MODULE 1

ENVIRONMENTAL MANAGEMENT STANDARDS

1.1 ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION):

It is the most widely used standard on which environmental management system is based on.

ISO 14001: It is the international standard that specifies requirements for an effective environmental management system. It helps organizations improve their environmental performance through efficient use of resources, reduction of waste, gaining a competitive advantage and the trust of stakeholders.

1.2 SIGNIFICANCE OF ENVIRONMENTAL MANAGEMENT

i. It helps an organization address its regulatory requirements in a systematic and cost-effective manner.
ii. This proactive approach can help reduce the risk of non-compliance and improve health and safety practices for employees and the public.
iii. Business reputation – people may be more likely to support a business that cares about its impact on the environment.
iv. Good for business through: cost savings – by spending less on raw materials, energy, water and waste management.
v. **i**mproving resource efficiency and reducing unnecessary expenditure - you will have policies and procedures in place that help you manage waste and resources more effectively. This can reduce your associated raw material and operating costs.

1.3 ENVIRONMENTAL PROTECTION

It is the practice of protecting the natural environment by individuals, organizations and governments. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to repair damage and reverse trends.

1.4 ENVIRONMENTAL MANAGEMENT

Environmental management is defined as the management of the interaction and impact of human activities on the natural environment.

Environmental management is not merely a management of environment but it is essentially the management of various activities with intolerable constraints imposed by the environment itself and with full consideration of ecological factors. Thus, it involves environmental planning, conservation of resources, environmental status evaluation, and environmental legislation and administration. The focus of environmental management is on implementation, monitoring and auditing; on practice and coping with real-world issues, rather than theoretical planning.

1.5 ENVIRONMENTAL PROBLEMS AND ITS CHARACTERISTICS

The various environmental issues at global level and their characteristics are listed below,

- Depletion of natural resources
- Water pollution
- Air pollution
- Ground water pollution
- Toxic chemicals & soil pollution
- Ozone layer depletion
- Global warming
- Loss of bio-diversity
- Extinction of wildlife and loss of natural habitat
- Nuclear wastes and radiation issues

Characteristics of environmental problems are as follows,

i. Water pollution is characterized by the presence of excess physical, chemical or biological substances that change the qualities of the water and are capable of causing harm to living organisms.
ii. Air pollution is characterized by the release of pollutants such as carbon monoxide, lead, nitrogen oxides, ground-level ozone, particle pollution (often referred to as particulate matter), and sulfur oxides into the atmosphere as a result of human activities and wildfires.
iii. Temperatures are rising world-wide due to greenhouse gases trapping more heat in the atmosphere. Droughts are becoming longer and more extreme around the world. Tropical storms becoming more severe due to warmer ocean water temperatures.
iv. Contamination of water bodies due to use of chemical fertilizers and pesticides on agricultural lands.
v. Deforestation can directly lead to biodiversity loss when animal species that live in the trees no longer have their habitat, cannot relocate, and therefore become extinct.
vi. Deforestation also increase in release of Carbon dioxide into the atmosphere, because of absence of trees to absorb the carbon dioxide.
vii. Waste generation is a result hyper consumption of resources which is characterized by accumulation of non-biodegradable trash in the form of plastic packaging, toxic e-

waste, and harmful chemicals that leach into our waterways. When this waste ends up in landfills, it generates enormous amounts of methane, which ranks as one of the worst greenhouse gases because of its high potential for global warming. It creates severe explosion hazards.

1.6 SYSTEMS APPROACH TO CORPORATE ENVIRONMENTAL MANAGEMENT

Corporate enterprises are some of the important vehicles of economic development in a country. There is a nexus between economic development issues and environmental management issues. Therefore, sustainable economic development should be environment-friendly. A company may be guided by short-term considerations where environmental issues, in the absence of legal compulsions, may be ignored. Companies must not forget that, with economic development, the environmental awareness has been on the increase.

1.6.1 TRADITIONAL APPROACH

- The traditional approach to environment management emphasizes control of various types of pollutions at the process and output levels (emission to air, discharges to water, solid and other wastes, contamination of land, noise, heat, etc.) But if the technology that is used for production purposes is not environment-friendly, the management system cannot be that effective in preventing environmental degradation.
- Recycling of waste materials, consumption of products by the consumers, disposal of packing materials after consumption, are some such important issues in an environment management that need to be properly addressed in any effective management system.
- Any effective management system should not only take care of the present needs of the society but also promote sustainable economic development.

1.6.2 SYSTEMS APPROACH: STEPS TO DEVELOP CORPORATE ENVIRONMENATL MANAGEMENT.

Step 1: Define Organization's Goals for Environmental Management System (EMS)

The first step in EMS planning is to decide why you are pursuing the development of an EMS. Are you trying to improve your environmental performance (e.g., compliance with regulations or prevent pollution)? Write your goals down and refer back to them frequently as you move forward. As you design and implement the EMS, ask the following questions: How is this task going to help us achieve our goals? How should we define the project scope? (i.e., What is the

fence line of the organization that the EMS will cover? One location or multiple locations? Should we pilot the EMS at one location then implement the system at other locations later?)

Step 2: Secure Top Management Commitment

One of the most critical steps in the planning process is gaining top management's commitment to support EMS development and implementation. Management must first understand the benefits of an EMS and what it will take to put an EMS in place. To develop this understanding, explain the strengths and limitations of your current approach and how those limitations can affect the organization's financial and environmental performances. Management also has a role in ensuring that the goals for the EMS are clear and consistent with other organizational goals. Management's commitment should be communicated across the organization.

Step 3: Select an EMS Champion

Not all small or medium-sized organizations have the luxury of choosing among multiple candidates, but your choice of a project champion is critical. The champion should have the necessary authority, an understanding of the organization, and project management skills. The champion should be a "systems thinker" (ISO 9000 or ISO 14001 experience can be a plus, but is not necessary), should have the time to commit to the EMS-building process, and must have top management support.

Step 4: Build an Implementation Team

A team with representatives from key management functions (such as engineering, finance, human resources, production and/or service) can identify and assess issues, opportunities, and existing processes. Include contractors, suppliers or other external parties as part of the project team, where appropriate. The team will need to meet regularly, especially in the early stages of the project. A cross-functional team can help to ensure that procedures are practical and effective, and can build commitment to, and "ownership" of, the EMS.

Step 5: Hold kick-off meeting

Once the team has been selected, hold a kick-off meeting to discuss the organization's objectives in implementing an EMS, the initial steps that need to be taken and the roles of team members. If possible, get top management to describe its commitment to the EMS at this meeting. The kick-off meeting is also a good opportunity to provide some EMS training for team members. Follow-up this meeting with a communication to all employees.

Step 6: Conduct Preliminary Review

The next step is for the team to conduct a preliminary review of your current compliance and other environmental programs/systems, and to compare these against the criteria for your EMS (such as ISO 14001:2015). Evaluate your organization's structure, procedures, policies, environmental impacts, training programs and other factors. Consider utilizing an ISO 14001 self-assessment tool or incorporating other gap analysis tools.

Step 7: Prepare Budget and Schedule

Based on the results of the preliminary review, prepare a project plan and budget. The plan should describe in detail what key actions are needed, who will be responsible, what resources are needed, and when the work will be completed. Keep the plan flexible, but set some stretch goals. Think about how you will maintain project focus and momentum over time. Look for potential "early successes" that can help to build momentum and reinforce the benefits of the EMS.

Step 8: Secure Resources, Assistance

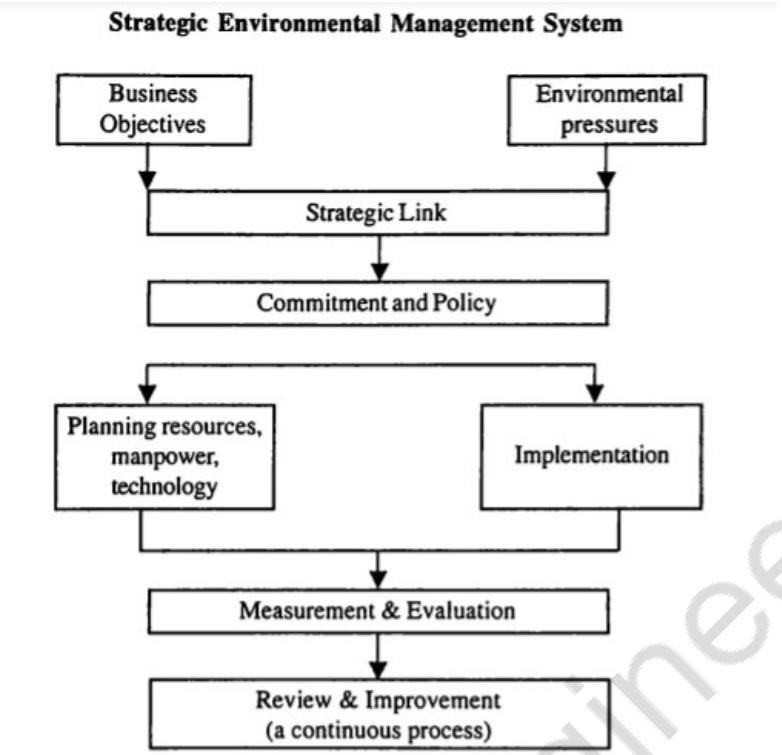
The plan and budget should be reviewed and approved by top management. In some cases, there may be outside funding or other types of assistance that you can use.

Step 9: Involve Employees

Ownership of the EMS will be greatly enhanced by meaningful employee involvement in the EMS development process. Employees are a great source of knowledge on environmental, and health and safety issues related to their work areas, as well as on the effectiveness of current processes and procedures. These employees can help the project team in drafting procedures.

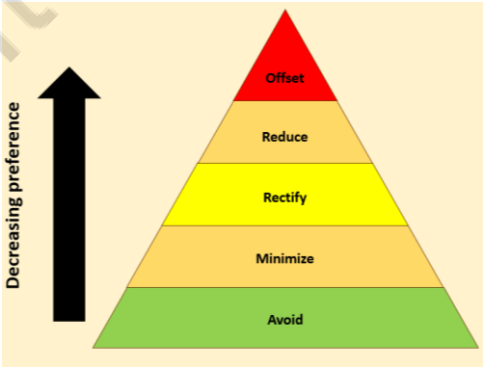
Step 10: Monitor and Communicate Progress

As you build the EMS, be sure to regularly monitor your progress against the goals and project plan, and communicate this progress within the organization. Be sure to communicate the accomplishments that have been made and describe what will happen next. Build on small successes. Be sure to keep top management informed and engaged, especially if additional resources might be required.



1.7 CLASSIFICATION OF ENVIRONMENATL IMPACT REDUCTION EFFORTS

Impact reduction is vital, because it ensures that the adverse environmental impacts of a developmental project are minimized or completely avoided. Mitigation/ impact reduction comes with a variety of levels, and this is commonly called as **"mitigation hierarchy"** in environmental impact assessment.



The hierarchy begins from the most beneficial method of mitigation and goes on to the least beneficial method of mitigation.

i. **Avoid:** It is the first step in the reduction efforts. It is the complete mitigation of an impact, by preventing it from happening. It is obviously the most preferred form of mitigation, because it ensures no environmental damage.

ii. **Minimize:** Here, the team recognizes that the environmental impact cannot be completely side-stepped; instead, they take steps to ensure minimal damage is done to the environment.

iii. **R**ectify**:** Rectification of an impact implies that the impact has already happened; what we are doing now is damage control. In a way, rectification allows us to correct the mistake that led to the adverse environmental impact.

iv. **Reduce:** Reduction of the extent of the impact through management practices and/or change in our methodology. It is when even reduction is not possible that we go for the final step of the mitigation hierarchy-environmental offset.

v. **Environmental offset:** It is commonly defined as actions taken outside of the development site to compensate for the impacts in the development site. In effect, this means that the development authorities undertake environment conservation activities to compensate for what they do in order to achieve "no net environment loss", or more specifically "no net biodiversity loss".

The various efforts used in this context can be classified generally as follows,

- **Protection of ambient air and climate:** Prevention of pollution through in-process modifications: Activities and measures aimed at the elimination or reduction of the generation of air pollutants through in-process modifications related to: - cleaner and more efficient production processes and other technologies (cleaner technologies), the consumption or use of cleaner products. Treatment of exhaust gases and ventilation air: activities involving the Installation, maintenance and operation of end-of-pipe equipment for the removal and reduction of emissions of particulate matter or other air-polluting substances either from the combustion of fuels or from processes: filters, dedusting equipment, catalytic converters, post-combustion and other techniques.

- **Wastewater management:** Activities and measures aimed at reducing the generation of surface water pollutants and wastewater through in-process modifications related to: - cleaner and more efficient production processes and other **t**echnologies (cleaner technologies), - the consumption or use of 'cleaner' (adapted) products.

- Cleaner technology is aimed at prevention activities consist of replacing an **e**xisting production process by a new process designed to bring about a **r**eduction of water pollutants or wastewater generated during production. It includes separation of networks, treatment and re-use of **w**ater used in the production process, etc. Use of cleaner products: prevention activities consist of modifying an existing production process so as to provide for the substitution of raw **m**aterials, catalysts and other inputs by non- (or less) water polluting **p**roducts.

- **Waste management:** Activities and measures aimed at eliminating or reducing the generation of solid waste through in-process modifications related to cleaner technologies which is aimed at prevention activities. By replacing an existing production process by a new process designed to reduce the toxicity or volume of waste produced during the production process, including by separation and re-processing. Use of cleaner products: protection activities consist of modifying or adapting the production process or facilities so as to provide for the substitution of raw materials, catalysts and other intermediate inputs by new, "adapted" inputs the use of which produces less waste or less hazardous waste.

- **Protection and remediation of soil, groundwater and surface water: A**ctivities **a**nd measures aimed at eliminating or reducing the generation of solid waste through in-process modifications related to cleaner technologies which is aimed at prevention activities. It consists of replacing an existing production process by a new process designed to reduce the toxicity or volume of waste produced during the production process, including by separation and re-processing. Use of cleaner products: protection activities consist of modifying or adapting the production process or facilities so as to provide for the substitution of raw materials, catalysts and other intermediate inputs by new, "adapted" inputs the use of which produces less waste or less hazardous waste.

- **Noise and vibration abatement (excluding workplace protection):** The adaptation of equipment, vehicles (buses, trucks, or **t**rain and power units in the case of rail transport, aircraft and ships) in **o**rder to make them less noisy: soundproofing of hoods, brakes, exhaust **s**ystems, etc. Also includes plant modifications, specially conceived foundations to **a**bsorb vibrations, extra cost for regrouping of buildings and/or of

facilities in the interest of noise abatement, special facilities in building **c**onstruction or reconstruction, equipment and machines conceived or **c**onstructed for low noise or vibrations, low noise level flares and **b**urners, etc.

- **Protection of biodiversity and landscapes:** Activities and **m**easures aimed at the conservation, reintroduction or recovery of **f**auna and flora species, as well as the restoring, rehabilitation and **r**eshaping of damaged habitats for the purpose of strengthening their **n**atural functions. Also includes conserving the genetic heritage, re-colonizing destroyed **e**cosystems, placing bans on exploitation, trade, etc. Of specific animal **a**nd plant species, for protection purposes.

- **Protection against radiation:** Collection and transport of high-level radioactive waste consists of **t**he collection of high-level radioactive waste, generally by **s**pecialized firms and their transport to the place of treatment, **c**onditioning storage and disposal. Conditioning of high-level **r**adioactive waste consists of activities that transform high level **r**adioactive waste into a proper and fit condition for transport and/or **s**torage and/or disposal.

1.8 BUSINESS CHARTER FOR SUSTAINABLE PRODUCTION AND CONSUMPTION

Sustainable consumption and production refers to "the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of future generations".

Sustainable production and consumption lead to Sustainable development which can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The International Chamber of Commerce (ICC) is a non-governmental organization serving world business. Its membership extends to more than 130 countries and includes thousands of business organizations and enterprises with international interests.

ICC has more than 80 years of experience as an international body representing the interests of businesses in all sectors, all over the world. It works to promote world trade and investment based on free and fair competition, and to harmonize trade practices and formulate guidelines and terminology for importers and exporters.

In response to the World Commission on Environment and Development report, ICC developed a 'Business Charter for Sustainable Development' which sets out 16 principles for environmental management.

The application of the principles thus improves business operations and strategies, while also driving innovation and shaping better policies and decision-making.

1.8.1 KEY BENEFITS IMPLEMENTING THE CHARTER PROVIDES KEY BENEFITS:

- Information clarity, and a framework of tools and methodologies.
- Reduction of risks and liabilities.
- Enhancement of efficiency and effectiveness of existing products and services.
- Generation of new business opportunities. Longer-term cost reductions.
- Enhancement of knowledge, education, and awareness.
- Increased employee loyalty.
- Higher standing in society and better reputational value.

1.8.2 The 16 Principles of ICC's business charter for sustainable development are as follows,

The charter covers environmentally relevant aspects of health, safety and product stewardship.

1. **CORPORATE PRIORITY:** To recognize environmental management as among the highest corporate priorities and as a key determinant to sustainable development; to establish policies, programmes and practices for conducting operations in an environmentally sound manner.

2. **INTEGRATED MANAGEMENT:** To integrate these policies, programmes and practices fully into each business as an essential element of management in all its functions.
3. **PROCESS OF IMPROVEMENT:** To continue to improve corporate policies, programmes and environmental performance, taking into account technical developments, scientific understanding, consumer needs and community expectations, with legal regulations as a starting point, and to apply the same environmental criteria internationally.

4. **EMPLOYEE EDUCATION:** To educate, train and motivate employees to conduct their activities in an environmentally responsible manner.

5. **PRIOR ASSESSMENT:** To assess environmental impacts before starting a new activity or project and before decommissioning a facility or leaving a site.

6. **PRODUCTS AND SERVICES:** To develop and provide products or services that have no undue environmental impact and are safe in their intended use, that are efficient in their consumption of energy and natural resources, and that can be recycled, reused, or disposed of safely.

7. **CUSTOMER ADVICE:** To advise and, where relevant, educate customers, distributors and the public in the safe use, transportation, storage and disposal of products provided, and to apply similar considerations to the provision of services.

8. **FACILITIES AND OPERATIONS:** To develop, design and operate facilities and conduct activities taking into consideration the efficient use of energy and materials, the sustainable use of renewable resources, the minimization of adverse environmental impacts of waste generation, and the safe and responsible disposal of residual wastes.

9. **RESEARCH:** To conduct or support research on the environmental impacts of raw materials, products, processes, emissions and wastes associated with the enterprise and on the means of minimizing such adverse impacts.

10. **PRECAUTIONARY APPROACH:** To modify the manufacture, marketing or use of products or services or the conduct of activities, consistent with scientific and technical understanding, to prevent serious or irreversible environmental degradation.
11. **CONTRACTORS AND SUPPLIERS:** To promote the adoption of these principles by contractors acting on behalf of the enterprise, encouraging and, where appropriate, requiring improvements in their practices to make them consistent with those of the enterprise; and to encourage the wider adoption of these principles by suppliers.

12. **EMERGENCY PREPAREDNESS:** To develop and maintain, where significant hazards exist, emergency preparedness plans in conjunction with emergency services, relevant authorities and the local community, recognizing potential transboundary impacts

13. **TRANSFER OF TECHNOLOGY:** To contribute to the transfer of environmentally sound technology and management methods throughout the industrial and public sectors.

14. **CONTRIBUTING TO THE COMMON EFFORT:** To contribute to the development of public policy and to business, governmental and intergovernmental programmes and educational initiatives that will enhance environmental awareness and protection.

15. **OPENNESS TO CONCERNS:** To foster openness and dialogue with employees and the public, anticipating and responding to their concerns about the potential hazards and impact of operations, products, wastes or services, including those of transboundary or global significance.

16. **COMPLIANCE AND REPORTING:** To measure environmental performance; to conduct regular environmental audits and assessment of compliance with company requirements, legal requirements and these principles; and periodically to provide appropriate information to the board of directors, shareholders, employees, the authorities and the public.

1.9 ENVIRONMENTAL STEWARDSHIP

Stewardship of the environment refers to protecting the environment through recycling, conservation, regeneration and restoration. It means taking responsibility for our choices. The responsibility for environmental quality should be shared by all those whose actions affect the environment.

Environmental stewardship can be defined as "the responsible use (including conservation) of natural resources in a way that takes full and balanced account of the interests of society, future generations, and other species, as well as of private needs, and accepts significant answerability to society" (Worrell & Appleby, 2000, p. 263).

Aldo Leopold (1887–1949) promoted **environmental stewardship** based on a land ethic "dealing with man's relation to land and to the animals and plants which grow upon it. One of the first commonly accepted definitions of sustainable development came from the World Commission on Environment and Development, later renamed the Brundtland Commission. It defined sustainable development as meeting "the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 41). Sustainable development differs from environmental stewardship in that it may include aspects of social, economic and environmental sustainability, whereas environmental stewardship focuses solely on the natural world

1.9.1 TYPES OF ENVIRONMENTAL STEWARDS

There are 3 types of environmental stewards: **doers, donors, and practitioners.**

- Doers go out and help the cause by taking action. For example, the doers in an oil spill would be the volunteers that go along the beach and help clean up the oil from the beaches.
- A donor is the person that financially helps the cause. They can do anything from donating their money, to hosting public events to raise funds. They are typically governmental agencies.
- Practitioner work on a day-to-day basis to steer governmental agencies, scientists, stakeholder groups, or any other group toward a stewardship outcome.

1.9.2 DRIVERS AND BARRIERS OF ENVIRONMENTAL STEWARDSHIP

Drivers/ What motivates stewardship behaviors

- Information and scientific evidence about the status of natural resources.
- Increasing awareness of the risks and opportunities associated with business supply chains
- Growing public interest in environmentally responsible purchasing and investing
- Regulations, customers, competitors and the local community.

Barriers/ What hinders people and organizations from adopting stewardship behaviors

- The perception that small actions do not really make a difference
- Difficulty in making green products competitive in the marketplace
- Lack of attention to environmental performance by investment and financial institutions
- Difficulty in measuring stewardship behavior and performance
- Lack of commitment from the management of the stakeholders
- Lack of financial resources
- Lack of expertise on EMS
- Effect on the existing organizational structures

1.9.3 PRINCIPLES OF ENVIRONMENTAL STEWARDSHIP

Core Principle 1: Resource Conservation – making the most efficient use of resources (materials, energy and water) through: Energy Efficiency and Conservation Water Efficiency and Conservation Solid Waste Management and Conceptualizing Waste as a Resource Publications Management Events Management

Core Principle 2: Pollution Prevention – minimizing contamination of the environment by chemicals or other materials through: Vehicle/Fleet Management of the Use of Chemicals and Other Hazardous Substances.

Core Principle 3: Occupational Health and Safety Managing Indoor Air Quality Comfort and Productivity in the Workplace Emergency and Disaster Management

1.9.4 BENEFITS OF ENVIRONMENTAL STEWARDSHIP

The Benefits of implementing an environmental stewardship programme are,

i. Saving costs and adding value,

ii. Potentially reducing company site's regulatory responsibilities,

iii. Improving environmental performance and reducing liability

iv. Providing company with a competitive advantage due to more effective and efficient operations.

