# 10. ENVIRONMENTAL MANAGEMENT PLAN

## 10.1 Introduction

The Environmental Management System (EMS) is designed to provide a process to ensure the Project's compliance with the applicable national and international laws and regulations.

This framework Environmental Management Plan ("EMP") will require further development to produce the final EMS for the construction and operation of the Plant.
The primary objectives of this EMS are as follows:

To establish minimum standards for an Environmental Management System for the Project
Provide a framework that can be customized into a site specific EMS following the conclusion of the Project development but prior to commencement of construction
Provide an EMS framework that will facilitate ISO 14000 certification at the Project site, if necessary

ISO 14001 provide guidelines that provides organizations with guidelines to develop appropriate environmental management practices, and where appropriate seek registration with a relevant certification establishment.

The following outline is based on the general requirements of an environmental management plan for this Project consistent with the requirements under the ISO 14001 standard.

1. Environmental policy
2. Planning
    - Environmental aspects
    - Legal and other requirements
    - Objectives and targets
    - Environmental management program(s)
3. Implementation and operation
    - Structure and responsibility
    - Training, awareness and competence
    - Communication
    - Environment management system documentation
    - Document control
    - Operational control
    - Emergency preparedness and response
4. Checking and corrective action
    - Monitoring and measurement
    - Non-conformance and corrective and preventative action
    - Records
    - Environmental management system audit
5. Management review

Specific monitoring requirements are outlined in Chapter 11.

## 10.2 Key Elements of the EMS

The key elements of the EMS areas follows:

- Assessing environmental effects (environmental aspects)
- Compliance with laws / regulations (legal and other requirements)
- Setting environmental objectives and targets
- Environmental management program(s)
- Structure and responsibility
- Training, awareness and competence
- Document control
- Emergency preparedness
- Reporting
- Audit and management review.

The EPC Contractor will be primarily responsible for maintaining the EMS during construction whilst the Chief Operating Officer of the Project Company will have primary responsibility for maintaining the EMS during the operations phase.

### 10.2.1 Assessing Environmental Effects (Environmental Aspects)

This Environmental Impact Assessment comprises the environmental assessments that has been carried out in relation to construction and operation (and future decommissioning) activities at the Project site. The assessment covers:

- Air emissions;
- Water intake and discharge;
- Waste characterization and inventory;
- Aesthetics;
- Noise;
- Consumption of chemicals, energy and other raw materials; and
- Labour and social issues.

Please refer to Chapter 7 of this ESIA Report for detailed review of the specific construction and operational impacts.

### 10.2.2 Compliance with Laws/Regulations

Approvals / permits / consents / licenses relating to the environment will be in place prior to construction and operational phases. The “permits-to-construct” and the “permits-to-operate” will be displayed at locations easily accessible to personnel operating at the Plant. The approvals / permits / licenses will include the following:

- Land use permits;

- Planning permission;
- Environmental approvals (discharge to air, discharges to water, transport of waste, etc.)
- Water intake permits; and
- Contract with special and approved for transport of hazardous material.

Securing the requisite approvals and permits will be the responsibility of the Project Company. Should any other approvals or permits be required for new activities, these will be obtained prior to the commencement of any such activities.

### 10.2.3 Environmental Compliance Targets and Objectives

There are a number of specific environmental objectives that relate to the construction and operation of the plant. The primary environmental objectives are as follows:

- Design, construct and operate its facilities in a manner that protects human health and minimizes the impact of its operations on the environment
- Strive for an injury-free work force and minimize environmental impact through implementation of programs in its facilities and the surrounding communities that reduce risks to employees, neighbors, the public at large and the environment
- The Project Company and EPC Construction Contractor will encourage and promote waste minimization, the sustainable use of natural resources, recycling, energy efficiency, resource conservation and resource recovery
- The Project Company will actively participate with the state and national governmental agencies to ensure that the development and implementation of environmental policies, laws, regulations and practices serve the public interest and are based on sound scientific judgment
- All employees are expected to work in a safe manner and comply with the company's Environmental policies and procedures. The Project Company should promote a culture that encourages each employee to be environmentally responsible.

The Project Company should develop and maintain written safety policies and programs to address known hazards at the plant. The KNO has very well documented safety operating procedures and manuals which the Project Company should replicate. Policy and program effectiveness and compliance should be regularly assessed

One of the most important components of these management systems is the *Environmental Performance Review*.

