stable performance over a reasonable length of time.



Sustain Waste Minimization

- **The biggest challenges in Waste Minimization lies in sustaining Waste Minimization.**
- **The enthusiasm of the Waste Minimization team wanes off with time.**
- **Such tragic ends should be avoided.**
- **Backing out from commitment, predominance of production at any cost, absence of rewards and appreciation, and shifting of priorities are some of the commonly encountered reasons, which one should check and avoid.**

- **Also monitoring and review of the implemented measures should be communicated to all employees in the industry so that it fans the desires for minimizing wastes.**
- **Involvement of as large a number of employees as possible and rewarding the deserving ones, will help long term sustenance of Waste Minimization.**
- **Having implemented Waste Minimization solutions in the area under study, the Waste Minimization team should go back to Step-2 i.e. analyzing the process steps and identifying and selecting the next wasteful area.**
- **In this way, the cycle continues, till all the steps are exhausted.**

- In a nutshell, a philosophy of minimizing waste must be developed within the company.
- This means that Waste Minimization should become an integral part of company's activities.
- All successful Waste Minimization programmes, till date, have been founded on this philosophy.