	Category	Example of Qualifying Stewardship practice
1	Environmental Policy	Write a policy (1-page document) that explains your company's environmental goals and policies.
2	Environmental Management System	Sites can obtain ISO 140001 certification **or** develop and utilize their own EMS to annually (or more frequently) evaluate their environmental performance.
3	Annual Environmental Report	Yearly report posted to your company web page that explains your company's environmental performance for the past year.
4	Carbon Footprint	Report that shows all greenhouse gas emissions. Must include both onsite and offsite contributions.
5	Environmental Purchasing Policy	Establish an Environmental Purchasing Policy that requires the purchase of environmentally responsible products whenever possible.
6	Vendor/Supply Chain Requirements	Establish vendor requirements/contracts with businesses that supply your company to ensure environmentally sound business practices are employed.
7	Mentoring Other Businesses	Does the site offer mentoring of an environmental nature to other businesses? If yes, describe the mentoring program and any available contact information the site can provide.
8	Outreach Program	Participate or offer assistance to community leaders and local groups to address, educate and collaborate on environmental issues in the community.
9	Green Building Certification	Obtain LEED building certification (or other recognized green building certification) for new or major building renovation projects.
10	Green Building Implementation	Utilize green building design concepts in new construction or renovation projects. No formal certification by LEED is required.
11	Life Cycle Assessments	Conduct a detailed LCA of any products or site services/activities to evaluate environmental impacts, determine inefficiencies and institute improvements.
12	Hazardous Materials Reduction	Reduce the amount of hazardous materials used at your facility or exchange your use of high hazard materials for less hazardous materials.
13	Water Use Reduction	Implement changes at your facility that result in reduced water use. Examples: installation of water saving fixtures, grey water recycling systems, reuse of production waste water, rain water harvesting systems, etc.
14	Material Conservation	Conserve materials used at your site by changing process, product or formulations, participate in waste exchanges, reuse operational waste, etc. Materials **required** to be recycled by the State or your County **do not** qualify.
15	Employee Trip Reduction	Provide a program to reduce or eliminate employee commuting trips to the workplace. Examples: telework program, flexible work schedules, incentives to carpool or use public transportation, etc.
16	Process/Operations Energy Use Reduction	Reduce energy use associated with onsite processes or production operation. Examples: VFD motors on equipment, solar powered equipment or lights, etc.
17	Transportation Energy Use Reduction	Reduce transportation energy use by upgrading company fleet to hybrid Vehicles or electric vehicles, switching to cleaner burning fuels, etc.
18	Renewable Energy Use	Major installations, such as solar panels or wind turbines, to generate renewable energy for onsite use; or you can purchase energy from a green energy power provider.
19	Environmental Enhancement Project	Reclamation projects at your site or in the community, such as a wildlife habitat restoration, rain gardens, invasive species weed control, or use of native species.
20	Innovative Program	Any environmental activity not recognized under other stewardship categories, such as being a member of a state sponsored voluntary program (i.e. NJ Clean Marina program).
21	EPA Voluntary Program	Become a participating member/partner of an EPA Voluntary Program.

1.10 ENVIRONMENTAL MANAGEMENT PRINCIPLES

The principles of environmental management are helpful in environmental decision making. There are 7 environmental principles which are explained below,

1. POLLUTER PAYS PRINCIPLE (PPP):

For the last two decades, many economists have suggested that firms discharging polluting effluents to the environment should somehow be made to pay a price for such discharges related to the amount of environmental damage caused.

OECD (Organization for Economic Co-operation and Development) has suggested the Polluter Pays principles (PPP) as a general basis for the environmental policy. It states that if measures are adopted to reduce pollution, the costs should be borne by the polluters. According to the OECD Council, "The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment is the so-called Polluter Pays Principle." The essential concern of this principle is that polluters should bear the costs of abatement without subsidy.

2. THE USER PAYS PRINCIPLE (UPP): It is considered as a part of the PPP. The principle states that all resource users should pay for the full long-run marginal cost of the use of a resource and related services, including any associated treatment costs. It is applied when resources are being used and consumed.

3. PRECAUTIONARY PRINCIPLE (PP): This proposes protecting the environment through precautionary measures, especially for heavy activities that might cause more damage to the environment. Precautionary principle has major objectives which include measuring primary and secondary activities posing a threat to the environment.

Then industries are advised on ways and methods to implement which will not affect the environment so much throughout their daily activities. Precautionary activity measures the impact of any company and its activities, prescribing methods and measures with less negative impact on its environment according to environment impact assessments carried out at the time. Precautionary principle has been essential to protecting the environment, people, safe environment, implementation of polices and reducing degradation and soil erosion.

4. PRINCIPLE OF RESPONSIBILITY: Among principles of environmental management, this states each person and firm needs to be held accountable and take responsibility to maintain safe, clean and sustainable development. Ecological sustainability should be attained by ensuring the use of resources is properly managed and not wasted, people must go about knowing that one of their duties is to protect the environment, safe applies for firms and corporations extracting and committing gasses polluting the environment.

5. PRINCIPLE OF EFFECTIVENESS AND EFFICIENCY: It the responsibility of government in every country, city or state to ensure, well-structured policies and procedures are put in place for essential waste management. Failure to properly mage waste can lead to diseases, soil problems, chemical build ups, water borne diseases. Hence its essential that through the principle of effectiveness and efficiency, major agencies and council do everything possible to reduce waste building up and control dump sites for garbage. Encourages various organization bodies and agencies to decentralize, implement new methods of management, proposed through new public management NPM to enable them attain desired results when protecting the environment at minimal cost.

6. PRINCIPLE OF PROPORTIONALITY: This refers to striking a balance between development and protecting the environment. Building of basic essential infrastructure through development has been considered major part for Human development, therefore, protecting the environment but so does development. Without the environment which provides for land, man would not have where to build homes.

But one important key point to take note of is that both must be fairly managed and balanced. Development should not hinder and destroy the environment and also environmental protection must happen while allowing development.

7. PRINCIPLE OF PARTICIPATION: Every citizen, person, government and firms have a responsibility to participate in environmental decision making and protection policies. Through collective collaboration in the affairs of the environment it's easy to foster a shift and wave reflecting need to protect the environment. Every individual should take a major step and contribute to issues relating to solid waste management, garbage collection, construction, chemicals, gaseous omission and demolition materials which are likely to affect the environment and how to reduce the impact.

1.11 NATIONAL POLICIES ON ENVIRONMENT

Environmental policies may be either enacted as laws by governing bodies or created and enforced by government agencies. They may originate from local, national or foreign governments, and address an array of issues including,

- Air or water quality,
- Fossil fuel extraction,
- Energy conservation,
- Habitat protection or restoration,
- Pesticide use,
- Storage/disposal of hazardous materials,
- Trafficking of endangered species.

1.11.1 ENVIRONMENTAL POLICY IN INDIA- NATIONAL ENVIRONMENT POLICY, 2006.

The National Environment Policy (NEP) 2006 by the Ministry of Environment and Forests (MoEF) aims at mainstreaming environmental concerns into all developmental activities. It emphasizes conservation of resources, and points that the best way to aid conservation is to ensure that people dependent on resources obtain better livelihoods from conservation, than from degradation of the resources.

The National Environment Policy (NEP), 2006 was an effort towards India's commitment to clean environment and making positive contribution to international efforts. The NEP builds on the various earlier policies which had addressed the challenges of environment and need of sustainable development prior to this policy. Some of them are:

- National Forest Policy, 1988
- National Conservation Strategy and Policy Statement on Environment and Development, 1992
- Policy Statement on Abatement of Pollution,1992
- National Agriculture Policy, 2000
- National Population Policy, 2000
- National Water Policy, 2002

1.11.1.2 OBJECTIVES OF NATIONAL ENVIRONMENTAL POLICY, 2006.

i. **Conservation of critical environmental resources:** To protect and conserve critical environmental resources and invaluable natural and man- made heritage which are essential for life-supporting livelihoods and welfare of the society

ii. **Inter-generational Equity**: To ensure judicious use of environmental resources to meet the needs and aspirations of present and future generations.

iii. **Efficiency in Environmental Resources Use:** To ensure efficient use of environmental resources in the sense of reduction in their use per unit of economic output and to minimize adverse environmental impacts on society.

iv. **Environmental Governance in the Management of Resources:** To apply the principles of resources. To apply the principles of good governance (i.e. transparency, rationality, accountability, reduction in costs and time, and public participation) to the management of environmental resources.

v. **Enhancement of Resources:** Appropriate technology and traditional knowledge, managerial skills, and social capital will be used for conservation and enhancement of resources.

vi. **Livelihood Security for the Poor:** To ensure equitable access to environmental resources for poor tribal community, which are most dependent on environmental resources for their livelihood.

vii. **Integration of Environmental Concerns for Socio-economic:** Development; to integrate environmental concerns into policies, plans, programs and projects for socio-economic development.

1.11.2.3 STRATEGIES OF NATIONAL ENVIRONMENTAL POLICY, 2006.

- **Land Degradation:**
  - ❑Adoption of science based and traditional sustainable land use practices through research and development.
  - ❑Pilot scale demonstrations and farmers' training.
  - ❑Promote reclamation of wasteland and degraded forest land
  - ❑To reduce desertification through action plans.

- **Forests:**
  - ❑To formulate an innovative strategy for increase of forest.
  - ❑ Afforestation of degraded forest land, wasteland and tree cover on private or revenue land.

- **Wildlife:**
  - ❑Expanding the Protected Area Network
  - ❑Paralleling multi-stakeholder partnerships for afforestation
  - ❑Encouraging eco-tourism at wildlife sites.
  - ❑Implementing measures for captive breeding and release into the wild identified endangered species.

- **Biodiversity :**
  - ❑Strengthen the protection of biodiversity hot spots.
  - ❑Pay attention to the potential impacts of development projects on biodiversity resources and natural heritage.
  - ❑Conservation of Genetic material of threatened species of flora and fauna

- **Wetlands :**
  - ❑ Identification of valuable wetlands and to prevent their degradation and enhance their conservation.
  - ❑ Sustainable tourism strategies for identified wetlands.
  - ❑To take explicit account of impacts on wetlands of significant development projects.

- **Conservation of Man-made Heritage :**
  - ❑Setting ambient environmental standards, especially for air quality, the potential impacts on designated heritage sites
  - ❑Integrated regional development plans formulation

- **Environmentally Sensitive Zones :**
  - ❑Identify ESZs.
  - ❑Formulate area development plans
  - ❑Create local institutions for the environmental management of such areas.

- **Sustainable Mountain Development :**
  - ❑Norms for infrastructure construction in mountain regions
  - ❑Promotion of organic farming
  - ❑Sustainable tourism

- **Sustainable Coastal Resources :**
  - ❑Sustainable management of mangroves
  - ❑Protection to coastal environment

- **Conservation of Freshwater Resources:**
  - ❑River Management
  - ❑Groundwater

1.12 ABATEMENT OF POLLUTION

Abatement is a general term used for methods or technologies that reduce the amount of pollutant generated in a chemical or other manufacturing facility.

(or)

Pollution abatement refers to technology applied or measure taken to reduce pollution and/or its impacts on the environment.

The most commonly used technologies are scrubbers, noise mufflers, filters, incinerators, waste—water treatment facilities and composting of wastes.

Pollution abatement involves source reduction, in-process recycling, in-plant recycling, design modifications, off-site recycling, and treatment to make the waste less hazardous. Source reduction refers to the examination of various processing units in detail to determine if wastes can be minimized.

The step involves several layers of study:

- Waste inventory is generated.
- Critical processes leading to waste are identified.
- Alternative processing strategies are studied to reduce the amount of waste generated in these processes.

1.12.1 ABATEMENT OF DIFFERENT TYPES OF POLLUTION

1. AIR

- Smog, ground-level ozone pollution, acid rain and climate change influenced by greenhouse gas emissions are all products of fossil-fuel combustion, whether for industrial processes, electricity generation or gasoline-powered vehicles.
- Examples of contemporary abatement strategies include requiring smoke-stack scrubbers on coal-fired power plants to reduce emissions of sulfur and nitrogen dioxides and placing caps on carbon emissions to reduce greenhouse gases.

2. WATER

- Water pollution usually comes in one of two major forms, point source pollution and nonpoint source pollution. Point sources include specific release of pollutants into waterways, like industrial effluents or untreated sewage.
- Nonpoint sources are not locally specific and include pollution from storm water runoff in urban areas and pollutant leaching from contaminated soils.
- Abatement measures include requiring treatment of sewage waste water solids, installation of storm runoff retention systems (also called wet ponds) in areas with a high density of impervious surfaces and educating the public about the dangers of storm water pollutants to streams, rivers and aquifers.

3. SOIL

- Land pollution can come from a variety of sources. Landfills, chemical and fuel refinery leaks or spills and industrial agricultural techniques that require heavy use of pesticides and chemical fertilizers all contribute to soil pollution.
- Abatement measures include eliminating lead from fuels to reduce lead pollution of the soil, requiring underground liners for landfills, voluntary recycling programs, regulating fuel and chemical production to minimize risks of spills or leaks and exploring alternative agricultural methods to reduce the need for pesticides and herbicides.

4. ENERGY CONSERVATION

- Another basic but important pollution abatement strategy includes what many calls reducing your carbon footprint. More people using fewer resources and less energy reduces pollution impacts on a larger scale.
- Examples of conservation include: using cleaner-burning fuels and renewable sources of energy like solar or wind power, using public transportation or carpooling, recycling and reusing paper, plastics and metals, insulating your home to make it more energy-efficient, installing energy-efficient appliances, and buying locally produced goods to reduce the need for shipping of products over long distances.

1.13 CONSERVATION OF RESOURCES

Consumption of natural resources is increasing with growing population. With the increasing industrialization and urbanization, we need to conserve natural resources for their destruction will also upset the ecological balance. Conservation is the proper management of a natural resource to prevent its exploitation, destruction or degradation. Conservation is the sum total of activities, which can derive benefits from natural resources but at the same time prevent excessive use leading to destruction or degradation.

The nature provides us with all our basic needs but we tend to over exploit. If we go on exploiting nature, there will be no more resources available in future. Hence there is an urgent need to conserve nature for the following reasons.

- To maintain ecological balance for supporting life.
- To preserve different kinds of species (biodiversity).
- To make the resources available for present and future generations.
- To ensure survival of human race.
- To prevent negative impact on the environment.

1.13.1 METHODS ADOPTED TO CONSERVE RESOURCES

i. Promote efficient water use techniques, such as sprinkler or drip irrigation, among farmers. Provide necessary pricing, inputs, and extension support to feasible and remunerative alternative crops which may be raised by efficient water use.

ii. Support practices of rain water harvesting and artificial recharge and revival of traditional methods for enhancing groundwater recharge.

iii. Mandate water harvesting and artificial recharge in all new constructions in relevant urban areas

iv. Prepare and implement a comprehensive strategy for regulating use of ground water by large industrial and commercial establishments on the basis of a careful evaluation of aquifer capacity and annual recharge.

v. Support R&D in cost effective techniques suitable for rural drinking water projects for remedial measures and removal of arsenic fluoride, and other toxic substances.

vi. Improve productivity per unit of water consumed in industrial processes, by making water assessments and water audits mandatory in identified industries and utilities.

vii. Suitable sites for dumping the toxic waste material may be identified and remedial measures may be taken to prevent the movement of the toxic waste in the ground water

viii. Consider mandating the installation of water saving closets and taps in the building bye-laws of urban centers.

1.14 CHARTER ON CORPORATE RESPONSIBILITY FOR ENVIRONMENTAL PROTECTION.

- The Ministry of Environment & Forest (MoEF) has launched the Charter on "Corporate Responsibility for Environmental Protection (CREP)" in march 2003 with the purpose to go beyond the compliance of regulatory norms for prevention & control of pollution through various measures including waste minimization, in-plant process control & adoption of clean technologies.
- Industrial development is an important constituent in our pursuits for economic growth, employment generation and betterment in the quality of life.
- On the other hand, industrial activities, without proper precautionary measures for environmental protection are known to cause pollution and associated problems. Hence, it is necessary to comply with the regulatory norms for prevention and control of pollution.
- Alongside, it is also imperative to go beyond compliance through adoption of clean technologies and improvement in management practices.
- Commitment and voluntary initiatives of industry for responsible care of the environment will help in building a partnership for pollution control. This is the very purpose of this Charter.

- The Charter has set targets concerning conservation of water, energy, recovery of chemicals, reduction in pollution, elimination of toxic pollutants, process & management of residues that are required to be disposed of in an environmentally sound manner.
- The Charter enlists the action points for pollution control for various categories of highly polluting industries.
- The Charter also enables the industry to know the Government programmes, priorities and concerns in respect of 17 categories of major polluting industries and gives appropriate time for implementation of action points identified in the sectoral discussions thus relieving the industry from the sudden burden and enforcement pressure.

17 CATEGORIES OF HIGHLY POLLUTING INDUSTRIES

1. Aluminium Smelting
2. Basic Drugs & Pharmaceuticals Manufacturing
3. Chlor Alkali/ Caustic Soda
4. Cement (200TPD and above)
5. Copper Smelting
6. Dyes and Dye Intermediate
7. Fermentation (Distillery)
8. Fertiliser
9. Integrated Iron & Steel
10. Leather Processing including Tanneries
11. Oil Refinery
12. Pesticide Formulation & Manufacturing
13. Pulp & Paper (30 TPD and above)
14. Petrochemical
15. Sugar
16. Thermal Power Plants
17. Zinc Smelting

MODULE 2

ENVIRONMENTAL MANAGEMENT OBJECTIVES

2.1 ENVIRONMENTAL QUALITY OBJECTIVE

This includes a good living environment, good standards of public health, the safeguarding of biological diversity and long-term ecosystem productivity, and conservation of the natural and cultural landscape.

There are 16 environmental quality objectives.

i. Reduced Climate Impact
ii. Clean Air
iii. Natural Acidification only
iv. A Non-Toxic Environment
v. A Protective Ozone Layer
vi. A Safe Radiation Environment
vii. Zero Eutrophication
viii. Flourishing Lakes and Streams
ix. Good-Quality Groundwater
x. A Balanced Marine Environment, Flourishing Coastal Areas
xi. Thriving Wetlands
xii. Sustainable Forests
xiii. A Varied Agricultural Landscape
xiv. A Magnificent Mountain Landscape
xv. A Good Built Environment
xvi. A Rich Diversity of Plant and Animal Life

i. Reduced Climate Impact

- The UN Framework Convention on Climate Change - stabilization of concentrations of greenhouse gases in the atmosphere at level - ensure that human activities do not have a harmful impact on the climate system
- Goal achieved - biological diversity is preserved, food production is assured and other goals of sustainable development
- All countries, must have responsibility for achieving global objective

ii. Clean Air

The air must be clean enough not to represent a risk to health or to animals, plants or cultural assets.

iii. Natural Acidification Only

- Acidifying effects of deposition and land use must not exceed the limits that can be tolerated by soil and water.
- Deposition of acidifying substances must not increase the rate of corrosion of materials or cultural artefacts and buildings

iv. A Non-Toxic Environment

The environment must be free from man-made or extracted compounds and metals that represent a threat to human health or biological diversity

v. A Protective Ozone Layer

The ozone layer must be replenished so as to provide long-term protection against harmful UV radiation

vi. **A Safe Radiation Environment**

Human health and biological diversity must be protected against the harmful effects of radiation in the external environment.

vii. **Zero Eutrophication**

Eutrophication is caused by excessive levels of nitrogen and phosphorus, it increases algal blooms that block light from getting into water and harm plants and animals. It also prevents oxygen from getting into water, making it hypoxic and creates dead zone where no organisms survive. Therefore, environmental quality objective is aimed at zero eutrophication.

viii. Flourishing Lakes and Streams

- Lakes and watercourses must be ecologically sustainable and its variety of habitats must be preserved
- Natural productive capacity, biological diversity, cultural heritage assets and the ecological and water-conserving function of the landscape must be preserved, at the same time as recreational assets are safeguarded

ix. Good-Quality Groundwater

Groundwater must provide a safe and sustainable supply of drinking water

x. A Balanced Marine Environment and Flourishing Coastal Areas

- The sustainable productive capacity, and biological diversity must be preserved

- Coasts must be characterized by a high degree of biological diversity and a wealth of recreational, natural and cultural assets
- Industry, recreation and other utilization of the seas, coasts must be compatible with the promotion of sustainable development
- Particularly valuable areas must be protected against encroachment and other disturbance.

xi. **Thriving Wetlands**

The ecological and water-conserving function of wetlands in the landscape must be maintained and valuable wetlands preserved for the future

xii. **Sustainable Forests**

The value of forests and forest land for biological production must be protected, at the same time as biological diversity and cultural heritage and recreational assets are safeguarded

xiii. A Varied Agricultural Landscape

The value of the farmed landscape and agricultural land for biological production and food production must be protected, at the same time as biological diversity and cultural heritage assets are preserved and strengthened

xiv. A Magnificent Mountain Landscape

- The pristine character of the mountain environment must be largely preserved, in terms of biological diversity, recreational value, and natural and cultural assets
- Activities in mountain areas must respect these values and assets, with a view to promoting sustainable development
- Particularly valuable areas must be protected from encroachment and other disturbance

xv. A Good Built Environment

- Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment
- Natural and cultural assets must be protected and developed
- Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources

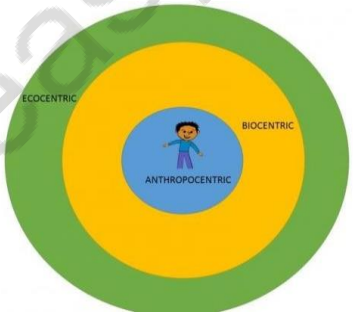
xvi. A Rich Diversity of Plant and Animal Life

- Biological diversity must be preserved and used sustainably for the benefit of present and future generations
- Species habitats and ecosystems and their functions and processes must be safeguarded

- Species must be able to survive in long-term viable populations with sufficient genetic variation
- People must have access to a good natural and cultural environment rich in biological diversity, as a basis for health, quality of life and wellbeing

2.2 RATIONALE OF ENVIRONMENTAL STANDARDS

- Environmental standards are administrative regulations or civil law rules implemented for the treatment and maintenance of the environment.
- Environmental standards should preserve nature and the environment, protect against damage, and repair past damage caused by human activity.
- Environmental standards are typically set by government and can include prohibition of specific activities, mandating the frequency and methods of monitoring, and requiring permits for the use of land or water.
- Standards differ depending on the type of environmental activity.
- Historically, the development of environmental standards was influenced by two competing ideologies: eco-centrism and anthropocentrism.
- Eco-centrism frames the environment as having an intrinsic value divorced from the human utility, while anthropocentrism frames the environment as only having value if it helps humanity survive. This has led to problems in establishing standards



- In recent decades, the popularity and awareness of environmentalism has increased with the threat of global warming becoming more alarming than ever since the Intergovernmental Panel on Climate Change (IPCC) released their report in 2018.
- The report asserts that based on scientific evidence “if human activities continue to at this rate it is predicted to increase in-between 1.5-2 °C over pre industrial levels in-between 2030 and 2052”.

- Busby argues that Climate change will define this century and that it is no longer a faraway threat. In turn, the demand for protecting the environment has risen.
- Developments in science have been fundamental for the setting of environmental standards. Improved measurements and techniques have allowed scientists to better understand the impact of human-caused environmental damage on human health and the biodiversity which composes the natural environment
- Therefore, environmental standards in modern times are set with the view that humans do have obligations toward the environment, but they can be justified in terms of obligations toward other humans. This means it is possible to value the environment without discarding anthropocentrism. Sometimes called prudential or enlightened anthropocentrism.
- This is evident as environmental standards often characterize the desired state (e.g. the pH of a lake should be between 6.5 and 7.5) or limit alterations (e.g., no more than 50% of the natural forest may be damaged). Statistical methods are used to determine the specific states and limits the enforceable environmental standard.
- Penalties and other procedures for dealing with regions out of compliance with the standard may be part of the legislation

2.3 CONCENTRATION AND MASS STANDARDS

Concentration

- Concentration is the mass of a pollutant in a defined volume of water.

Mass

- Mass is the amount of a pollutant that is discharged into a water body during a period of time (i.e. tons of sediment per year)

Both concentration and mass standards provide information of environmental significance.