- The frequency of audits should be similar to the regime practiced at the KNO Plant
- Audit teams constituted by a multi disciplinary team including environmental professional. Engineers to promote a critical approach to the audit process
- When an audit is completed, the auditors report the findings to the site environmental management team and work with them to develop action plans to correct any deficiencies identified
- It is anticipated that Department of Petroleum Resources (Nigeria) will carry out

regular inspections of the Plant to ensure compliance with environmental regulations and permits.

### 10.2.4 Environmental Management Program

Specific environmental management programs and procedures will be in place prior to the commencement of construction and operation of the Plant. Procedures will include:

- Effluent Monitoring Procedures
- Stack Emission Monitoring Procedures
- Solid Waste Management Program (disposal and reuse procedures
- Emergency Response Procedures
- Environmental and Security Management.

Detailed provisions will be issued with the EPC Contractor (for the construction phase) prior to the start of construction. Detailed provisions for the operation phase will be issued by the Project Company prior to the completion of commissioning/operation start.

The programs should be reviewed according to the frequency specified in the document control system, or on an as-required basis following any incident, or non-compliance.

The solid waste management program is a key component of the environmental management program and it is presented in the following section as an example of an environmental management program.

**Solid Waste Management Program**

During both construction and operation phases, waste should be handled according to a waste management plan to be completed by the EPC contractor (for the construction phase) and the Project Company (for the operation phase) prior to the start of these phases.

The ESIA outlines waste management system requirements for construction and operation as follows:

- Individuals and the company must accept responsibility for waste generated
- Waste reduction at source, followed by recycling, reuse, or recovery are the preferred options
- Where options other than disposal are not feasible, destruction or treatment to render the waste non-hazardous should be the practice
- If the hazard cannot be eliminated, the waste should be contained in a secure manner and monitored to ensure it is not and will not be damaging the environment
- Wastes should be segregated and quantified so they can be effectively managed.
- The amount of waste disposed offsite will be kept to a minimum.

**Hazardous Waste Management**
Hazardous waste materials, such as catalysts, will be handed back to the suppliers for specialist disposal. All hazardous waste shipped from site will be subject to a waste manifest to track generation, transportation through licensed and approved contractors.

**Non-Hazardous Waste Management**
Non-hazardous industrial solid waste shall be stored in collection containers located within the plant site and will be appropriately identified with markings. These waste materials will be frequently removed in accordance with an agreed schedule by an approved and licensed contractor. A waste handling program should exist for all non-hazardous waste steams in order to avoid waste accumulation.

The monitoring program will ensure proper implementation of the management plan. Solid non-hazardous waste quantities and the location of (government approved) final disposal sites will be documented and the documentation kept for a minimum of 10 years.

### 10.2.5 Structure and responsibility

- All personnel working at the plant must be aware of their environmental responsibilities under the relevant national and international legislation, and all EPC contractors and operational staff members and contractors must undergo the Induction/Orientation Program, which should include a section on Environmental Awareness.
- Each Supervisor is responsible for the management of environmental issues in their respective sections
- The EPC contractor (during the construction phase) and the Plant Management (during the operation phase) will oversee the waste management system and find efficient ways to minimize the waste produced.
- The EPC contractor (during the construction phase) and the Plant Management (during the operation phase) are responsible for the co-ordination of the Environmental Management System.
- The EPC contractor (during the construction phase) and the Plant Management (during the operation phase) should have the overall responsibility for environmental performance at the site and should be required to assign dedicated resources to coordinate all aspects of the Environmental Management System.

### 10.2.6 Training, awareness and competence

Training of personnel to ensure awareness and knowledge of the relevant EHS provisions should be mandatory. The training program should cover:

- Fundamental understanding of the process plant operations
- Security of operations
- Incident Reporting
- Emergency Response and Notification
- Environmental Protection
- Site Hazards

- Personal Protective Equipment
- General Safety Rules & Safety Program
- Work Permit System/ Hazard Identification.

