

UNIT 6

Life Cycle Assessment (LCA)

STRUCTURE

Overview

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6.2 Stages in Product LCA

6.3 A Code of Good Conduct for LCA

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Summary

Suggested Readings

Case 6.1: Software for Performance of LCA

Case 6.2: Environmental Effects to be considered in LCA

Case 6.3: Life Cycle Analysis: Substitutes for PVC

Case 6.4: Life Cycle Analysis: A Case of Steel Sector in India

OVERVIEW

In Unit 5, we discussed, among others, how audits help improve the environmental performance of an industry. In Unit 6, we will discuss yet another tool for environmental management, i.e., life cycle assessment (LCA). We will first trace the evolution of LCA and describe the stages of a product life cycle. We will then identify the elements that contribute to the code of good conduct for an LCA. We will also explain the main steps involved in the LCA process, i.e., goal setting, inventory analysis, impact assessment and profile evaluation. We will close the Unit by explaining the application of LCA in private and public sectors.

LEARNING OBJECTIVES

After completing this Unit, you should be able to:

Life Cycle Assessment (LCA)

- explain the concept of life cycle assessment (LCA) as an environmental management tool and its potential for identifying all the environmental impacts throughout the entire life cycle of a product;
- describe what a code of good conduct for LCA entails;
- discuss the basic steps involved in an LCA process;
- conduct/co-ordinate an LCA and critically evaluate its outcomes.

6.1 EVOLUTION OF LIFE CYCLE ASSESSMENT

Life cycle assessment (LCA) is a tool to evaluate the environmental effects of a product or process throughout its entire life cycle. An LCA entails examining the product from the extraction of raw materials for the manufacturing process, through the production and use of the item, to its final disposal, and thus encompassing the entire *product system*. A schematic representation of a product life cycle is given in Fig. 6.1.

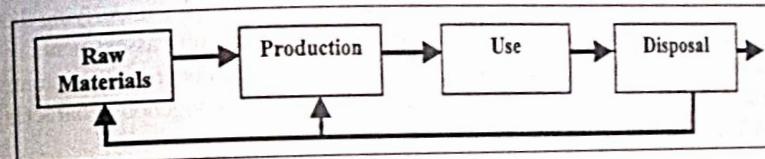
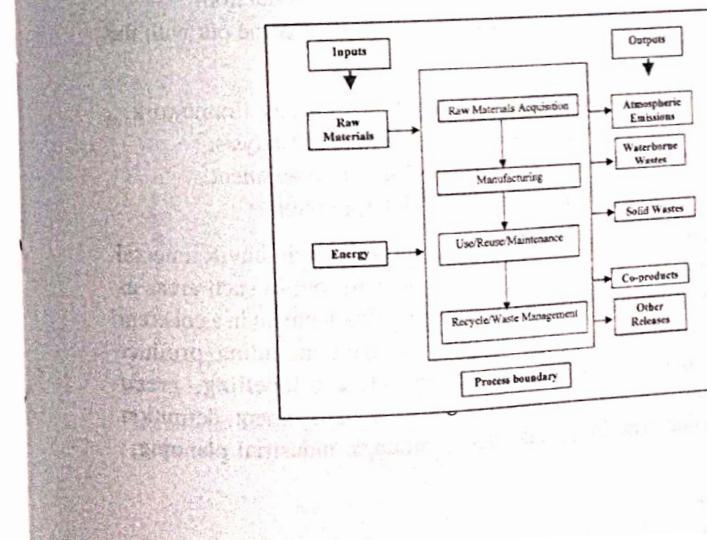


Figure 6.1 Product Life Cycle

The assessment process includes identifying and quantifying energy and materials used and wastes released to the environment, assessing their environmental impact and evaluating opportunities for improvement as illustrated in Figure 6.2.



The unique feature of this type of assessment is its focus on the entire life cycle, rather than a single manufacturing step or environmental emission. The theory behind this approach is that operations occurring within a facility can also cause impacts outside the facility's gates that need to be considered when evaluating project alternatives.

The principles underlying an LCA were developed in the late 1960s for the evaluation of environmental impacts of products and were popularly known as resource and environmental profile analysis (REPA). Initially, it was used mainly on the consumption of energy and other resources. Knowledge of environmentally damaging releases and actions and the estimation of their effects, was too rudimentary at that time to allow a quantitative treatment of the environmental impacts of the product life cycle.

Assessments of product life cycle experienced a renaissance through studies of the environmental loadings and potential impacts of beverage containers (e.g., beer cans, milk containers) performed in various European countries in the early 1980s. These studies involved further elaborations of the principles underlying the assessment of product life cycle and entailed a series of life cycle assessments of materials used in packaging containers (i.e., polyethylene, cardboard, aluminium, etc.). A common feature of the items analysed was their homogenous character and their widespread use in many different contexts.

The late 1980s and early 1990s have seen international attempts to standardise the principles underlying life cycle assessments and to develop codes of good conduct in this field. The list of products that have been subjected to LCA has grown quickly and now includes more complex products such as paints, insulation materials, window frames, refrigerators, hotplates, television sets, etc., as well as the entire service systems or technologies such as electricity production.

As a part of ISO 14000 series of standards, ISO in 2000 has come out with the following standards:

- ISO 14040: Environmental Management—LCA—Principles and Framework.
 - ISO 14041: Environmental Management—LCA—Inventory Analysis.
 - ISO 14042: Environmental Management—LCA—Impact Assessment.
 - ISO 14043: Environmental Management—LCA—Interpretation.

Since the last decade or so, LCA is gaining importance as an environmental management tool. It has now emerged as a decision support tool in such areas as business, regulation and policy and to structure technology development in a coherent way. Many potential applications of LCA are envisaged including product improvement and design, environmental management, eco-labelling, green accounting, environmental auditing and reporting, resource management, definition of best available technology (BAT), product policy, strategic industrial planning,

Life Cycle Assessment (LCA)

strategic environmental policy development, etc. As a general concept, the life cycle approach aims to support the overall goal of sustainability.

LEARNING ACTIVITY 6.1

State the basic concept of a life cycle assessment.

Note:

- a) Write your answer in the space given below.
b) Check your answer with the one given at the end of this book

6.2 STAGES IN PRODUCT LCA

Figure 6.3 gives a diagrammatic representation of the stages in the life cycle of a product.