2.4 EFFLUENT AND STREAM STANDARDS

2.4.1 EFFLUENT STANDARDS

- They are generally established for the effluent from industry and municipality waste water treatment plant to be discharge into stream, land, sewer, ocean etc.

- Effluent standard system is carried out to control the following stream standard system.
- No detail stream analysis is required to determine exact amount of waste treatment; effluent standard can serve as a guide to establish the stream classification or during organization of any pollution abatement program.
- Unless the effluent standards are upgraded, this system does not provide any effective protection for an over loaded stream.
- Main disadvantage of this type of standards is that there is no control over total volume of polluting substances added to stream each day.

.4 Parameter	.4 Unit	Effluent Discharge Standards						
		Africa				Asia		
		Nigeria	Tanzania	Ghana	Uganda	Thailand	Malaysia	India
Temperature	°C	40	-na-	-na-	35	40	40	-na-
pH	-	6–9	6.5–8.5	6–9	6–8	5.5–9	5.5–9.0	6.5–8.5
BOD	mg O_2/L	30–50	30	50	50	20–60	50	30
COD	mg O_2/L	60–90	60	250	100	120–400	100	250
Oil and grease	mg/L	10	5	5	10	5–15	10	10
DS	mg/L	200	3000	1000	1200	3000	-na-	-na-
SS	mg/L	25	100	50	100	50	100	50–100
Total N	mg/L	10	10	-na-	10	-na-	-na-	10

2.4.2 STREAM STANDARDS

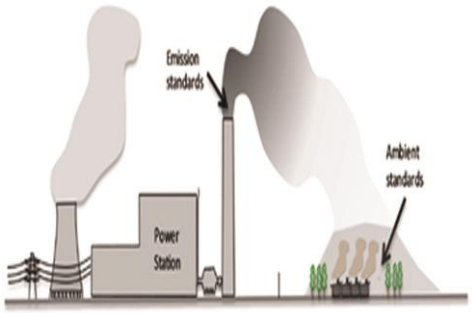
- The system is based on establishing classification or standard quality for a stream & regulating any discharge to the extent, necessary to maintain the established stream classification or quality
- The primary objective of stream standards is to protect and preserve each stream for its best usage on a equitable basis for both upstream & downstream uses.
- The stream standard system is the prevention of excessive pollution regardless of type of industry or other factors such as location of industry or municipality.
- Pollution abutment should be considered in the decisions concerning location of a plant just as carefully as the labors, transportation, market & other conditions.
- It also allows the public to establish goals for maintaining quality of water for present as well for future needs.

S.NO.	Parameter	Requirement desirable Limit	Remarks
1.	Colour	5	May be extended up to 50 if toxic substances are suspected
2.	Turbidity	10	May be relaxed up to 25 in the absence of alternate
3.	pH	6.5 to 8.5	May be relaxed up to 9.2 in the absence
4.	Total Hardness	300	May be extended up to 600
5.	Calcium as Ca	75	May be extended up to 200
6.	Magnesium as Mg	30	May be extended up to 100
7.	Copper as Cu	0.05	May be relaxed up to 1.5
8.	Iron	0.3	May be extended up to 1
9.	Manganese	0.1	May be extended up to 0.5
10.	Chlorides	250	May be extended up to 1000
11.	Sulphates	150	May be extended up to 400
12.	Nitrates	45	No relaxation
13.	Fluoride	0.6 to 1.2	If the limit is below 0.6 water should be rejected, Max. Limit is extended to 1.5
14.	Phenols	0.001	May be relaxed up to 0.002
15.	Mercury	0.001	No relaxation

Treated Effluent Quality of Common Effluent treatment Plant
[Concentration in mg/l except pH & Temperature]

Parameters	Into inland surface waters	On land for irrigation	Into Marine Coastal areas
pH	5.5-9.0	5.5-9.0	5.5-9.0
BOD [3days at 27 °C]	30	100	100
Oil & Grease	10	10	20
Temperature	Shall not exceed 40 °C in any section of the stream within 15 meters down steam from the effluent outlet	-	45 °C at the point of discharge.
Suspended Solids	100	200	(a) For process waste water-100 (b) For cooling water effluent 10 percent above total suspended matter of effluent cooling water
Dissolved Solids (inorganic)	2100	2100	-
Total residue chlorine	1.0	-	1.0
Ammonical nitrogen(As N)	50	-	50
Total Kjeldahl nitrogen(as N)	100	-	100
Chemical Oxygen Demand	250	-	250
Arsenic (as As)	0.2	0.2	0.2
Mercury (as Hg)	0.01	-	0.01
Lead (as Pb)	0.1	-	1.0
Cadmium (as Cd)	1.0	-	2.0
Total Cadmium (as Cr)	2.0	-	2.0
Copper (as Cu)	3.0	-	3.0
Zinc (as Zn)	5.0	-	15
Selenium (as Se)	0.05	-	0.05
Nickel (as Ni)	3.0	-	5.0
Boron (as B)	2.0	2.0	-
Percent Sodium	-	60	-
Cynide (as CN)	0.2	0.2	0.2
Chloride (as Cl)	1000	600	-
Fluoride (as F)	2.0	-	15
Sulphate (as SO_4)	1000	1000	-
Sulphide (as S)	2.8	-	5.0
Pesticides	Absent	Absent	Absent
Phenolic compounds (as C_6H_5OH)	1.0	-	5.0
Note: All efforts should be made to remove colour and unpleasant odour as far as possible.			

2.5 EMISSION AND AMBIENT STANDARDS



Emission Standards

- **Emission standards** are never-exceed levels applied directly to the quantities of emissions coming from pollution sources.
- Emission standards can be set on a wide variety of different bases. For example:
  - Emission rate (e.g., kilograms per hour),
  - Emission concentration (e.g., parts per million of biochemical oxygen demand, or BOD, in wastewater),
  - Percentage removal of pollutant (e.g., 60-percent removal of waste material before discharge).
- In the language of regulation, emission standards are a type of performance standard, because they refer to end results that polluters who are regulated must achieve.

Ambient Standards

- An **ambient standard** is a never-exceed level for a pollutant in the ambient environment.
- For example, an ambient standard for dissolved oxygen in a particular river may be set at 3 parts per million (ppm), meaning that this is the lowest level of dissolved oxygen that is to be allowed in the river.

Ambient vs. Emission Standards

- Setting emission standards at a certain level does not necessarily entail meeting a set of ambient standards. This is due to naturally occurring processes.
- Sometimes the environment will convert a certain type of pollutant into something more damaging. As a result, ambient environmental quality depends on emissions and natural degradation. This is often the case with organic pollutants.
- Researching the link between emission levels and ambient quality levels is a major part of environmental science.

Pollutant	Time weighted average	Concentration of Ambient Air		
		Industrial area	Residential rural & other area	Sensitive area
Sulphur dioxide (SO_2)	Annual[a]	80 µg/m^3	60 µg/m^3	15 µg/m^3
	24 h[b]	120 µg/m^3	80 µg/m^3	30 µg/m^3
Oxides of nitrogen (NO_2)	Annual[a]	80 µg/m^3	60 µg/m^3	15 µg/m^3
	24 h[b]	120 µg/m^3	80 µg/m^3	30 µg/m^3
Suspended Particulate Matter (SPM)	Annual[a]	360 µg/m^3	140 µg/m^3	70 µg/m^3
	24 h[b]	500 µg/m^3	200 µg/m^3	100 µg/m^3
Respirable Particulate Matter (size Less than 10 µm) RPM	Annual[a]	120 µg/m^3	60 µg/m^3	50 µg/m^3
	24 h[b]	150 µg/m^3	100 µg/m^3	75 µg/m^3
Lead as Pb	Annual[a]	1.0 µg/m^3	0.75 µg/m^3	0.50 µg/m^3
	24 h[b]	1.5 µg/m^3	1.0 µg/m^3	0.75 µg/m^3
Carbon monoxide	8 h[b]	5.0 mg/m^3	2.0 mg/m^3	1.0 mg/m^3
	1 h	10.0 mg/m^3	4.0 mg/m^3	2.0 mg/m^3

2.6 MINIMUM NATIONAL STANDARDS (MINAS)

1976 – CPCB developed concept of evolving industry specific effluent standards

Based on comprehensive study of the problems of the industry.

An attempt was made

- To identify relevant pollution parameters
- Its pollution potential
- Best pollution control technologies available in India

MINAS contemplated a minimum level of treatment for specific industrial wastewater – based on

- Annual turnover of the industry.
- Techno-economic feasibility of the control objective.
- Initially textile and man-made fibers were studied and standards were set
- Later included oil refineries, chloroalkali etc.,
- Disposal specificity was not a part of MINAS.
- Standards were considered to be minimum standards that a specific industry should achieve irrespective of the mode of disposal.
- In Environmental Protection Act 1986, some of these standards were incorporated
- Since these were minimal standards – SPCB were permitted to make them only stringent and in no case relax them.

2.6.1 Advantages of MINAS

- Appear to be simple and direct.
- Apparently set clearly specified targets.
- Appeal to people's sense of getting environmental pollution reduced immediately.
- Are consistent with our ethical sense that pollution is bad and ought to be declared illegal.
- Conform to an operation of the legal system, which is to define and stop illegal behaviour.

2.7 ENVIRONMENTAL PERFORMANCE EVALUATION

Environmental Performance Evaluation (EPE) is "an internal process and management tool designed to provide management with reliable and verifiable information on an ongoing basis to determine whether an organization's environmental performance is meeting the criteria set by the management of the organization".

EPE, as detailed in International Standard, follows a "Plan-Do-Check-Act" management model.

2.7.1 The steps of this ongoing process are the following:

1. Plan

- Planning EPE;
- Selecting indicators for EPE

2. Do

Using data and information which includes:

- collecting data relevant to the selected indicators;
- analyzing and converting data into information describing the organization's environmental performance;
- assessing information describing the organization's environmental performance in comparison with the organization's environmental performance criteria;
- reporting and communicating information describing environmental performance.

3. Check and Act

Reviewing and improving EPE.

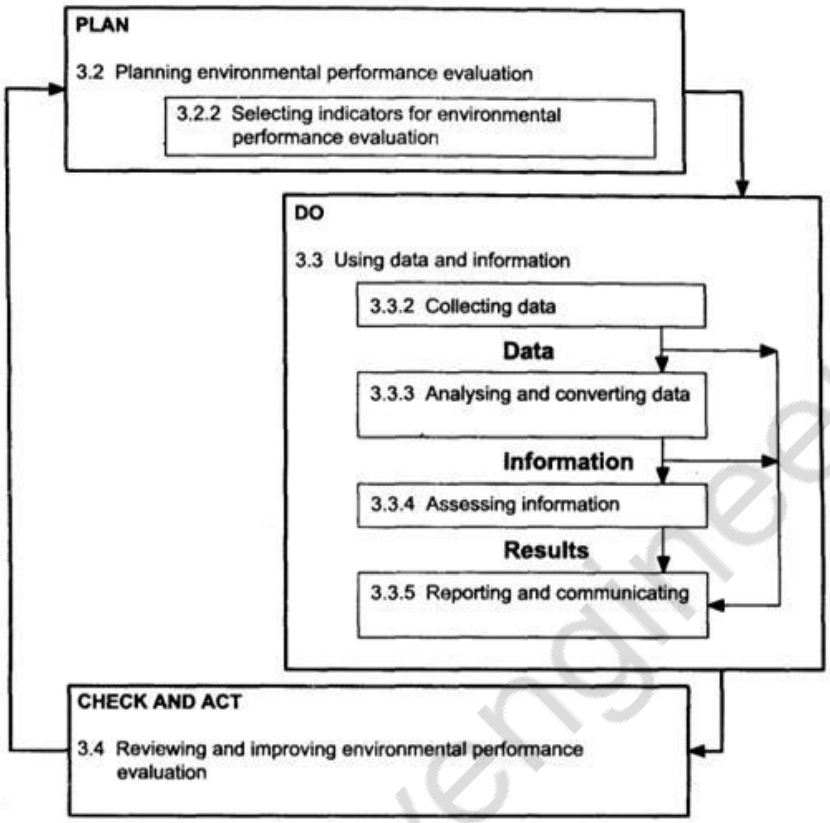


Figure 1 — Environmental performance evaluation

2.7.2 ENVIRONMENTAL PERFORMANCE INDICATORS

EPI provide information that helps evaluation and decision making within organizations that engage in environmental efforts.

2.7.2.1 OBJECTIVES OF EPI

- To measure and evaluate environmental burdens, environmental problems that need to be solved and outcomes of environmental efforts comprehensively in order to promote environmental activities of organizations and to obtain information that helps decision making regarding these activities.
- To provide a common foundation of information between an organization and interested parties in order to facilitate that interested parties, such as consumers, business partners, residents in local communities, shareholders, and financial institutions, understand environmental activities of the organization

- To provide a common foundation of information for macro-level environmental policies of the national and local governments

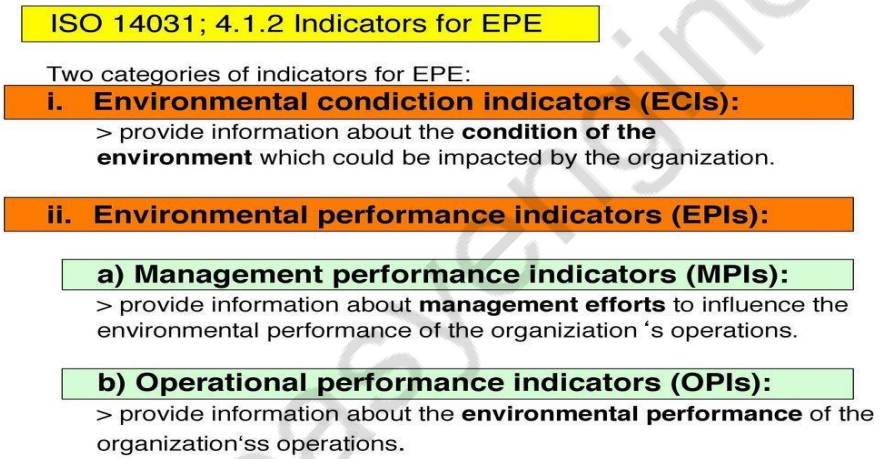
2.7.2.2 TYPES OF ENVIRONMENTAL PERFORMANCE INDICATORS

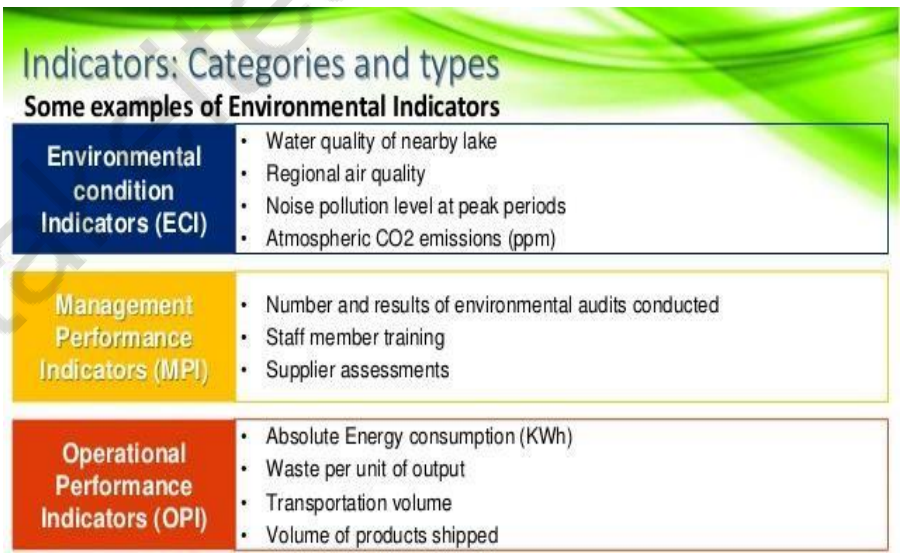
ISO standard describes two general categories of indicators for EPE:

i. Environmental Performance Indicators (EPIs); and
ii. Environmental Condition Indicators (ECIs).

There are two types of Environmental Performance Indicators:

i. Management Performance Indicators (MPIs)
ii. Operational Performance Indicators (OPIs)





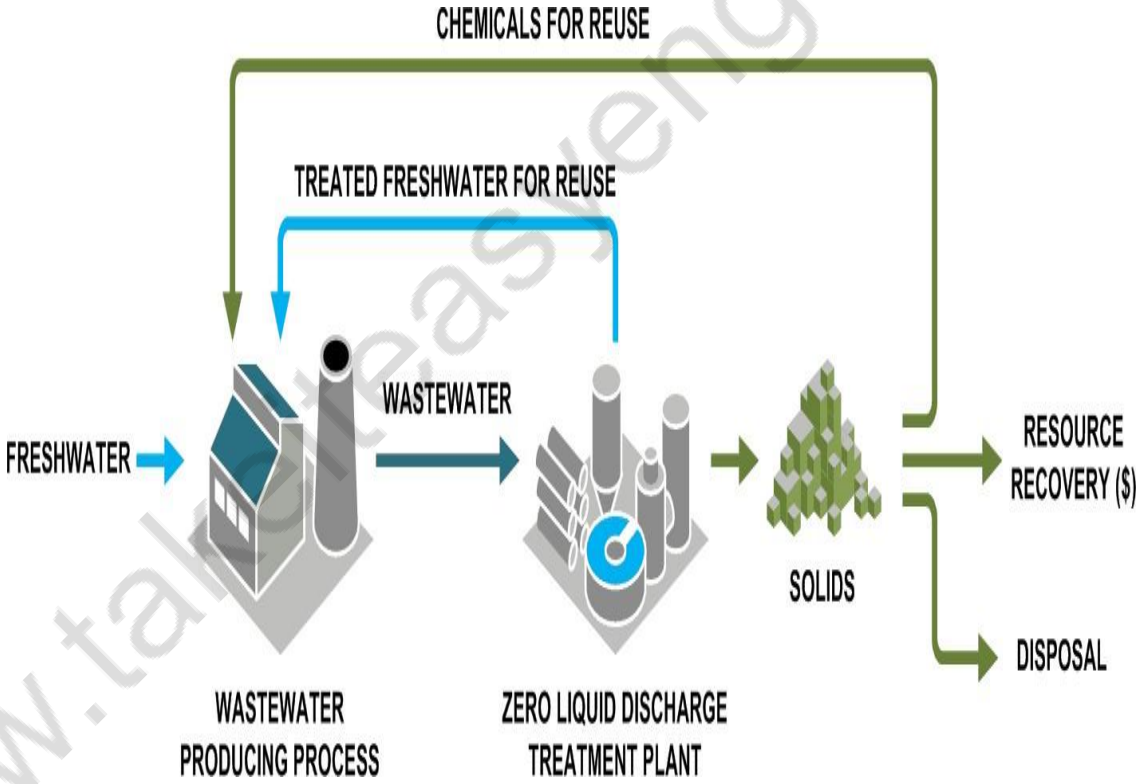
2.8 ZERO DISCHARGE TECHNOLOGY

In a world where freshwater is an increasingly valuable resource, industrial processes threaten its availability on two fronts, unless the water is treated.

Many industrial processes require water, and then reduce the availability of water for the environment or other processes, or alternately contaminate and release water that damages the local environment.

Another important reason to consider zero liquid discharge is the potential for recovering resources that are present in wastewater. Some organizations target ZLD for their waste because they can sell the solids that are produced or reuse them as a part of their industrial process.

Regardless of an organization's motivations to target zero liquid discharge, achieving it demonstrates good economics, corporate responsibility and environmental stewardship. By operating an in- house ZLD plant, disposal costs can be reduced, more water is re- used, and fewer greenhouse gases are produced by off-site trucking, which minimizes impact on local ecosystems and the climate



Zero liquid discharge (ZLD) is an engineering approach to water treatment where all water is recovered and contaminants are reduced to solid waste.

While many water treatment processes attempt to maximize recovery of freshwater and minimize waste, ZLD is the most demanding target since the cost and challenges of recovery increase as the wastewater gets more concentrated.

Salinity, scaling compounds, and organics all increase in concentration, which adds costs associated with managing these increases. ZLD is achieved by stringing together water treatment technology that can treat wastewater as the contaminants are concentrated.

2.8.1 BENEFITS OF ZERO DISCHARGE TECHNOLOGY

- There are a number of benefits to targeting zero liquid discharge for an industrial process or facility:
- Lowered waste volumes decrease the cost associated with waste management.
- Recycle water on site, lowering water acquisition costs and risk. Recycling on-site can also result in less treatment needs, versus treating to meet stringent environmental discharge standards.
- Reduce trucks associated with off-site waste water disposal, and their associated greenhouse gas impact and community road incident risk.
- Improved environmental performance, and regulatory risk profile for future permitting.
- Some processes may recover valuable resources, for example ammonium sulfate fertilizer or sodium chloride salt for ice melting.
- Several methods of waste management are classified as zero liquid discharge, despite using different boundaries to define the point where discharge occurs.
- Usually, a facility or site property line that houses the industrial process is considered the border or 'boundary condition' where wastewater must be treated, recycled, and converted to solids for disposal to achieve zero liquid discharge.
- Certain facilities send their liquid waste off-site for treatment, deep well disposal, or incineration and they consider this to qualify as zero liquid discharge. This approach to zero liquid discharge eliminates continuous discharge of liquids to surface waters or sewers, but can significantly increase cost.
- Some engineers describe their designs as near-zero liquid discharge or minimal liquid discharge to highlight that they discharge low levels of wastewater, but do

not eliminate liquid in their waste. For some facilities, it may be more economic to approach but not achieve complete ZLD by concentrating brine to lower volumes.

- Furthermore, it may be possible to avoid the creation of liquid waste on-site through careful water conservation or by treating contaminants at their source before they can enter the main flow of water.

2.9 CLOSING THE LOOPS

Production system in which the waste or by-product of one process or product is used in market for another product.

Closed-loop recycling is the process by which a product or material can be used and then turned into a new product (or converted back to raw material) indefinitely without losing its properties during the recycling process.

By reducing the production and use of raw materials, closed-loop recycling minimizes harm to the environment and discourages resource depletion. In contrast, open-loop recycling is the process by which a product is recycled but has to be mixed with raw materials to become a new product, typically leading to down cycling.

Ideal closed-loop systems produce no waste. They are called "closed" because products have a circular life cycle, beginning as raw materials and either being recycled into replacement products, returning to the original raw materials, or being returned to the environment as biodegradable waste.

This reduces the amount of (non-biodegradable) waste disposed, as recyclables are recovered and reused, rather than ending up in a landfill or as a pollutant.

It is a stable and sustainable system in which natural resources are renewed and waste never builds up. A closed loop

Closed-loop recycling involves: collecting and sorting recycled materials, extracting resources from the materials, and using those resources as inputs in the manufacturing of products practically identical to the original. Recycled materials are collected from homes, businesses, and recycling banks.

The most suitable materials for closed-loop recycling are aluminium, glass, and plastic. These are known to maintain their quality throughout many cycles of extraction, production, use, and recycling. For example, aluminium cans can be recycled and turned into new cans with practically no material degradation or waste.

- Under a closed-loop system, businesses reuse the same materials over and over again to create new products for purchase. It's a way to conserve natural resources and divert waste from the landfill, and increasingly, more companies are adopting it.

- Moving from a traditional linear system to a circular system, otherwise known as closing the loop, is a growing idea in the world of sustainable design and manufacturing.

- Closing the loop means moving from traditional design, which looked at the linear model for design and production – make, use and dispose – to how the disposal stage could be fed back into the creation of a new product.

Example:

- Buying recycled products is part of Closing the Loop
- Step is critical because it maintains the market demand for recyclables.
- Without a demand for recycled products, there is no economy to support recycling
- Creating stable markets for recycling ensures the continuation and expansion of recycling programs everywhere.
- Recycling waste newspaper to make paper-board or other type of paper.

