Module 2

- Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies -**8 Hours**

ENVIRONMENTAL MANAGEMENT

- Environmental management and its strategy -
  - Characterized by long-term objectives and
  - Business areas

    (Company wants to be active and tries to obtain the necessary resources in order to succeed in the competitive environment)

- Environmental strategy means
  - Compliance with the obligations set by the applicable legislation and
  - Voluntary decision of the company to mitigate its impact on the environment.

AIM OF ENVIRONMENTAL MANAGEMENT

- To minimize the damage caused to the environment
- To reduce the amount of waste
- An efficient use of natural resources
- Protection of biodiversity
- Climate and others

In the longer run

- Companies may profit from a range of other benefits
  - Improvement of the financial results
  - Enhancing company reputation
  - Recruiting new and retaining the existing employees

(- To build a strong position of the enterprise on the market

- To acquire new business opportunities

-To reduce costs in the individual areas of its business activities)

Environmental Quality Objectives

1) Reduced Climate Impact
2) Clean Air
3) Natural Acidification only
4) A Non-Toxic Environment
5) A Protective Ozone Layer
6) A Safe Radiation Environment
7) Zero Eutrophication
8) Flourishing Lakes and Streams

Objectives cont….

9) Good-Quality Groundwater
10) A Balanced Marine Environment, Flourishing Coastal Areas
11) Thriving Wetlands
12) Sustainable Forests
13) A Varied Agricultural Landscape
14) A Magnificent Mountain Landscape
15) A Good Built Environment
16) A Rich Diversity of Plant and Animal Life

1. 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

2. Clean Air

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

3. 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

4. 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

5. A Protective Ozone Layer

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

6. A Safe Radiation Environment

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

7. Zero Eutrophication

- Nutrient levels in soil and water
  - Adversely affect human health
  - Biological diversity
  - Possibility of varied use of land and water use

8. 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

9. Good-Quality Groundwater

- Groundwater must provide a safe and sustainable supply of drinking water

10. 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

11. Thriving Wetlands

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

12. 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

13. 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

14. 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

15. 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

16. 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

Rationale of Environmental standards

- Report issued by an expert group on the subject of environmental health should place great emphasis on criteria and standards.
- Public health are dependent upon standardized values, procedures and substances

Examples –

- Motor Vehicle emission – authority for other sources of atmospheric pollution
- Water supply under interstate carriers but not for water used in schools, offices, hospitals etc.,
- Need for functional rather than categorical approach to standards developed
- Move on set up of standards initiated by Public Health Service - effect from 1 Jan, 1967

Authorities includes –

- Public Health Service
- Bureau of Disease Prevention and Environmental Control
- Five national centers concerned - air pollution, radiological health, urban and industrial health, communicable disease control, and chronic disease control

Statutory authority for developing criteria and enforcing standards for the following

- Control of air pollution
- Interstate spread of communicable disease
- Ionizing radiations
- Solid wastes
- Accidental injuries, occupational hazards
- Pesticides
- Noise
- Control of rodents, mosquitoes, and other vectors of disease

- Extended study and consultation both within and outside the Public Health Service
- Determined - any health protection standard promulgated by Bureau should meet the characteristics like-

CHARACTERISTICS

Standard should be truly relevant to the health and well-being of man

- Should be addressed to the prevention or control of a health hazard or to other statutory responsibilities of the Public Health Service.

Standard must be realistic and attainable

- Standard should – employ the best available methods of control under conditions which are economically feasible and which do not constitute unacceptable risks to human health
- Health protection standards should be attainable within the current state of the art and at a financial cost which is not prohibitive

Adherence to the standard should be measurable with reasonable precision and reliability

- Responsible for enforcing and also those who are required or expected to comply with the standard must be able to ascertain when a violation· has taken place

Standard should be aggressive in terms of protecting the public health

- Uncertainties as to the degree of control necessary should, be resolved in that direction which will afford the greater protection to the public

Standard should clearly identify the population group it is intended to protect

- Example: some standards are designed to protect the general population
  - Some to protect a segment of the population
  - Some to protect persons living in certain geographic areas
  - Some to protect workers in certain occupation groups

EFFLUENT AND STREAM STANDARDS

STREAM PROTECTION MEASURES

Methods of maintaining a stream

- **Effluent Standards**
- **Stream Standards**

Effluent Standard: The Quality Standards established for the wastewater that has been processed from the units.

