May 2012

ENVIRONMENTAL ASSESSMENT GENERAL GUIDELINE

National Environment Commission
Royal Government of Bhutan

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Foreword

In 1999, the National Environment Commission published six sectoral environmental assessment guidelines for the mining, roads, industries, hydropower, power transmission lines and forestry sectors. These guidelines were intended to guide different project proponents through the process of acquiring an environmental clearance for their projects. These sectoral guidelines were later revised in the year 2003 to make them more practical and relevant to the Bhutanese context and also to streamline with the provisions of the Environmental Assessment Act 2000 and its Regulation 2002.

The revised sectoral guidelines of 2003 have played a very instrumental role in guiding the proponents and the sector agencies in the Environment Assessment (EA) process. However, these sectoral guidelines were long overdue for revision and through the World Bank IDF grant the guidelines were revisited and proposed for revision. All the relevant stakeholders were consulted several times for this revision and through the expert input from both local and international consultants the guidelines were revised to align with the changing government policies and rules and with the long-term objectives of protecting our pristine environment.

The NEC is grateful to the World Bank for their financial assistance to revise and update these guidelines. The revision and updating of these guidelines were accomplished through close consultation with all the relevant stakeholders. We would also like to express our gratitude and appreciation to all the ministries and stakeholders for their active participation, support and inputs. The NEC would also like to thank the team from the Centre for Science and Environment, New Delhi for their hard work and inputs in updating these guidelines especially Mr. Chandra Bhushan, Mr. Sujit Kumar Singh and Ms. Swati Singh Syambal. We are confident that the revised guidelines will be more useful documents that facilitate and expedite the environmental clearance process.

The environmental assessment process endeavors to mitigate and prevent undesirable impacts of developmental activities. It is in no way intended to hamper socio-economic development in Bhutan but to guide project proponents and sector agencies in making right investments in land, manpower, technology and mitigation measures to ensure that their projects have the least possible impacts on the environment. It’s the sincere wish and hopes of NEC that all the stakeholders’ make the best use of these guidelines, which in turn will help in protecting our fragile ecosystem. Sound implementation of these guidelines will go a long way in minimizing the negative impacts of developmental activities on Bhutan’s environment.

Dr. Ugyen Tshewang
Secretary, NEC

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List of Abbreviations

GDP	Gross Domestic Product
CA	Competent Authority
HQ	Headquarters
PM	Particulate Matter
USEPA	United States Environmental Protection Agency
GNI	Gross National Income
GNH	Gross National Happiness
FDI	Foreign Direct Investment

EC	Environmental Clearance
EA	Environmental Assessment
EIA	Environmental Impact Assessment
NEC	National Environment Commission
CSE	Centre For Science and Environment
RGoB	Royal Government of Bhutan
ToR	Terms of Reference
EMP	Environment Management Plan
NOC	No Objection Certificate
EMS	Environment Management System
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
TSS	Total Suspended Solid
TDS	Total Dissolved Solid
STP	Sewage Treatment Plant
ETP	Effluent Treatment Plant
FDM	Fugitive Dust Model
MEE	Multi-effect Evaporator
RO	Reverse Osmosis
BAT	Best Available Technology
SOx	Oxides of Sulphur
NOx	Oxides of Nitrogen
PM	Particulate Matter

CHAPTER 1

Introduction to development projects

1.1 Background

To balance industrial growth and environmental degradation, today development projects in most countries require an Environmental Impact Assessment (EIA). This holds true for Bhutan as well. It is regulated ***under the Environmental Assessment (EA) Act, 2000 and Regulation for Environmental Clearance of Projects 2002.*** The EA Act and its Regulation establishes procedures for the assessment of potential effects of strategic plans, policies, programs and projects on the environment, and for the determination of policies and measures to reduce potential adverse effects and to promote environmental benefits. According to the EA Act, Environmental Clearance (EC) is mandatory for any project/ activity that may have adverse impact(s) on the environment. The Regulation for Environmental Clearance of Projects 2002 defines responsibilities and procedures for the implementation of the EA Act concerning the issuance and enforcement of environmental clearance. According to the legal framework, the National Environmental Commission (NEC) is the nodal agency for administering and granting Environmental Clearance (EC).

The scope of the guideline is as follows:

- Provide guidance and assistance to various stakeholders involved in the EA process.
- Assist the regulatory agency and EIA practitioners to understand the main areas of concern and use that understanding to enhance the quality of the EIA study and report.
- Inform the regulatory agency and EIA practitioners about the best environmental management practices.
- Assist the regulatory agency to better assess the EIA report and arrive at a sound decision.

Box 1: Highlights of the FDI policy in Bhutan

- Foreign investors may hold up to 70 per cent of the equity
- Minimum project size of US$ 1 million in the manufacturing sector
- Minimum project size of US$ 500,000 in the services sector
- A total of 14 sectoral areas are open as follows:
    i. Mineral processing
    ii. Forestry and wood-based industries
    iii. Agriculture and agro-processing
    iv. Livestock-based industries
    v. Light industries including electronics
    vi. Engineering and power-intensive industries
    vii. Tourism including hotels
    viii. Transport services
    ix. Roads and bridges
    x. Education
    xi. Business infrastructure
    xii. Information technology
    xiii. Financial services
    xiv. Housing

Source: http://www.unescap.org/tid/publication/indpub2402_chap4.pdf

1.2 Introduction to Environmental Impact Assessment (EIA)

According to the United Nations Environment Programme's Division of Technology, Industry and Economics, an EIA is a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, finding ways and means to reduce the adverse impacts, shaping projects to suit the local environment, and presenting options to decision-makers.

An EIA can bring about both environmental and economic benefits, such as reduction in costs and time taken for implementation and design of a project and lesser intervention of legalities and regulations. A properly conducted EIA lessens conflicts by promoting community participation, informs decision-makers, and helps lay the base for environmentally sound projects *(See Box 2: Integration of EIA in the project cycle).*

1.3 Generic steps in the EIA process

The EIA process comprises of six key steps:

i. **Screening**: This first step helps decide whether an EIA is required for a project. An appropriately designed screening system can prove to be an effective tool to prevent the squandering of time and money on assessing projects with insignificant environmental impacts.

ii. **Scoping**: Scoping is considered the backbone of an EIA process, and is ideally undertaken at the project planning stage. The main objective of the scoping process is to establish the environmental and social priorities, set the boundaries for the study and define the Terms of Reference (ToR). Systematic and well planned scoping forms the basis of an effective and efficient EIA process. It also helps avoid unfocused and voluminous reports. Ideally, the role of scoping is to determine three key issues: a) Site alternatives, b) Design alternatives, c) Justifications for the project

iii. **Baseline data generation**: Baseline data provides a detailed description of the existing status of various environmental and social components in the study area. Both primary and secondary data is collected to describe this status.

iv. **Impact assessment**: In this step, the characteristics of potential impacts are identified, evaluated and predicted using

SCOPING HELPS FIND ANSWERS TO QUESTIONS LIKE:

- What are the issues to be addressed?
- How should one proceed with the EIA study?
- What is the extent of the analysis needed?
- What is the infrastructure needed?
- What kind of people should be involved in the assessment?

the baseline information on one hand and the features of the project on the other (cause-effect relationship). Impact predictions are normally done by using common methodologies and models. However, models should be used with care and prudence, as most of them are designed keeping in mind the requirements of the developed world; also, in most developing countries, the quality of data used to design these models is not always adequate.

v. **Mitigation of impacts**: At this stage, the possible preventive, remedial and compensatory measures for each adverse impact are determined and recommended.