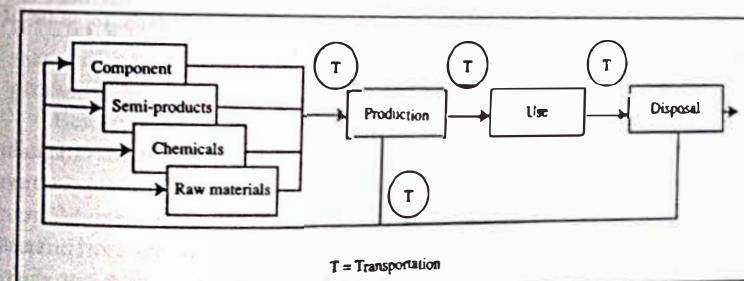


Figure 6.3 Product Life Cycle Stages

Environment Impact Assessment

13.0 INTRODUCTION

A development project is meant to give economic benefits to the society. These economic benefits like increase in GDP, employment generation, foreign exchange earning, etc., which are mostly aimed at, are tangible ones. Simultaneously, the project also causes some social and environmental losses and gains. The losses include depletion of non-renewable resources, pollution, deforestation, involuntary displacement, disruption of social structure of indigenous population, etc. which are mostly intangible and often missed in the cost-benefit analysis before deciding for the project. A sustainable project should have a good net benefit taking into consideration of both tangible and intangible costs and benefits. Earlier a project was taken up based on the techno-economic feasibility, i.e., by integrating technical possibility with economic viability. What is needed today is to further integrate with it the environmental compatibility (Figure 13.1).

The basic objective of Environmental Impact Assessment (EIA) is to identify and evaluate the potential impacts (both beneficial and adverse) of development projects on the environmental system (including social system). This helps in selecting environmentally compatible sites and planning environmental safeguards.

The term EIA can be defined in many ways. In a broad way, it can be defined as:

a process designed to ensure that all potentially significant impacts are satisfactorily assessed and taken into account in planning, designing, authorization and implementation of all relevant types of actions of a development project.

When, Who and How

Realizing the importance of the EIA exercise when going in for a development project, three fundamental questions arise about the exercise. They are:

When to do it?

Who to do it?

How to do it?

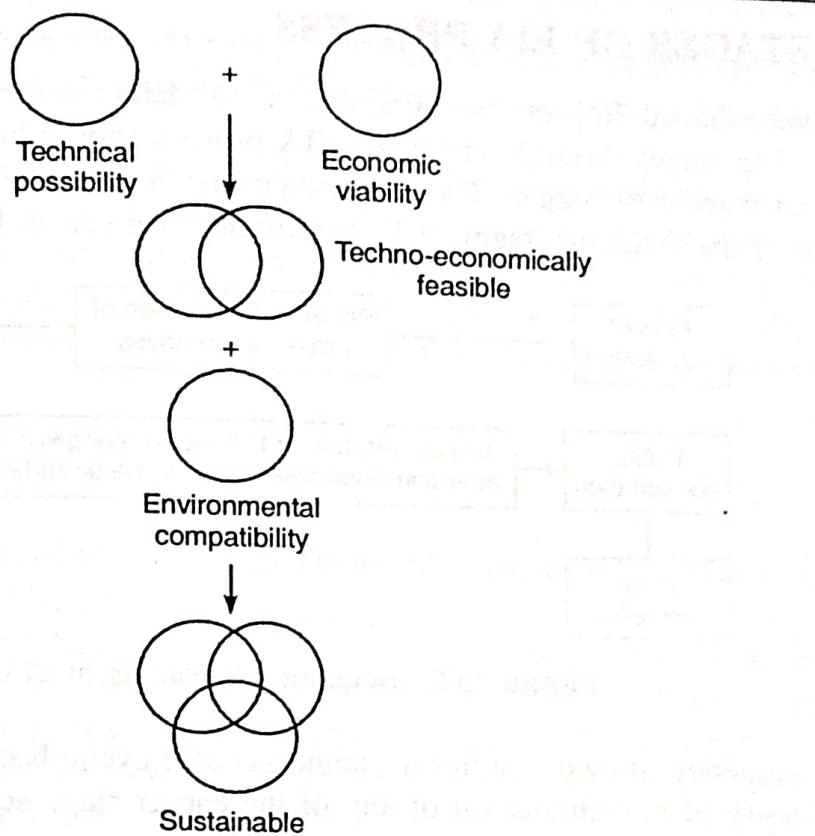


Figure 13.1 Sustainable Project.

It must be borne in mind that environment impact assessment is a part of the decision-making process. It must therefore be carried out before the final decision is taken about a project. Unfortunately many project proponents conceive it as only a regulatory requirement and a post-decision activity. Such an approach, which can be described as *Decide-Act-Defend (DAD)* approach, defeats the very purpose of EIA.

When a development project is proposed, the proponents of the project obviously support it. It is equally true that the vital interests of some other people will be affected by the project or at least perceived to be so. Such people will naturally oppose the project. There is therefore a conflict of interests. On the principle of natural justice, environmental impact assessment study should not be carried out by any of the interest parties—those who support the project and those who oppose it. Ideally a non-interest party should carry it out.

Whoever carries out the EIA study of a project, he does so to assist the decision-maker to take the right decision. The final decision-maker is not expected to be a technical expert. He may be an industrialist, bureaucrat, a political leader or a group of these persons. The EIA report should, therefore, be prepared and presented in a manner such that the decision-maker should be able to understand it and take a correct decision. It should also be prepared after consultation with all the stakeholders.

EIA is one of the several kinds of inputs to the decision-making process. All potentially important impacts that are to be assessed for the process are financial, economic, environmental, social and strategic. It may be useful to include all positive and negative impacts in a single document to make the decision easy.

13.1 STAGES OF EIA PROCESS

The Environmental Impact Assessment is a mandatory requirement under the law for some projects. The stages through which the EIA process should be carried out are not confined to the formal mandatory stages. The early stages are less formal and non-mandatory. The whole sequence of the different stages of EIA activities is given in Figure 13.2.