Stream Standard: The Standard Quality established in accordance with the designation of water bodies

EFFLUENT STANDARDS

- Effluent standards pertain to the quality of the discharge water itself
- Based on economics than on absolute protection of the stream
- Easy to control
- Detailed stream analysis are not required
- It do not establish an overall level of pollutant loading for a given water body
- Ratio of wastewater to stream flow are not considered
- Treatment is obligatory irrespective of the size of industry

- For effective protection of an overloaded stream, the effluent standards are required to be upgraded
- Large industries have an edge over small industry

EFFLUENT DISPOSAL STANDARDS

TABLE 1: EFFLUENT DISPOSAL STANDARDS

Sl.No.	CHARACTERISTICS	STREAM CLASSIFICATION				
		A	B	C	D	E
1	Dissolved Oxygen mg/L (Min)	6	5	4	4	-
2	Biochemical Oxygen Demand mg/L (Max)	2	3	3	-	-
3	Total Coliform Organism MPN/100mL	50	500	5000		
4	Total Dissolved Solids mg/L (Max)	500	-	1500	-	2100
5	Chlorides (as Cl.mg/L (Max.)	250	-	600	-	600

STREAM STANDARDS

- Stream standards refer to the quality of the receiving water downstream from the origin of the wastewater discharge
- It is based on establishing classification of quality for a stream
- Quality of the receiving water is regulated to maintain established stream classification
- Prevention of excessive pollution/ Loading is limited to what the stream can assimilate
- No consideration of type and location of industry

- Allows public to establish goals for present and future water quality
- Confusion of zone of different classification
- Controversy over proportion of stream to be reserved for future usage (municipal, industrial, agriculture etc.)
- Opposition from industry/ public to change the established classification

- A detailed stream analysis is required to determine the level of wastewater treatment required to maintain the health of the ecosystem

- Cost of treatment may affect the survival of industry

STREAM CLASSIFICATION IN INDIA

TABLE 2: STREAM CLASSIFICATION

CLASS OF STREAM	DESIGNATED BEST USE
A	Drinking Water Source without conventional treatment after disinfection
B	Outdoor bathing
C	Drinking Water with conventional treatment followed by disinfection
D	Propagation of wild life-fisheries
E	Irrigation, industrial cooling controlled wastewater disposal

Concentration and Mass

Concentration

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

Load (Mass)

- Load is the amount (mass) 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 load provide information of environmental significance, but each has limitations

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

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, chloro-alkali 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

TWO BASIC PROBLEMS

- Since these standards were not disposal specific , it lead to many anomalous situations
- Tended to become rather stringent and in many cases almost the maximum achievable standards
- MINAS are indeed not minimal standards but maximum achievable standards

Emission and ambient standards

- Ambient air quality refers to the condition or quality of air surrounding us in the outdoors
- National Ambient Air Quality Standards are the standards for ambient air quality set by the Central Pollution Control Board (CPCB) that is applicable nationwide.
- The CPCB has been conferred this power by the Air (Prevention and Control of Pollution) Act, 1981.

Ambient Air Quality Standards in India

- The Air (Prevention and Control of Pollution) Act 1981 was enacted by the Central Government with the objective of arresting the deterioration of air quality
- The Air (Prevention and Control of Pollution) Act 1981 describes the main functions of the Central Pollution Control Board (CPCB) as follows

- To advise the Central Government on any matter concerning the improvement of the quality the air and the prevention, control and abatement of air pollution.
- To plan and to be executed a nation-wide programme for the prevention, control and abatement of air pollution.
- To provide technical assistance and guidance to the State Pollution Control Board

- To carry out and sponsor investigations and research related to prevention, control and abatement of air pollution
- To collect, compile and publish technical and statistical data related to air pollution and
- To lay down annul standards for the quality of air

Table 1: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual* 24 hours**	50- 80	20 -80
Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual* 24 hours**	40- 80	30 -80
Particulate Matter (size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual* 24 hours**	60- 100	60 -100
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ $\mu g/m^3$	Annual* 24 hours**	40- 60	40 -60
Ozone (O_3) $\mu g/m^3$	8 hours* 1 hour**	100- 180	100 -180
Lead (Pb) $\mu g/m^3$	Annual* 24 hours**	0.50 -1.0	0.50 -1.0

- Maximum amount of a specific pollutant allowed to be discharged into the atmosphere from a single fixed or mobile source.

