Environmental Impact Assessment-A Methodological Approach

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Abstract - Environmental Impact Assessment (EIA) is a key aspect of many large scale industrial applications. It is a method helps to analyze the potential environmental impacts of major developmental projects. Un fortunately both the process and the outcome of EIA can be difficult and confusing leaving local communities unsure as to how a development might affect them. This guide is intended as a broad introduction to the Environmental Impact Assessment .It is an useful technique for decision making to understanding of the environment indications including physical ,chemical, biological ,socio-economic components of total environmental concerns which could be integrated to analysis of the project costs and advantages. This activity should be undertaken early enough in the planning stage of projects for selection of environmentally compatible sites, process technologies and such other environmental safeguards. The basic steps immersed in EIA are screening, scoping, baseline data, impact identification, prediction, evaluation, mitigation, EIS preparation, review and environment audit, involving public participation at various steps. EIA can be formed into a useful tool to identify the environmental quality of areas but only if local people feel able to enroll with the process effectively.

Key words: screening, scoping, base line data, impact identification, prediction, evaluation, mitigation, EIS preparation

I. INTRODUCTION

The term environmental impact assessment, , has come to have a variety over the last several years (for example, see Rosenberg and others 1981, Bean lands and Duinker 1983, Hirst 1984, Larkin 1984). Here, we following, simple definition: environmental impact assessment (EIA) is the process of systematic identification and evaluation and potential effects of proposed projects, plans, programs or legislative actions relative to physical chemical and biological components of atmosphere .The present era of fast development and growth is aimed at raising the quality of human life by providing greater opportunities for jobs, better provisions of basic requirements and comforts, healthy environment ensuring physical and mental well-being of humans. Also growth and development lead to several environmental damages like pollution of the atmosphere depletion of natural resources, energy crisis, occupational health hazards , and global environmental problems like climate change ozone layer depletion, and loss of biodiversity. Thus, development is subjected to some environment impacts. Ii is realized that before a development project is going to be established, prediction and assessment of its impacts should be necessary , so that measures could be taken to reduce those impacts. This concept was formulated as a methodical procedure known as Environmental Impact Assessment (EIA).it is a procedure to plan some development activity with well-defined environmental goals so that damage due to the activity both during developmental stage and production stage have minimum impact on the natural system and the population in the area. The National Environmental Policy Act (NEPA) U.S.A. in 1969 first of all provided the environmental impact assessment guidelines through Council for Environmental Quality (CEQ).In India, the detailed notification of EIA was issued in the year of 1994 which the Ministry of Environment and Forests provided guidelines for project proponents to have EIA and prepare an Environmental Impact Statement prior to clearance of the project.

II. ENVIRONMENT IMPACT ASSESSMENT

The changes caused by a development project on the landscape and ecology of the area and on the quality of water and air along with that on various socio-economic aspects of human life is defined as impact. Impacts could be categorized in different manners:

(i) **Positive and negative impacts**: Some of the development actions have beneficial impacts while others

have deteriorative or adverse effects. Accordingly they are designated as positive and negative impacts.

For example, most development projects are aimed to raise the quality of life. Thus, there are usually positive socio-economic impacts like better employment opportunities, better infrastructure facilities, medical facilities etc, however sometimes the project has serious negative socio-economic impact, sometimes the project (e.g. a big inhabitants who are uprooted from their native place. Their displacement and rehabilitation are big issues to be tackled. Similarly, pollution caused by various emissions from a project has negative impact, whereas the same project could be useful from ecological point of view if involves development of vegetation or a forest that provides habitat for some wildlife. Thus, every project or development has certain positive and negative impacts, which has to be assessed.

(ii) Reversible and irreversible impacts

Some of the impacts caused by the development projects are for a short-term and could be reversed over a period of time by adopting appropriate control or remedial measures. For instance damage caused to a water body near the development area would be considered reversible if we are able to restore its quality using proper treatment technologies. However, if a development activity involves destruction of a forest and loss of habitat of some endangered or endemic species, it is an irreversible impact. Thus an irreversible impact is one which is a long-term impact that cannot be restored. Therefore, irreversible impacts should be very carefully assessed.

(iii) Light s moderate and severe impacts:

The magnitude of the impacts caused by a development projects needs to be assessed. It could it be light, moderate or severe. The magnitude of such impacts could be represented in different ways In different systems, different numerical scales could be taken. In the above example, a scale of 1 to 5 has been taken, where 1 is very little impact and 5 represents severe impact.

III. GOALS OF EIA

To satisfy the responsibilities towards the future generations as trustees of environment. To approve safe, healthy, productive, aesthetically ,culturally pleasant surroundings. To provide broad range of beneficial uses of environment without deterioration or effect on human health. To safeguard historical, cultural and natural heritage. To achieve a balance between population and resource consumption for a good standard living. To ensure sustainable development with minimum envir-onmental destruction.

IV. EIA METHODOLOGY

The various stages of EIA are screening, scoping, base line data, impact identification, prediction, evaluation, mitigation, EIS preparation, review and environment audit, involving public participation at different levels.