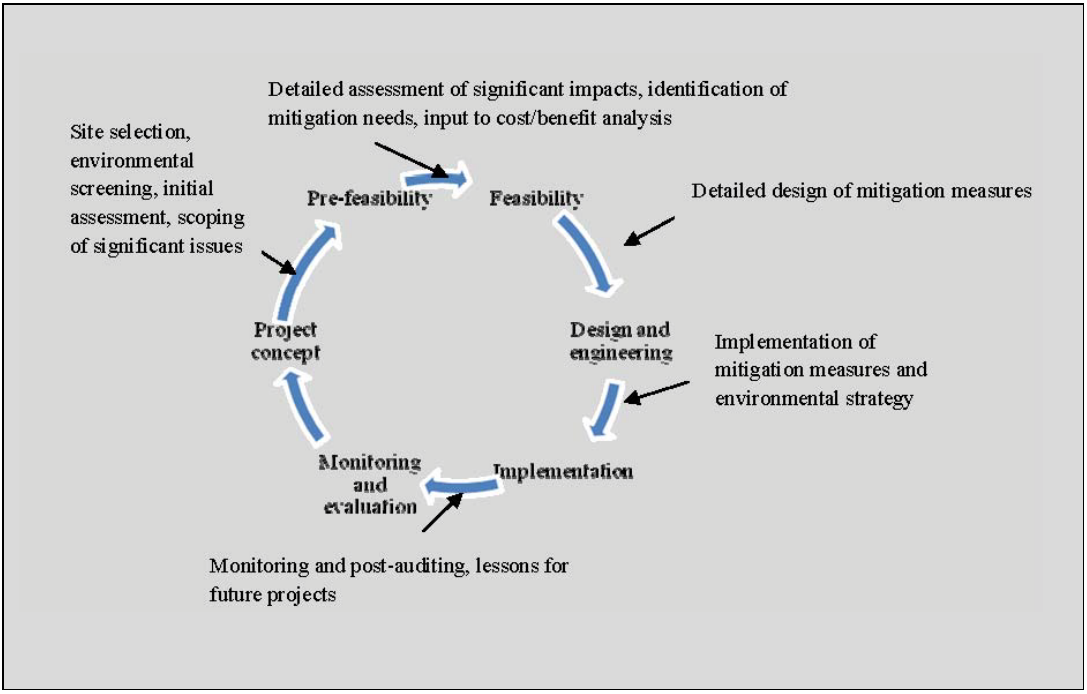
vi. **Environmental Management Plan**: An environmental management plan (EMP), also referred to as an impact management plan, is usually prepared as part of the EIA reporting process. It translates recommended mitigation and monitoring measures into specific actions that have to be carried out by the proponent. Depending upon specific requirements, the plan may be included in the EIA report or can be prepared as a separate document.

Box 2: Integration of EIA in the project cycle

A development project is accomplished in six stages: (1) Project concept (2) Pre-feasibility (3) Feasibility (4) Design and engineering (5) Implementation and (6) Monitoring and evaluation. Environment Impact Assessment plays an important role in every stage of this cycle. Most of the EIA activities take place during the pre-feasibility and feasibility stages. Between project concept and pre-feasibility stage, the EIA process involves site selection, screening, initial assessment and scoping on significant issues. Detailed EIA assessment starts at the project feasibility stage. This includes an evaluation of significant impacts, including the gathering of baseline information, prediction and quantification of impacts, and a review of the EIA by the regulatory agency.

Following these initial steps, environmental protection measures are identified, environmental operating conditions are determined, and environmental management is established. In the last phase of the feasibility study, the monitoring needs are identified, and an environmental monitoring programme and environment management plan are formulated.

Environmental monitoring is designed to generate information on the actual impact due to the project activity, compliance with environmental conditions and the effectiveness of the environmental mitigation measures. The environmental management plan, which describes the mitigation measures, is considered in the project cycle right from the implementation of the project (during construction, operation and maintenance); the plan's aim is to reduce the environmental impacts.



1.4 Good practices in EIA

An EIA should not be used just as a tool for obtaining an environmental clearance; rather, the project implementer should see it as a management tool for sound planning of projects. On the other hand, it should be the responsibility of NEC and the Competent Authorities to ensure that the project causes minimal environmental impacts and brings maximum social and economic benefits.

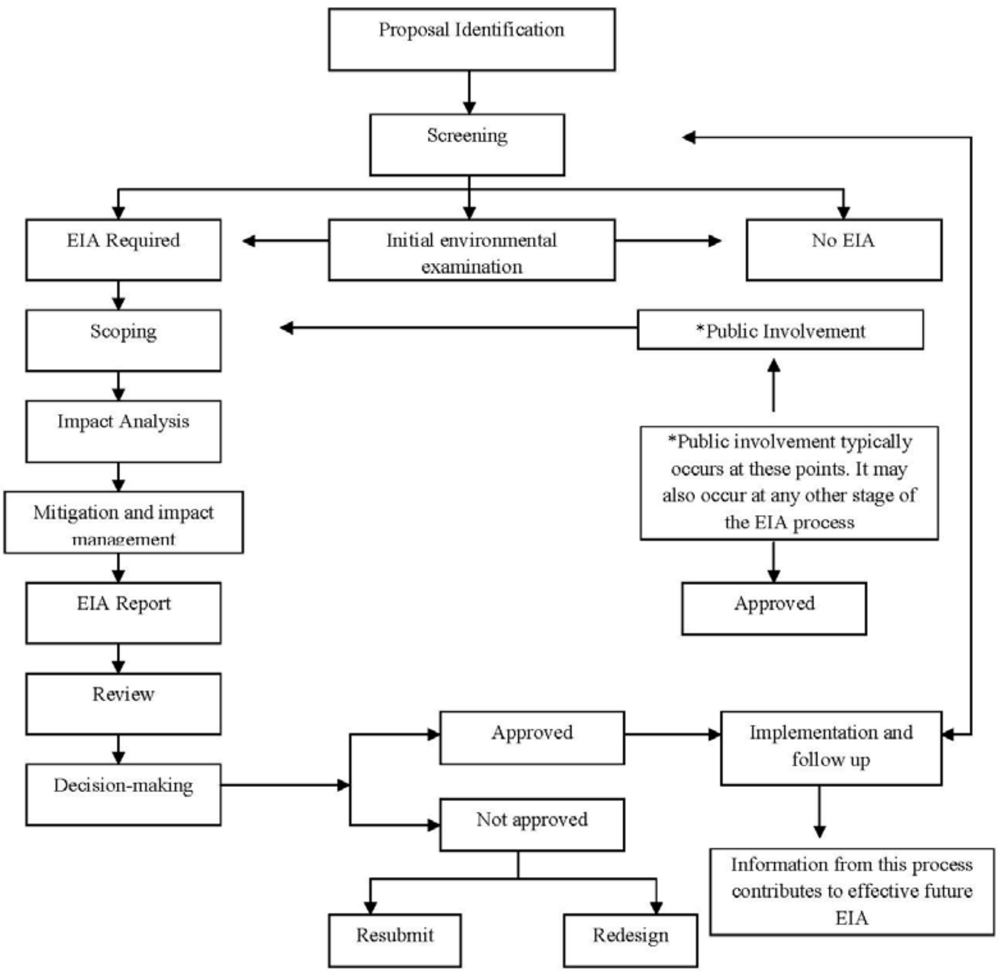
The effectiveness of the EIA process depends on many guiding factors – these include:

- The extent and kind of legal support it is getting in the host countries
- How the EIA is being conducted
- The stakeholders involvement at different stages
- The quality of the EIA report
- Accreditation status of consultants who prepare the EIA report
- Composition and skills of the review committee

As a good practice, it is always recommended to conduct an Initial Environmental Examination (IEE) of the project to determine if it requires an EIA or not. It is also advisable to involve the public from the very beginning from scoping process to the review of the EIA report (*See Figure 1.1: Best Practices in EIA*).It is also recommended to consider the size, scale, site sensitivity and pollution potential while deciding the study area, duration and scope of the EIA study.