### 10.2.7 Document Control

Documentation and records system is central to the implementation of the EMS. The KNO has developed and operated a very effective and sophisticated documentation system which should be replicated by the Project following relocation of the process plant. The documentation system will include:

- Plant Operations manuals (KNO Plants 4,5 and 6 operations manuals updated to reflect conditions at the relocated plant)
- Compliance and monitoring records and reporting based on KNO format
- Incident reporting based on KNO format
- Training manuals (KNO Plants 4,5 and 6 training manuals updated to reflect conditions at the relocated plant)
- Training records
- Project records – building on KNO Plants 4,5 and 6 project records
- Materials Management System.

This document describes the different types of records systems for environmental management at the site.

### 10.2.8 Emergency Procedures

Specific emergency procedures must be developed by the EPC Contractor (for the construction phase) and the Project Company (for the operation phase) prior to the commencement of these phases. These procedures govern any emergency incidents at the Project site such as spills, fires, gas leaks etc. Emergency Response procedures should cover all anticipated emergency incidents.

### 10.2.9 Reporting

Full and detailed logs of the following incidents must be recorded:

• environmental limits breaches
• all major incidents.

In addition, all regulatory reporting and a full comprehensive annual EHS report should be included in the financial statements of the Project Company.

### 10.2.10 Auditing and Management Review

Auditing is an important component of the Environmental Management Systems consistent with ISO 14001. The audit of the EMS should be undertaken annually and should cover:

Verification of ongoing conformance with to all applicable laws and regulations
Confirmation of the continued efficacy of management systems to ensure compliance with

the applicable environmental standards
Identification of actual and/or potential environmental risks

The audit process will also assist management in identifying and prioritizing activities to enhance environmental compliance.

## 10.3 Occupational Health and Safety & Community Health and Safety

The Project Company will implement all reasonable precautions to protect the health and safety of its workers. Although this will primarily apply during the operations phase, the Project Company will also ensure that all contractors and sub-contractors employed at the Project site during the construction phase will put in place occupational health and safety policies to protect their workers.

The Project has been designed and located to be isolated from the community so the provisions usually required for plants located close to communities would be limited for this Project.

The emphasis should be placed on instituting preventive and protective measures in the following order of priority:

1. Eliminating the hazard such as using less hazardous chemicals wherever possible
2. Controlling the hazard primarily through the use of engineering control measures
3. Minimizing the hazard through the design and use of safe work systems such as training safe work procedures, lock-out and tag-out
4. Providing appropriate personal protective equipment ("PPE").

### Facility Design and Operation

1. *Integrity of Workplace Structures* – the plant buildings will be built and designed to be structurally sound, fire-resistant and noise-absorbing materials will be used for cladding on ceilings and walls, wherever possible, the large rotating equipment will be relocated from KNO in their dedicated modular buildings
2. *Standard Operating Procedures ("SOPs")* - will be designed for emergency evacuations and practice drills will undertaken, at least, annually
3. *Workspace and Emergency Exits* – adequate space will be provided for each worker, the number and capacity of emergency exits will be sufficient for the orderly evacuation of the maximum number of people and exits must be clearly marked to be visible in total darkness
4. *Fire precautions* – the plant will be designed to minimize fire incidents through the application of the relevant fire codes, fire detectors, alarm systems and fire-fighting equipment will be installed, as standard
5. *Lavatories and showers* – adequate facilities will be installed consistent with the number of workers expected to work at the plant
6. *Lighting* – the plant will be designed to maximize natural lighting and emergency lighting will be installed with automatic activation in the event of failure of the principal artificial light source
7. *Safe Access* – passageways for pedestrians and vehicles within the plant battery limits will be segregated for safe and easy access, equipment requiring servicing will be unobstructed and unrestricted for ready access.
8. *First Aid and medical facilities* – eye wash stations and well equipped first-aid stations will be provided throughout the Plant. A medical facility capable of treating trauma

and serious illnesses up to the point of transfer to hospital will be provided within the plant battery limits

9. *Air Supply* – sufficient fresh air should be supplied for indoor and confined work spaces
10. *Work environment temperature* – the temperature in work, rest room and other facilities will be maintained at levels appropriate for the facility during service hours.