Environmental Performance Evaluation

Environment Performance Indicators

Purpose

1. Environmental performance indicators provide information that
   - Helps evaluation and
   - Decision making within organizations that engage in environmental efforts

2. Environmental performance indicators provide a common foundation of information for

- Organizations and external interested parties (such as consumers, business partners, residents in local communities, shareholders, and financial institutions) and
- It helps interest parties' proper understanding of activities of the organizations and their environmental efforts

3. Environmental performance indicators provide a common foundation of information that helps the integration of environmental policies of the national and local governments, such as basic environment plans, and environmental activities of organizations

Objective of EPI

1. 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.

2. 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

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

Table 2: Structure of Environmental Performance Indicators

Operational Indicators

Core Indicators	Input	Total Energy Input Total Amount of Material Input Water Resource Input
	Output	Amounts of Greenhouse Gases Emissions Amounts of Release and Transfer of Chemical Substances Total Amount of Production or Sales Total Amount of Waste Generation Total Amount of Final Disposal of Waste Total Amount of Water Drainage

Sub Indicators	Indicators That Qualitatively Supplement the Core Indicators	Breakdown of Energy Input Kinds of Resources, State of the Resources at the time of input Breakdown of Water Resources Emissions of Substances Under the Kyoto Protocol Amounts of Emissions of Other Substances Under Regulations Amounts of Products or Services that Are Measured in Unit Other than Weight Amount of Production or Sales of Products that Contribute to Reduction of Environmental Burden

		Amount of Production or Sales of Products with Certified Environmental Labelling Amount of the Use of Containers and Wrappers Methods of Waste Disposal Kinds of Waste Generated Kinds of Water Area Where Wastewater are discharged Quality of Water

	Environmentally important indicators which may not be applicable to all business organizations	Repeated Use of Water within the Organization Emission of Sulfur Dioxide and Nitrogen Oxide Concentration in Emissions that are under Regulation Noise, Vibration, Odor Nitrogen, Phosphorus Concentration in Water Emissions that are under Regulation
	- Indicators that would be important for establishing sustainable society	Repeated Use of Materials within the Organization Recycled Materials within the Organization Thermally Recycled Materials within the Organization

		Energy Efficiency for Each product Group Amount of CO_2 Emission (From Use of Product) Proportions of Reusable and Recyclable Part for Each Product Group Amount of Products, Container and Wrappers Collected Amount of Consumed Material, Containers and Wrapper Reused, Recycled and Thermally Recycled, and its Proportion State of Contamination in Soil, Ground Water and Sediment Area of Greening, Planting Trees, and Restoration Amount of Chemical Substance Storage

Environmental Management Indicators (Sub-Indicators)

Sub-Indicator	Environmental Management Systems Technology for Environmental Protection, Research and Development for Designing for the Environment of Products and Services Environmental Accounting Green procurement (purchase) Environmental Communication and Partnership Compliance with Environmental Law and Regulations Occupational Safety and Health Social Contribution concerning the environment

Sub-Indicator	Management Indicators that Measure Efficiency with Combination With Operation Indicators	Amount of Sales Amount of production Area of Floor Number of Employees, Etc.
	Indicators that Are Related to Management Indicators	Indicators that Measure Eco-efficiency Integrated Indicators of Environmental Burden

CLOSING THE LOOP

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

Example : recycling waste newspaper to make paper-board or other type of paper

- 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

POLLUTION PREVENTION

- Pollution prevention is an environmental approach fundamentally different from approaches that focus on managing or controlling pollution after it has been generated

- Pollution prevention occurs prior to the creation of a waste or a pollutant and thus occurs prior to the consideration of alternatives such as pollution control, waste management, treatment, recycling or disposal

Barriers of pollution prevention

1. **REGULATORY BARRIERS TO POLLUTION PREVENTION**

a) **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

b) 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

c) **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.

d) 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

e) 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.

f) 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 provide little incentive to go beyond standards and prevent pollution at the source.

g) Data Gathering and Management

- Data gathering and management systems have generally developed along media-specific lines.
- It focus on end-of-pipe emissions and quantities of waste generated as a means of enforcing and ensuring compliance with existing regulatory requirements.
- Need for improved data relating to pollution prevention is recognized at both the federal and state levels.