Screening

It is done to see whether the project needs an EIA authorization or not. Further, there are some restricted areas where generally development projects are not approved., *like* Coastal Regulation Zone (CRZ), Dahanu Taluka in Maharashtra, Aravalli range, Reserve forests etc.

Scoping

It involves determination of the extent of EIA required for the project proposal. Depending upon the project, basically two types of EIA may be carried out. When the **EIA** report is based on a particular seasonal data, it is called *rapid EIA.* When the EIA report is based on detailed seasonal data, it is called *Comprehensive EIA.*

Baseline data

It gives comprehensive picture of the overall environ-mental setting of the project area resembles any significant environmental item prior to initiation of the action; any potentially critical environmental change and knowledge about the site to the decision makers and analysts, who might be remarkable with the general project location.

The following environmental parameters are usually studied while preparing the baseline data:
Site project location and topography ,Regional demography such as number of population live in 10 and 50 kilometer radius; resource consumption pattern, Regional areas like historical and cultural heritage sites. For this archaeological or state register can be verified ,Geological aspects like Land form, soil type, landscape etc. are observed ,Hydrology deals with study of Groundwater and surface water resources ; water quality parameters, pollution issues etc. are studied, Meteorological parameters involve extreme Temperature wind speed and direction, dew point, atmospheric stability, rainfall, storms etc. are noticed, Ecology studied about The flora, fauna endangered species, ecological succession stage, functions of ecosystems etc. are recorded .

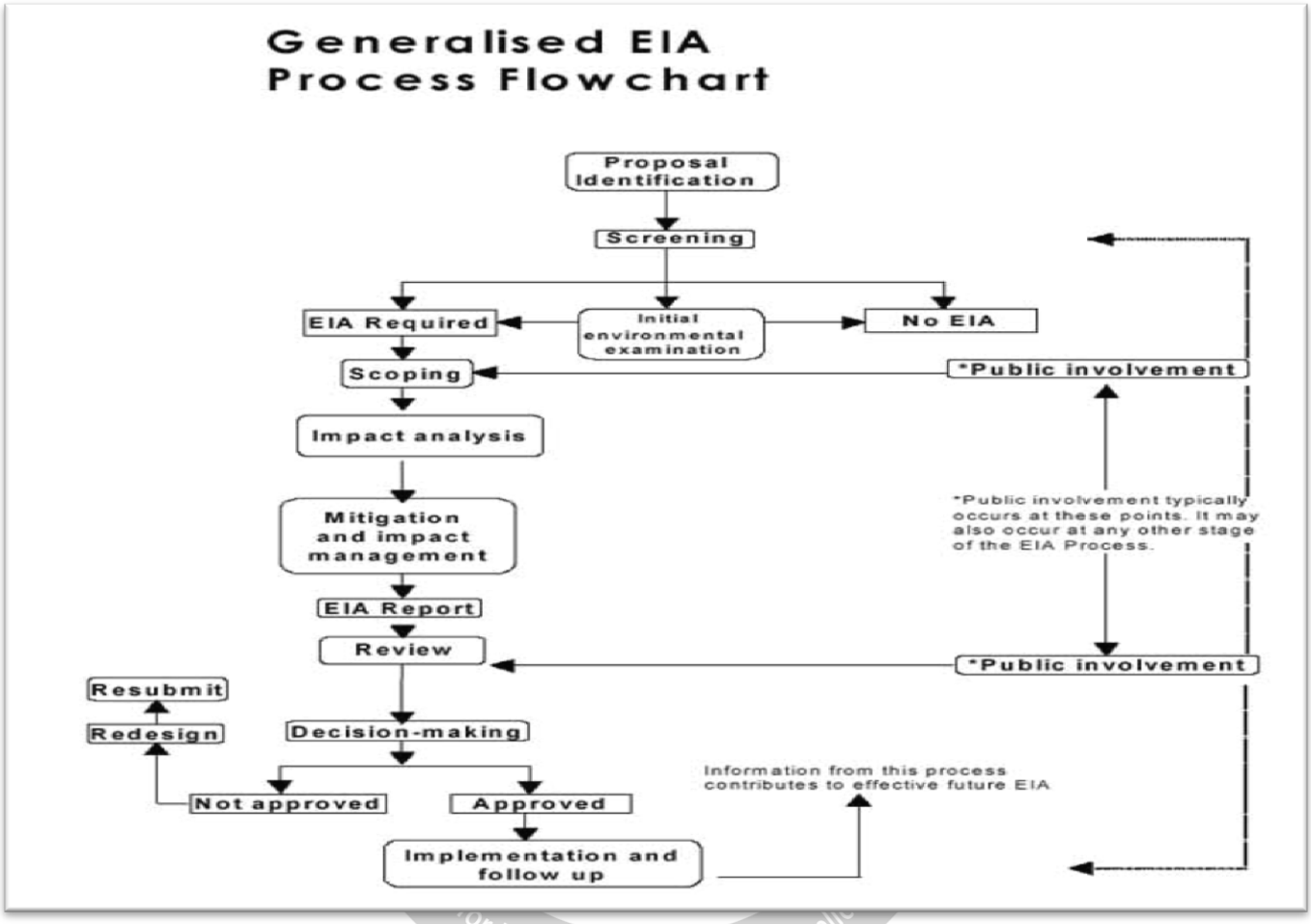
For a particular project, some of the parameters may be important while for others, some other parameters could be important.