**Communication and Training**

1. *OHS Training* – will be provided to all new employees to cover basic site rules, basic hazard awareness, safe work practices, personal protection and preventing injuries to other employees
2. *Visitor Orientation* – a visitor orientation and control program will be established to ensure visitors do not enter hazard areas unescorted
3. *New employee and contractor training* – all new employees and contractors will receive detailed training and information prior to working at the plant
4. *Area signage* – hazardous areas (electrical rooms, compressor rooms etc), emergency exits etc should be marked appropriately
5. *Hazard code communication* – copies of hazard coding system should be posted outside the facility, at emergency entrance doors and fire emergency connection systems. Information regarding the types of hazardous materials stored, handled or used at the facility should be shared proactively with emergency personnel and security personnel.

**Physical Hazards**

1. *Rotating and moving equipment* – the KNO rotating equipment have been designed to eliminate trap hazards and ensure that operators are kept out of harm's way during normal operating conditions. Guards should be designed and installed to conform with appropriate machine safety standards. The requisite turning off, disconnecting, isolating and de-energizing (Locked Out and Tagged Out) procedures will be adopted
2. *Noise* – no employee will be exposed to noise levels greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection and no unprotected ear will be exposed to a peak sound pressure level of 140 dB(C). The use of hearing protection will be actively enforced. The buildings design will incorporate the use of acoustic insulating materials where feasible
3. *Vibration* – workers exposure to vibration from hand and power tools and large equipment will be controlled through equipment selection, installation of vibration dampening pads and limiting the duration of exposure
4. *Electrical* – the plant will adopt the appropriate electrical safety measures for a facility of this nature to include marking all energized electrical devices with warning lights, locking-out and tagging-out all devices during service or

maintenance etc

5. *Eye Hazards* – the use of machine guards or splash shields and/or safety glasses or face shields (as appropriate) will be mandatory
6. *Welding/Hot Work* – the use of proper eye protection such as welder goggles and barrier screens will be mandatory. Hot work procedures will form an integral part of the Standard Operating Procedures for the plant.
7. *Industrial Vehicle Driving and Site Traffic* – right-of-way, site speed limits etc will be clearly established to control site traffic. Drivers will undergo training and licensing as well as frequent basic medical surveillance

**Chemical Hazards**

1. *Air Quality* – air quality will be regularly monitored consistent with the IFC guidelines outlined in Section 2
2. *Fire and Explosions* – prevention and control strategies for fires and explosions are outlined in Section 4.4
3. *Asbestos* – Agrium have confirmed that there is no residual asbestos containing materials in KNO plants 4, 5 and 6. The Functional Design Specification for the EPC Contractor prohibits the use of asbestos for the relocated plant construction.

**Biological Hazards**

1. Work processes, engineering and administrative controls will be designed, maintained and operated to avoid or minimize the release of biological agents into the work environment
2. Measures to eliminate and control hazards from known and suspected biological agents at work places will be maintained in close cooperation with local health authorities.

**Radiological Hazards**

1. Work places with occupational and natural exposure to ionizing radiation will be established and operated inn accordance with the appropriate international standards and guidelines
2. Exposure to non-ionizing radiation (such as static magnetic fields, static electric fields, radio frequency, microwave radiation, light and near-infrared radiation and ultraviolet radiation) will be controlled to internally recommended limits.

**Communication Systems**

1. Alarm bells, visual alarms will be used to alert workers and emergency services to an emergency
2. Alarm and warning systems will be tested at least annually
3. Plans and measures will be implemented to communicate a potential emergency to the community if the community is at risk from such potential emergency
4. Emergency information will be communicated to the media through trained local spokesperson and via formal press releases with accurate information and

appropriate level of detail for the emergency.

**Hazardous Material Release Mitigation, Implementation Strategies and Emergency Response Plan**

*Strategy 1: Promote public awareness of potential hazards associated with handling of toxic and hazardous substances.*

Implementation Actions

- Cooperate with the local community, Ikpobha-Okha local government, Edo State and federal agencies to develop and disseminate information about the location, types and amounts of hazardous substances to be handled by the plant.
- Communicate Emergency Response Plan to the local community, Ikpobha-Okha local government, Edo State and federal agencies with particular emphasis on hazardous material spill, fire and explosion.

*Strategy 2. Promote public knowledge of how to react to accidental hazardous material release, plant fire and explosions*

Implementation Actions

- Develop public education program to teach plant staff and the community about sheltering in place and developed emergency preparedness plans and kits.

- Develop evacuation plans for all areas within the plant and the potentially impacted community areas and provide public education about where to find evacuation information.