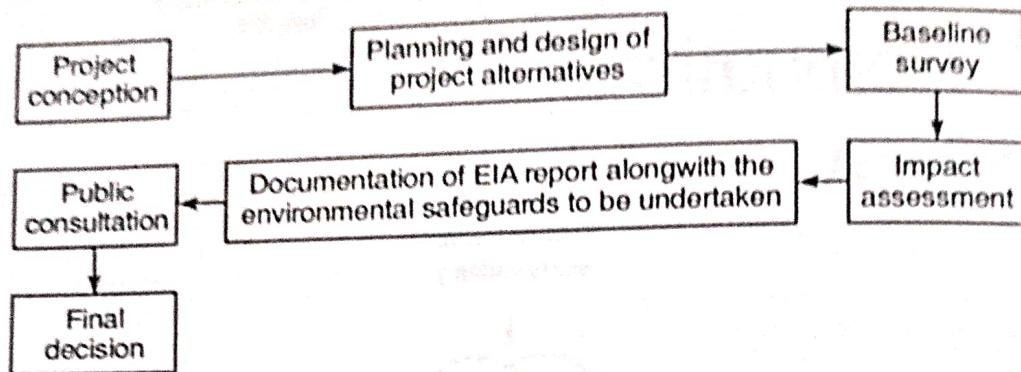


Figure 13.2 Sequence of Stages of EIA Activities.

The sequence, shown in a linear manner, is also cyclic because after each stage, there may be a necessity of re-examination of any of the earlier stage activity.

Project Planning and Design

Project design and planning is one of the very early steps taken by the project developer to implement a project and is always done much in advance before submitting application to the appropriate authority for authorization/clearance. The EIA process should ideally start at this early stage and should be integrated with all the ongoing design and planning works of the project till its execution.

The EIA process should look into the following at the design and planning stages.

- Review the alternative ways of meeting the overall objective of the project including zero option, i.e., not taking up the project at all.
- Examine the alternative locations for the proposed project, if the same is not location-specific (e.g., mining project)
- Study the alternative process designs, site layouts and other facilities of the proposed project.

The EIA study at this stage should be done alongwith other studies (technical and financial) in order to arrive at an optimal environmentally compatible alternative while accommodating, to the extent possible, all other vital interests of the developer. At this stage, the various alternatives available will be many and detailed EIA studies for all the alternatives are not possible nor necessary. A Rapid Environmental Screening (RES) can eliminate most of the alternatives. Obviously, environmentally incompatible processes and unsuitable sites are eliminated through the RES without going to any detailed study.

The proper and systematic EIA study starts after this. The remaining few number of alternatives after RES can be environmentally studied through a Rapid EIA process and the developer can, on the basis of it, take a tentative decision before the submission of the proposal.

to the competent regulatory authority for clearance. The rapid EIA can usually be carried out with 3 months' seasonal study. A comprehensive EIA requires a full one-year study covering all seasons.

A question arises whether the developer should consult the general public at the project planning stage. Ideally he should do so. But consultations at this early stage may be somewhat 'sensitive' for all the parties involved. Unnecessary politicalization and possible sabotage by vested interests inimical to the project may make this activity very risky. Therefore, consultations undertaken at this early stage, though very useful, have to be designed and implemented with special care.

Baseline Study

Baseline study of the environment of the project area before the start of the project is one of the most important activities of the EIA process.

Land, water and air, the three major components of the physical environment, where the impact of the project may be felt. The baseline study should focus on those components. Landuse pattern, topography, soil quality, etc., are some of the important parameters of land that need to be studied. Water availability, water discharge and ambient water quality are the parameters of the water environment that are required to be reported. The baseline data on air includes ambient air quality, ambient noise level and meteorological data. The latter is particularly important to predict the movement of pollutants after establishment of an air-polluting industry. Also the various structures existing in the project area should be recorded because those structures may face significant impact due to the project. Some of the structures may be of important cultural heritage and therefore considered eco-sensitive.

The baseline data on the biological environment include data on cropping pattern, fisheries, livestock, forest cover, biodiversity and such other parameters.

Human settlement, demographic pattern (language, religion, caste and gender break-up), income distribution, etc., are some of the important socio-economic parameters which need to be studied as a part of the baseline information collection in the project area.

The relative importance of the different parameters depends upon the type of the project. Table 13.1 shows same indicative baseline information that may be required to be collected.

The baseline information can be obtained from both primary and secondary sources. They must be representative.

Impact Assessment

Impact assessment has many aspects, viz., *impact identification, evaluation and prediction*.

Range of Impacts

Broadly the environment components where impact is felt include.

- The receiving environmental media (air, water and land)
- The living acceptors occupying the media (human beings, flora and fauna)
- The built environment (structures, buildings and monuments)
- The social environment (economic status, social system and culture)

Table 13.1 Baseline Information on Various Environment Components in EIA

Physical environment	Biological environment	Socio-cultural environment	Ecological relationship
Land. Landuse, topography and drainage, mineral and other resources, soil quality, groundwater table, special geological features.	Flora. Trees, shrubs, grass, crops, microflora, aquatic plants, endangered species.	Socio-economic. Occupation, economic distribution, social division, special cultural practices, employment, health and safety.	Biodiversity, salinization of water sources materials, eutrophication, disease-insect vectors, food chain etc.
Water. Water availability, water discharge, water recharge, and surface and groundwater quality.	Fauna. Birds, land animals including reptiles, fish and shellfish, benthos, insects, micro fauna, endangered species, barriers, corridors.	Aesthetics and human interest. Recreational facilities (hunting, fishing, boating, trekking, swimming, camping, picnicking, resorts, etc.), scenic views, open space and wilderness qualities, unique physical features, parks and reserves, rare and unique species or eco-systems, monuments, historical and archeological sites and objects, religious sites, etc.	
Air. Ambient air quality, noise level, temperature, meteorology (micro and macro).	Human beings. Human settlement, demography (language, religion, caste, community, gender break-up), indigenous population, community health, population density etc.	Cultural. Cultural pattern (life-style) particularly of indigenous population.	
Processes. Flood, erosion, air movement, stability (slides, slumps), stress-strain (earthquake)		Constructed facilities. Structures, transportation network, utility network, waste disposal, barriers, corridors, etc.	