Best practices in the EIA process include preparing a report which is comprehensive and focused, and contains only the significant parameters instead of data and information which are irrelevant to the overall assessment of the project. The extent of the assessment required should be decided after careful examination of likely impacts on the environmental and existing socio-economic settings at the project site.

Figure 1.1: Best practices in EIA



1.5 Environmental and socio-economic impacts of development projects

Just as two development projects are not identical in operation, process and environmental impacts, development projects are also not identical in terms of pollution potential. Some projects are reckoned as water polluting, some are air polluting, some are hazardous in nature or some are a combination of these. However, there are some impacts, which are almost similar in all projects irrespective of the type of development (*See Table 1.1: Potential impacts during the construction phase)*

The environmental and social impacts of a development project begin right from the initial stage of construction and increases manifold during the operational phase (*See Table 1.2: Potential impacts of a development project during project operation).* If the project operations are not properly monitored and regulated properly, then, there may be some environmental and social impacts, which may extend beyond the project's decommissioning.

In any development project, the scale of impacts will depend on the type, nature of project, location sensitivity and the scale of project. Air pollution is caused due to the release of emissions during site preparation, civil activities, storage yard and utilities. Land environment gets affected due to the disposal of liquid, solid and hazardous materials/wastes. Development projects also cause significant impacts on socio-economic environment, if the project requires large land areas for the project siting. Therefore, issues of displacement and loss of livelihood are key concerns, especially if the projects are proposed in populated areas. Moreover, if the land requirement is large, concerns such as impacts on biodiversity or changes in land use patterns also become significant.

Table 1.1: Potential impacts during the construction phase

Activities/Issues	Potential Impacts
Land acquisition	• Displacement and loss of livelihood. • Loss of common properties. • Loss of cultural heritage • Loss of productivity of land • Impacts on indigenous people, if applicable.
Site clearing/deforestation	• Change in land use pattern • Land degradation • Landslides due to slope failure. • Erosion and loss of topsoil • Siltation of water bodies • Loss of natural habitat and habitat fragmentation. • Impact on flora and fauna • Loss or change of local ecosystems.
Civil works such as earth moving and building of structures	• Dust pollution • Generation of wastewater and site runoff.

	• Increase in sediment load in the nearby water bodies • Noise pollution • Loss of scenic value of the landscape
Emissions from heavy equipment operation	• Air pollution • Noise pollution • Effects on health of workers and local residents
Disposal of construction wastes	• Water pollution • Effects on health of workers and local population
Noise from heavy equipment operation	• Noise pollution • Annoyance for workers and local population
Influx of construction workers	• Pressure on local resource. Increased demand on the existing infrastructure, electricity, water and energy. • Generation of sewage. • Risk of spread of communicable diseases.

Source: Industry & Environment Unit, Centre for Science & Environment, 2012

Table 1.2: Potential impacts of a development project during project operation

Activities	**Impacts**
Emissions from combustion, processes and utilities	***Point source emission:*** • Particulate emission. • Release of gaseous pollutants (SOx, NOx, VOCs) and toxic gases. • Emissions of heavy metal. • Reduces visibility. • Green house gas emissions (CO_2) • Odour and nuisance. • Ecological toxicity and health impacts. **Non-point source emission (fugitive dust):** • Fugitive emissions during loading, unloading, transportation and storage of raw materials and product.
Water resource	• Ground and surface water depletion. • Change in physical and chemical characteristics of the surface and ground water such as increase in turbidity, increase in organic load, change in colour, change in temperature due to effluent discharge, etc. • Contamination of river, streams, lake, ponds, etc • Decrease in ecological productivity of the receiving water • Metal toxicity (i.e. mercury, cadmium, lead, chromium, arsenic, etc.) • Contamination of water leads to causes diarrhoea, skin irritation etc.
Noise hazards	• Occupational hazards • Annoyance to the local community
Solid and hazardous wastes	• Impact on the environment - rivers, scenic areas, and roadsides. • Aesthetic impact. • Odour and nuisance.

	• Contamination of land and ground water due to leaching of heavy metals and organics. • Risk of corrosion and fire/explosion in case of corrosive and flammable substance. • Health impact due to poor management of waste.
Risk/disaster	• Onsite/offsite risk such as electrical risks, fire, explosion, process risks, fall from height and harmful chemical gases. • Road safety hazards.
Traffic	• Congestion/increased pressure on local roads.

Source: Industry & Environment Unit, Centre for Science & Environment, 2012

CHAPTER 2

Scoping

2.1 Introduction

The primary function of scoping also referred to as setting the Terms of Reference (ToR) of an EA, is to establish the environmental priorities and to set the boundaries for the study. The objective of the ToR is to make the assessment process concise and focused, and avoid creating a voluminous or data deficient report. The ToR provides the benchmark for data collection and limits the possibility of inefficiency in the EA process. It also acts as a benchmark to be used by the Competent Authority/NEC to decide whether the EIA report has been compiled after meeting all the requirements or not.

There are various tools that can be used for scoping, such as ***questionnaire checklists, network method, comparison with other similar projects, matrix and ad-hoc methods, etc***. The selection of scoping tools largely depends on the size of the project and the existing environmental and social characteristics of the project area.

Note: *The ToR given below is a generic one and can be framed as per the project requirements. While framing the ToR, ground realities, background information of the study area (such as population in and around the project site) and project-specific peculiarities,* applicable *laws, rules, guidelines and policies need to be considered to make the ToR relevant and precise. A site visit is also recommended before framing the ToR; this enhances the scope of the EA process and makes it more efficient. There may be a possibility that some parts of this ToR are not applicable for a given project.*

2.2 Terms of Reference (ToR) for a development project

The ToR should include the following conditions, details and components:

2.2.1 General information

- Executive summary of the project, which summarizes the project characteristics, environmental and social issues and the proposed mitigation measures.

- Information about the project proponent and his/her experience with following details (a) Name of the project (b) Name of the applicant (c) Present mailing address including telephone number, fax, and email (if any) (d) Name of the environmental focal person (e) (f) Telephone number of environmental focal person

- The justification for the project and consideration of alternatives.
- Project financial statement, project benefits and the project activity schedule.
- Name of organization/consultant preparing the EIA report, qualifications and experience of experts involved in the EA and report preparation.
- List of all regulatory approvals and No Objection certificate (NOC) required for the project and the status of these approvals.
- A declaration from the proponent stating that the information disclosed in the EIA report is correct**.**

2.2.2 Essential maps for EA

- A map specifying the location of the project.
- A study area map indicating features such as locations of human settlements, locations of other industries or other air and water polluting sources.
- A map specifying the land use patterns of the project site and study area.
- A map specifying location of rivers, existing roads, drainage system, protected area boundaries, Dzongkhag HQ, important installations, international border, and existing infrastructure, wherever applicable.
- A contour map (at 2 or 3 m interval) of the project site.
- A map clearly delineating the locations of various monitoring stations (ambient air and meteorology, water, noise and soil), if applicable.
- Layout plan of proposed site indicating the built up areas with covered construction such as buildings, recreational facilities, including access/approach roads, landscape, parking spaces and other infrastructures.
- Diagrammatic sketch and layout of the wastewater treatment plant, if any
- A layout map showing the solid and hazardous wastes disposal site, if applicable.

Note: Depending upon the type, size and location sensitivity, NEC can decide the study area and recommend appropriate scale for Environmental Assessment.

2.2.3 Project description

- Describe whether proposed land use is as per approved Master Plan/ Development plan of the area. If there is no approved plan, the consent from appropriate authority should be taken and should be submitted for Environment clearance. If an area is outside municipal limits /outside planning area, a full justification for the proposed development should be provided.