Base-line data on the site location, geology, hydrology, meteorology, ecology and any historical or cultural heritage are collected by primary or secondary methods. **Primary data** is collected by actual visit to the site and study of various parameters, while **secondary data**

could be collected by consulting data available on the parameters from other sources

Secondary data collection

Various government agencies and boards have the relevant data available with them on a time-scale-basis. While Meteorological stations posses the data on annual rainfall ,humidity, temperature, evaporation, soil temperature ,wind speed and wind direction, the Agriculture Departments can make available the data on cropping patterns and irrigation. Archaeological Departments can provide us the required data on any historical or cultural heritage of the area. Base-line data on groundwater level, surface water resources are also available in various Water Boards. Census data provides useful base-line information on population, demography, socio-economic status, etc.



Primary data collection

This can be done by actual visit to the area and collection of data by survey method. Scientific methodology can be adopted for assessment of all relevant parameters and questionnaire method can be used to collect data on socio-economic aspects, occurrence of some diseases, information on some important natural, cultural or historical heritage, etc.

Use **of remote sensing and GIS for data acquisition:**

Satellite data available through remote sensing and use of Geographical Information System (GIS) are very useful modern techniques for acquisition of base line data on vegetation, land-use, land-cover, water bodies, major soil types, water-logging, deforestation, urbanization, irrigation systems, water resources, industrial growth etc. The data acquired on satellite imageries and digitized and overlaid by GIS to get a comprehensive account of various parameters. Ground trothing is however, necessary to confirm the interpretation of the images.

Impact identification:

It contains the details of project fundamentals and baseline environmental parameters to confirm the identification of full range of environmental problems .During identification process, the positive and negative, direct and **indirect** significant and insignificant impacts are assumed.

Impact prediction:

Here the magnitude of modifications going to occur due to the project are predicted by using mathematical models or mass balance models.

V. MECHANISTIC/MATHEMATICAL MODEL

The cause and effect relationships of various activities due to the project details are indicated in the form of a flow chart .The various components and their

relationships in the flow chart are then expressed in the form of mathematical equations. This is frequently done for predicting socio-economic impacts .We can predict the impacts of a thermal power plant or an industry by predicting how much emissions would be there and what would be the distribution/transmission pattern, that would affect people/flora/ fauna. Mathematical models are quite useful in making such predictions, which we include mathematical expressions of various important parameters influencing dispersal of the pollutants in the air under the prevailing meteorological and topographic conditions. Prediction of impact of a project on downstream water quality is also successfully carried out using mathematic models.

Mass-balance model:

This is regularly adopted where physical variations are involved. Here a system approach is taken and all inputs into a system are balanced by the outputs under steady state conditions. Thus, at steady state:

Inputs ($I, + I_2$ **+ 1$_3$)** + Outputs $P_I + 0_2 + 0_3$) = Zero

This works on materials balance theory. So while we know about the inputs, we can predict the outputs.

Impact evaluation:

It is done by consideration of the costs and benefits of the project . Long-term effects and side-effects of the project are also calculated. Indirect evaluation of environmental parameters are also finished, *e.g.*, loss of a endamic species of , degradation of a ponds etc.

Mitigation:

Once the impacts are predicted and evaluated, mitigation measures are to be recommended to avoid ,or minimize or rectify the adverse effect due to the project. Review and a draft impact statement is prepared at this particular stage.

Decision analysis:

Public occurrence is involved by arranging group discussion or by adopting questionnaire method to reach the decision about the project and its evaluation .

Environmental audit:

It contains the impacts predicted in EIS before the project was started and actual impacts after implementation of the project.

Environmental impact statement (EIS):

Based on the data acquired and review suggestions a final EIS is prepared as per the format provided by the Ministry of Environment and Forests development in our country .The EIS clearly mentions the main aim of the project, its envir-onmental damages, that are in avoidable, mitigation measures to reduce the effects, alternative to the proposed action etc.

Environmental Impact Statement (EIS)

The EIS is prepared by the project components at the time of project proposal submission , which is known as the *draft EIS.* After evaluation and review by the Impact Assessment committee , the *final EIS* is obtained. Some important statements are Effect on land involves land degradation and subsidence., clearance of forest habitats, Air pollution and dispersion pollutants along with possible health problems, Water pollution including surface water and ground water pollution which shown effect on aquatic life, Noise pollution due to the project depends on machinery , Loss of flora and fauna due to the project during construction. Socio-economic impacts including resettlement of people, cultural loss and health aspects, Risk analysis and disaster management plan, Recycling and reduction of solid waste ,Efficient use of inputs including energy and matter

VI. Conclusion

EIA is done with an aim to select the best alternative method through which adverse effect on the environment can be reduced or minimized without compromising with the economic and social benefits of the development project. Thus, the main purpose of EIA is precisely to evaluate the type and level of damage caused to surrounding environment in a well-defined remedial measures can be initiated on those aspects demanding the action at the right time.

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