Impacts can be both positive and negative. These impacts are not restricted to those of direct or immediate nature and they are not necessarily independent of each other. All these impacts ultimately and jointly have effect on man, his activities and quality of life.

Impacts on the living media. The following are some of the impacts of an industrial project on the environmental media:

Changes in air quality. Air pollution is caused by the stack and fugitive emissions. This is felt in different degrees in the work environment and the general outside environment.

Changes in the ambient level of noise. Operation of plants and machineries in an industry increases the noise level much to the discomfort of the people nearby. This is very much felt in the work environment.

Changes in the water quality. Pollutant-carrying effluent from any industry may pollute the water body to which it is discharged or the groundwater to which it percolates. The changes in the water quality due to pollution can be chemical and biological. Discharges from cooling towers can also cause thermal pollution.

Water availability. Establishment of a highly water-demanding industry in a water-deficit area will necessarily affect the water use in other sectors (agriculture, domestic, etc.).

Change of landuse. Industrialization changes the landuse pattern in an area.

Changes in land quality. Changes in the landscape of an area, soil erosion, deposition of chemical residues on soil, etc., are some of the impacts of an industry on land affecting the quality of the latter.

Impacts on the living receptors. Humans, animals and plants are directly affected by industrial activities. Some of the impacts are as follows:

Human health effects. Air and water pollution may bring changes in the level of human mortality and morbidity.

Changes in the amenity value of the environment. The establishment of an industry may affect leisure and recreational facilities in an area.

Impact of agriculture and horticulture. Establishment of any industry in a predominantly agricultural area promotes changeover of landuse from agriculture to industrial and commercial uses. Besides, air, water and soil pollution may affect soil fertility.

Impact on forests. Forest is an important ecological endowment. Unless special care is taken, industrialization may promote deforestation.

Impact on natural ecosystem. Changes in the damage levels to flora and fauna and the natural ecosystem, in general, with consequential effects on species diversity and abundance may result from industrialization. These impacts are mostly overlapping.

Impact on the built environment. The built environment consists of all structures, including buildings and monuments in an area. The main impacts of built environment are:

- Changes in the damage levels to individual buildings and monuments in an area.
- Changes in the aesthetics, appearance of individual buildings and surroundings.

Many of the monuments are important cultural heritages and require protection. There are restrictions on establishment of industries in areas close to monuments (Chapter 9).

Socioeconomic impacts. Economic impacts are generally positive and tangible. There are also negative economic impacts like unequal distribution of economic returns resulting in widening gap between the rich and the poor.

Social impacts can also be mixed. Increased flow of capital and higher job opportunities raise the purchasing power of local citizens. Consequently health and educational status increases. On the negative side, sudden increase of wealth, large influx of non-locals, imbalance in sex ratio, loss of traditional livelihood and skills, etc., which are the outcome of commercialization, adversely affect the social order consequently increased crime rate, alcoholism, and sexual aberration result. The population, which is subject to maximum adverse social impacts, is mostly the persons who are involuntarily displaced. The Relief and Rehabilitation (R and R) package given to them do not compensate the social losses. A new settlement of the displaced persons cannot replicate the original one and the original cultural life is hardly revived. This is particularly true for the indigenous population with distinctive cultural life.

Hazard risks. The above examples of environmental impacts due to any industrial project relate to 'normal' circumstances. Another type of impact is caused by any 'accident' taking place in the project. For example, although nuclear power plants are normally very safe from any radioactive contamination, few large accidents in such plants in the world have made nuclear power plants environmentally hazardous in public perception.

Environmental impacts at different stages. The environmental impacts of an industrial project are felt at three stages. The main adverse impacts at different stages are as follows:

Stage 1 (Construction Stage). Noise and dust, vehicular pollution, insanitation, social problems due to migrant population, etc., are the common adverse impacts felt at this stage.

Stage 2 (Operation Stage). Air, water and soil pollution, accident risks, deforestation, biodiversity loss, socio-economic problems, etc. are mostly outcomes of operation of industrial plants in any area.

Stage 3 (Secondary Impacts). These impacts are felt long after the operation of the industrial plant and arise from the secondary activities that follow the primary activity of the establishment of the mother industry. It should be borne in mind that the local population is not widely benefited economically by the primary activity. The main beneficiaries are the Government, which earns revenue, the shareholders and the direct employees. The locals mainly benefit from the secondary activities like establishment of small ancillary and downstream industries, transport, providing services and such other low-investment activities. It is, therefore, necessary to promote such activities in an organized way. Secondary impacts include urbanization, insanitation, pollution, culture changes, local-nonlocal conflicts, etc. Although these are very important, most EIA reports do not consider them.

13.2 IDENTIFICATION AND EVALUATION OF IMPACTS

The EIA process is primarily concerned with the assessment of significant environmental impacts. All EIA regulations and guidelines hardly define or describe what can be considered as significant impacts? The significance of an impact depends upon the type of the project and the nature of the environment. It is inevitably determined to a large extent in the decision-making context of a particular project under examination. The following are a few considerations to identify potentially significant environmental impacts.

- Is the impact in question likely to threaten the existing or proposed environmental standards?
- Is it likely to conflict with the overall national environmental objectives, policies and plans?
- Is it likely to violate any of the restrictions, guidelines, standards, etc., of any environmental control authority (e.g., Pollution Control Board) or any local authority (e.g., Development Authority) so as to conflict with the objectives, policies or plans of those authorities?
- Is it likely to cause concern to international and national environmental interest groups and the local communities?

While predicting environmental impacts, one should be able to distinguish between their likely magnitude and size from their significance; the latter is important for the decision-making purposes. The distinction between the terms, significance and magnitude can be understood from the following example.

The predicted ground level concentration of an air pollutant in a project area may show numerically a large increase but it may not be significant, if at the increased level, the concentration remains well within the ambient air quality standard. Similarly, where the concentration of the pollutant is already close to the upper limit of the ambient air quality standard, even a small predicted increase may be significant for decision-making. The project proposal is likely to be rejected in such a case. The predicted magnitude of impact is primarily an objective exercise. On the contrary, the determination of the significance of an impact involves some value judgement and hence, it is more subjective in nature.

Various techniques are adopted for assessment of significant impacts. Some widely used techniques are checklists, matrices, networks, cause-effect diagrams and computer simulation models.