Resource requirement

- Details of the process/activities (with flow charts, *wherever applicable*) involved in the project, including the technology to be used. The EA should justify the selection of the technology with reference to resource conservation (energy and water) and pollution potential.

- Provide the following details, wherever it is applicable (a) Total site area (b) Total built up area (provide area details) and total activity area (c) Connectivity to the city , utilities and transportation networks and community facilities (d) Parking requirements

- Describe the list of raw materials to be used, their daily consumption, sourcing, and methods of storage.

- Describe, if any, hazardous chemicals, toxic or inflammable substances to be used, their quantities and storage methods. The material safety data sheet of each individual hazardous chemical should be annexed with the EIA report.

- Description of utilities and services, their capacities, and raw material requirement, if applicable.

- Details of energy sourcing and total energy requirement: If a captive power is proposed, the EIA report should provide the following details: capacity, daily or annual fuel consumption, pollution potential and its management plan.

- Water requirement: This will include sourcing of water, quantities sourced, and daily water consumption in kilolitres per day, quantity of effluents generated, and quantity of wastewater recycled/reused and discharged.

- Details of the workforce to be employed in the project and the working hours

2.2.4 Activities for site preparation

Information on existing land use patterns in the study area

- Area acquired for the proposed project and the land use patterns at the project site and study area, with explanatory notes.
- Land ownership patterns of the acquired land (if project is coming in an approved industrial estate then it is not applicable).
- Details of the topography of the study area, and local area hydrology.
- Details of water bodies such as lakes, ponds, springs, streams, natural drains and rivers in the study area and their distances from the project site.
- The boundaries of the nearest human settlement and its distance from the project site.
- Presence of any other industries in the study area, including the names, products manufactured, distances from the project site, etc.
- The flood plain boundary and floodability of the area: The EA should prepare flood hazard zonation mapping scale indicating the peak and lean river discharge as well as flood occurrence frequency, *if applicable*.
- Presence of sensitive areas (if any) such as forests, national parks, historical or archaeological sites, residential areas, parks or playing fields, tourist resorts etc. in the study area and their distances from the project site.

2.2.5 Baseline data

- *Data on ambient air quality:* This should include parameters such as PM10 and gaseous pollutants, and site-specific information on existing meteorological conditions such as temperature, humidity, rainfall and wind speed and direction, wherever applicable.
- Details of forest land diverted (if applicable).
- Ambient noise data at the project site, including the processes/ operations/ activities that are likely to generate noise. Information should also include areas

likely to be affected by noise as this is crucial from the occupational health point of view.

- In case treated effluents are disposed off in water bodies such as rivers or natural drain, then the water characteristics of the receiving water bodies, including details of downstream competitive users, if applicable.

- If treated effluent discharged in the river, the lists of aquatic flora and fauna present in the river.

- Information on potential sources (point and non-point emissions) of air pollution, including fugitive emissions from processes, material handling, storage sites and other sources that may generate fugitive dust.

- Information on probable sources of stack emissions, if applicable – the number of stacks, their diameter, exit temperature and flow rates, and the proposed pollutant concentration from the stacks including the type of pollution control equipment.

- Details of the quantity of solid/hazardous wastes likely to be generated.

- Information on estimated quantity and quality of effluents to be generated – quality of both treated and untreated effluents: The data should include information for parameters like Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), heavy metals and toxic chemicals (if applicable).

- Detailed information on existing natural drainage/run-off patterns at the project site and in the study area, if applicable.

- Estimation of groundwater flow in the study area, including the depth of groundwater in different seasons and aquifer characteristics, if applicable.

- Characteristics of topsoil, its thickness and estimates of total quantity of topsoil to be produced during land clearing; the EA should discuss the management plan for topsoil conservation and utilization in the EMP.

- Inventory of flora and fauna present at the project site and in the study area

- Surface and sub-surface water characteristics in the study area.

- Details of existing socio-economic status of the study area such as population density, human population close to the plant, economic profiles, literacy rates, common diseases, and infrastructure facilities available in the study area (such as conditions of roads, hospitals, educational institutes, water supply and sanitation) including displacement due land acquisition, if applicable.

2.2.6 Impact assessment

- Impacts of the construction phase of the project on ambient air, ambient noise, existing infrastructure and social structure.
- Impacts of the project operations and allied activities on ambient air quality.
- Impacts of fugitive emissions on workers and local community.
- Impacts of the project on water availability and quality of ground and surface water resources. If the project discharges its effluents into surface water bodies such as rivers, then the impact of this discharge on the quality of the receiving medium and its aquatic life.
- Impact of project on local area hydrology
- Impact of storm water on water bodies
- Impacts of noise on workers and the local community.
- Potential activities/operations likely to cause an impact on land.
- Impact of solid and hazardous waste on land and water sources, if applicable.
- Impacts on biodiversity: terrestrial and aquatic ecology (if any).
- Socio-economic impacts of the project.

Risk assessment

- Identification of risk-prone areas based on potential risks and mitigation measures for the same.
- Identification of processes/operations that have the potential to impact onsite/offsite emergency, if applicable.

2.2.7 Mitigation and Environmental Management Plan (EMP)

The EMP should discuss the mitigation measures to be taken against each impact, the timeline for completion, the responsible departments for implementation, the budget, post-monitoring provisions and the process of reporting to the concerned regulatory authority.

- Proposals for environmental management during initial stage of project construction, e.g. erosion and sediment control systems, noise and dust mitigation strategies, etc.

- Details of water pollution control, including justification of selection of treatment schemes, design criteria, size of treatment units and final discharge characteristics; tentative costs of the treatment plant, recurring expenditures and details of reuse of treated wastewater and efficiency of the wastewater treatment plant (the treated wastewater should confirm to prescribed national standards), if applicable.

- Information on air pollution control technology for reducing point source emissions, including justification of the selection of pollution control equipment (PCE), technical specifications of the PCE, its efficiency, tentative costs, recurring expenditures including the height of the stacks with justification, if applicable.

- Detailed management plan to reduce fugitive emissions during raw material and product handling, loading/unloading operations, transportation and storage -- this should be provided along with proper timelines and budgets. The project should also discuss the levels of mechanization incorporated in raw material and product handling, to ensure fugitive emissions remain well within the permissible limit.

- A mitigation plan to control run-off from raw material storage yards, if any. Provisions for covered storage yards for raw materials and products.

- Provisions for covered conveyor, bucket elevators or pneumatic transportation, wherever applicable.

- Details of mitigation measures for noise control, including noise abatement from equipments, operations and traffic.

- Detailed management plans to improve the road network or existing roads to meet the projected traffic densities, if applicable.

- Details of energy and water conservation measures.

- Detailed mitigation measures for the augmentation of groundwater resources (if the project is sourcing groundwater).

- A detailed mitigation plan for biodiversity protection and conservation (if the project is likely to impact biodiversity).

- Detailed management plan for solid and hazardous wastes, including information on design, leachate collection and treatment systems, in case a hazardous waste disposal facility is proposed at the project site, if applicable.

- Mitigation measures to prevent land and water contamination from raw materials and chemical storage site, if applicable.

- Details of the plant storm water collection and treatment system -- mitigation measures for storm water is crucial, especially if there is a river, agricultural land or a sensitive area adjoining the proposed project.

- A flood management plan to protect the plant and surrounding areas, if applicable.

- A plan for emergency preparedness, if any -- details of the expenditure to ensure safety and occupational health of the workers.

- Plan for the green belt development.

- Details of the parking spaces, and provision for canteen and rest rooms for workers and drivers.

- Road safety measures planned to reduce road accidents, if applicable.

- Best practices such as colour coding and labelling cleanliness to ensure safety and environmental compliance.