2. ECONOMIC BARRIERS TO POLLUTION PREVENTION

a) Inaccurate Market Signals

- In some instances, the costs of releasing toxic substances may be less than the cost of implementing a pollution prevention project
- Because the full environmental cost of the release is not included in the calculation.

b) Incomplete Cost/Benefit Analysis

- Indirect benefits (e.g., lower future liabilities, potential for "environmental marketing" and positive investment image) are not commonly considered in an analysis and therefore do not reflect the advantages of implementing preventive projects.
- Failure to take into consideration all relevant costs and benefits or failure to properly allocate these costs to appropriate operations and processes may present unnecessary barriers to pollution prevention.

c) Inappropriately Short Time Horizons

- Companies with very short-term perspectives on criteria for investment (e.g., 1-2 year payback periods) may be less likely to support certain prevention projects despite the fact that they would be economically viable in a moderate payback timeframe.

d) Fear of Market Share Loss/Consumer Pressure

- Surveys suggest that the most significant barrier to pollution prevention is reluctance to tamper with proven processes for fear of adverse effects on product quality

e) Inappropriate Product/Process Specifications

- Very specific cases involving the barrier, "fear of customer loss," result from unnecessarily rigid specifications for products or processes.

f) Fear of Production Interruption

- If prevention options require major operational changes, equipment alterations or process modifications, companies may resist implementation because of concern about not being able to produce the product at all or having higher reject rates through less reliable actions

g) Limited Access to Necessary Resources

- Prevention projects can face stiff competition for limited internal capital resources also presents a significant barrier to pollution prevention.
- Access to external sources of capital to fund prevention projects may also be limited. The shortage of staff resources

h) Worker Fear of Job Loss

- If employees or labor groups look upon pollution prevention as a threat to their jobs, these concerns may pose a barrier to pollution prevention efforts
- Experience shows that companies with pollution prevention programs are often strengthened economically, and produce higher quality products in a more efficient manner.

3) EDUCATIONAL BARRIERS TO POLLUTION PREVENTION

a) Lack of Top Level Support. It is common for educational leaders to simply exclude pollution prevention and environmental protection from institutional priorities

b) Insufficient Faculty Motivation and Training Barrier is caused, in part, by the difficulty in creating new courses, unavailability of teaching aids (e.g., case studies and research pressures.

c) Insufficient Student Interest. Student demand for treatment of environmental issues has been small, possibly because they haven't yet seen a connection between job success and environmental expertise.

d) Inflexible Curriculum Requirements. At most educational institutions the degree coursework is already crowded with requirements and continually faces new demands to add more credits and topics. In many instances, there is simply little or no room to add pollution prevention into the program.

e) Lack of Instructional Materials.

- Not sufficient existing material (e.g., casebooks, text books or videos) that is easily available to integrate into existing classes.

INSTITUTIONAL BARRIERS TO POLLUTION PREVENTION

Three categories of institutional barriers are

a) Organizational: Reflect the ways in which companies manage human and material resources.

b) Technical: Address the development and use of technologies and operational practices.

c) Societal: Describe some ways in which society impacts pollution prevention efforts.

- Lack of Top Management Support.
- Lack of Clear Communication of Priorities or Support.
- Organizational Structures may Separate Environmental Decisions from Production Decisions.
- Habit and Inertia may Inhibit Change.
- Lack of Involvement of affected Workers.
- Reward System does not Focus on Pollution Prevention.
- Firms may lack the Technical Ability to Apply Preventive Methods and Technologies.

- Frequent Changes to Output, Product Design and Other Factors may make Implementation more Difficult.
- Lack of Information about Sources of Waste and Releases, Alternative Strategies, and Resources.
- Preventive Applications of Currently available.
- Perception that Pollution Prevention addresses only Manufacturing Processes.
- Lack of Consumer Environmental Awareness.