Checklists. As the name implies, a list of those features of the proposed project which can give rise to significant environmental impacts (project characteristics checklist) and a list of the aspects of the environment which are potentially sensitive to the project (environment characteristics checklist) are prepared. The checklists may, if required, carry explanatory notes for guidance because inexperienced staff often uses checklists. Checklists can be used as a flexible identification tool, which can be amended and adapted to the particular situation in which it is to be applied.

Table 13.2 shows the checklists of a gas production project on the biological environment in a sea island in Canada.

Table 13.2 Example of An EIA Checklist

Checklist for description of the biological environment

(Extract from specific guidelines for gas production project in Sable Island Area)

(a) Microorganisms

- Distribution and abundance of indigenous microbiota, with special reference to oleoclasts and their effectiveness relative to specific hydrocarbon components.

(b) Phytoplankton

- Species composition, distribution, abundance and production on a seasonal basis.

(c) Macrophytes

- Species composition, distribution and abundance with special emphasis on existing (and potential) commercially important species, sensitivity to hydrocarbons.

(d) Zooplankton

- Species composition, distribution, abundance on a seasonal basis;
- Evaluation of biomass on a seasonal and geographic basis, including an analysis of the degree of variation.

(Contd.)

The table shows that although the population of India is 3.4 times more than that of U.S.A. Its overall energy use and waste generation are less than 1/8th that of USA. Thus more consumerism leads to more waste production.

Consumerism highlights (after Paul Ehrlich)

- On an average, a U.S. citizen consumes 50 times as much as an Indian.
- A U.S. born baby due to high consumerism will damage the planet earth 20–100 times more in a lifetime than a baby born in a poor family of LDC.
- A Japanese with a similar lifestyle as that of an American causes half the impact on environment. This is due to better technology. By adopting energy efficient and eco-friendly technologies and by following 3'R principle of Reduce, Reuse, Recycle they have minimized the waste generated due to consumerism.

6.16 ENVIRONMENTAL LAWS

India is the first country in the world to have made provisions for the protection and conservation of environment in its constitution. On 5th June, 1972, environment was first discussed as an item of international agenda in the **U.N. Conference on Human Environment** in Stockholm and thereafter **5th June** is celebrated all over the world as **World Environment Day**. Soon after the Stockholm Conference our country took substantive legislative steps for environmental protection. The Wildlife (Protection) Act was passed in 1972, followed by the Water (Prevention and Control of Pollution) Act 1974, the Forest (Conservation) Act, 1980, Air (Prevention and Control of Pollution) Act, 1981 and subsequently the Environment (Protection) Act, 1986.

Constitutional Provisions

Provisions for environmental protection in the Constitution of India were made in 1976 within four years of Stockholm Conference through the 42nd amendment as follows:

Article 48-A of the Constitution provides: "The state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country."

Article 51A(g) provides: "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures."

Thus our Constitution includes environmental protection and conservation as one of our fundamental duties.

Some of the important Acts passed by the Government of India are discussed here.

6.16.1 WILDLIFE (PROTECTION) ACT, 1972

The Act, a landmark in the history of wildlife legislation in our country, came into existence in 1972. Wildlife was transferred from State List to Concurrent List in 1976, thus giving power to the Central government to enact the legislation.

The Indian Board of Wildlife (IBWL) was created in 1952 in our country, which after the enactment of the Wildlife (Protection) Act actively took up the task of setting up Wildlife National Parks and sanctuaries. The major activities and provisions in the Act can be summed up as follows:

- (i) It defines the wildlife related terminology.
- (ii) It provides for the appointment of Wildlife Advisory Board, wildlife warden, their powers, duties etc.
- (iii) Under the Act, comprehensive listing of endangered wildlife species was done for the first time and prohibition of hunting of the endangered species was mentioned.
- (iv) Protection to some endangered plants like Beddome cycad, Blue vanda, Ladies slipper orchid, Pitcher plant etc. is also provided under the Act.
- (v) The Act provides for setting up of National Parks, Wildlife Sanctuaries etc.
- (vi) The Act provides for the constitution of Central Zoo Authority.
- (vii) There is provision for trade and commerce in some wildlife species with license for sale, possession, transfer etc.
- (viii) The Act imposes a ban on the trade or commerce in scheduled animals.

(ix) It provides for legal powers to officers and punishment to offenders.

(x) It provides for captive breeding programme for endangered species.

Several conservation projects for individual endangered species like lion (1972), tiger (1973), crocodile (1974) and brown antlered deer (1981) were started under this Act. The Act is adopted by all states in India except J & K, which has its own Act.

Some of the major drawbacks of the Act include mild penalty to offenders, illegal wildlife trade in J & K, personal ownership certificate for animal articles like tiger and leopard skins, no coverage of foreign endangered wildlife, pitiable condition of wildlife in mobile zoos and little emphasis on protection of plant genetic resources.