- The organizational set-up and requirement of manpower for environmental, health and safety management, including clear responsibilities.

- Documentation of impacts that cannot be mitigated, with proper reasons.

- A water assistance plan for the local community, in case it is affected by pollution or scarcity of water resources due to the plant’s operations, if applicable.

- Frequency of training and awareness programmes on environment and safety, and the annual budgets allocated for them.

Mitigation and EMP for socio-economic impacts

- *Preparation of a resettlement and rehabilitation plan (R&R), if displacement is involved:* The plan should include details of the compensation provided, including land-for-land compensation, employment or money; provisions at the resettlement colony (such as basic amenities including housing, educational facilities, infrastructure and alternate livelihood potential); a clear timeline for implementation; responsibility; budgets; grievance mechanism, etc.

- Public hearing issues raised and commitments made by the project proponent on the same should be included EIA reports in the form of tabular charts.

- The R&R plan should assess and take into consideration the impact of displacement on women and vulnerable communities such as landless labourers, tribals, etc., and prepare a detailed management plan to improve their status.

- A detailed compensation package for the community that is likely to lose its livelihood.

- Detailed EMP for improving and enhancing socio-economic conditions in and around the project site and the budgetary provisions.

CHAPTER 3

Impact Assessment

3.1 Introduction

The scientific and technical reliability of an EA study depends on the skills of the EA practitioners/reviewers, who estimate and review the nature and magnitude of the environmental change that the proposed project may entail. Impact prediction and evaluation is a vital exercise for assessing impacts, deciding alternatives, setting down mitigation measures and developing an environmental management plan. Predicting the magnitude of impacts and evaluating their significance is the core exercise of impact assessment. This process is also known as impact analysis and can be broadly broken down into three overlapping phases:

- *Identification*: To specify the impacts associated with each phase of the project and the activities undertaken
- *Prediction:* To forecast the nature, magnitude, extent and duration of the main impacts; *and*
- *Evaluation:* To determine the significance of residual impacts after taking into account how mitigation will reduce a predicted impact.

In assessing environmental impacts and their significance, some key concerns have to be kept in mind:

- Identity who or what is affected
- Description of how they are affected
- Evaluation against a set of consistent assessment criteria

Normally, in impact assessment, potential impacts can be categorized into various parameters ranging from its type and nature to magnitude and reversibility, each signifying its importance in impact prediction and decision making (*See Table 3.1: Parameters which determine impact characteristics*).

Table 3.1 Parameters which determine impact characteristics

Parameters	Description
Type	Positive or negative
Nature	Direct, indirect, cumulative
Magnitude or severity	Low, moderate, high
Timing	Short term, long term, intermittent, continuous
Duration	Temporary/permanent
Reversibility	Reversible/irreversible
Significance	Local, regional or global

Source: *EIA Training Resource Manual*, Second Edition 2002, United Nations Environment Programme (UNEP), p 263

Development projects have several environmental impacts, which have already been discussed in *Section 1.5Environmental and socio-economic impacts of development projects*. There are also some socio-economic and cultural impacts, which local communities feel most acutely in their everyday lives. It is, therefore, necessary that these impacts are given the prominence they deserve in the EA study, while describing the changes expected to result from major development projects. A consideration of socio-economic and cultural impacts should be integrated, wherever possible, into every discussion of physical and biological changes and not just treated separately as a minor issue.

3.2 Impact identification

In the EA of a development project, the potential impacts are globally well documented, and do not normally require extensive impact identification. However, there are some impacts such as displacement, loss of livelihoods, influence of topography and meteorology on water and air pollution, feasibility with respect to land use, geological characteristics, other sensitive receptors such as forest/biodiversity etc., which are site-specific and can only be identified once the data on them is available or generated. There are various tools that can be used for impact identification, such as questionnaires, checklists, network method, comparison with other similar projects, matrix and ad-hoc methods.

To ensure effective impact identification, one should always opt for a simple, logical and systematic approach. As a good practice in EA, it is always recommended to consider all potential project impacts and their interactions. At the same time, it is important to ensure that indirect and cumulative effects which may be potentially significant are not unintentionally omitted. All the identified impacts may not require a detailed analysis and evaluation – the level of detailing should match the scale, sensitivity and complexity of the impact. The choice of the chosen methodologies should reflect these criteria.

3.3 Impact prediction

Predictions of impacts are normally based on commonly used qualitative and quantitative methods and models. Expert judgment and comparison with similar projects can also be used for impact prediction. While there are a number of models for predicting impacts on physical environment (air, water and noise), modeling socio-economic and cultural impacts is difficult and is generally done through qualitative assessment or economic analysis. A model can be effective only if the input data is correctly inserted. The use of models, therefore, should be done with care and prudence considering factors like availability and reliability of data.

The sophistication of the prediction methods to be used should be kept in proportion to the 'scope' of the EA. For instance, a complete mathematical model of atmospheric dispersion should not be used if only a small amount of relatively harmless pollutants is emitted. However, if the project has very high air pollution potential then all possible modeling exercises should be done to predict the impact on ambient air quality. All prediction techniques involve assumptions and uncertainties. While quantifying and stating an impact, these assumptions should be clearly identified. Also, uncertainty of prediction in terms of probability and the margins of error should be mentioned. *Table 3.2* gives the list of general prediction models/methods used for assessing the impact of development projects.

Note: *For small development projects, instead of using sophisticated assessment models, the focus should be on mitigation measures and EMP.*

Table 3.2: General models/methods used for impact prediction

Impacts	Assessment method/model
Air quality(if applicable)	Air dispersion models • **ISCST 3** (appropriate for point, area and line sources; applicable for flat or rolling terrains; requires source data, meteorological data and receptor data as inputs). Note: *ISCST 3 is a common model widely used in India for the air pollution modeling* • **PTMAX** (screening model applicable for a single point source; computes maximum concentration and the distance of maximum concentration occurrence as a function of wind speed and stability class). • **PTDIS** (screening model applicable for a single point source; computes maximum pollutant concentration and its occurrence for the prevailing meteorological conditions; requires average meteorological data (wind speed, temperature, stability class etc.); used mainly to see the likely impacts of a single source. • Fugitive dust model (FDM)
Soil erosion(if applicable)	• Soil loss models such as revised universal soil loss equation (RUSLE)
Floods (if applicable)	• Peak flow hydrograph for rainfall-runoff events in large river basins or small urban watersheds • HEC-HMS • FLO-2D • TUFLOW
Ecology(if applicable)	• Ecological models • Comparative evaluation of conservation value • Expert opinion
Land use(if applicable)	• Map overlay techniques • Comparative valuation against structure and/or local plans
Noise	• *Dhwani:* For prediction of impacts due to multiple noise sources, developed by NEERI, Nagpur, India • SoundPLAN: Noise and air pollution planning and mapping software • FHWA (Federal Highway Administration): Noise impact due to vehicular movement on highways
Socio-economic	• Cost-benefit analysis

	• Metaphors and analogies: Experience gained in similar kinds of projects is used to predict the socio-economic impacts. • Extrapolative methods: Prediction based on the linear extrapolation of current trends. • Normative methods: Desired socio-economic goals specified, and an attempt made to project the social environment backwards in time to examine whether existing or planned resources and environmental programmes are adequate to meet the goals.
Potential risk and disaster	• Risk assessment

3.4. Impact evaluation

In impact evaluation, the predicted adverse impacts are judged for their significance. Therefore, the criteria for evaluating the significance of impacts and their effects should be set in advance (*See Box 3: Impact evaluation criteria*). The criteria for evaluating the significance should be based on local standards wherever possible. Where local standards are not available, acceptable international standards should be used (e.g. IFC, WHO or USEPA standards and guidelines of others countries, etc.). In all cases, the choice of the appropriate standard must be robust, defensible and relevant to the local situation. If there are no appropriate existing standards available, then the criteria should be developed and their use must be clearly explained in the EA. As a good practice in impact evaluation, it is better to use established procedures or guidelines, or relevant criteria which are comparable. While doing impact evaluation, it is equally important to understand the nature and characteristics of impacts on potential target areas, such as air, water, land, human beings, etc. to understand the significance, importance and intensity (*See Box4: Possible evaluation criteria for determining impact significance*). It is also essential to find out the answers to the following three questions:

- Are there residual environmental impacts?
- If yes, are these likely to be significant?
  If yes, are these significant effects likely to occur? Is the probability high, moderate or low?