2.10 CLEANER PRODUCTION

Cleaner production aims to minimize or avoid practices such as waste treatment (including stabilization, encapsulation, and detoxification), waste dilution to comply with regulations (e.g., releasing contaminated water into rivers or streams during high flow periods, blending arsenic containing fumes with flotation Cleaner production (CP) is a preventative approach to managing the environmental impacts of business processes and products. CP uses changes in technology, processes, resources or practices to reduce waste, environmental and health risks; minimize environmental damage; use energy and resources more efficiently; increase business profitability and competitiveness; and increase the efficiency of production processes. Cleaner production is applicable to all businesses, regardless of size or type.

Cleaner production is a preventive, company-specific environmental protection initiative. It is intended to minimize waste and emissions and maximize product output.

By analyzing the flow of materials and energy in a company, one tries to identify options to minimize waste and emissions out of industrial processes through source reduction strategies.

Improvements of organization and technology help to reduce or suggest better

choices in use of materials and energy, and to avoid waste, waste water generation, and gaseous emissions, and also waste heat and noise.

2.10.1 BENEFITS OF CLEANER PRODUCTION

1. Improving environmental situation
2. Continuous environmental improvement
3. Gaining competitive advantage
4. Increasing productivity
5. Increasing economic benefits

2.10.2 CLEANER PRODUCTION PRACTICES

- Good housekeeping- Take appropriate managerial and operational actions to prevent: Leaks, spills, to enforce existing operational instructions
- Input substitution- substitute input materials By less toxic, or by renewable materials, or by adjunct materials which have a longer service lifetime in production.
- Better process control- Modify: Operational procedures, equipment instructions, and process record keeping in order to run the processes more efficiently and at lower waste and emission generation rates.
- Equipment modification- modify the existing production equipment and utilities in order: Run the processes at higher efficiency, lower waste and emission generation rates.
- Technology change- replace of The technology, processing sequence, synthesis pathway. In order to minimize waste and emission generation during production.
- On- site Recovery/Reuse- Reuse of the wasted materials in the same process for another useful application within the company.
- On- site Recovery/Reuse- Reuse of the wasted materials in the same process for another useful application within the company.

2.10.3ENVIRONMENTAL STRATEGIES

Passive environmental strategies

- **Dilute and disperse**: It involves the attenuation of pollutants by permitting them to become physically spread out, thereby reducing their effective point concentration. The dispersal and the consequent dilution of a given substance depends on its nature and the

characteristics of the specific pathway used to achieve this. It may take place, with varying degrees of effectiveness, in air, water or soil.

Reactive environmental strategies

- **End- of- pipe approaches:** From the 1960s onwards, it became obvious that the dilute and disperse strategy was no longer effective for important point-source pollutions. A complete technology and business was developed to install purification units at the end of the emission pipes of various production processes. This approach is called 'end-of-pipe' because they usually represent the last stage of a process before the stream is disposed or released to the environment. Although effective to a certain extent the end-of pipe approach is not "the solution".

- **On – site recycling**: End of pipe methods often resulted in increased costs with no appreciable benefits to industries in terms of enhanced materials or energy uses, as a result, recycling wastes and resource recovery methods were evolved in 1980s; which were actually better mechanisms of resource use and waste minimization tactics over the end-of pipe strategy.

Proactive environmental strategies

- Cleaner Production: After 1990s, new ideas have emerged to reduce emissions to the environment at the source i.e. proactive environmental strategy. It is a dynamic capability that allows organizations to evolve and align their strategy with the changing and uncertain environment. It has been argued that, the transition from reactive to proactive approaches involves complex organizational changes that do not always result in business success. This pollution prevention and waste minimization strategy appeared to be necessary to reduce the enormous costs of clean-up actions, certainly from the moment that the polluter pays principle was brought into legislation. This new approach of cleaner production seems very promising because it combines an environmental and a business concern.

2.11 CLEANER TECHNOLOGY

Clean technology, is any process, product, or service that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources, or environmental protection activities. Clean technology includes a broad range of technology related to recycling, renewable energy, information technology, green transportation, electric motors, green chemistry, lighting, grey water, and more.

The current key sectors in the clean technology industry are:

- Sustainable energy and energy optimization to reduce dependence on fossil fuels
- The provision of clean water to all who need it
- Pollution reduction
- Recycling and waste management

i. **Sustainable Energy and Energy Optimization**: Many technologies use sustainable sources of energy, or optimize energy usage to reduce dependence on carbon fuels.

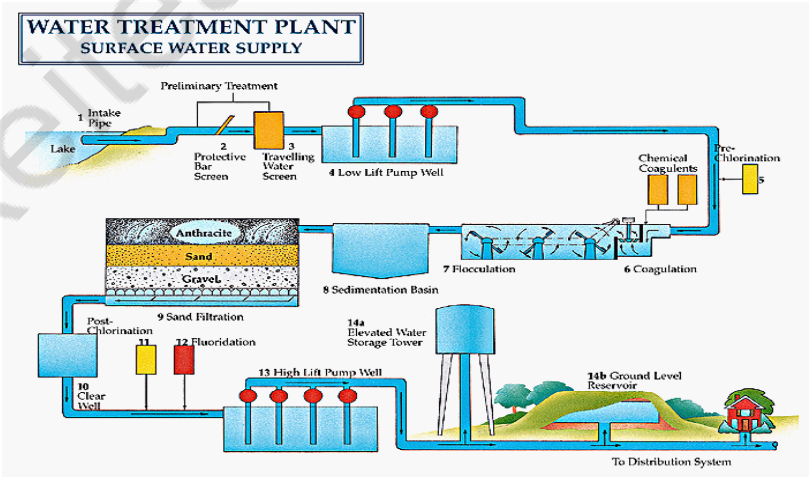
- Wind power – This sustainable resource is typically exploited in the form of vast wind farms, often found offshore. A wind farm contains a large group of individual wind turbines connected up which generate electricity without producing any greenhouse gas emissions after construction.
- Hydroelectric power – This refers to the use of the gravitational force of water falling

or flowing to produce electricity. Once constructed, a hydroelectric power plant will produce extremely low levels of greenhouse gases when compared to fossil fuel-based techniques.

- Solar energy – Two techniques are used to generate electricity from solar energy; photovoltaics (PV) or concentrated solar power systems (CSPs). The former uses the photovoltaic effect to directly convert light into an electrical current, whilst the latter uses lenses or mirrors to focus a beam of light directly onto a small area. This is converted into heat which subsequently drives a heat engine to generate electricity.
- Geothermal energy – This is simply the heat from the earth itself. This heat can be used similarly to the directed light beams for CSPs to heat up water to drive heat engines and generate electricity, or systems in buildings can capture the earth's naturally occurring thermal energy for space heating.
- Smart energy – This refers to the numerous ways that energy usage can be optimized with the introduction of connected energy consumption, automated energy distribution, and responsive energy supply – all made possible with the advent the Internet of Things (IoT).
- Energy reduction – This encompasses all of the ways that energy usage is reduced from the demand side, including automated systems, human behavior management, sustainable development, and sustainable building management.

ii. Clean Water

- Water treatment – This refers to the treatment of raw water to ensure that it is safe for human consumption.
- Wastewater treatment – The conversion of wastewater into water that can then be entered into the water cycle or reused is referred to as wastewater treatment.



iii. Pollution Reduction

- Emission control – There are several methods to reduce global emissions. The adoption of clean technologies, such as the sustainable energy sources listed

above, as well as a transition from conventional gasoline-powered vehicles to biofuel and electric vehicles, are just a few of the suggested ways to control emissions.

- Pollutant monitoring – Air monitoring stations which provides annual reports on the volume of pollutants. Similar techniques of monitoring the levels of air pollutants are employed around the world, including the use of satellites and drones to create impartial, accurate monitoring reports.
- Remediation of polluted sites – When a request for environmental remediation of a location is made by government or other land remediation authorities, immediate action must be taken by the landowners to ensure the location is made safe for humans and animals. This can involve cleaning soil, groundwater, surface water, or sediment by removing pollutants and contaminants.

iv. Recycling and Waste Treatment

- Recycling of consumer products – The majority of consumer products in today's market have many parts or components which can be recycled. Once a product reaches its "post-consumer" stage, it should be sorted correctly to ensure it does not end up in landfills.
- Reduction and treatment of toxic waste – Often in the form of dangerous chemicals or materials, toxic or hazardous waste should be treated very carefully. Most governments have plans in place for the reduction, collection, treatment, and regulation of toxic and hazardous waste.

2.12 POLLUTION CONTROL VS POLLUTION PREVENTION - OPPORTUNITIES

2.12.1 Pollution prevention

EPA defines pollution prevention as:

- Source reduction
- Use of nontoxic or less-toxic alternatives.
- Re-using materials rather than putting them into the waste stream.

Pollution prevention opportunities

- Reducing or eliminating toxic materials
- Replacing a material in the production line.
- Reformulating the product.

- Installing new or modifying existing process equipment.
- ➢ Closed loop (on site) recycling
- ➢ Developing new technology that helps others implement
- ➢ Involves holistic approach.

2.12.2 Pollution control

Pollution control is the process of reducing or eliminating the release of pollutants into the environment. It is regulated by various environmental agencies which establish pollutant discharge limits for air, water, and land.

Pollution Control Opportunities

- End of pipe treatment
- Open loop (off site) recycling
- Incineration or disposal
- Burning waste for energy recovery
- Transferring waste from one medium to other.
- Incorporation waste from one medium to other.

2.13 POLLUTION PREVENTION BARRIERS

i. End-of-Pipe Focus

- In most instances, the end-of-pipe focus of existing regulations does not create a direct barrier to pollution prevention.
- Potential negative effect of focusing industrial and public resources on controlling pollutants after it has been created rather than on product, process, or raw material changes

ii. Media-Specific Focus

- Current regulations address one environmental medium at a time.
- The result can be transfer of pollutants from one environmental medium to another and concentration on media-specific solutions rather than multi-media preventive approaches.
- Media-specific focus does not always encourage multi-media preventive approaches

iii. Regulatory Program Evaluation Criteria

- Current benchmarks for measuring the success of

programs do not include consideration of pollution prevention progress

- The focus is on more easily quantified performance measures such as the number of permits issued or the number of inspections performed.

iv. Regulatory Inflexibility

- Lack of flexibility can sometimes create a barrier to pollution prevention.
- Pollution prevention is a customized process, varying facility by facility.
- May require flexibility and short-term variances in compliance schedules for emission standards or permits

v. Regulatory Uncertainty

- Industry personnel working to implement pollution prevention strategies may be required to consult with several agencies and with decision-making authority.
- Innovative project or a pollution prevention proposal may require multiple approvals for different aspects of that project, which may be difficult to obtain. This can discourage facilities from undertaking pollution prevention practices.

vi. Pollution Fees

- If structured on a multi-media basis with a significant correlation to quantities of pollutants created and set at sufficient levels, fees can provide incentives for pollution prevention
- Current fees are for the most part media-specific, set at levels determined by the costs of regulatory services, and in some cases are not closely correlated with quantities of pollutants released.
- Although fees set up in this manner do not present direct barriers to pollution prevention, it provides little incentive to go beyond standards and prevent pollution at the source.

MODULE 3

ENVIRONMENTAL MANAGEMENT SYSTEM

3.1 ENVIRONMENTAL MANAGEMENT SYSTEMS (EMS)

- An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency.
- An Environmental Management System (EMS) is a framework that helps an organization achieve its environmental goals through consistent review, evaluation, and improvement of its environmental performance.
- Some of the primary environmental issues that are affecting businesses today include pollution, waste disposal, water quality, and water supply issues, and climate change

3.1.1 ENVIRONMENTAL MANAGEMENT SYSTEM PROCESS

1. **Environmental policy**: Develop a statement of your organization's commitment to the environment. Use this policy as a framework for planning and action.
2. **Environmental aspects**: Identify environmental attributes of your products, activities and services. Determine those that could have significant impacts on the environment.
3. **Legal and other requirements**: Identify and ensure access to relevant laws and regulations (and other requirements to which your organization adheres).
4. **Objectives and targets**: Establish environmental goals for your organization, in line with your policy, environmental impacts, views of interested parties and other factors.
5. **Environmental management program**: Plan actions to achieve objectives and targets.
6. **Structure and responsibility**: Establish roles and responsibilities and provide resources.
7. **Training, awareness and competence**: Ensure that your employees are trained and capable of carrying out their environmental responsibilities.
8. **Communication**: Establish processes for internal and external communications on environmental management issues.
9. **EMS documentation**: Maintain information on your EMS and related documents.

10. **Document control**: Ensure effective management of procedures and other system documents.
11. **Operational control**: Identify, plan and manage your operations and activities in line with your policy, objectives and targets.
12. **Emergency preparedness and response**: Identify potential emergencies and develop procedures for preventing and responding to them
13. **Monitoring and measurement**: Monitor key activities and track performance.
14. **Nonconformance and corrective and preventive action**: Identify and correct problems and prevent recurrences.
15. **Records**: Keep adequate records of EMS performance.
16. **EMS audit**: Periodically verify that your EMS is operating as intended.
17. **Management review**:Periodically review your EMS with an eye to continual improvement.

3.2 EMAS (ECO-MANAGEMENT AND AUDIT SCHEME)

- It is one of the Voluntary instruments of environmental protection, i.e., it positively motivates organizations to responsible approach and to improving its environmental performance beyond the legal requirements.
- Established by the European Union in order to detect and monitor the impacts of the activities of organizations on the environment and to publish information in the form of individual environmental statements
- EMAS is a proactive approach of the company to monitoring, control and gradual reduction of the impact of the activities of the organization on the environment.
- It is designed for organizations functioning in the private sector (joint stock companies, limited liability companies, etc.) as well as for organizations of state and public administration (ministries, municipalities, etc.) or its parts (producing unit, remote workplaces).
- EMAS system is one of two ways which an organization can use to implement the EMS
- The second tool used to implement the environmental management system is ISO

- Both ways are similar to each other in many parts - environmental policy, continuous improvement, objectives and target values, programs, the implementation of the system and its operation, monitoring, and management review
- EMAS, however, extends the ISO 14001 system, especially in terms of transparency when organizations with an established system according to EMAS are obliged to publish environmental statements and hold open discussions with the public and other interested parties

3.3 ISO 14000

1. ISO 14000 is the international standard that specifies requirements for an effective environmental management system (EMS).
2. The primary objective of the ISO 14000 series of standards is *to promote effective environmental management systems in organizations*. It provides a framework that an organization can follow, rather than establishing environmental performance requirements.
3. The ISO 14000 family includes most notably the ISO 14001 standard, which represents the core set of standards used by organizations for designing and implementing an effective environmental management system (EMS).
4. Other standards in this series include ISO 14004, which gives additional guidelines for a good EMS and standards that are more specialized dealing with specific aspects of environmental management.

List of **ISO 14000** series standards

- **ISO 14001** Environmental Management Systems. (Requirements with guidance for use)
- **I SO 14004** Environmental management systems (General guidelines on principles, systems and support techniques)
- **ISO 14015** Environmental assessment of sites and organizations
- **ISO 14020** series (14020 to 14025) Environmental labels and declarations
- **ISO 14030** discusses post production environmental assessment
- **ISO 14031** Environmental performance evaluation—Guidelines
- **ISO 14040** series (14040 to 14049), Life Cycle Assessment, LCA, discusses pre-production planning and environment goal setting.
- **ISO 14050** terms and definitions.
- **ISO 14062** discusses making improvements to environmental impact goals.
- **ISO 14063** Environmental communication—Guidelines and examples
- **ISO 14064** Measuring, quantifying, and reducing **Greenhouse Gas** emissions.

3.3.1 ISO 14001 requires an organization to:

1. Develop an **environmental policy** with a commitment to compliance*;*
2. Have a procedure for identifying and having access to **environmental laws and regulations**;
3. Set **objectives and targets** that are in line with its environmental policy (which includes a commitment to compliance);
4. Establish **operational control procedures**;
5. Establish procedures for **emergency preparedness and response**;
6. Establish a procedure for periodically **evaluating compliance**

3.3.2 ISO 14001 requires an organization to:

- Environmental policy
- Environmental laws and regulations;

- Objectives and targets
- Operational control procedures;
- Emergency preparedness and response;
- Evaluating compliance

3.3.3 ISO 14000 HISTORY

According the most recent reports, there are more than 10,000 companies worldwide certified to ISO 14000. Of these, the majority are in Japan (2600), (2,600), followed by Germany (1,600), UK (1,200), Sweden (650), Taiwan(500), USA (590), the Netherlands (475), Korea (460), Switzerland (400) and France (360).

The Export-Import (EXIM) Bank of India provides grants of up to 50% of the cost incurred in obtaining the EMS certificate to export oriented units

Certification of EMS ISO 14001 has the following benefits to companies

- Prove that its activities have been evaluated and accepted by an accredited, independent third party.
- It shows that an external 'stamp' of approval of the EMS has been given and that, the organization's commitment to improve environmental performance is valid
- Shows commitment to the protection of the Environment. Possibly, the greatest positive impact to the environment will be in the reduction of hazardous waste
- This would apply to reduction, reuse or recycling, all of which maximize natural resources. There is thus conservation of other natural resources in the process.
- Gives new organizations more chance with regulators that the written documentation necessary to demonstrate compliance with the regulations will be abide by.
- Overall, relations with regulators would improve after ISO 14001 certification. 'The agency will know the certified organization care for the environment and has systems in place even before visiting the operation'. This positive relation is extremely valuable and would help foster a better working relationship.
- It levels the playing field of international trade bringing more competitors to the scene. These means companies certified to ISO 14001 have market access all over the world.
- Insurance companies these days find it easier transacting business with companies that have effective EMS like ISO 14001 as they view such a company as having limited liability. Investors these days also try to invest in environment friendly companies.

3.4 BENEFITS OF EMS

- Improved environmental performance.
- Enhanced compliance.
- Prevention of pollution.
- Resource conservation.
- New customers/markets.
- Increased efficiency/reduced costs.
- Enhanced employee morale.
- Fewer accidents.
- Enhanced image with the public, regulators, lenders, investors; i.e. stakeholders.

- Employee awareness of environmental issues and responsibilities.
- Reduced liabilities.
- Competitive advantages.

3.5 CONCEPT OF CONTINUAL IMPROVEMENT AND POLLUTION PREVENTION

Continual Improvement is an important aspect of any EMS and ISO 14001.

- Pollution prevention is generally defined as "the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants or wastes at the source".
- Organizations that implement continuous improvement achieve this by making small, gradual improvements over time.
- Pollution prevention also includes practices that reduce the use of energy, water or other resources through conservation or more efficient use.
- Where pollution prevention is not feasible, the EMS should include options for recycling, treatment and disposal, considered in that order.

3.5.1 CONTINUOUS IMPROVEMENT AIMS TO:

- Increase Efficiency
- Increase Quality
- Reduce Costs

3.5.2 POLLUTION PREVENTION TECHNIQUES AND PRACTICES FOCUS ON

- Substances of concern
- Materials and feedstock substitution
- Operating efficiencies
- On-site reuse and recycling
- Training
- Purchasing practices
- Product design
- Equipment modifications
- Product reformulation
- Process changes

- Clean production
- Avoidance of cross-media transfer of pollutants or waste
- Life-cycle assessment

1) Materials and feedstock substitution are methods of source elimination.

- Polluting materials in a production process or embedded in a product are replaced with less polluting or nonpolluting substances
- Opportunities for materials and feedstock substitution include:

- Painting applications
- Parts cleaning
- Metal finishing
- Printing operations
- Building and grounds maintenance

2) Operating efficiencies and training are examples of how normal parts of good operation can provide effective ways to prevent pollution.

Examples include

- Changing production schedules to minimize equipment and feedstock change overs
- Improving maintenance schedules
- Segregating by-products at the source
- Training staff to improve material handling and recognize opportunities

3) Product design and reformulation includes methods for preventing pollution associated with the entire life cycle.

- Addressing environmental concerns at an early stage can avoid environmental impacts throughout the product life cycle in a cost-effective manner.
- Results of redesigning or reformulating a product include

- Reducing toxicity of a product
- Reducing waste material
- Extending the life of a product
- Extending the life of the materials used
- Reducing energy and material intensity needed to produce, use and dispose of the product

4) Equipment modifications and process changes involve new technologies or approaches to existing operating systems processes and practices to improve production efficiencies and reduce pollution and waste.

- ❖ An example is mechanical stripping instead of using solvents to remove paint and varnish

5) The Value of Waste

- Waste can also be viewed as a loss of valuable process materials that could have economic and environmental benefits if reused or recycled.

The following approaches reflect this perspective on the value of waste.

- **On-site reuse and recycling** is considered pollution prevention because it occurs at the same place as the original activity.
- **Reuse** means using materials again in their original form or in new applications.
- **Recycling** extends the effective life of resources. Environmentally sound recycling is usually preferable to end-of-pipe solutions.
- Raw materials, chemicals and treated and untreated wastewater are examples of materials that could be reused or recycled.
- Some examples of reuse and recycling are
- ❖ Recovering metals by ion exchange or reverse osmosis
- ❖ Recycling cooling water
- ❖ Reusing trim and cuttings from plastic moulding in on-site production rather than taking them for off-site disposal

3.6 ENVIRONMENTAL POLICY

What is an environmental policy?

- An environmental policy is a statement about an organization's environmental position and values
- The ISO 14001 standard states that an environmental policy is the organization's overall environmental performance intentions and direction formally expressed by top management
- An environmental policy is usually published as a written statement, expressing the commitment of the senior management to improving appropriate environmental performance.

- Environmental policy is the commitment of an organization or government to the laws, regulations, and other policy mechanisms concerning environmental issues.
- These issues generally include air and water pollution, waste management, ecosystem management, maintenance of biodiversity, the protection of natural resources, wildlife and endangered species.
- The ISO 14001 standard is probably the best reference standard for the development of an environmental policy

Environmental policy must be:

- appropriate to the organization;
- include a commitment for continual improvement and prevention of pollution;
- include a commitment to comply to relevant legal and other requirements; and,
- provide the framework for setting and reviewing environmental objectives and targets

3.6.1 BENEFITS OF DEVELOPING AN ENVIRONMENTAL POLICY

- An organization can publicly advertise that it has considered its environmental performance and has adopted best practice or is working towards improving its environmental performance.
- It is all relative to the organization and the type of industry but the environmental policy can advertise the environmental status and environmental objectives of the organization to all stakeholders.
- Current and potential clients can read the statement and are able to determine whether they would like to continue or start business with the organization. ***It also can provide clear direction to all stakeholders about the organization's environmental values.***

3.6.2 Who should develop an environmental policy?

- A senior manager or managing team should endorse the environmental policy but not necessarily be directly responsible for developing the policy.
- Should appoint someone talented, familiar with the organization and who has the ability of writing interesting factual statements.
- Choose someone which can inspire and communicate the true environmental policy of the organization.

3.6.3 What is the usual procedure for maintaining an environmental policy?

- Similar to an environmental management system environmental policy should be regularly be reviewed
- When there has been change or change is planned, or when there has been a significant performance issue the environmental policy should be reviewed.
- Otherwise, more general reviews should occur periodically (e.g. annually).

3.6.4 What should be included in an environmental policy?

- The ISO 14001 standard is probably the best reference standard for the development of an environmental policy.

In summary, an environmental policy must be

- Appropriate to the organization;
- Include a commitment for continual improvement and prevention of pollution;
- Include a commitment to comply to relevant legal and other requirements; and,
- Provide the framework for setting and reviewing environmental objectives and targets.
- Understand whether the organization presents a direct environmental risk to their operations;

3.7 INITIAL ENVIRONMENTAL REVIEW

- The first step in creating an EMS is to perform an Initial Environmental Review.
- This process will enable organization to understand what aspects of the organization have a significant environmental impact.
- This tells organization where they are and creates a road map for the organization.
- The initial environmental review is the **starting point** for a good environmental management system.
- The Environmental Review is an **initial assessment** to help to create an EMS.
- The Environmental Audit **assesses the performance** of the organizations' EMS.