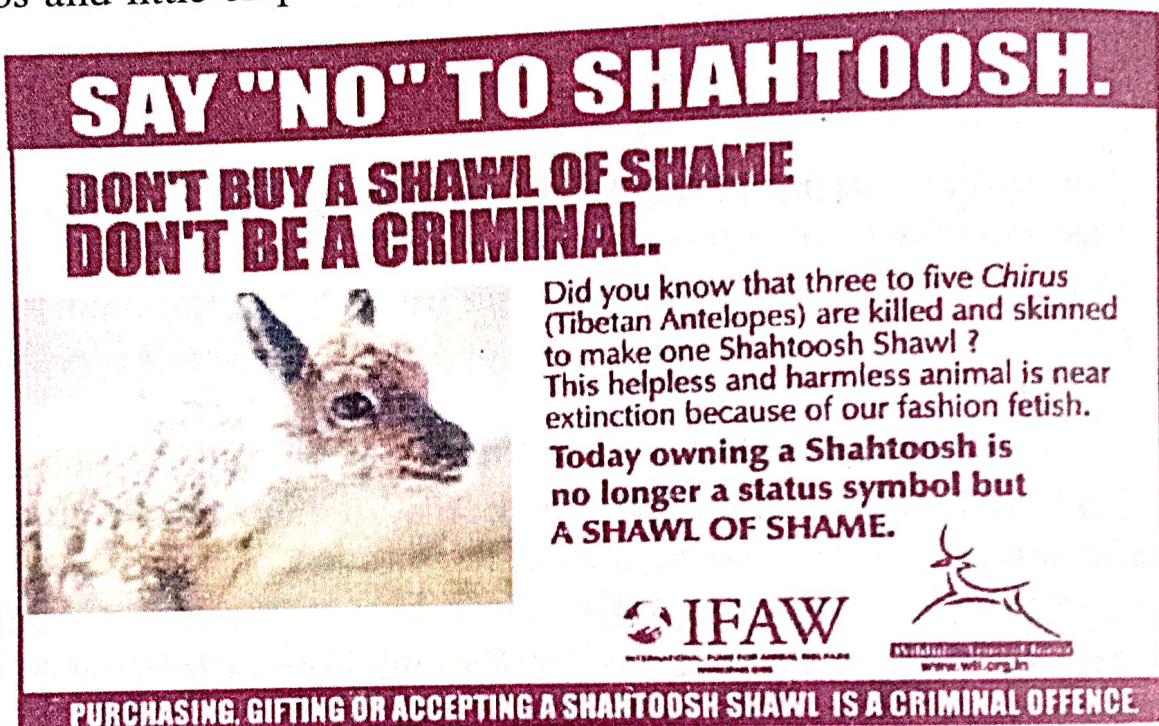


Fig. 6.12 An advertisement for Public notice and awareness

6.16.2 FOREST (CONSERVATION) ACT, 1980

This Act deals with the conservation of forests and related aspects. Except J & K, the Act is adopted all over India. The Act covers under it all types of forests including reserved forests, protected forests or any forested land irrespective of its ownership.

The salient features of the Act are as follows:

(i) The state government has been empowered under this Act to use the forests only for forestry purposes. If at all it wants to use it

in any other way, it has to take prior approval of central government, after which it can pass orders for declaring some part of reserve forest for non-forest purposes (e.g. mining) or for clearing some naturally growing trees and replacing them by economically important trees (reforestation).

(ii) It makes provision for conservation of all types of forests and for this purpose there is an advisory committee which recommends funding for it to the central government.

(iii) Any illegal non-forest activity within a forest area can be immediately stopped under this Act.

Non-forest activities include clearing of forest land for cultivation of any type of plants/crops or any other purpose (except re-afforestation). However, some construction work in the forest for wildlife or forest management is exempted from non-forest activity (e.g. fencing, making water-holes, trench, pipelines, check posts, wireless communication etc.)

1992 Amendment in the Forest Act

- In 1992, some amendments were made in the Act which made provisions for allowing some non-forest activities in forests, without cutting trees or limited cutting with prior approval of central government. These activities are setting of transmission lines, seismic surveys, exploration, drilling and hydroelectric projects. The last activity involves large scale destruction of forests, for which prior approval of the centre is necessary.
- Wildlife sanctuaries, national parks etc. are totally prohibited for any exploration or survey under this Act without prior approval of central govt. even if no tree-felling is involved.
- Cultivation of tea, coffee, spices, rubber and plants which are cash-crops, are included under non-forestry activity and not allowed in reserve forests.



Fig. 6.13 Tea plantation in hills. In reserve forests it is considered a non-forest activity and hence prohibited.



Fig. 6.14 Growing Mulberry tree for silk worm rearing is a non-forest activity.

- Even cultivation of fruit-bearing trees, oil-yielding plants or plants of medicinal value in forest area need to be first approved by the central govt. This is because newly introduced species in the forest area may cause an imbalance in the ecology of the forest. If the species to be planted is a native species, then no prior clearance is required.
- Tusser cultivation (a type of silk-yielding insect) in forest areas by tribals as a means of their livelihood is treated as a forestry activity as long as it does not involve some specific host tree like Asan or Arjun. This is done in order to discourage monoculture practices in the forests which are otherwise rich in biodiversity.
- Plantation of mulberry for rearing silkworm is considered a non-forest activity. The reason is same as described above.
- Mining is a non-forestry activity and prior approval of central govt. is mandatory. The Supreme Court in a case *T.N.*

Godavarman Thirumulpad Vs. Union of India (1997) directed all on-going mining activity to be ceased immediately in any forest area of India if it had not got prior approval of central government.

- Removal of stones, bajri, boulder etc. from river-beds located within the forest area fall under non-forest activity.
- Any proposal sent to central govt. for non-forest activity must have a cost-benefit analysis and Environmental Impact Statement (EIS) of the proposed activity with reference to its ecological and socio-economic impacts.

Thus, the Forests (Conservation) Act has made ample provisions for conservation and protection of forests and prevent deforestation.

6.16.3 WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974

It provides for maintaining and restoring the wholesomeness of water by preventing and controlling its pollution. Pollution is defined as *such contamination of water, or such alteration of the physical, chemical or biological properties of water, or such discharge as is likely to cause a nuisance or render the water harmful or injurious to public health and safety or harmful for any other use or to aquatic plants and other organisms or animal life.*

The definition of water pollution has thus encompassed the entire probable agents in water that may cause any harm or have a potential to harm any kind of life in any way.

The salient features and provisions of the Act are summed up as follows:

(i) It provides for maintenance and restoration of quality of all types of surface and ground water.

(ii) It provides for the establishment of central and state boards for pollution control.

(iii) It confers them with powers and functions to control pollution.

The Central and State Pollution Control Boards are widely represented and are given comprehensive powers to advise, coordinate and provide technical assistance for prevention and control of pollution of water.

(iv) The Act has provisions for funds, budgets, accounts and audit of the Central and State Pollution Control Boards.

(v) The Act makes provisions for various penalties for the defaulters and procedure for the same.

The main regulatory bodies are the Pollution Control Boards, which have been conferred the following duties and powers:

Central Pollution Control Board (CPCB):

- It advises the central govt. in matters related to prevention and control of water pollution.
- Coordinates the activities of State Pollution Control Boards and provides them technical assistance and guidance.
- Organizes training programs for prevention and control of pollution.
- Organizes comprehensive programs on pollution related issues through mass media.
- Collects, compiles and publishes technical and statistical data related to pollution.
- Prepares manuals for treatment and disposal of sewage and trade effluents.
- Lays down standards for water quality parameters.
- Plans nation-wide programs for prevention, control or abatement of pollution.
- Establishes and recognizes laboratories for analysis of water, sewage or trade effluent sample.