Box 3: Impact evaluation criteria

- Comparison with laws, regulations or accepted national or international standards.
- Consistency with international conventions or protocols.
- Reference to pre-set criteria such as conservation or protected status of a site, features or species.
- Consistency with government policy objectives.
- Comparison with best practices
- Existing environmental and social stress in the area.
- Extent of impact on biodiversity.
- Acceptability to local community or general public.
- Severity of the impact (reversible or irreversible).

Box 4: Possible evaluation criteria for determining impact significance

- No impacts
- No significant impacts without or with available and practicable mitigative measures
- Impacts, but significance not quantifiable
- Significant impacts even with available and practicable mitigation measures
- Impacts cannot be mitigated

CHAPTER 4

Mitigation and Environmental Management Plan (EMP)

4.1 Introduction

Mitigation is the process of providing solutions to prevent impacts, or reduce them to acceptable levels.

The objectives of mitigation are:

- to enhance the environmental and social benefits of a proposal;
- to avoid, minimize or remediate the adverse impacts; and
- to ensure that the residual adverse impacts are kept within acceptable levels

A good industrial project should incorporate environmental and social alternatives at the initial stages of project development. However, there are some which can be managed only after impact identification and prediction.

Mitigation measures can be classified into structural and non-structural measures.

- ***Structural measures*** include design or location changes, engineering modifications and construction changes, landscape or site treatment, mechanization and automation, etc.
- ***Non-structural measures*** include economic incentives, legal, institutional and policy instruments, provision of community services and training and capacity building. Non-structural measures are increasingly being used now. They can be applied to reinforce or supplement structural measures or to address specific impacts.

An Environmental Management Plan (EMP) is a framework for the implementation and execution of mitigation measures and alternatives. It usually covers all phases of the project, right from pre-construction to the operation and maintenance phases of the industrial project. The plan outlines mitigation measures that will be undertaken to ensure compliance with environmental laws and regulations and to eliminate adverse impacts. The objectives of an EMP, thus, are:

- To ensure that mitigation measures are implemented
- To establish systems and procedures for this purpose
- To monitor the effectiveness of mitigation measures

- To ensure compliance with environmental laws and regulations
- To take any necessary action when unforeseen impacts occur

The EMP outlines:

- The technical work schedule to carry out the mitigation, including details of the required tasks and reports and the necessary staff skills and equipment;
- Detailed accounting of the estimated costs to implement the mitigation plan; and
- Planned operations or implementation of the mitigation plan, including a staffing chart and proposed schedules of participation by the members of the project team, and activities and inputs from various government agencies.

The EMP should also address the formation of a monitoring committee, with the objective of finding out whether different pollution-related issues and social development programmes related to health, education, roads, infrastructure, employment etc., are keeping to the time schedule or not. In case of a delay, the reasons for the delay need to be identified and suggestions made for removing them.

EMP and post-project monitoring

A good Environmental Management Plan should contain the following:

- A summary of all potential impacts.
- A detailed description of recommended mitigation measures.
- A time-line for implementation of mitigation measures.
- Resource allocation and responsibilities for implementation
- A programme for surveillance, monitoring and auditing.
- A statement of compliance with relevant standards.
- A contingency plan when the impacts are greater than expected.

An EMP should also incorporate a monitoring plan that is carefully designed and is related to the predictions made in the EA and to key environmental indicators. The EMP should also outline the need for monitoring, its duration and reporting procedures. The programme for surveillance, monitoring and auditing should clearly identify the following:

- Parameters for monitoring all significant impacts, including impacts on bio-diversity and socio-economic impacts
- Monitoring locations, including sample surveys, to assess the socio-economic impacts
- Frequency of monitoring

- Reporting frequency to the regulatory agency
- Provision for annual environmental and social audit of the project

4.2 Mitigation measures and EMP for a development project

Many environmental and social impacts in case of a development project can be avoided by appropriate site selection. In most cases, site selection is governed by presence of raw material, labour and market. However, in case of the significant impact on environment or people, there is always an option of changing the site in this sector.

The technology used in various activities and operations also has significant impact on the environment, especially with respect to pollution generation and resource consumption. The reviewer should encourage and ensure implementation of the Best Available Technology (BAT) in the activities/operations as well as pollution control and abatement. For instance, Total Dissolved Solid (TDS) containing wastewater is reluctant to physical and biological treatment methods – hence, based on the water quality appropriate treatment should be suggested such as:

As mentioned, consideration of alternatives be it raw material, technology or site – should be given serious consideration in preparation of a mitigation plan. In addition, other mitigation measures needs to be adopted for different kinds of impacts.

4.2.1 Mitigation measures during pre-construction stage

There can be considerable environmental impacts during the construction phase — mainly due to civil works such as site preparation, heavy earthmoving, vehicle movement, site level rising, RCC foundation, etc. Construction phase impacts are usually temporary and a localised phenomenon, except the permanent changes they might introduce in the local landscape and land use patterns at the project site. However, these impacts should be given due consideration wherever applicable and detailed protocol/procedures should be implemented to prevent/mitigate the adverse impacts and occupational hazards. These include:

- Provision of continuous water spray in case of un-metaled roads or where there is a likelihood of fugitive dust emission.

- Use of personal protective devices, such as earplugs and masks, to mitigate occupational health hazards must be encouraged.

- The construction site should be provided with mobile toilets, safe drinking water, medical facilities, etc. for the workers.

- The approach roads to the project site should be widened to facilitate vehicular traffic.

- Noise-prone activities should be restricted in the night, particularly during the period between 10 PM and 6 AM, in order to have minimum environmental impacts.

- The green belt area should be delineated before the start-up of the earthwork; tree plantation should be done in this area so that the trees can grow to a considerable size by the time of the commissioning of the proposed project.

4.2.2 Mitigation measures for land

- Land clearing activities should be minimal.
- Removing vegetative cover only from the specific site on which construction is to take place would check the impact of soil erosion.
- Removed soil should be used immediately in horticulture and gardening.
- In case the development project is coming close to a catchment area and receives heavy rainfall, there is potential to affect the river due to run off from the project site. In such a case, if it is not possible to go for an alternative, then following mitigation measures are recommended to reduce the impacts:

    i. The plan for catchment and site treatment should be formulated on the basis of natural drainage and run-off.
    ii. The locations of waste storage site and disposal area should be adjusted on the basis of site contour.
    iii. Storm water drains should be constructed all around the project, wherever applicable.

4.2.3 Mitigation measures for protection and conservation of sensitive locations

An alternative site is the best option for avoiding impacts on sensitive locations (such as forests, wildlife sanctuaries, rivers, lakes, ponds, national parks, archaeological sites, etc.). If an alternative site is not available, then the following measures are recommended:

- Buffer strips should be maintained between the project and the sensitive locations.
- Conservation plans should be prepared by experts in case of biodiversity-rich areas.
- Top priority should be accorded to enforcement and monitoring of impacts.
- In case the unit discharges its effluent in a river, it should take care the discharge does not affect the aquatic flora and fauna. If river flow is less during summer, plant should make other arrangements for disposing its effluent.