There are four main areas

- ❖ Review previous environmental issues
- ❖ Consider any regulations which have operational impact
- ❖ Identify and evaluate possible environmental issues in organization.
- ❖ Outline current operations and how it is managed; also consider indirect impacts

Initial Environmental Review enables organization to:

- Identify how existing site operations have an environmental impact – eg. the impact of normal operating conditions, abnormal conditions and emergency situations
- establish which of these impacts are significant and need improvement by setting objectives and targets
- identify breaches or potential breaches of environmental legislation
- identify relevant EMS documentation which needs to be put in place
- quantify emissions, discharges, and material and utility use
- identify opportunities for improving performance and minimizing waste
- evaluate previous emergency situations and accidents
- develop your environmental policy

3.7.1 BENEFITS OF AN INITIAL ENVIRONMENTAL REVIEW

Helps determine the organization's environmental position, and should include

- ❖ Environmental statutory and regulatory requirements
- ❖ Recognize items/areas with environmental impact
- ❖ Environmental Performance Criteria
- ❖ Feedback of previous experiences
- ❖ Opportunities for improvement in-house as well as external (contractors, vendors, etc.,)

3.8 ENVIRONMENTAL ASPECT AND IMPACT ANALYSIS

- Identification and evaluation of significant environmental aspects, especially in the planning phase, is the most fundamental part of EMS.
- To understand the environmental aspects and impacts is one of the key success factors of implementing an ISO 14001 EMS.

The following definitions used in ISO 14001 provide a clear understanding of the terms.

- **Environmental Aspect:** Element of an organization's activities, products, or services that can interact with the environment.
- **Environmental Impact:** Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities.

The organization needs to establish and maintain procedures to identify the environmental aspects that it can control and have influence over. Direct and indirect aspects need to be distinguished. **Direct aspects** result directly from facility operations, such as raw material use in production. **Indirect aspects** can only be indirectly connected to a facility operation, such as aspects related to the production of raw materials that are purchased from a supplier.

- The term ―aspect‖ is neutral. Environmental aspects can be either:
- Positive (such as manufacturing a product out of recycled materials).
- Negative (such as creating toxic materials).

The Link Between Aspects and Impacts - Some Examples from a Real Company

Aspects	Potential Impacts
Emissions of volatile organic compounds	Increase in ground level ozone
Discharges to stream	Degradation of aquatic habitat and drinking water supply
Spills and leaks	Soil and groundwater contamination
Electricity use	Air pollution, global warming
Use of recycled paper	Conservation of natural resources

Things to Consider in Evaluating Environmental Aspects:

- ☐ Air Emissions
- ☐ Water Effluents
- ☐ Solid and Hazardous Wastes
- ☐ Land Use
- ☐ Contamination of Land
- ☐ Raw Material and Resource Use
- ☐ Local Issues (e.g. concerns raised by the community such as: noise, odor, dust, traffic, appearance, etc.)
- ☐ Normal and Abnormal Conditions (e.g., start-up, shutdown, emergencies)

3.9 LEGAL AND OTHER REQUIREMENTS

Almost all organizations implementing ISO 14001 are aware that legal requirements are the foundation and basic requirement of ISO 14001

Some of the important legislations for environment protection are as follows:

- The Environment (Protection) Act, 1986
- The National Green Tribunal Act, 2010
- The Air (Prevention and Control of Pollution) Act, 1981
- The Water (Prevention and Control of Pollution) Act, 1974
- The Environment Protection Act, 1986
- The Hazardous Waste Management Regulations, etc.

Legal requirements include:

- National, regional and local requirements.
- Standards in locations where an organization sells products /services.
- Permit conditions.
- Regulatory obligations.

Other requirements might include (for example):

- Organization-specific codes.
- International Chamber of Commerce (ICC) Charter for Sustainable Development.

3.10 OBJECTIVES AND TARGETS

Setting objectives requires an analysis of the exposure to different environmental aspects:

- Environmental aspects which have high public priority and to which the organization contributes heavily. Here environmental objectives should be set.
- Environmental aspects which have low public priority and to which the organization contributes heavily.
- Environmental aspects which have high public priority and to which the organization has a low contribution.

How to Establish Objectives for Environmental Management

- "Objectives and targets help an organization translate purpose into action". An attempt should be made to connect these goals with other existing strategic plans.

Figure 4.2 *Environmental Objectives and Targets are Determined by Many Different Factors [NSF International, 2001, p. 28].*

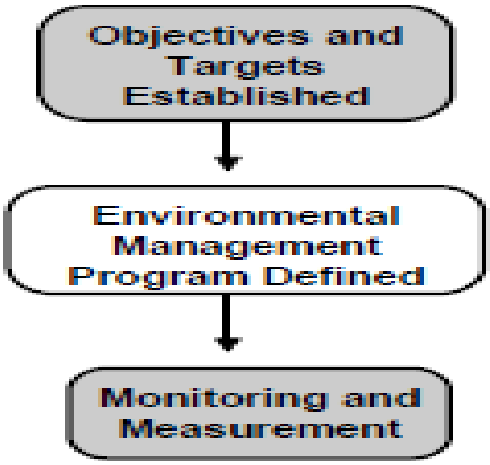
The best objectives are referred to as S.M.A.R.T. objectives

- specific,
- measurable,
- achievable,
- realistic and
- time-based,

and this way of creating objectives makes a target an integral part of the objective.

3.11 ENVIRONMENTAL MANAGEMENT PROGRAMS

- An Environmental Management Program is the roadmap the organization will follow to achieve its environmental objectives and targets.
- It is a document that provides the details of what must be done, by whom, how, and when, for each of the defined objectives and targets.
- The objectives and targets themselves must be assigned priorities at the start.



When devising the environmental program:

- Management must designate responsibility for achieving the objectives and targets at each function and level within the organization.
- Management must provide the means for fulfilling the objectives and targets. A time frame in which objectives and targets will be achieved needs to be established.

The environmental management program should be integrated into the company's overall strategic plan.

Within the spirit of the EMS, environmental management programs should be reviewed periodically and revised regularly to reflect changes in the company's objectives and targets.

1. **Air Emissions:** Program includes performance standards for the boilers, emergency generators and incinerators. This program also encourages and supports alternative transportation including bus, carpool.
2. **Energy Management:** This program seeks to reduce electricity consumption associated with laboratory, utility, office, and outdoor operations and support the agency wide efforts to reduce campus building energy intensity and increase usage of renewable energy.
3. **Green Purchasing:** Program encourages the purchase of recycled content materials, energy-efficient equipment, alternative fueled vehicles, bio-based products, environmentally preferable products, and non-ozone depleting substances.
4. **Hazardous Materials Management:** Program provides criteria for the safe and environmentally sound storage, handling, transportation and disposition of hazardous materials used in laboratory research, support and maintenance operations, and construction activities
5. **Hazardous Waste Management:** This program provides for the management of hazardous wastes to ensure that such wastes are identified, accumulated, stored, transported, treated, and disposed or recycled in an environmentally sound manner
6. **Pesticides:** This program follows integrated pest management (IPM) principles when controlling pests in the animal facilities, inside campus buildings, and on campus grounds

through limited pesticide application in a manner that is effective yet safe for the environment, personnel, and research activities

7. **Solid Waste Management:** Program ensures that solid wastes are identified, classified, collected, transported, stored, recycled, treated and/or disposed safely and in a manner protective of human health and the environment. Maximization of the quantity of material diverted from the landfill, either by recycling, reuse, or reduction in quantities used, is a primary objective
8. **Storm water Management:** Program focuses on reducing the potential for outdoor petroleum and chemical spills, and minimizing the impact of construction projects on the storm water conveyance system.
9. **Wastewater:** Program reduces the potential for pollutants to enter the sanitary sewer system through effective pretreatment, source reduction, proper chemical disposal, and other wastewater management programs
10. **Water Consumption:** Program seeks to reduce water consumption associated with laboratory, utility, facility, and domestic operations.

3.12 STRUCTURE AND RESPONSIBILITY

- For EMS to be effective, roles and responsibilities must be clearly defined and communicated. In an organization, the commitment of all employees is needed.
- Top management plays a key role by providing the resources needed to ensure that the EMS is implemented effectively

Top management should appoint a management representative.

This representative:

1. ensures that the EMS is established and implemented;

2. Reports on its performance over time; and

3. Works with others to modify the EMS when necessary.

The management representative:

- Ensures that the EMS is established and implemented as planned.
- Regularly reports on its performance.
- Works with others to modify and improve the EMS as needed.
- Coordinates actions and projects for the continuous im-provement process

Functions	How They Can Help (Possible Roles)
Purchasing	• Develop and implement controls for chemical / other material purchases
Human Resources	• Define competency requirements and job descriptions for various EMS roles • Integrate environmental management into reward, discipline and appraisal systems
Maintenance	• Implement preventive maintenance program for key equipment
Finance	• Track data on environmental management costs • Prepare budgets for environmental management program • Evaluate economic feasibility of environmental projects
Engineering	• Consider environmental impacts of new or modified products and processes • Identify pollution prevention opportunities
Top Management	• Communicate importance of EMS throughout organization • Provide necessary resources • Track and review EMS performance
Line Workers	• Provide first-hand knowledge of environmental aspects of their operations • Support training for new employees

3.13 TRAINING AWARENESS AND COMPETENCE COMMUNICATION

- EMS training is basically intended "to explain the importance of the EMS to staff, and to explain their responsibilities for EMS operations".
- Passive management support is often caused by management's ignorance about the EMS.

Competence:

- The first step is to identify what skills and abilities are required for a person to perform the job function so as to avoid the potential significant impacts.
- This competence can be gained in the form of outside education, training, or experience.

Training:

- After identifying what competencies are required for the processes to avoid potential significant environmental impacts, you need to find people with these competencies to fill these positions.
- Of course, in reality there will often be a choice of candidates who have many of the required competencies, but not all of them.
- This is where training comes into place, especially when you are first implementing your environmental management system

Training of all employees is very important because every employee:

- Can have potential impacts on the environment through his or her daily activities.
- Can be a useful resource for generating ideas about establishing operational control for a process, defining environ-mental aspects or defining structural responsibilities.

Training must take place when:

- New employees are hired.
- A change in job descriptions takes place.
- The corrective action process notes failure to follow instructions.
- New procedures are introduced or already existing procedures are altered.
- EMS aspects/objectives/targets have changed.

Key Steps in Developing a Training Programme:

Step 1: Assessment of training needs & requirements.

Step 2: Defining training objectives.

Step 3: Selecting suitable methods and materials.

Step 4: Preparing training plan.

Step 5: Conducting training.

Step 6: Tracking of training (and maintaining records).

Step 7: Evaluating training effectiveness.

Step 8: Improving training programme

Awareness:

Even those who have the desired competencies need to be made aware of how their tasks can lead to the identified potential environmental impacts.

The requirements of ISO 14001 separate the need for awareness into four distinct areas:

- Conforming to the environmental policy and procedures
- Significant environmental aspects and potential impacts
- Roles and responsibilities to achieve conformity
- Potential consequences of departure from procedures

3.14 COMMUNICATION

Communication is the glue that holds together the elements of an environmental management system. Effective environmental management requires effective communications.

Communications will help:

- motivate the workforce;
- explainthe environmental policy (both internally and externally) and how it relates to the overall business vision / strategy;
- ensure understanding of roles and expectations;
- demonstrate management commitment;
- monitor performance; and
- Identify potential system improvements.

An effective EMS should include procedures for:

- communicating internally (between levels and functions), and
- Soliciting, receiving, documenting and responding to external communications.

Internal and External Communication

- An effective EMS requires this information to be communicated both internally and externally.
- Internal communication is the communication within a facility or organization that is directly related to the EMS. It is required to establish communications on and between all relevant levels of functions within the organization.

Internal communication will:

- Motivate the workforce.
- Gain acceptance for management's plans and efforts.
- Explain the environmental policy and the EMS and how they relate to the overall organizational vision.

- Ensure understanding of roles and expectations.
- Demonstrate management commitment.
- Monitor and evaluate performance.
- Identify potential system improvements.

External communication is the communication between the organization and interested parties outside the organization. There are numerous benefits resulting from effective communications.

- Effective external communication will:
- Demonstrate management ‘s commitment to the environment.
- Make others aware of the organization’s environmental policy and commitment to environmental responsibility.

3.15 DOCUMENTATION AND DOCUMENT CONTROL

EMS documentation consists of:

- The environmental policy.
- The organizational structure and key responsibilities.
- A description or summary of how an organization satisfies EMS requirements
- System-level procedures
- Activity or process-specific procedures/work instructions
- Other EMS-related documents
- Documents are an important element of an environmental management system (EMS) as they provide written evidence of procedures, records and instructions.
- They can also provide a history of the EMS, enabling organization to check whether improvements are continuing to being made.

Documents likely to be part of EMS include:

- An environmental policy
- Objectives and targets
- Structure and responsibilities
- Information on how the ems operates
- How documents and operational procedures are controlled
- Monitoring and measurement records
- Corrective and preventive action

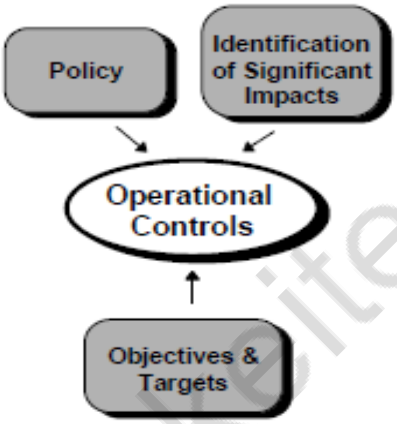
- Records, training and auditing information
- Management Review Decisions

- Without a mechanism to manage these EMS documents, an organization cannot be sure that people are working with the right documents.
- To ensure that everyone is working with the proper EMS documents, every organization should have a procedure that describes how such documents are controlled.
- Implementation of this procedure should ensure that:

EMS documents can be located.

- They are periodically reviewed.
- Current versions are available where needed.
- Obsolete documents are removed

3.16 OPERATIONAL CONTROL



- Operational controls are required to control significant environmental aspects and impacts, but also to keep track of legal and other requirements, objectives and targets as well as environmental policy,
- Effective operational planning and control lies at the heart of every effective EMS (Environmental Management System).

The operation control defined must should take into consideration:

- create controls in line with its environmental requirements to ensure that the design and development process for the product or service considers the life cycle stage
- define the environmental requirements for the procurement of products and services
- communicate all relevant environmental requirements to external providers which include contractors
- consider the need to provide information in regards to the end-of-life treatment of products and services with consideration in, transportation, delivery, use, and final disposal.

- maintain detailed documentation to ensure that the processes have been carried out as planned.

3.17 MONITORING AND MEASUREMENT

- An EMS without effective monitoring and measurement processes is like driving at night without the headlights on you know that you are moving but you can't tell where you are going Monitoring and measurement enables an organization to:
- Evaluate environmental performance.
- Analyze root causes of problems.
- Assess compliance with legal requirements.
- Identify areas requiring corrective action.
- Improve performance and increase efficiency.
- Monitoring helps organization to manage business better.
- An EMS without an effective monitoring and measurement program is like driving at night without the headlights on — you know that you are moving but you can't tell where you are going!

Monitoring and measurement enables you to:

- gauge your environmental performance;
- analyze root causes of problems;
- identify areas where corrective action is needed; and,
- improve performance / increase efficiency.

Organization should develop procedures to:

- monitor key characteristics of operations and activities that can have significant environmental impacts;
- track performance (including how well organization meet objectives and targets);
- calibrate and maintain monitoring equipment; and,
- through internal audits, periodically evaluate your compliance with applicable laws and regulations

3.18 MANAGEMENT REVIEW

- Management review is intended to ensure that the environmental management system is healthy, and to look for places that improvement can happen.
- Management reviews also offer a great opportunity to keep EMS efficient and cost-effective.
- The management review process in ISO 14001 is basically the same as the internal environmental audit for EMAS.
- Management itself determines the intervals in which it per-forms reviews. Generally, the scope of the review should be comprehensive, though not all elements of an EMS need to be reviewed at once.

Top management must periodically review the EMS in order to:

- Ensure its continuing suitability, adequacy and effectiveness.
- Address possible needs for changes to the environmental policy, objectives and targets, and other elements of the EMS.
- Identify opportunities for continual improvement.

Other objectives of the management review are to:

- Review regulatory compliance and to determine the causes of non-compliance.
- Determine whether or not operational controls, procedures, corrective actions, preventive measures and continuous improvement efforts were able to improve the environmental performance of the organization.
- Determine process improvements due to EMS measures.
- Determine if there are operational areas existing that could possibly be improved with EMS measures.

MODULE 4

ENVIRONMENTAL AUDIT

4.1 ENVIRONMENTAL MANAGEMENT SYSTEM AUDITS

An Environmental Management System (EMS) Audit refers to a systematic and documented verification process of objectively obtaining audit evidence to determine whether an organization's EMS conforms to the audit criteria and communicating the results of this process to the client.

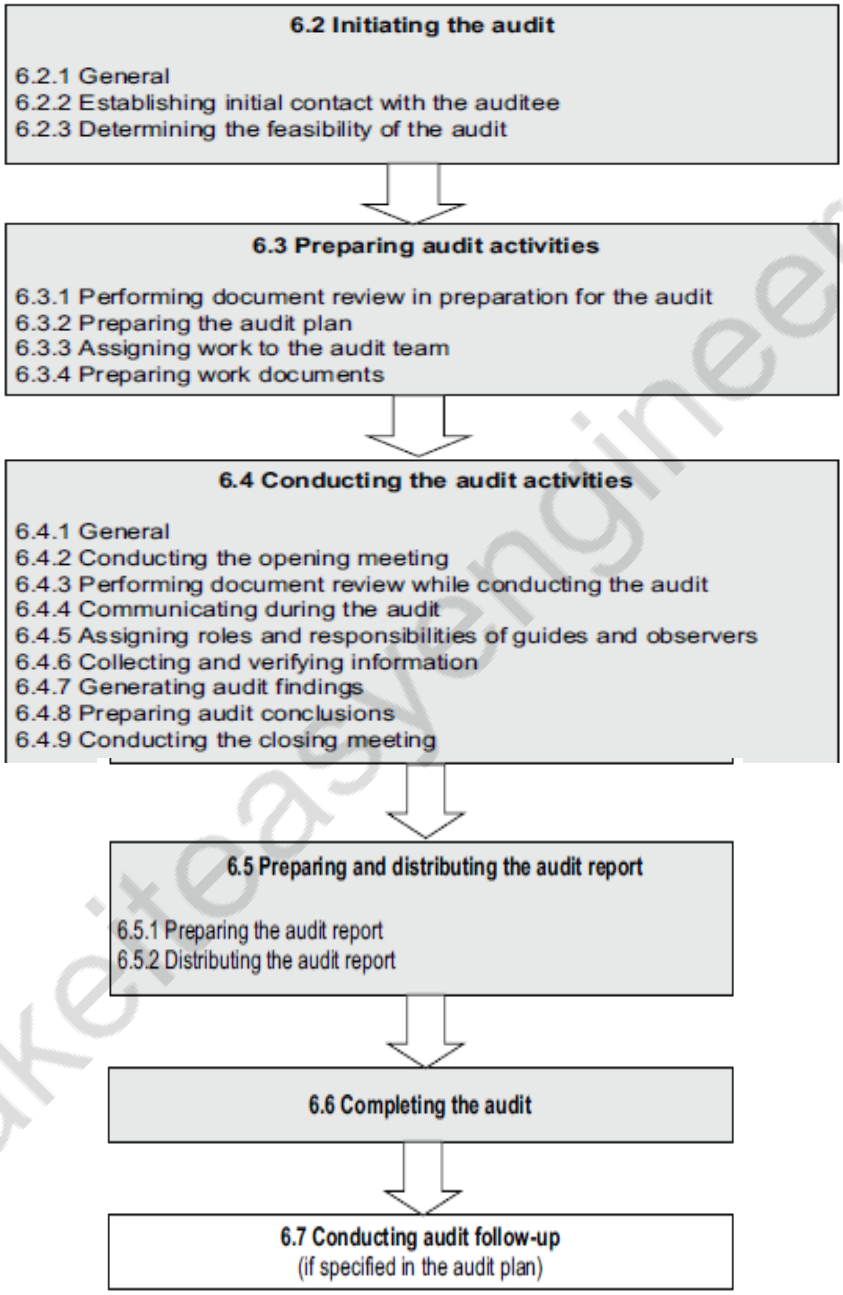
The objectives of a typical EMS audit include:

- Determining conformance of an auditee's EMS with the EMS audit criteria;
- Determining whether the auditee's EMS has been properly implemented and maintained;
- Identifying areas of potential improvement in the auditee's EMS;
- Assessing the ability of the internal management review process to ensure the continuing suitability and effectiveness of the EMS;
- Evaluating the EMS of an organization where there is a desire to establish a contractual relationship

Principles of Auditing

- Integrity: the foundation of professionalism
- Fair presentation: the obligation to report truthfully and accurately
- Due professional care: the application of diligence and judgement in auditing
- Confidentiality: security of information
- Independence: the basis for the impartiality of the audit and objectivity of the audit conclusions.
- Evidence-based approach: the rational method for reaching reliable and reproducible audit conclusions in a systematic audit process.

4.1.2 STEPS TO BE FOLLOWED IN AUDITING



1. Initiating the audit

When an audit is initiated, the responsibility for conducting the audit remains with the assigned audit team leader until the audit is completed.

- **Establishing initial contact with the auditee:** The initial contact with the auditee for the performance of the audit can be informal or formal and should be made by the audit team leader.
- **Determining the feasibility of the audit:** The feasibility of the audit should be determined to provide reasonable confidence that the audit objectives can be achieved.

2. Preparing audit activities

- **Performing document review in preparation for the audit:** The relevant management system documentation of the auditee should be reviewed
- **Preparing the audit plan:** The audit team leader should prepare an audit plan based on the information contained in the audit programme and in the documentation provided by the auditee
- **Assigning work to the audit team**
- **Preparing work documents:** The audit team members should collect and review the information relevant to their audit assignments and prepare work documents, as necessary, for reference and for recording audit evidence

3. Conducting the audit activities

- **Conducting the opening meeting**: An opening meeting should be held with the auditee's management and, where appropriate, those responsible for the functions or processes to be audited
- **Performing document review while conducting the audit**
- **Communicating during the audit**: During the audit, it may be necessary to make formal arrangements for communication within the audit team, as well as with the auditee, the audit client and potentially with external bodies
- **Assigning roles and responsibilities of guides and observers**: Guides and observers (e.g. regulator or other interested parties) may accompany the audit team
- **Collecting and verifying information:** During the audit, information relevant to the audit objectives, scope and criteria, including information relating to interfaces between functions, activities and processes should be collected by means of appropriate sampling and should be verified.

- **Generating audit findings:** Audit evidence should be evaluated against the audit criteria in order to determine audit findings.
- **Preparing audit conclusions**
- **Conducting the closing meeting:** A closing meeting, facilitated by the audit team leader, should be held to present the audit findings and conclusions.

4. Preparing and distributing the audit report

- Preparing the audit report: The audit team leader should report the audit results in accordance with the audit programme procedures.
- Distributing the audit report: The audit report should be issued within an agreed period.

5. Completing the audit

- The audit is completed when all planned audit activities have been carried out, or as otherwise agreed with the audit client

6. **Conducting audit follow-up**

- The conclusions of the audit can, depending on the audit objectives, indicate the need for corrections, or for corrective, preventive or improvement actions

4.2 ROLES AND QUALIFICATIONS OF AUDITORS

EMS auditors should be trained in auditing techniques and management system concepts. Familiarity with environmental regulations, facility operations, and environmental science is a big plus, and in some cases may be essential to adequately, assess the EMS.