*Strategy 3. Develop emergency response capabilities in the event of an accidental discharge of toxic or hazardous substances.*

Implementation Actions

- Support training programs for first responders particularly process plant first aiders and the plant fire departments.

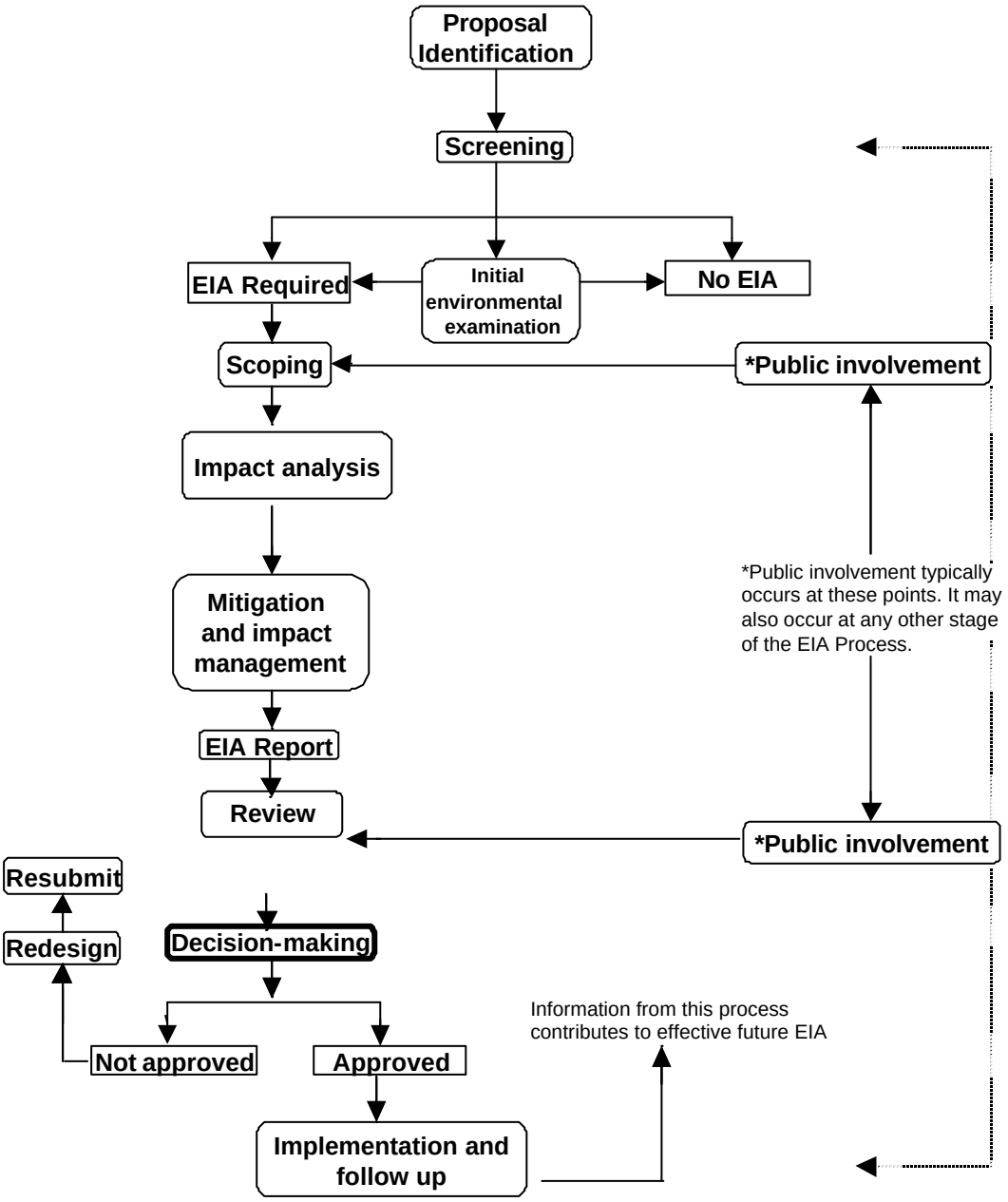
- The emergency response team should be capable of responding at the technician level, with support from additional responders trained to operations level.