The State Pollution Control Boards also have similar functions to be executed at state level and are governed by the directions of CPCB.

- The board advises the state govt. with respect to the location of any industry that might pollute a stream or a well.
- It lays down standards for effluents and is empowered to take samples from any stream, well or trade effluent or sewage passing through an industry.
- The state board is empowered to take legal samples of trade effluent in accordance with the procedure laid down in the Act. The sample taken in the presence of the occupier or his agent is divided into two parts, sealed, signed by both parties and sent for analysis to some recognized lab. If the samples do not conform to the prescribed water quality standards (crossing maximum permissible limits), then 'consent' is refused to the unit.

- Every industry has to obtain consent from the board (granted for a fixed duration) by applying on a prescribed proforma providing all technical details, along with a prescribed fee following which analysis of the effluent is carried out.
- The board suggests efficient methods for utilization, treatment and disposal of trade effluents.

The Act has made detailed provisions regarding the power of the boards to obtain information, take trade samples, restrict new outlets, restrict expansion, enter and inspect the units and sanction or refuse consent to the industry after effluent analysis.

While development is necessary, it is all the more important to prevent pollution, which can jeopardize the lives of the people. Installation and proper functioning of effluent treatment plants (ETP) in all polluting industries is a must for checking pollution of water and land. Despite certain weaknesses in the Act, the Water Act has ample provisions for preventing and controlling water pollution through legal measures.

6.16.4 THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981

Salient features of the Act are as follows:

(i) The Act provides for prevention, control and abatement of air pollution.

(ii) In the Act, *air pollution has been defined as the presence of any solid, liquid or gaseous substance (including noise) in the atmosphere in such concentration as may be or tend to be harmful to human beings or any other living creatures or plants or property or environment.*

(iii) Noise pollution has been inserted as pollution in the Act in 1987.

(iv) Pollution Control Boards at the central or state level have the regulatory authority to implement the Air Act. Just parallel to the functions related to Water (Prevention and Control of Pollution) Act, the boards perform similar functions related to improvement of air quality. The boards have to check whether or not the industry strictly follows the norms or standards laid down by the boards under section 17, regarding the discharge of emission of any air pollutant. Based upon analysis report consent is granted or refused to the industry.

(v) Just like the Water Act, the Air Act has provisions for defining the constitution, powers and function of Pollution Control Boards, funds, accounts, audit, penalties and procedures.

(vi) Section 20 of the Act has provision for ensuring emission standards from automobiles. Based upon it, the state govt. is empowered to issue instructions to the authority incharge of registration of motor vehicles (under Motor Vehicles Act, 1939) that is bound to comply with such instructions.

(vii) As per Section 19, in consultation with the State Pollution Control Board, the state government may declare an area within the state as “air pollution control area” and can prohibit the use of any fuel other than approved fuel in the area causing air pollution. No person shall, without prior consent of state board operate or establish any industrial unit in the “air pollution control area”.

The Water and Air Acts have also made special provisions for appeals. Under Section 28 of Water Act and Section 31 of Air Act, a provision for appeals has been made. An **Appellate Authority** consisting of a single person or three persons appointed by the Head of the State, the Governor, is constituted to hear such appeals as filed by some aggrieved party (industry) due to some order made by the state board within 30 days of passing the orders.

The appellate authority after giving the appellant and the state board an opportunity of being heard, disposes off the appeal as expeditiously as possible.

6.16.5 THE ENVIRONMENT (PROTECTION) ACT, 1986

The Act came into force on Nov. 19, 1986, the birth anniversary of our late Prime Minister Indira Gandhi, who was a pioneer of environmental protection issues in our country. The Act extends to whole of India. Some terms related to environment have been described as follows in the Act:

(i) **Environment** includes water, air and land and the interrelationships that exist among and between them and human beings, all other living organisms and property.

(ii) **Environmental pollution** means the presence of any solid, liquid or gaseous substance present in such concentration, as may be, or tend to be, injurious to environment.

(iii) **Hazardous substance** means any substance or preparation which by its physico-chemical properties or handling is liable to cause

harm to human beings, other living organisms, property or environment.

The Act has given powers to the central government to take measures to protect and improve environment while the state governments coordinate the actions. The most important functions of central govt. under this Act include setting up of:

- (a) The standards of quality of air, water or soil for various areas and purposes.
- (b) The maximum permissible limits of concentration of various environmental pollutants (including noise) for different areas.
- (c) The procedures and safeguards for the handling of hazardous substances.
- (d) The prohibition and restrictions on the handling of hazardous substances in different areas.
- (e) The prohibition and restriction on the location of industries and to carry on process and operations in different areas.
- (f) The procedures and safeguards for the prevention of accidents which may cause environmental pollution and providing for remedial measures for such accidents.

The power of entry and inspection, power to take sample etc. under this Act lies with the central government or any officer empowered by it.

For the purpose of protecting and improving the quality of the environment and preventing and abating pollution, standards have been specified under Schedule I-IV of Environment (Protection) Rules, 1986 for emission of gaseous pollutants and discharge of effluents/waste water from industries. These standards vary from industry to industry and also vary with the medium into which the effluent is discharged or the area of emission. For instance, the maximum permissible limits of B.O.D. (Biochemical Oxygen Demand) of the waste water is 30 ppm if it is discharged into inland waters, 350 ppm if discharged into a public sewer and 100 ppm, if discharged onto land or coastal region. Likewise, emission standards vary in residential, sensitive and industrial area. Naturally the standards for sensitive areas like hospitals are more stringent. It is the duty of the Pollution Control Board to check whether the industries are following the prescribed norms or not.

Under the **Environmental (Protection) Rules, 1986** the State Pollution Control Boards have to follow the guidelines provided under Schedule VI, some of which are as follows:

- (a) They have to advise the industries for treating the waste water and gases with the best available technology to achieve the prescribed standards.
- (b) The industries have to be encouraged for recycling and reusing the wastes.
- (c) They have to encourage the industries for recovery of biogas, energy and reusable materials.
- (d) While permitting the discharge of effluents and emissions into the environment, the state boards have to take into account the assimilative capacity of the receiving water body.
- (e) The central and state boards have to emphasize on the implementation of clean technologies by the industries in order to increase fuel efficiency and reduce the generation of environmental pollutants.