As a guidance standard, 14012 can only recommend such qualifications, and the key is to ensure the audit team is familiar with the EMS that they are responsible for, and not all other areas of environmental science or regulations. Secondly, it is understood that no single individual may have all of these qualifications, hence the concept of the audit team

Traits of a good auditor:

- Independent (activity being audited)
- Impartial
- Tactful
- Attentive to detail
- Objective

Auditor responsibilities and activities should cover:

- following the directions of and supporting the lead auditor;
- planning and carrying out the assigned task objectively, effectively and efficiently within the scope of the audit;
- collecting and analyzing relevant and sufficient audit evidence to determine audit findings and reach audit conclusions regarding the EMS;
- preparing working documents under the direction of the lead auditor;
- documenting individual audit findings;
- safeguarding documents pertaining to the audit and returning such documents as required;
- assisting in writing the audit report

4.3 ENVIRONMENTAL PERFORMANCE INDICATORS AND THEIR EVALUATION

Environmental Performance Indicators provide information that helps evaluation and decision making within organizations that engage in environmental efforts.

- *The first objective* of environmental performance indicators is to measure and evaluate environmental burdens, environmental problems that need to be solved
- *The second objective* is to provide a common foundation of information between an organization and interested parties
- *The third objective* is to provide a common foundation of information for macro-level environmental policies of the national and local governments.

Types of environmental performance indicators

ISO standard describes two general categories of indicators for EPE:

- Environmental Performance Indicators (EPIs); and
- Environmental Condition Indicators (ECIs).

There are two types of Environmental Performance Indicators:

- Management Performance Indicators (MPIs)
- Operational Performance Indicators (OPIs)

ISO 14031; 4.1.2 Indicators for EPE

Two categories of indicators for EPE:

i. Environmental condition indicators (ECIs):

> provide information about the **condition of the environment** which could be impacted by the organization.

ii. Environmental performance indicators (EPIs):

a) Management performance indicators (MPIs):

> provide information about **management efforts** to influence the environmental performance of the organiziation 's operations.

b) Operational performance indicators (OPIs):

> provide information about the **environmental performance** of the organization'ss operations.

Indicators: Categories and types

Some examples of Environmental Indicators

Environmental condition Indicators (ECI)	• Water quality of nearby lake • Regional air quality • Noise pollution level at peak periods • Atmospheric CO2 emissions (ppm)
Management Performance Indicators (MPI)	• Number and results of environmental audits conducted • Staff member training • Supplier assessments
Operational Performance Indicators (OPI)	• Absolute Energy consumption (KWh) • Waste per unit of output • Transportation volume • Volume of products shipped

Examples of performance indicators and metrics1

OPI	MPI	ECI
Raw material used per unit of product (Kg/unit)	Environmental costs or budget ($/yr)	Contaminant concentration in ambient air (µg/m3)
Energy used annually per unit of	Percentage of environmental	Frequency of photochemical

product (MJ/1000 L product)	targets achieved (%)	smog events (#/yr)
Energy conserved (MJ)	Number employees trained (% # trained/to be trained)	Contaminant concentration in ground- or surface water (mg/L)
Number of emergency events or unplanned shutdowns (#/yr)	Number of audit findings (#)	Change in groundwater level (m)
Average fuel consumption of vehicle fleet (L/100 Km)	Time spent to correct audit findings (person-hr)	Contaminant concentration in surface soil (mg/Kg)
Hazardous waste generated per unit of product (Kg/unit)	Time spent responding to Environmental incidents (person hr. / yr.)	Concentration of a contaminant in the tissue of a specific local specie (µg/Kg)
Emissions of specific pollutants to air (Ton CO2/yr)	Number of complaints from Public or employees (#/yr.)	Population of an specific species within a defined area (#/m2)
Wastewater discharged per unit of product (1000 L/unit)	Number of suppliers contacted about environment management. (#/yr)	Fish deaths in a specific watercourse (#/yr)
Air emissions were exceeded (days/yr)	Management levels with specific environ responsabilities (#)	Employee blood lead levels (µg/100 mL)

Objectives and Benefits of an Environmental performance evaluation (EPE)

1. Better understanding of an organization's impacts on the environment,
2. Providing a basis for benchmarking management, operational and environmental performance,
3. Identifying opportunities for improving efficiency of energy and resource usage,
4. Determining whether environmental objectives and targets are being met,
5. Demonstrating compliance with regulations,
6. Determining proper allocation of resources,
7. Increasing the awareness of employees, and,
8. Improving community and customer relations

Environmental Performance Evaluation (EPE) is "an internal process and management tool designed to provide management with reliable and verifiable information on an ongoing basis to

determine whether an organization's environmental performance is meeting the criteria set by the management of the organization".

Environmental Performance Evaluation (EPE) is an internal management process that uses indicators to provide information comparing an organization's past and present environmental performance with its environmental performance criteria.

EPE, as detailed in this International Standard, follows a "Plan-Do-Check-Act" management model.

The steps of this ongoing process are the following:

1. Plan

- planning EPE;
- selecting indicators for EPE

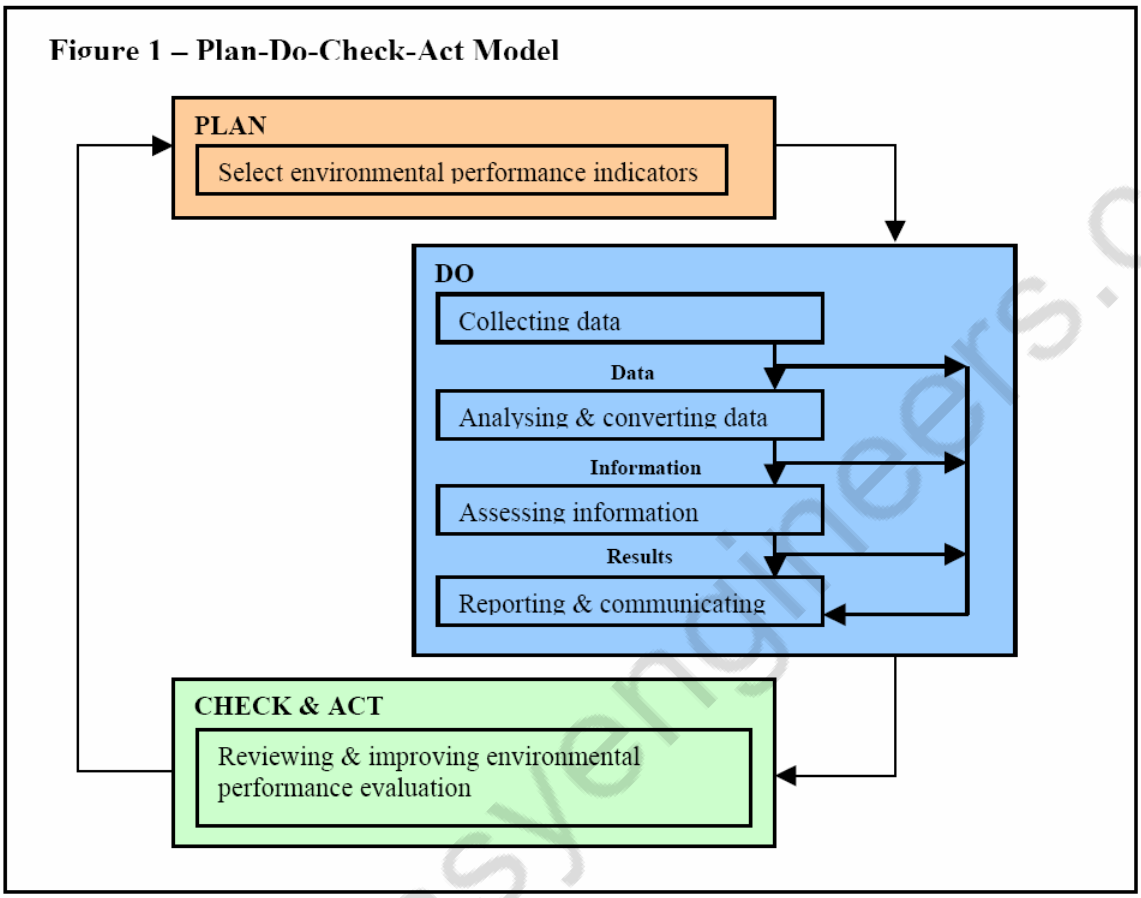
2. Do: Using data and information which includes:

- collecting data relevant to the selected indicators;
- analyzing and converting data into information describing the organization's

Environmental performance;

- assessing information describing the organization's environmental performance in comparison with the organization's environmental performance criteria;
- Reporting and communicating information describing environmental performance.

3. **Check and Act**: Reviewing and improving EPE.

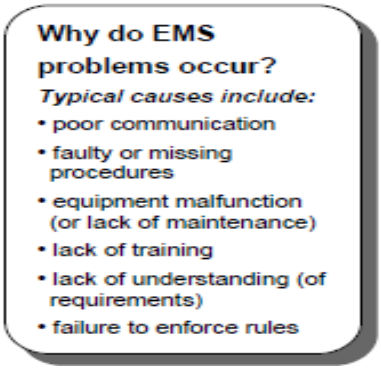


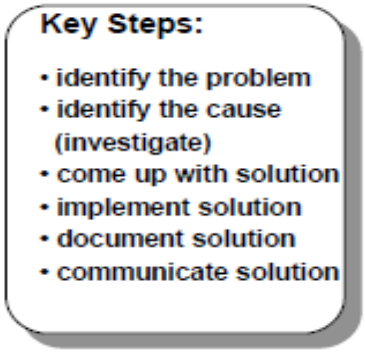
4.4 NONCONFORMANCE – CORRECTIVE AND PREVENTIVE ACTIONS

No EMS is perfect when system deficiencies are encountered organization will need a process to ensure that:

- Problems including nonconformities are investigated;
- Root causes are identified;
- Corrective actions are identified and implemented; ,
- Corrective actions are tracked and documented.

EMS nonconformities and other system deficiencies should be analyzed to detect patterns or trends. Identifying these trends will allow you to anticipate and prevent future problems.





"**Root cause analysis**" is a process by which you can identify causes and preventive actions.

Example: If a spill occurs several times in your raw material transfer area, you would attempt to identify the root cause of the spill occurring so that you could address the cause and prevent the spill in the future

4.4.1 What is a Major Non-Conformance?

Deficiency that seriously impairs the effectiveness of the EMS

Examples:

- An element of ISO 14001 not implemented
- Procedures not developed or not implemented
- Failure to take corrective or preventive action
- Several minor non conformances

4.4.2 What is a Minor Non-Conformance?

A minor deficiency that does not seriously impair the effectiveness of the EMS

Examples:

- One or a few individuals (out of many) do not use a procedure correctly
- Procedure needs minor changes to be effective.
- One or a few records incomplete

4.4.3 What are Corrective and Preventive Actions?

- Corrective action fixes the immediate problem (e.g., repair a leaking valve)
- Preventive action is designed to stop the problem occurring again, or stop problems before they happen (e.g., improved maintenance procedures)

- Effective preventive actions are a key to CONTINUAL IMPROVEMENT

ISO 14001 Non-Conformance, Corrective and Preventive Action says:

The organization shall establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance, taking action to mitigate any impacts caused, and for initiating and completing corrective and preventive action.

4.4.4 Steps to Identify and Correct Non-Conformance

- Identify problem through routine inspection, monitoring, audit findings, trend analysis, employee comments, complaint, experience
- Investigate problem and its underlying causes. Involve persons with first-hand knowledge of the issues, and authority to achieve solutions
- Identify best solution(s) and persons responsible for implementing them
- Ensure solution is adequate for the size and nature of the problem, i.e., fix the underlying cause(s) once and for all
- Follow-up with monitoring to confirm that implemented solution is effective long-term
- Involve people throughout with sufficient influence to 'make things happen' promptly

4.4.5 Non-Conformance Investigation Example

PROBLEM:

- Environmental monitoring results not submitted to government on time

Possible underlying causes:

- Responsibility for reporting not clearly communicated
- Inadequate training or awareness of reporting schedule requirements
- Written procedure not available
- Insufficient supervision and checking

Principles of Corrective and Preventive Action

- Don't ignore problems and hope they'll go away

  Ask:
- Who? What? When? How? Where? WHY? until you arrive at the root cause of the problem

- Fix deficiencies in the system, not just symptoms of the problem

4.5 COMPLIANCE AUDITS

An Environmental Compliance Audit is an investigation of the compliance status of a facility and/or the extent of environmental liability. This process is a systematic, documented evaluation of a facility, focusing on current operating and administrative procedures and processes.

An environmental compliance audit can also be used to determine whether an existing environmental management system is effectively:

- maintaining compliance
- identifying deficiencies
- taking corrective actions

- Environmental compliance audits are thorough inspections and reviews of facilities to ensure a company or site is meeting environmental regulations.
- An environmental compliance audit may include a review of compliance with local, state or federal rules as well as internal company policies.
- A regulatory compliance audit may incorporate all media, including air, soil, water, energy, noise and waste. Or the scope may consist only of an environmental site assessment for one regulated area, such as soil.
- Each audit is custom designed for an individual facility to ensure environmental regulation compliance specific to that site.
- Environmental compliance audit allows a company to identify and address any existing or potential environmental issues before they become legal issues or lead to regulatory fines and penalties.
- Educating the company's staff on environmental compliance is also a part of the audit.
- Environmental compliance audits focus on a company's operations and systems. A customized, detailed checklist-type protocol is typically used to conduct the audit.
- Environmental compliance consulting also may include questionnaires, site visits, and records reviews, interviews with staff, and comprehensive facility inspections and compliance reviews.

- Conducting a compliance audit not only lowers the risk of violating environmental regulations, but also demonstrates a company's commitment to continually improving the environment

4.6 WASTE AUDITS

- A waste audit is a physical analysis of waste composition to provide a detailed understanding of problems, identify potential opportunities, and give you a detailed analysis of your waste composition.
- A waste audit is a thought-out process that is used to determine the amount and types of waste produced by a company.
- Organizations conduct waste audits to minimize the organization's waste impact on the environment. Organizations conduct waste audits voluntarily and as mandated by local, state and federal laws.

A waste audit will help organization to clearly, identify their waste generation to:

- Establish baseline or benchmark data.
- Characterize and quantify waste streams.
- Verify waste pathways.
- Identify waste diversion opportunities.
- Identify source reduction opportunities.
- Assess effectiveness and determine ways to improve efficiency of your current waste management systems.
- Gain specific information for local government accreditation.
- Obtain detailed data on waste generation.

4.6.1 Process of Waste Audit:

- A waste audit is a process used to calculate the type and amount of waste generated by an organization. Any size organization can perform this type of audit.
- The data collected from the audit will identify the type of waste produced by the organization and how the organization manages this waste. The audit can also make the

organization more effective at reducing waste management costs by educating staff about proper waste disposal and making better use of natural of waste produced by a company

Validating the Data

- Once the organization receives the data from a waste audit, the organization must validate the data. The company must ensure that the data collected during this process is sample representative. Additionally, the data must consider the organization over time.
- If the organization had previous waste audits, the organization should compare the data from the present waste audit to the data previously generated.
- Once the organization successfully validates the data and makes sure the data is representative of the habits of the organization, the organization can take measures to make changes to waste management procedures.

Implementation

- Organizations may choose to implement aspects of the waste audit with the help of different environmental agencies such as the Environmental Protection Agency or various state and local agencies.
- Environmental agencies have many resources that the organization can use to make the implementation process more effective. Each organization has specific waste management needs, but reduction, collection and recycling are common tools used by organizations during the implementation process.

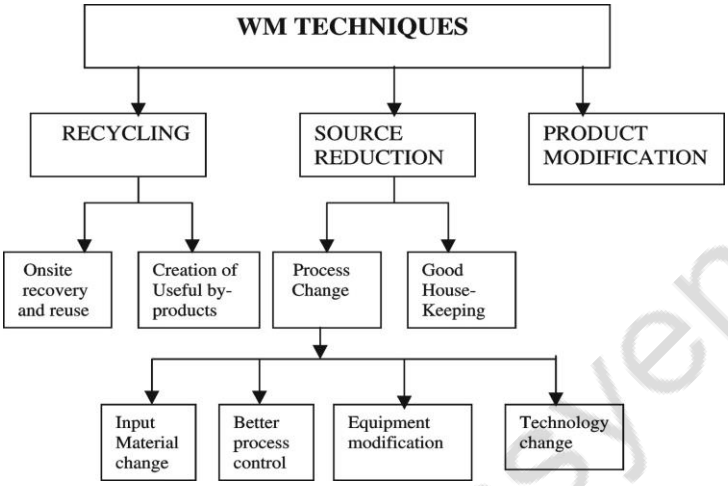
Monitoring and Reviewing

- In many cases, the initial excitement of performing and implementing these audits does not last long. A monitoring and review process performed weekly, bi-monthly or monthly by the organization can help to ensure the long-term success of changes to waste management policies.
- Typically, organizations will create a waste team responsible for this monitoring and review process. Additionally, rotating the team members involved in the monitoring and review process will discourage complacency and encourage organization-wide participation in waste management changes

4.6.2 Waste Minimization Planning

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



The following are the techniques:

1. **Waste Reduction at source** – this can be achieved by changing or modification of production process and/or equipment's used, with assurance that product quality is not affected.

- **Product or raw materials substitution** involves substitution of raw materials with that of less toxic substances and can produce the same product quality but of less residual unwanted by-products.
- **Process change, modification and control** includes the use of latest technology involving new equipment or the process itself. Its application, however, is process-specific and shall be carefully studied before being implemented for selection of the best and the most acceptable alternatives.
- **Good housekeeping practice** is the key aspect in keeping waste minimization program a success and has a minimum capital requirement and yet provides the highest return on investment. This can be easily accomplished thru awareness programs & campaigns of company staff on the benefits of waste generation and its control. This includes proper

waste segregation & waste classification to determine its quality, proper storage, and determining its value or usability. On the part of the management, regular waste audit for reconciling what goes in and what out are useful tool in determining the overall benefits of good and realistic housekeeping programs.

2. **Waste Re-Use and Recycling** – is the practice of recovering usable component of a declared waste for subsequent use in other purpose or sale either with or without pre-treatment. Generally, recycled materials can either be used in the same service from which it was generated or in an entirely different premises, activities or purpose with consideration on possible mis-use, its effect, the efficiency and safety of the receiver or user.

3. **Treatment of Waste** – eliminates the toxic content of the waste stream, reduces the risk of pollution and health of the public, and increases its acceptability for discharge into the environment for its intended use. This also provides incentive to the user as it enhances the quality of waste and increases the potential for recycling.

Benefits of Waste Minimization Practice:

Waste minimization practice benefits not only the company or the waste generator, but the government regulatory agency as well. This includes:

- Increase of production, but lessen the waste generation;
- Saving money by reducing waste treatment & disposal cost, raw material purchases and other operational costs including storage;
- Optimize use of resources (like water);
- Enhance public and worker's health and safety;
- Improve environmental performance, regulatory compliance & meeting to any national waste minimization goals;
- Extend the useful life of landfills and disposal sites;
- Reduce potential environmental liabilities; and
- Promotes good public image on environmental protection.

4.7 DUE DILIGENCE AUDIT

Due diligence is the investigation or exercise of care that a reasonable business or person is expected to take before entering into an agreement or contract with another party.

Due diligence is an investigation or **audit** of a potential investment or product to confirm all facts, such as reviewing all financial records, plus anything else deemed material. It refers to the care a reasonable person should take before entering into an agreement or a financial transaction with another party.

A Process used to identify environmental problems associated with a piece of property prior to purchase. The scope of property transfer assessments often is much broader and focusses more on business risks and liabilities as opposed to regulatory compliance.

Enforcement and Compliance history online (ECHO)

A web based tool that provides access to compliance and enforcement for opportunity 800,000 EPA regulated facilities. ECHO allows users to find permit, inspection, violation, enforcement action, and penalty information covering the past two years. The data in ECHO are updated monthly.

Effects

Refers to changes, actual or potential, caused by a chemical, activity, or process as it comes into contact with humans or the environment.

Effluent

Any gaseous or liquid waste fluid emitted by a source. A discharge from an exit is relatively self-contained, such an industrial smokestack or a sewage treatment plant. Often referred to as the source of pollution or pollution itself, pollutant discharges into water

Emergency response

Responses to incidental releases of hazardous substances where the substances can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

Environmental Due Diligence(EDD) is the assessment and management of environmental liabilities and risks.

- Environmental Due Diligence is both a legal and technical exercise – an action of analyzing your organization's site or a site your organization is looking to acquire. It is often demonstrated by a formal assessment of the organization and land to identify any existing or previous environmental conditions and/or contaminations and quantify financial and legal risks.
- The environmental assessment which is a part of a due diligence process mainly aims at identifying any claims or liabilities generated by environmental degradation, such as potential soil and groundwater contamination resulting from current or historical activities performed on the site which is subject to the transaction process.
- Also, another objective of an environmental due diligence (EDD) is the estimation of associated remediation costs, which may affect the closing of the transaction; if such costs are identified, they can serve as an efficient negotiation tool for the parties involved in the transaction and they can ultimately be turned into commercial advantages.

4.8 ENVIRONMENTAL STATEMENT: FORM 5

- In today's world every industry is optimizing their Sources, equipment's, processes to face increasing competitions are forced to minimize Environmental pollution. There is need of pressure on pollution contributing industries to optimize their production by improving production technologies.
- Environmental statement is process of self-inspection for improvement in processes and reduction in waste over the last year.
- The only mandatory process in Environmental Statement is to fill up the Form V and submit it to Pollution Control Board. If you notice Form V there are fields where industry needs to put their last year's Numbers with Current Years Numbers to identify where they stand.

4.8.1 Environmental Statement Submission Date

- Notification for Environmental Statement form V Published on 28 Apr 1992 by Ministry of Environment and Forest. As per act (Water, Air and Hazardous waste) every industry should submit environmental statement for financial year ending (i.e. 31st Mar) to concerned state pollution control board.

Information Collected through Environmental Statement Form V

In the environmental statement every industry should to provide information on production, consumption of raw, water, pollutants discharged in environment, solid and hazardous waste with their treatment processes.

Important things to be reported to pollution control board are:

- if that company is reusing its by-products or waste material which results in reduction in consumption of air, water or energy
- production cost
- additional investment proposals for environmental protection i.e. up gradation, improvement in process or new equipment's to reduce environmental pollution.

4.8.1 Environmental Statement Form V Filling Process

There are total Nine Section in Environmental Statement Form V.

- **Part A** Basic information about company like name, address, industry category, production capacity and date of last environmental audit submitted.
- **Part B** This part is for comparison of water and raw material consumption for this financial year to previous year.
- **Part C** This part is to measure pollutants discharged to environment through medium air and water. How much in excess, an industry is releasing the pollutants into the environment.
- **Part D** This part to measure hazardous waste from processes and from pollution control facilities
- **Part E** This part is to measure solid waste generated by industry. Also details like quantity recycled, sold and disposed
- **Part F** Any new practices adopted to reduce hazardous waste.

- **Part G** Impacts of pollution control measures on natural resources and with cost of production.
- **Part H** Additional investment / process / measures to minimization or prevention of pollution.
- **Part I** In this part other information / initiatives to improve quality of environment needs to be given.

Whenever Part C, indicates high variation then Part H (i.e. additional investment proposals for environmental protection including abatement of pollution) should be taken more seriously

ANNEXURE

ENVIRONMENTAL STATEMENT FORM-V

(See rule 14)

Environmental Statement for the financial year ending with 31st March 2016

PART-A

i. Name and address of the owner/ occupier of the industry operation or process. Naveen Kumar Singh, Director In-charge
Jaypee Cement Corporation Limited,
Shahabad Cement Plant, Village- Bankur,
Tal- Chittapur, Dist. - Kalaburagi

ii. Industry category Primary-(STC Code) Secondary- (STC Code)

iii. Production category.