- Incorporation of best technology for air pollution control and adequate greenbelt development.
- Enforcement of stringent air emission standards.

4.2.4 General air pollution control measures

For the mitigation of air pollution refer *Table 4.1: Air pollution control measures*

Table 4.1: Air pollution control measures

Pollutant	Source	Mitigation
Fugitive dust	Loading, unloading, transport and open storage of solid materials; from exposed soil surfaces, including unpaved roads	• Use of dust control methods, such as enclosures, water suppression, or increased moisture content for open materials storage piles, including air extraction and treatment through a bag house or cyclone for material handling sources, such as conveyors and bins • Use of water suppression for control of loose materials on paved or unpaved road surfaces *(See Table 4.2: Fugitive emission controls and their efficiency).*
Particulate Matter (PM), if applicable	Main sources are the combustion of fossil fuels	• Fuel switching • Various control options: i. Fabric Filters- Applicability depends on flue gas properties including temperature (dry gas, <400F), chemical properties, abrasion and load. Typical air to cloth ratio range of 2.0 to 3.5 cfm/ft^2. Achievable outlet concentrations of 23 mg/Nm^3 **(99% efficiency)** ii. Electrostatic Precipitator (ESP) - Precondition gas to remove large particles. Efficiency dependent on resistivity of particle. Achievable outlet concentration of 23 mg/Nm^3 **(97-99% efficiency)** iii. Cyclone- Most efficient for large particles. Achievable outlet concentrations of 30 – 40 mg/Nm^3 **(74-95% efficiency)** iv. Wet scrubber- Achievable outlet concentrations of 30 - 40 mg/Nm^3 **(93-95% efficiency)**
SO_2, if applicable	Mainly produced by the combustion of fuels such as oil and coal	• Control system selection is heavily dependent on the inlet concentration. i. For SO_2 concentrations in excess of 10%, the stream is passed through an acid plant not only to lower the SO_2 emissions but also to generate high grade sulfur for sale. ii. For levels below 10%: **Absorption or 'scrubbing**,' where SO_2 molecules are captured into a liquid phase or adsorption, where SO_2 molecules are captured on the surface of a solid adsorbent. • Other control options are: i. Fuel switching (>90% efficiency) : Alternate fuels may include low sulfur coal, light diesel or natural gas with consequent reduction in particulate emissions related to sulfur in the fuel. Fuel cleaning or beneficiation of fuels

		prior to combustion is another viable option but may have economic consequences ii. Sorbent injection (30-70% efficiency): Calcium or lime is injected into the flue gas and the SO_2 is adsorbed onto the Sorbent iii. Dry flue gas desulfurization (70-90% efficiency) iv. Wet flue gas desulfurization (>90% efficiency): Produces gypsum as a by-product
NOx , if applicable	Associated with combustion of fuel. May occur in several forms of nitrogen oxide, namely: nitric oxide (NO), nitrogen dioxide (NO_2) and nitrous oxide (N_2O), which is also a greenhouse gas.	• Means of reducing NOx emissions are based on the modification of operating conditions such as minimizing the resident time at peak temperatures, reducing the peak temperatures by increasing heat transfer rates or minimizing the availability of oxygen
VOC, if allplcable	Equipment Leaks Handling of chemicals in open vats and mixing processes	• Implementing a leak detection and repair (LDAR) program that controls fugitive emissions by regularly monitoring to detect leaks, and implementing repairs within a predefined time period • Substitution of less volatile substances, such as aqueous solvents • Collection of vapours through air extractors and subsequent treatment of gas stream by removing VOCs with control devices such as condensers or activated carbon absorption • Collection of vapors through air extractors and subsequent treatment with **destructive control devices** such as: i. **Catalytic Incinerators**: Used to reduce VOCs from process exhaust gases exiting paint spray booths, ovens, and other process operations ii. **Thermal Incinerators**: Used to control VOC levels in a gas stream by passing the stream through a combustion chamber where the VOCs are burned in air at temperatures between 700º C to 1,300º C iii. **Enclosed Oxidizing Flares**: Used to convert VOCs into CO2 and H2O by way of direct combustion

Source: IFC 2007. Environmental, Health, and Safety General Guidelines

Table 4.2: Fugitive emissions controls and their efficiency

Control Type	**Control Efficiency**
Chemical Stabilization	0%-98%
Hygroscopic salts Bitumens/adhesives	60%-96%
Surfactants Wet Suppression- Watering	0%-68% 12%-98%

Speed Reduction Traffic Reduction	0%-80%
	Not quantified
Paving (Asphalt/Concrete) Covering with Gravel, Slag or Road Carpet Vacuum Sweeping	85%-99%
	30%-50%
	0%-58%
Water Flushing/Broom Sweeping	0%-96%

Source: IFC 2007. Environmental, Health, and Safety General Guidelines

4.2.5 Mitigation measures for protection and conservation of water resources

- Combined use of ground and surface water.
- Recycle and reuse of utility wastewater
- Use of closed type cooling towers (instead of the open loop type).
- Recharge of groundwater through rainwater harvesting and construction of water retention structures in the study area.
- Installation of water meters at strategic positions.
- Regular accounting of water balance to identify losses.

Wastewater management: The mitigation measures to prevent contamination of water resources by wastewater are as follows:

- Recycling and reuse of treated wastewater, wherever applicable.
- Adoption of best treatment option or appropriate treatment technology depending on the characteristic of the wastewater.

4.2.6 Mitigation measures for solid and hazardous wastes

- Construction waste should be used for filling low lying areas
- Sludge from wastewater treatment should be used as manure for horticulture or gardening subject to chemical characteristic. Based on chemical characteristics, the ETP sludge should be adequately disposed off. For example, if the sludge has hazardous characteristics, it should be disposed off in a sanitary landfill or at a common hazardous landfill site.
- Spent oil should be disposed off only through authorized vendors.
- Bio compositing of organic wastes, wherever possible

4.2.7 Chemical storage and management

- Underground storage tanks should be lined (preferably, double RCC lined).
- In case of chemical storage, especially that of hazardous chemicals, there should be RCC flooring coupled with embankments all around.
- Designated storage area with spill collection system.

- Underground storage of solvents or fuel is more practicable in cases where the water table is low. In case of high water table, storage above the ground is the best solution.
- Following are some of the management options for underground storage:
    i. Avoid storing highly soluble organic materials.
    ii. Assess the corrosion potential of soil.
    iii. For installing new structures, the storage site should be lined with impermeable liners or structures (such as concrete vaults) under and around the tanks, followed by monitoring ports at the lowest point of the liner or structure.
    iv. Location of the monitoring wells should be identified by considering the groundwater flow.
- Installation of fire fighting system.

4.2.8 Mitigation measures for socio-economic impacts

Displacement becomes a significant issue in the development project when land requirement is large. The best practices in land acquisition and R&R are as follows:

- Land should not be acquired without the consent of the majority of the project-affected population (PAP). The project proponent should receive ‘free, prior and informed consent’ from the PAP.

- Compensation for land should be based on the current market price.

- The R&R plan should be framed in consultation with the PAP.

- The PAP should have a say in the selection of the resettlement site and design of the housing and other infrastructure facilities.

- Basic amenities should be provided at the new resettlement site. This should include roads, safe drinking water, sanitation facilities, educational and health facilities, markets, community centers, playgrounds, etc.

- No physical displacement should be resorted to till the complete R&R package has been implemented.

4.2.9 Mitigation for risk and occupation safety

- The layout of the project should be such that the high-risk zones are separated from the low-risk zones. All high-risk zones must be easily accessible.
- Hazard and risk-prone areas should be identified and characterised by conducting risk assessment.