Under the Environment (Protection) Rules, 1986 an amendment was made in 1994 for Environmental Impact Assessment (EIA) of various development projects. There are 29 types of projects listed under Schedule I of the rule which require clearance from the central government before establishing.

Others require clearance from the State Pollution Control Board, when the proposed project or expansion activity is going to cause pollution load exceeding the existing levels. The project proponent has to provide EIA report, risk analysis report, NOC from State Pollution Control Board, commitment regarding availability of water and electricity, summary of project report/feasibility report, filled in a questionnaire for environmental appraisal of the project and comprehensive rehabilitation plan, if more than 1000 people are likely to be displaced due to the project.

Under the Environment (Protection) Act, 1986 the central government also made the Hazardous Wastes (Management and Handling) Rules, 1989. Under these rules, it is the responsibility of the occupier to take all practical steps to ensure that such wastes are properly handled and disposed off without any adverse effects. There are 18 hazardous waste categories recognized under this rule and there are guidelines for their proper handling, storage, treatment, transport and disposal which should be strictly followed by the owner.

The Environment (Protection) Act, 1986 has also made provision for environmental audit as a means of checking whether or not a company is complying with the environmental laws and regulations. Thus, ample provisions have been made in our country through law for improving the quality of our environment.

6.16.6 ISSUES INVOLVED IN ENFORCEMENT OF ENVIRONMENTAL LEGISLATION

We have seen that there are a number of important environmental laws in the form of Acts for safeguarding our environmental quality. But inspite of these Acts, we find that we are not able to achieve the target of bringing 33% of our land cover under forests. Still we are losing our wildlife. The rivers have been turned into open sewers in many places and the air in our big cities is badly polluted. The status of environment shows that there are drawbacks in environmental legislations and problems in their effective implementation.

Let us examine some important issues related to our Acts:

(a) Drawbacks of the Wildlife (Protection) Act, (1972)

- It seems as if the Act has been enacted just as a fallout of Stockholm Conference held in 1972 and it has not included any locally evolved conservation measures.
- The ownership certificates for animal articles (tiger, leopard skins etc.) are permissible which very often serve as a tool for illegal trading.
- The wildlife traders in Jammu and Kashmir easily get illegal furs and skins from other states which after being made into caps, belts etc. are sold or smuggled to other countries. This is so happening because J & K has its own Wildlife Act and it does not follow the Central Wildlife Act. Moreover, hunting and trading of several endangered species prohibited in other states are allowed in J & K, thereby opening avenues for illegal trading in such animals and articles.
- The offender of the Act is not subject to very harsh penalties. It is just up to 3 years imprisonment or a fine of ₹ 25,000 or both.

(b) Drawbacks of the Forest (Conservation) Act, 1980: This Act has inherited the exploitative and consumerist elements from the forest laws of British period. It has just transferred the powers from states to centre, to decide the conversion of reserve forest lands

to non-forest areas. Thus power has been centralized at the top. At the same time, the local communities have been completely kept out from the decision-making process regarding the nature of use of forest area. Very often, the tribals who lived in the forest and were totally dependent on forests retaliate when stopped from taking any resources from there and start criminal activities including smuggling, killing etc. The Act has failed to attract public support because it has infringed upon the human rights of the poor native people. They argue that the law is concerned about protecting the trees, birds and animals, but is treating the poor people as marginal. *Very poor community participation in the Act remains one of the major drawbacks which affects proper execution of the Act.* The forest-dwelling tribal communities have a rich knowledge about the forest resources, their importance and conservation. But, their role and contribution is neither acknowledged nor honoured.

Efforts are now being made to make up for the gaps in laws by introducing the principles of Public trust or Human rights protection.

DRAWBACKS OF POLLUTION RELATED ACTS

- The power and authority has been given to central government with little delegation of power to state governments. Excessive centralization very often hinders efficient execution of the provisions of the Acts in the states. Illegal mining is taking place in many forest areas. In Rajasthan alone, about 14000 cases of illegal mining have been reported. It becomes more difficult to check such activities at the central level.
- The provision of penalties in the Act is very insignificant as compared to the damage caused by the big industries due to pollution. The penalty is much less than the cost of the treatment/pollution control equipments. This always gives a loose rope to the industries.
- The Act has not included the “right to information” for the citizens. This greatly restricts the involvement or participation of the general public.
- The Environment (Protection) Act, 1986 regarded as an umbrella Act, encompassing the earlier two Acts often seems superfluous due to overlapping areas of jurisdiction. For instance Section 24 (2) of the new Act has made a provision that if the offender is punishable under the other Acts like

Water Act or Air Act also, then he may be considered under their provisions. Interestingly, the penalty under the older two Acts is much lighter than the new Act. So the offender easily gets away with a lighter punishment.

- Under Section 19, a person cannot directly file a petition in the court on a question of environment and has to give a notice of minimum 60 days to the central government. In case no action is taken by the latter, then alone the person can file a petition which certainly delays the remedial action.
- Litigation, particularly related to environment is very expensive, tedious and difficult since it involves expert testimony, technical knowledge of the issues and terminologies, technical understanding of the unit process, lengthy prosecutions etc.
- The state boards very often lack adequate funds and expertise to pursue their objectives.
- A tendency to seek to exercise gentle pressure on the polluter and out of the court settlements usually hinder the implementation of legal measures.
- For small units it is very expensive to install effluent treatment plant (ETP) or Air pollution control devices and sometimes they have no other option but to close the unit. The Act should make some provision for providing subsidies for installing treatment plants or common effluent treatment plants for several small units.
- The pollution control laws are not backed by sound policy pronouncements or guiding principles.
- The position of chairman of the boards is usually occupied by political appointees. Hence, it is difficult to keep political interference at bay.
- The policy statement of the Ministry of Environment and Forests (1992) of involving public in decision-making and facilitating public monitoring of environmental issues has mostly remained on paper.

Environmental policies and laws need to be aimed at democratic decentralization of power, community-state partnership, administrative transparency and accountability and more stringent penalties to the offender. There is also a need for environmental law education and capacity building in environmental issues for managers.