Sl No	Product	Unit of Measurement	Quantity
1	Cement	Million tons per Annum	2.4 (Installed capacity)
2	Ele Power	MW	60 (Installed capacity)

iv. Year of establishment May 2012

v. Date of the last environmental statement submitted. NA

PART-B

Water and Raw Material Consumption:

i. Water consumption in m^3/d

Process: 5710
Cooling: 700
Domestic: 290

Name of Products	Process water consumption per unit of products	
	During the previous financial year 2014 - 2015	During the current financial Year 2015 - 2016
Cement	NA	0.31 m^3/ T
Ele Power	NA	0.141 L/ kWh

ii. Raw material consumption

Name of Raw materials	Name of Products	Consumption of raw material per unit of output	
		During previous financial year 2014 -15	During current financial Year 2015 -16
Clinker	Cement	0.7 T / T	0.73 T / T
Flyash		0.28 T / T	0.24 T / T
Gypsum		0.03T / T	0.03 T / T
Coal	Ele Power	0.0 T / MWh	0.00105 T / kWh

** Industry may use codes if disclosing details of raw material would violate contractualobligations, otherwise all industries have to name the raw materials used.*

PART-C

Pollution discharged to environment/unit of output

(Parameter as specified in the consent issued)

(a) Water

Pollutants	Quantity of Pollutants discharged (mass / day)	Quantity of Pollutants discharged (mass / Volume)	Tolerance limit specified by KSPCB (Mass / Vol)	Percentage of variation from prescribed standards with reason
pH	-	7.61	5.5 to 9	All parameters are maintained in tolerance limit specified, as per CFO
Suspended Solids Max	8.27 kg/day	8 mg/l	100 mg / l	
Oil & Grease	-	ND	10	
Temp	-	Nil	Maximum 5ºC higher than intake temp	
Dissolved solids (Inorganic)	427 kg/day	413 mg/l	2100 mg / l Max	
Chlorides (As Cl)	59.29 kg/day	51.18 mg/l	1000 mg / l Max	
Dissolved Phosphates (As P)	0.058 kg/day	0.056 mg/l	5 mg / l Max	
Sulphate (As SO4)	52.15 kg/day	50.43 mg/l	1000 mg / l Max	

(b) Air

Pollutants	Quantity of Pollutants discharged (mass / day)	Quantity of Pollutants discharged (mass / Volume)	Tolerance limit specified by KSPCB (Mass / Vol)	Percentage of variation from prescribed Standards with reason
PM	191 kg/day	17 mg/Nm^3	50	Maintained as per tolerance limit
SO2	618 kg/day	55 mg/Nm^3	100	
NO2	2881 kg/day	257 mg/Nm^3	800	

PART-D
HAZARDOUS WASTES

(As specified under Hazardous Wastes (Management & Handling Rules,1989).

Hazardous Wastes	Total Quantity (kg)	
	During the previous financial year 2014-15	During the current financial Year 2015-16
From Process		
Used oil	NA	600
From Pollution control Facilities	NA	NA

PART- E
SOLID WASTES*:*

Solid Wastes	Total Quantity (kg)	
	During the previous financial year 2014-15	During the current financial Year 2015-16
From Process		
Bottom Ash	NA	13,92,000
Flyash	NA	6,82,08,000
Sludge	NA	10,40,000
From Pollution control Facilities	NA	Bag filters' dust collection is reused in production

PART - F

Please specify the characteristics (in terms of concentration and quantum)of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes. **Please refer Annexure A** to Form V

PART- G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production. **Please refer Annexure B** to Form V

PART - H

Additional measures/investment proposal for environmental protection including abatement of pollution.

PART - I MISCELLANEOUS:

Any other particulars in respect of environmental protection and abatementof pollution.

Annexure A
to Form V

PART F (Please specify the characteristics (in terms of concentration and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both thesecategories of wastes.)

1. Following **hazardous waste** from the plant are disposed in safe manner, according recommended practices without any nuisance to environment.

Sl No	Name	Quantity per year	Storage & transport	Disposal method
1	Used Oil	600 kg	Area earmarked, Stored in drums	Consumed in boiler with coal
2	Used lead acid batteries	15 Nos	Ear marked Storage area	Sold back to battery dealer (Authorized)

2. Other **solid wastes** are disposed in scientific manner to maintain clean and hygienic environment inside the plant and colony area.

Sl No	Name	Quantity per year	Storage & transport	Disposal method
1	Bottom Ash	13.92 T	It is collected at boiler and transported pneumatically to Silo	From silo it is pumped by dense phase conveying system for PPC production in cement mill. Surplus quantity is sold to nearby cement plants through bulkers
2	Fly ash	68208 T	It is collected in ESP hoppers and transported pneumatically to Silo	
3	Sludge	1040 T	Stored in landfill	Used as manure in horticulture
4	Metal/ Wood/paper	5.5T/ 18.25 T	Ear marked Storage area	Sold to scrap dealer

5	Garbage	36 T	Dust bins in colony area	Garbage is collected by Notified area Committee.

Annexure B

to Form V

PART G (Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.)

Water being very scarce commodity, maximum efforts are made to conserve it. One of the important technologies installed in the captive power plant is "Air cooled Condensers" in the place of conventional water-cooled condenser. This facilitates our plant to save water loss due to evaporation in the cooling tower. The total investment for Air cooled condenser is ₹ 16 crore.

Due to use of Air-Cooled Condenser in power plant there is saving in water consumption to the tune of 5000 m^3/ day.

MODULE 5

APPLICATIONS

5.1 APPLICATIONS OF EMS

- Environmental Management System is a tool for managing the impacts of an organisation's activities on the environment.
- It provides a structured approach to planning and implementing environment protection measures.
- EMS monitors environmental performance
- EMS integrates environmental management into a company's daily operations, long term planning and other quality management systems.
- Application of Environmental management system (EMS) in urban environment provides a city with orderliness, regularity, quietness and freshness environment.
- It contributes to the sustainable development and optimization in life level index of the city.
- Where malfunctions in manufacturing systems and other activities of a company may lead to environmental damage, procedures must be instituted to identify such malfunctions promptly and instigate remedial action

5.1.1 COMPONENTS OF EMS

1. Environmental Policy
2. Environmental Impact Identification
3. Objectives and targets
4. Consultations
5. Operational and Emergency procedures
6. Environmental Management Plan
7. Documentation
8. Responsibilities and Reporting Structure
9. Training
10. Review Audits and Monitoring Compliance
11. Continual Improvement

5.1.2 BENEFITS OF EMS

An EMS can assist a company in the following ways:

1. Minimize Environmental liabilities
2. Maximize the efficient use of resources
3. Reduce waste
4. Demonstrate a good corporate image
5. Build awareness of environmental concern among employees
6. Gain a better understanding of the environmental impacts of business activities.
7. Increase profit, improving environmental performance, through more efficient operations

5.2 WASTE AUDITS

- Waste Audit is a physical analysis of waste composition to provide a detailed understanding of problems, identify potential opportunities and give a detailed analysis of the waste composition.
- Establish baseline or benchmark data
- Characterise and quantify waste streams.
- Verify waste pathways
- Identify Waste diversion opportunities
- Access effectiveness and determine ways to improve efficiency of current waste management systems.

5.2.1 STEPS IN WASTE AUDITS

1. Background information

- Production processes, facility layout, waste stream generation, waste management costs.
- Source, type, quantity and concentration of waste

2. Plant Survey

- Verify and fill gaps in background data.
- Identify additional waste streams
- Actual operation data and manufacturing practices

3. Sampling

- Identify type of waste and point of origin.
- Determine fate (e.g., waste treatment, storm sewer, and atmosphere).

- Determine rate produced or emissions factors (amount produced per hour, per production unit)
- Determine variability (potential shock loading).

4. Plant Survey Methods and Procedures

- To identify missing or inaccurate information, a preliminary review of the data should be done during, or immediately following, the survey.

5. Evaluation and Selection of Waste Reduction Techniques

- List waste streams
- Identify potential waste reduction techniques for each waste stream
- Evaluate the technical and economic aspects of each technique
- Select the most cost effective waste reduction techniques for each waste stream

6. Waste Minimization Program Implementation and Monitoring

- Keeping employees informed.
- Maintaining records and data
- Corporate Commitment.

WASTEWATER MINIMIZATION

1) Process change: Process changes can reduce the inherent demand for water. An example is the replacement of wet cooling towers by dry air coolers.

2) Water reuse: Wastewater can be reused directly in other water using operations when the level of previous contamination does not interfere with the water using operation. This reduces both freshwater and wastewater volumes but leave the mass load of contaminant essentially unchanged.

3) Regeneration reuse: Wastewater can be regenerated by partial or total treatment to remove the contaminants that would otherwise prevent reuse. The regeneration is any operation that removes the contaminants that prevent reuse and could be filtration, pH adjustment, carbon adsorption, and other processes. Regeneration reduces both freshwater and wastewater volumes and decreases the mass load of contaminant.

4) Regeneration recycle: Wastewater can be regenerated to remove contaminants and then the water recycled. In this case, regenerated water may enter the water using operations in which the water stream has already been used. Also, recycle can sometimes create a buildup of undesired contaminants not removed in the regeneration process.

WASTEWATER REUSE INTO THREE WAYS AS FOLLOWS

1) Internal wastewaters recycle: Depending on the manufacturing process, water consumption can be cut down between 50% to 90% by adopting appropriate water recycling techniques.

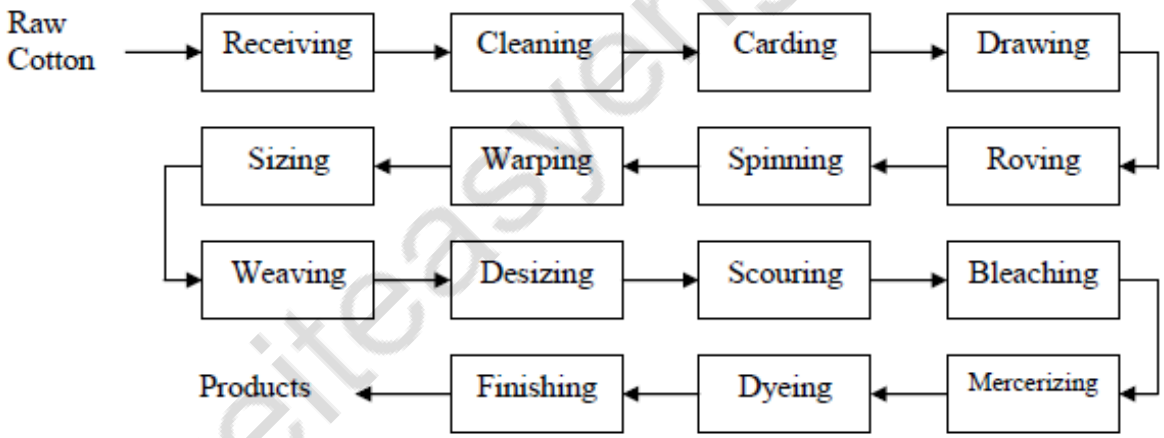
2) Reuse of treated industrial wastewater.

3) Reuse of treated wastewater for other activities such as irrigation, fire protection, dual system etc.

5.3 POLLUTION PREVENTION IN VARIOUS INDUSTRIES

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.

5.3.1.3 CLEANER PRODUCTION OPPORTUNITIES

1) Good housekeeping: Good housekeeping in textile industries is a program of maintenance, inspection, and evaluation of production practices should be established.

2) Reduction in water use-

- Minimizing leaks and spills
- Maintaining production equipment properly
- Identifying unnecessary washing of both fabric and equipment, and
- Training employees on the importance of water conservation.

3) Reuse in mercerizing: On the mercerizing range, the scope for water conservation and reuse lies in adopting a countercurrent flow pattern.

The water requirement can be reduced, if most of this water can be recovered as steam condensate from the multiple effect evaporators of the caustic recovery plant provided suction in the evaporations is carefully controlled to avoid boiling overflow.

4) Reuse in dyeing*:* Small saving can be affected if running washes are replaced by static ones wherever possible. Further, the batching or wetting water need not be drained out. It can be retained for use in the next operation like dyeing.

5) Reuse in printing and finishing: Uses water for various cooling and washing operation and reuse steam condensates in boilers.

6) Reuse of soaper wastewater: The colored wastewater from the soaping operation can be reused at the buckeye washer, which does not require water of a very high quality. Alternatively, the wastewater can be used for cleaning floors and equipment in the print and color shop

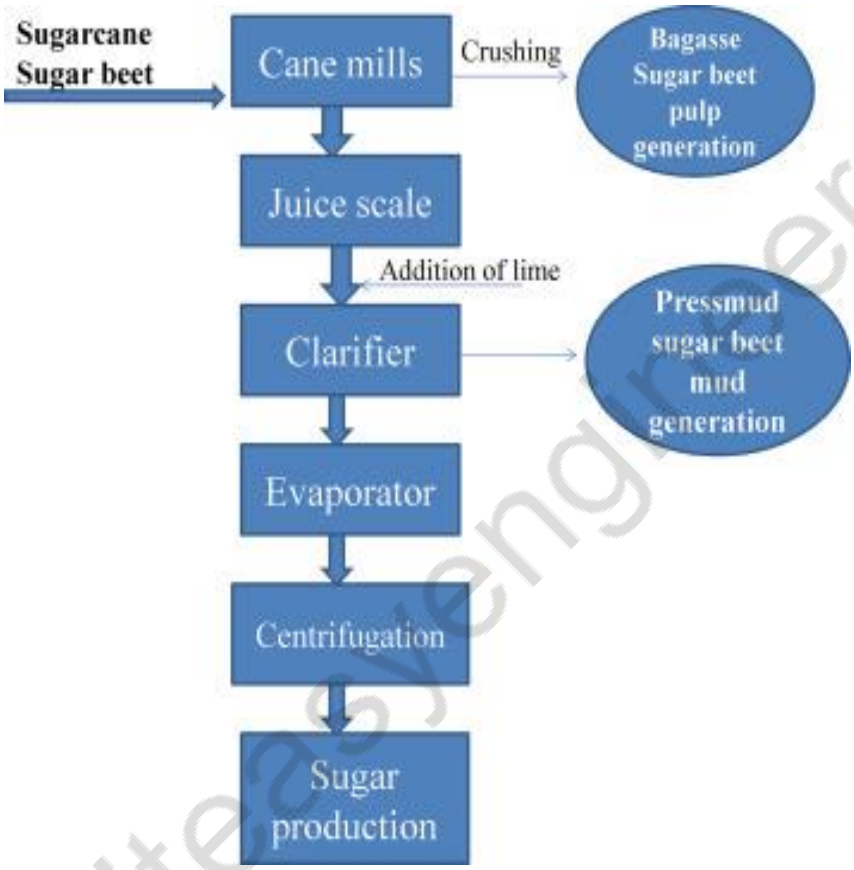
8) Counter current washing: Counter current washing is an employed frequently on continuous preparation and dye range. It can be applied at desire washers, scour washers, mercerizing washers, bleach washers, dye ranges, and print house soaper range.

9) Use of automatic shut-off valves: An automatic shut-off valve set to time, level, or temperature will control the flow of water into a process unit. One plant estimated that a reduction in water use of up to 20% could be achieved with thermally controlled shut-off valves.

10) Use of flow control valves: A flow or pressure reduction valve can significantly reduce the quantity of water used in a wash or clean-up step. These valves are particularly useful in cleaning areas where operators are not always aware of the need for water conservation.

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.

5.3.2.3 AUDIT APPROACH

The typical audit comprises of three steps as Pre-Audit, onsite Audit and Post Audit.

Pre-Audit: The Pre-Audit is conducted to get the background information and making the survey by using the questionnaires. The pre audit is useful to get familiar with the company and to save time requirement for the onsite audit.

Onsite Audit: The onsite audit means to identify the water usage, raw material consumption, by product produced, wastewater produced, solid waste, hazardous waste generated and also analysis report is produced for all this waste as well as air, noise and sound. The water used for all the purpose within the industry is also taken into account.

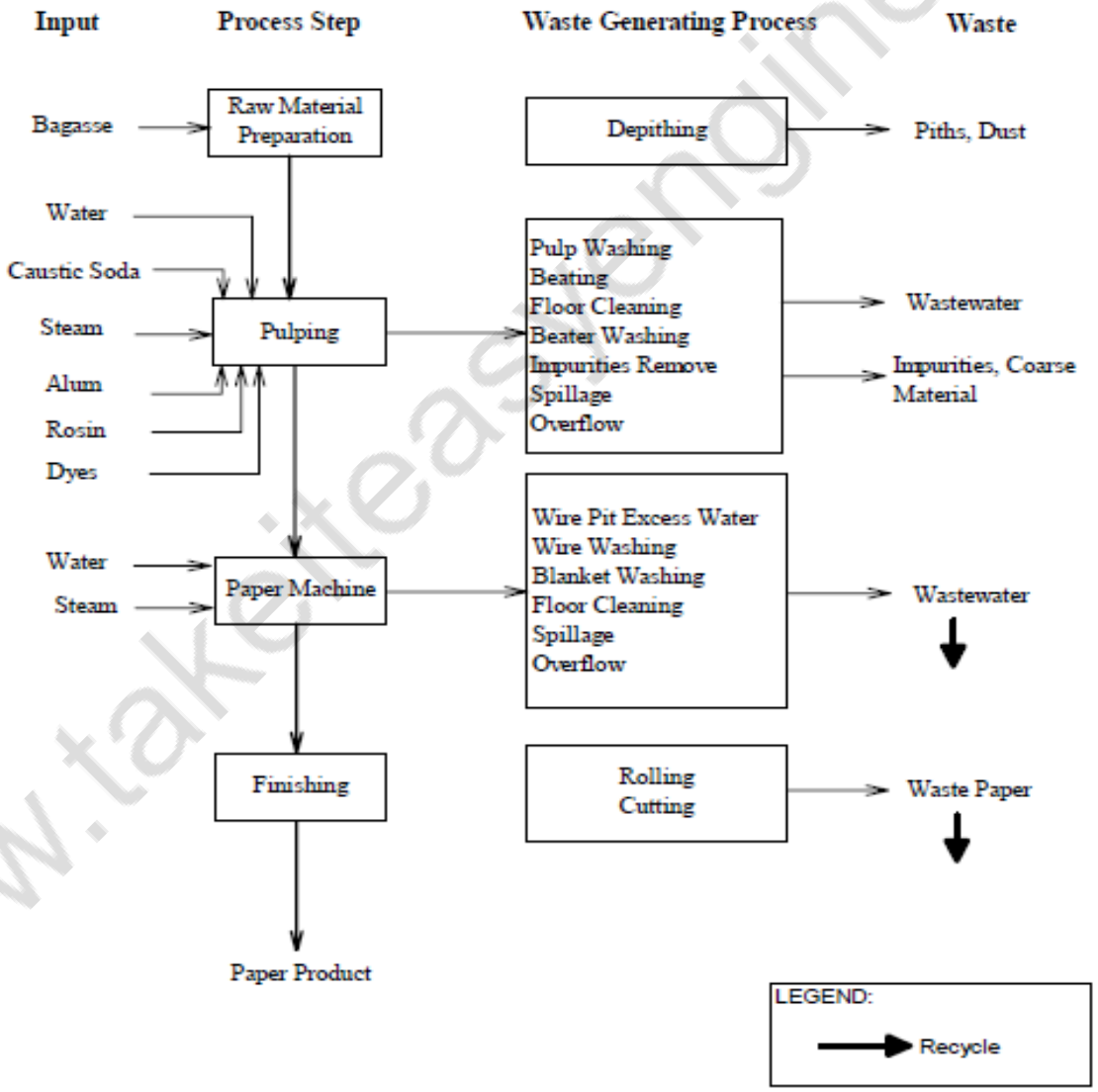
Post Audit: The final draft is prepared for raw material, water and energy consumption and also the waste generated on the action plan the recommendation are given.

The wastewater is generated in a sugar factory from processing, domestic purposes and some number of spent lees which is coming from distillery. All these wastewaters treated in ETP of sugar factory treatment process. To achieve BOD reduction from 1000 mg/lit i.e. 92% treatment efficiency. There is two stage biological treatment plants. The first stage will comprises of an

aerobic lagoon equipped with surface aerator and second stage is provided with conventional complete mix activated sludge process. The aerated lagoon in first phase is expected to reduce BOD by 50 %. The second stage is activated sludge process which further provides 90% reduction in BOD resulting into an effluent. An oil and grease trap are incorporated to remove all free and floatable material.

5.3.3 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

5.3.3.3 WASTE AUDITING OF THE MILL

Unit Operation of The Mill

1. Main processing sections consuming water are washing, diluting pulp before pumped to beaters, beating and paper making.
2. Beating unit operation is the process combining beating and washing.
3. Wastewater from office section

Solid Waste Generation from Production Process

1. Piths generated from depithing unit operation.
2. The amount of pith separated is accounted for 20% of the bagasse amount.
3. Cinder generated from coal burning from the steam boiler.
4. It is estimated that the cinder amount is accounted for 30% of the amount of coal consumed.
5. Waste paper (low quality product) come from finishing and cutting.
6. At present, this waste paper amount is about 15% of total paper amount from paper machine.
7. The amount of waste paper here seems to be high.
8. The reason leading this might be that the rolls in the paper machines were not clean resulting in paper is broken.
9. Another reason might be the edge for cutting too large.

Water Consumption

- River water from sedimentation unit is pumped to the production area of the mill.
- A part of the raw water is pumped to a tank where alum is added.

This water is used for two purposes:

1. Domestic use including staff housing and office consuming.
2. Steam boiler use after adding chemical to soften the water.

Evaluating Material Balance

1. A material balance of the input and output across the two sections of the paper production was made.
2. This difference was due to beside the washing wastewater there was the black liquor remain from cooking discharging.

3. In pulp and paper industry the useful component balances are : water balance, solid balance and COD balance.
4. These balances give a direct indication of the efficiency of utilization of fibrous raw material, chemical and water. It gives the relative importance of different waste streams in term of quantity of loss

Energy Audit of the Mill

The two major energy forms consuming in the mill are steam and electricity.

1. Coal is used to produce steam.
2. team supply to the cooking and drying process is produced by a steam boiler

5.3.3.4 IDENTIFICATION FOR CLEANER PRODUCTION OPPORTUNITIES

5.3.3.4.1 Causes of Waste Generation

1) Poor Housekeeping

- It was seen the spillage of the bagasse from the belt conveyors when transferring the bagasse from the depither to a digestor.
- The leaking and overflow of water taps in the mill leading to water consumption amount was increased.
- The insulation of steam pipeline has been in bad condition.

2) Poor Raw Material Quality

- It was easy to recognize when surveying the mill that depithed bagasse was still mixed with fine piths after depithing process.
- Hence the input material contains amount of non-fibrous material leading to consume more chemicals and energy.

3) Poor process and equipment design

- The concentrated black liquor from cooking operation have not been separated and collected.
- The spillage of pulp in washing pulp operation was seen due to inadequate size of the potcher (the tanks below the digestors)
- Time of beating was found to be too long (more than 2 hours).
- It was seen that edge cutter was too large.
- Consistency indicator was absence.

- Fiber recovery unit using for wastewater from paper machine was absence

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.