- Preparation of on-site emergency plan to meet any unforeseen events

Occupational safety

- Personal protective equipment (hand gloves, safety goggles, nose masks and helmets) to be provided to all the employees working in the plant.
- First aid facilities as well as safety equipment such as fire extinguishers and fire alarms to be made available at place of work.
- Medical examinations to be conducted for the workers from time to time. If significant occupational health problems are observed, the management should take appropriate measures.
- Identification and implementation of management procedures including process safety, training, incident investigation, employee participation, and contractor training.

4.2.10 Mitigation measures for noise

- Noise-prone areas at the project to be identified and clearly marked. Unauthorised persons should not be allowed entry in these areas. Workers engaged in these areas should be provided earplugs and muffs.
- Providing silencers or enclosures for noise-generating machines such DG sets, compressors, etc.
- The exposure time of workers should be reduced by practising work rotation.
- Green belt to be provided to act as noise attenuator.
- Regular maintenance of machinery,
- Anti-vibration mounts to be fitted on machines or enclosures.
- Walls to be fitted with sound-absorbing material.

4.2.11 Odour control measures: Techniques for prevention or minimization of odour include:

- Substituting odour-intensive substances with less impacting compounds
- Installing and modifying equipment to reduce use of odorous chemicals.

4.2.12 Others

- Separate environment or Environmental Health and Safety (EHS) department to look after environment, health and safety management.
- Provisions for parking, rest rooms and canteens for workers and drivers.

- Adoption of environment and safety management tools (such as ISO 14001 and 18001).
- The layout of the plant must ensure adequate space for green belt development.
- Height of the stacks should be optimum to ensure easy dilution and dispersion of pollutants, if applicable
- Use of display boards and colour coding should be practised.

CHAPTER 5

Review of an EIA report of a development project

5.1 Introduction

The purpose of reviewing an EIA report is to take decisions with respect to the following:

- Should the project be cleared in the form proposed by the project proponent?
- Should the project be modified to reduce the impacts and then cleared?
- Is the 'No project' option justified, considering the social and environmental cost?
- If the project is cleared, then what conditions may be prescribed for compliance during design, construction and operation of the project?

5.2 Composition of the EA review team

To ensure a proper review of the EIA report, the review committee should include experts from diverse fields with a good understanding of the development project and potential impact areas. The reviewers should be technically sound and competent enough to review the report. They should be able to make valuable suggestions/ recommendations to the project proponent for taking corrective action. Ideally, in the case of development projects, the team should comprise of the following experts:

- **A civil/mechanical/chemical/electrical engineer and experts** who are well versed with the project, activity, operation and associated technology and potential impacts of the development projects.
- **An environmental scientist/engineer** to overview the adequacy of mitigation options suggested for air, water and waste management.
- **A groundwater expert/hydrologist** to review and assess the hydrology of the study area and the drainage pattern.
- **A social science expert/anthropologist** to review the social issues and the resettlement and rehabilitation plan.
- **A biodiversity expert/botanist** who can review the biodiversity issues, biodiversity conservation and afforestation plan.
- **A geologist** to review the geological risks and associated impacts.
- **A safety engineer and occupational health expert** who can review the levels of safety, mechanization, disaster management plans, occupational hazards and

mitigation strategies to combat these hazards at the planning and operational stages.
- **Nominees** of the regulatory agency.

5.3 Reviewing an EIA report of a development project

While reviewing the EIA report, the following key aspects needs to be carefully examined:

- Has the EIA report evaluated the beneficial and adverse impacts of the project properly and clearly?
- Which are the unavoidable adverse impacts? Are they acceptable?
- Is the proposed mitigation plan sufficient to manage and control all adverse impacts?
- What kinds of safeguards need to be incorporated to ensure that the mitigation plan is implemented effectively?
- What are the parameters which need to be monitored during project construction and operation so that the state of the environment can be studied throughout the project life?
- Is the project acceptable to the local communities?
- Are the concerns of the local communities genuine and has the EIA report adequately addressed these concerns?
- Will the project improve the socio-economic status of the local communities?

Guidelines for using the reviewer checklist:

By using the *reviewer checklist for a development project*, the reviewer will be able to gauge the acceptability of the EIA report. This can eventually assist in determining the environmental feasibility of the project being assessed.

Scorecard approach: The checklist is designed to follow a "scorecard" approach, using a possible scoring range of 0-10. Scores for each relevant item in the checklist are totaled, and a calculation of the percentage of the total possible score is made.

Relevance: The checklist is a generic checklist for the development projects. Not all questions may be relevant to all the development projects. Therefore, the first step is to determine the ***relevance*** of each question, for the specific project being considered. For each question that is relevant, "1" is entered in the box under Column "A" of the checklist, "Is question relevant for *this* project?" Because the number of relevant parameters varies from project to project, the possible total score for each EIA report will vary accordingly.

Adequacy: It is then necessary to determine the ***adequacy*** of the EIA report in answering only those questions that are judged to be relevant. Under the "adequacy" heading (Column "B"), the reviewer is asked to assign a numeric score from 0-10. The numeric scoring for the various elements of the EIA report, based on their level of completeness, clarity, and quality, is as follows:

9-10: **Excellent:** Information provided is clear, comprehensive and detailed, with no gaps or weaknesses.

7-8: **Good:** Information provided is comprehensive, has only very minor weaknesses which are not of importance to the decision-making process.

5-6: **Adequate:** Information provided has some minor weaknesses, but the deficiencies do not strongly compromise the decision process; no further work is needed to add to the environmental information.

3-4: **Weak:** Information provided has gaps and weaknesses which will hinder the decision process; some additional work is needed to complete the information.

1-2: **Very poor:** Information provided has major gaps or weaknesses which would prevent the decision process from moving ahead; major work is required to rectify.

0: **Absent:** Information needed for decision-making is not included in the report, and needs to be provided in its entirety.

Importance: It is also necessary to determine the importance. In many cases, some of the issues is relevant for the project but is not very important or significant in impact assessment. For instance; name of project, project schedule is relevant for the project but it has not much importance in environmental and social impact assessment. Therefore, while assigning the value for ***importance***, reviewer should always keep in his/her mind the level of importance, a) relevant but least important, b) relevant but average important, c) relevant but most important.

In addition, for each relevant item, the reviewer is instructed to fill in comments for each relevant item. This should be made a mandatory procedure, so that the justification for assigning a specific value for adequacy as well as importance is well documented. For those items where the information provided in the EIA report is not adequate, it should be indicated in the far-right column what types of information are still required, in order to adequately address the question.

As a rule of thumb, an EIA report achieving a score in the range of 50-60% or higher should be considered acceptable. Borderline scores, or scores much lower than this limit, indicate that the EIA report is likely not acceptable. It should be noted, that while this design (i.e., using a numeric scorecard, and requiring reviewers to provide comments and justifications for their itemized determinations) is intended to minimize subjectivity, this "semi-quantitative" approach cannot totally eliminate all subjectivity from the review process, because the assignment of numeric scores is itself, by nature, a subjective process.

At the end of each section of the checklist, space is left for "other questions." The space provided here may be used to elaborate on the listed questions in each section (referencing the question number), or to add questions that may have specific relevance for the project being reviewed.

Overall Evaluation: There are six components that need to be evaluated to give the total score.

1. Applicant Information
2. Project Description
3. Baseline information
4. Impact Assessment
5. Mitigation and Environmental Management Plan (EMP)
6. Other Requirements

The final section of the checklist provides a framework for giving an overall evaluation of the EIA report. Each topic covered in the checklist is assigned a score, from 1-10, according to the same system used in the main section of the checklist. The resulting value provides a further basis for determining whether or not the environmental information presented is adequate ("acceptable" or "not acceptable") for making an informed determination about the quality of the EIA report. This is simply a way to cross-check the results that were obtained through a detailed itemized review of the EIA report *(Refer reviewer checklist)*.