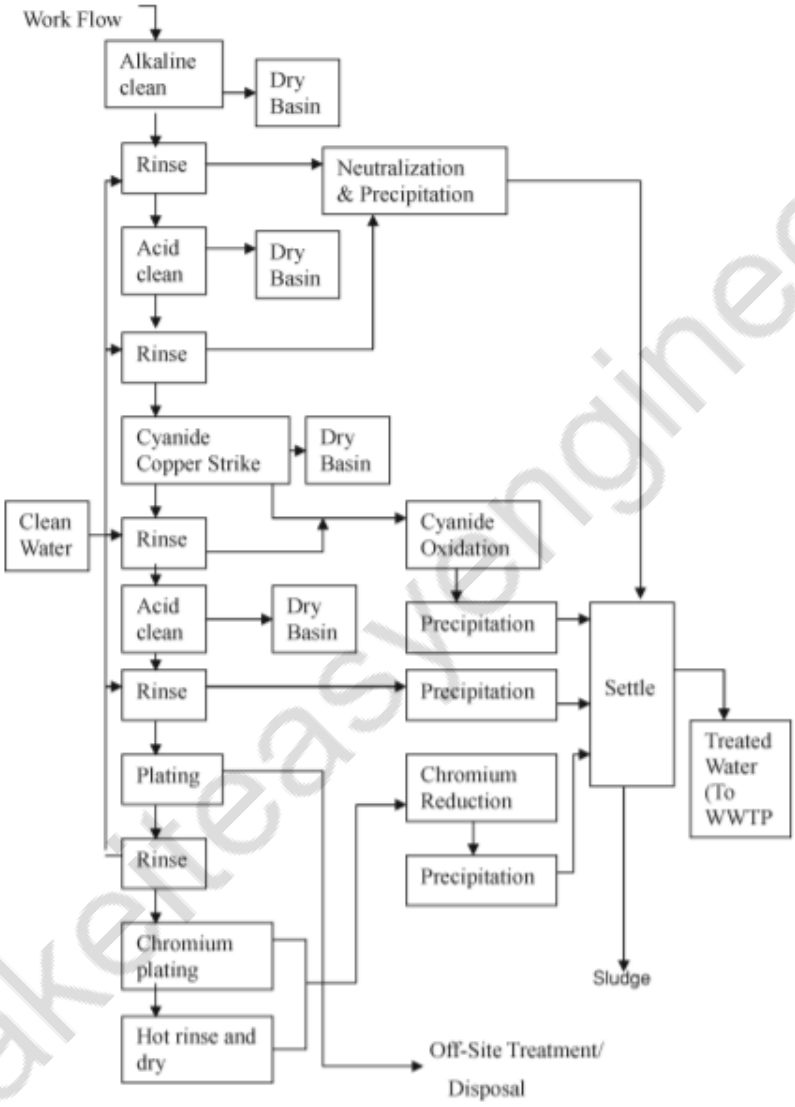
5.3.4 ELECTROPLATING INDUSTRY

- 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



5.3.4.1 SOURCES OF POLLUTANTS AND ITS CHARACTERISTICS

- Any or all of the substances used in electroplating (such as acidic solutions, toxic metals, solvents, and cyanides) can be found in the wastewater, either via rinsing of the product or from spillage and dumping of process baths

- Solvents and vapors from hot plating baths result in elevated levels of volatile organic compounds (VOCs) and, in some cases, volatile metal compounds, which may contain chromates.
- Approximately 30% of the solvents and degreasing agents used can be released as VOCs when baths are not regenerated.

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.
- Use trivalent chrome instead of hexavalent chrome; acceptance of the change in finish needs to be promoted.
- Give preference to water-based surface-cleaning agents, where feasible, instead of organic cleaning agents, some of which are considered toxic.
- Regenerate acids and other process ingredients whenever feasible.

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.
- Maintain the density, viscosity, and temperature of the baths to minimize dragout.
- Place recovery tanks before the rinse tanks (also yielding makeup for the process tanks). The recovery tank provides for static rinsing with high dragout recovery.

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.
- Clean racks between baths to minimize contamination.
- Cover degreasing baths containing chlorinated solvents when not in operation to reduce losses. Spent solvents should be sent to solvent recyclers and the residue from solvent recovery properly managed (e.g., blended with fuel and burned in a combustion unit with proper controls for toxic metals)

5.3.4.3 Practices That Will Lead to Compliance with Emissions Guidelines

1. Use cyanide-free systems.
2. Avoid cadmium plating.
3. Use trivalent chrome instead of hexavalent chrome.
4. Prefer water-based surface cleaning agents where feasible, instead of organic cleaning agents, some of which are considered toxic.
5. Minimize dragout.
6. Use countercurrent rinsing systems; recycle rinse waters to the process after treatment.
7. Regenerate and recycle process baths and rinse waters after treatment.
8. Recycle solvent collected from air pollution control systems.
9. Send spent solvents for recovery.
10. Do not use ozone-depleting substances.

11. Manage sludges as hazardous waste
12. Reuse sludges to the extent feasible but without releasing toxics to the environment

5.3.4.4 ENERGY CONSERVATION

- Replace lighting with energy efficient bulbs.
- Set up an energy audit for the facility and institute recommendations for energy efficiency.
- Turn off equipment after finish using it.
- Manage information electronically.
- When replacing equipment, check for energy saving features and train employees in energy-wise practices.

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).
- Sensitive receptors include, for example, hospitals, schools, daycare facilities, elderly housing and convalescent facilities as well as ecosystems.
- These are areas more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other 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.
- Process water consumption varies greatly from tannery to tannery, depending on used technology, processes involved, raw material used, and manufactured products, but

accounts for about 80% of the total water consumption. Technical water accounts about for the other 20% of total water consumption.

I**mpact 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.

Minimum recommendations for proper environmental management

- Chemicals and hazardous waste - All chemicals, hazardous waste and fossil fuels should be stored on a covered and paved area with secondary spill containment with at least equal capacity to the stored quantity, in order to prevent soil and groundwater contamination.
- Hazardous waste - should be stored to a maximum of 6 months and then properly manage for final elimination or recycling (and complying with local legislation).

Chemicals, by-products and waste.

- No chemicals, hazardous waste, nonhazardous waste and by-products should be dumped, burned or buried anywhere.
- These hazardous materials should be sent to authorized landfills or handed to authorized waste management companies.

Wastewater

- Wastewater- Before discharging any wastewater into the municipal sewer system or any other location, a previous characterization of the wastewater stream and continuous monitoring must be implemented to comply with local environmental legislation
- No untreated or highly contaminated wastewater should be discharged in close rivers, water canals, groundwater and land, to avoid high environmental, economic and social impact.

By-products and waste

- All potentially hazardous waste must be characterized (analyzed) in order to know if the waste can be classified as hazardous or nonhazardous, and implement appropriate management and recycling for each type of waste.

- An environmentally sound management and recycling plan of every generated by-product and waste should be developed collaborating with the local public administration.

Odors

- In order to prevent odors, it is necessary the correct management of accumulated wastes, cured and stored hides processes and the wastewater treatment plant.

Emissions

- All air emissions should be characterized (analyzed) setting limited emission values according to local environmental legislation and health and safety standards.
- If possible, the use of renewable energy should be implemented to avoid greenhouse and other harmful emissions while lowering.

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%.
- Practically, it has been seen that TDS in the composite effluent of a tannery processing salted raw hides/skins to semi-finished leather is reduced from 12,000-18,000 mg/L to 10,500-15,700 mg/L on account of desalting of raw stock, collection and proper disposal of the dusted salt,
- No commercially viable technology for removing salts from the tannery has been developed to date

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.

Measures for ensuring high efficiency in the process

- The chromium input must be optimized during conventional chrome tanning to reduce the possible waste (lowest possible quantity of chromium should be used).
- Use of short floats for reducing the chromium input, combining a low chromium input with a high chromium concentration.

Environmental benefits & Driving forces

- Lower consumption of water and tanning agents
- Lower volume of wastewater
- Lower amount of chromium contained in waste and effluents
- Lower amount of chromium in the sludge generated during wastewater treatment

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

Environmental benefits & Driving forces

- The substitution of amino resins with other filling agents for improving the leather fullness avoids the possibility that traces of free formaldehyde may appear in leather.
- The substitution of ammonia as a penetrating agent avoids the possibility that traces of hexavalent chromium may be formed in leather

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.

Environmental benefits & Driving forces

- Reduced amounts of waste and solvent emissions to air are the main environmental benefits.
- The avoidance of the mist and solid particulate emissions associated with spraying is also beneficial.
- Roller coating wastage rates of 3-5% are reported as opposed to 40% for conventional spraying.

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.

Environmental benefits & Driving forces

- Up to 30-40% of gross suspended solids in the raw waste stream can be removed by properly designed screens.
- Mechanical treatment and by means of a preliminary settling operation, it is possible to remove up to 30% COD, thus saving flocculating chemicals in the next stage and reducing the overall quantity of the sludge generated.
- With the subsequent physico-chemical treatment, it is possible to achieve a reduction of up to 55-75% in the COD.
- A significant reduction of the concentration of substances in the wastewater, particularly chromium (up to 95%) and sulphides (up to 95%) can also be achieved.
- Preparation of wastewater for biological treatment.

7. Water-Based Chemicals for Coating

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

Environmental benefits & Driving forces

- In the finishing operations, emissions from solvents impose a workplace health problem.
- It would be quite feasible for tanneries to apply aqueous finishes for base and middle finish coats and to apply aqueous nitrocellulose with polyurethane or polyacrylate top coats.
- Environmentally friendly crosslinking agents or self-crosslinking reactive polymers could also be incorporated.
- Benefits are felt from the reduction of VOCs in the workplace. If efficient technology and controlled operations are used, these emissions would be avoided.

8. Organic Waste Fractions and By-Products

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

Environmental benefits & Driving forces

- The reduction of wastes sent for disposal is the main reason for using these techniques, as well as obtaining useful by-products and the production of energy.

Ex: 1) Sheep wool can be used by the textile industry, i.e., in carpet manufacture

2) Gelatin and glue can be produced from untanned materials

9. Process Water Management

- A good process water management reduces the global environmental impact

Environmental benefits & Driving forces

- If the tannery implements efficient technical control and good housekeeping, a water consumption of approximately 12-25 m3/t can be achieved, versus 40 m3/t commonly employed.
- The economic feasibility of a change in consumption depends greatly on the cost of water consumption.
- Economizing in the use of water does not in itself reduce the pollution load, but it nevertheless has a number of beneficial effects:
- Saving of energy as a consequence of saving hot water
- Improved uptake of chemicals and consequently savings of chemicals result from the use of shorter floats
- Use of batch washing makes better control possible.
- Additionally, and importantly, the lower effluent volume makes it possible to construct a wastewater treatment plant with smaller capacity

5.4 HAZARDOUS WASTE MANAGEMENT

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

IGNITABILITY

- Waste with flash point < 60 degree C

TOXICITY

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

5.4.3 STORAGE OF HAZARDOUS WASTE

In a large establishment where a number of wastes are being generated, an area be designated as a storage area known as central hazardous waste accumulation area. This is an area where

hazardous wastes are accumulated prior to being picked up for treatment, recycling or disposal. Requirements for these areas include:

- The accumulation area must be locked or protected from unauthorized entry. A fence around the area is not required if it is in an area that is already restricted from unauthorized personnel.
- Containers must be labeled with the appropriate hazardous waste label.
- There must be appropriate signage identifying the area as hazardous waste storage, and a "No Smoking" signage.
- Weekly inspections must be conducted at these areas using the weekly inspection checklist.
- There must be sufficient aisle space to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, a n d decontamination equipment to any area of the operation.

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.

Few Physical treatment processes are:

- Reverse osmosis
- Flocculation
- Filtration
- Sedimentation
- Carbon Adsorption
- Distillation

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.
- The chemical treatment produces useful by-products and some-times residual effluent that are environmentally acceptable.
- Chemical reactions, either reduce the volume of the waste or convert the wastes to a less hazardous form.

Chemical treatment process

- Solubility
- Neutralization
- Precipitation
- Coagulation and flocculation
- Oxidation and reduction
- Ion exchange methods

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.
- Hazardous waste materials are toxic to some of the microorganism. But a substance, which is toxic to one group of organisms, may act as valuable source of food for another group.
- Bio-treatment is required in ideal conditions for better growth of bio agents and hence is a limitation factor also.
- These involve the use of microorganisms under optimized conditions to mineralize hazardous organic substances e.g. the use of pseudomonas under aerobic conditions break down phenols.

Biological treatment process

- Bioremediation
- Metal uptake through plant species
- Composting
- Bacterial culture

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

5.4.5 DISPOSAL OF HAZARDOUS WASTE

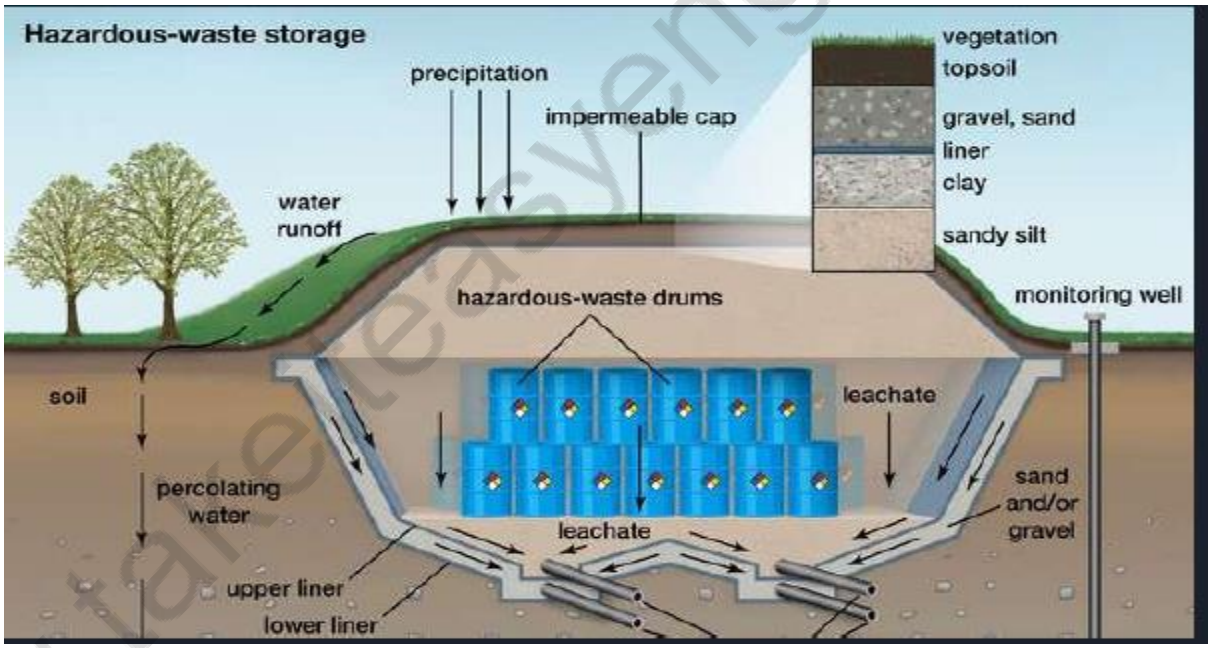
For Hazardous wastes, land disposal is the ultimate destination, although it is not an attractive practice, because of the inherent environmental risks involved.

- Two basic methods of land disposal include **landfilling** and **underground injection**.
- Prior to land disposal, surface storage or containment systems are often employed as a temporary method.

5.4.5.1 SECURE LANDFILLS

- Landfilling of hazardous solid or containerized waste is regulated more stringently than landfilling of municipal solid waste.

- Hazardous wastes must be deposited in so-called secure landfills, which provide at least 3 meters (10 feet) of separation between the bottom of the landfill and the underlying bedrock or groundwater table.
- A secure hazardous-waste landfill must have two impermeable liners and leachate collection systems.
- The double leachate collection system consists of a network of perforated pipes placed above each liner.
- The upper system prevents the accumulation of leachate trapped in the fill, and the lower serves as a backup.
- Collected leachate is pumped to a treatment plant.
- In order to reduce the amount of leachate in the fill and minimize the potential for environmental damage, an impermeable cap or cover is placed over a finished landfill.



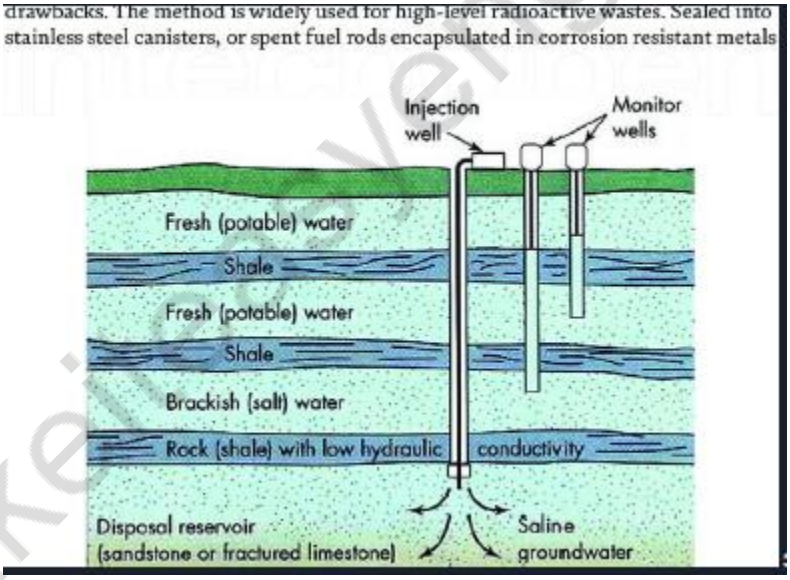
A groundwater monitoring system that includes a series of deep wells drilled in and around the site is also required.

●The wells allow a routine program of sampling and testing to detect any leaks or groundwater contamination.

●If a leak does occur, the wells can be pumped to intercept the polluted water and bring it to the surface for treatment.

5.4.5.2 DEEP-WELL INJECTION

- One option for the disposal of liquid hazardous waste is deep-well injection, a procedure that involves pumping liquid waste through a steel casing into a porous layer of limestone or sandstone.
- High pressures are applied to force the liquid into the pores and fissures of the rock, where it is to be permanently stored.
- The injection zone must lie below a layer of impervious rock or clay, and it may extend more than 0.8 km (0.5 mile) below the surface.
- Deep-well injection is relatively inexpensive and requires little or no pretreatment of the waste, but it poses a danger of leaking hazardous waste and eventually polluting subsurface water supplies.



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.

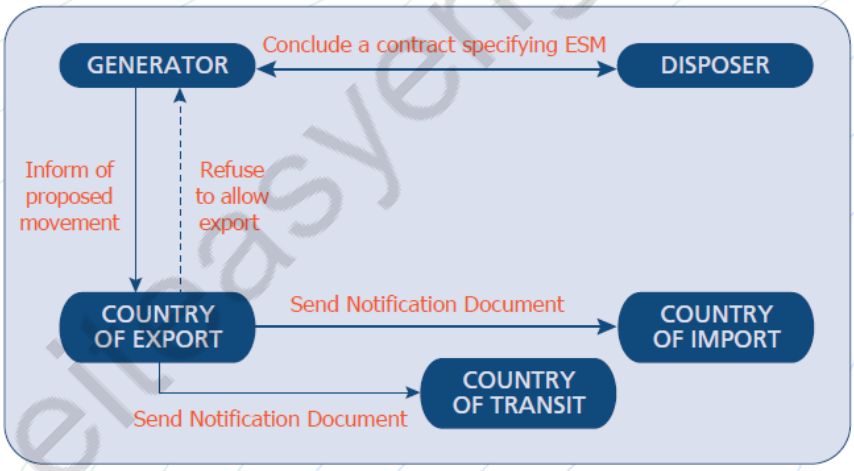
5.5. PROCEDURES FOR TRANSBOUNDARY MOVEMENT

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

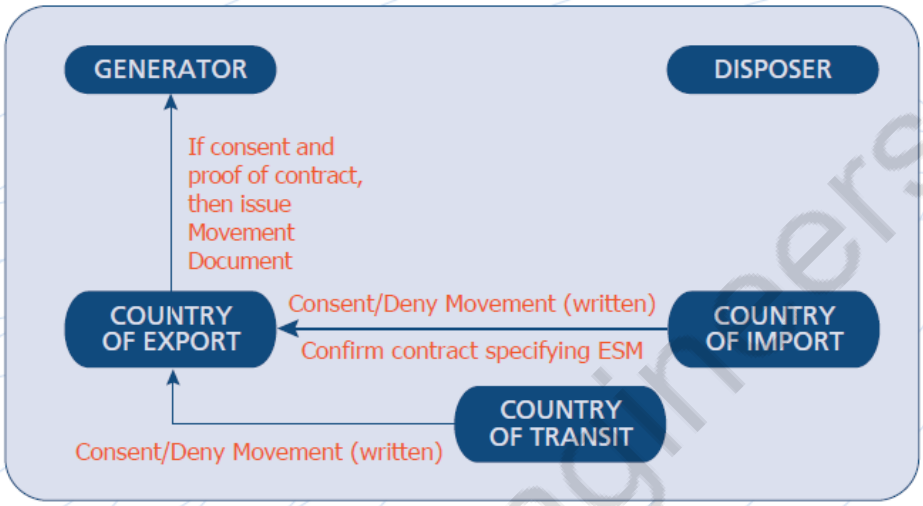
- The purpose of notification is for the exporter to properly inform the importer of a proposed transboundary movement of hazardous wastes or other wastes.
- The exporter/generator of the wastes must inform the Competent Authority (CA) of the State of export of a proposed shipment of hazardous or other wastes.
- Before the shipment can be allowed to start the generator and the disposer conclude a contract for the disposal of the waste. Under the Convention this contract must ensure that the disposal is conducted in an environmentally sound manner.
- If the CA of the State of export has no objection to the export, they inform - or requires the generator/exporter to inform, the CA of the States concerned (State of import and State of transit) of the proposed movement of hazardous wastes or other wastes by means of a "notification document".



Stage 2: Consent & Issuance of Movement Document

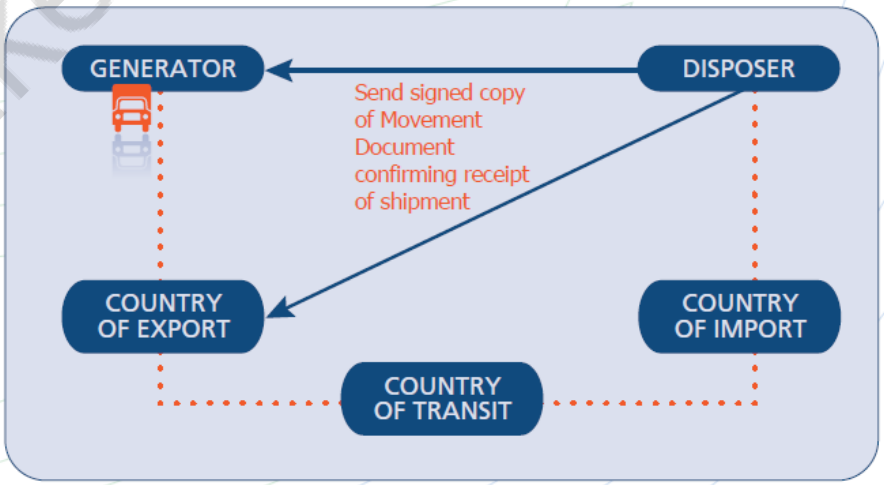
- The purpose of stage 2 is to ensure that the importer agrees to the proposed transboundary movement and accompanies the shipment of hazardous wastes or other wastes.
- On receipt of the notification document, the CA of the country of import must provide its written consent or denial.
- The CA of any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

- Once the relevant CAs have established that all the requirements of the Convention have been met and have agreed to the movement, the CA of the country of export can proceed with the issuance of the movement document and authorize the shipment to start.



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.
- The Convention requires a confirmation from the disposer when the disposal has taken place, according to the terms of the contract, as specified in the notification document. If the CA of the country of export has not received the confirmation that disposal has been completed, it must inform the CA of the country of import accordingly.