- Conduct a hazardous materials risk analysis specific to the materials used and transported within and outside the plant.
- The construction phase emergency response plan will form an integral part of the

Construction Phase Site Rules to be completed prior to Construction Start – this document will be issued to and adhered to by all the contractors operating at the site.

- The operations phase emergency response plan will form integral part of the Plant Operations and Maintenance Manual to be completed prior to Plant Commissioning – this document will be issued to and adhered to by all the staff working at the plant.

# Decision-making in the EIA process



# EIA is a process to:

- gather information necessary for decision-making
- inform approval and condition setting
- help determine if a proposal is acceptable

# Decision-making is a process of:

- political choice between alternative directions
- weighing the benefits and costs
- negotiation, bargaining and trade-offs
- balancing economic, social and environmental factors

# Decision-makers need to understand:

- EIA aims and concepts
- EIA legislation, procedure and guidelines
- the effectiveness of EIA practice
- the limitations on EIA information
- how EIA process and practice measure up internationally
- issues of public consultation and third party challenges

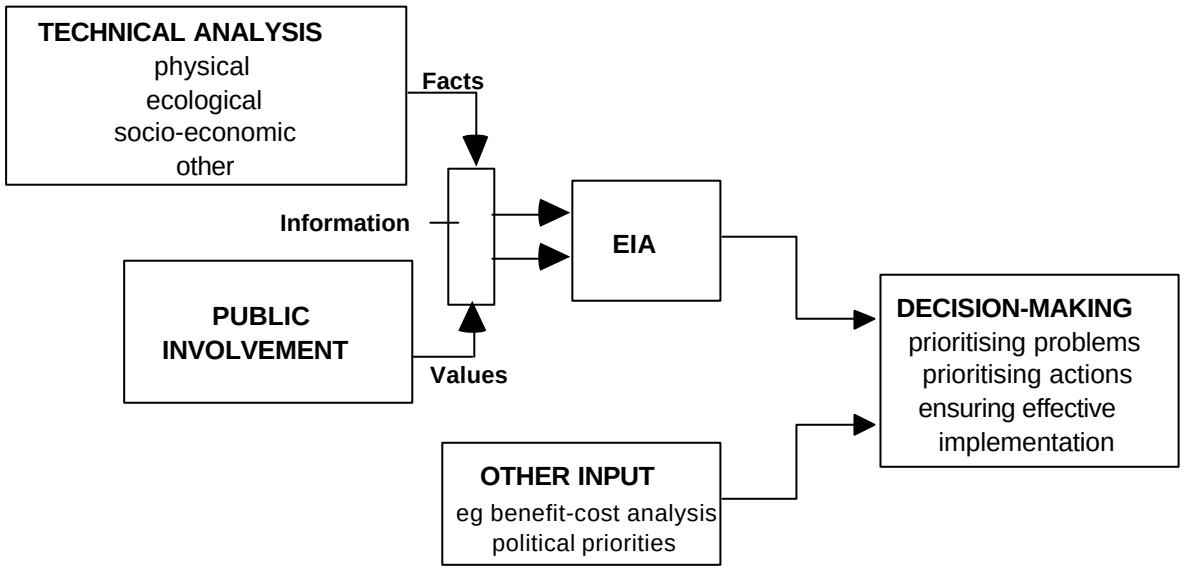
# Decision-makers should be encouraged to:

- implement sustainability mandates and commitments
- broaden their perspectives on the environment
- critically review information and advice
- better communicate information and decisions
- apply the precautionary principle
- improve the process of making trade-offs
- adopt more open and participatory approaches
- use strategic tools including SEA and environmental accounting

# Decision-making is a continuing process, comprising:

- interim decisions made at each stage of EIA
- final approval of a proposal
- enforcement of conditions attached to approvals

# EIA as part of the decision-making process



# Information for decision-makers should include:

- background of the proposal
- policy context
- alternatives considered
- public inputs and balance of opinion
- significant impacts
- proposed mitigation and monitoring
- extent that the proposal conforms to sustainability principles

# EIA responsibilities imposed on decision makers

- meet no further requirements
- take account of information in the EIA report
- provide reasons for the decision
- act in accordance with recommendations of a review body

# Outcomes from EIA decision-making

- proposal approved
- proposal approved with conditions
- proposal on hold pending further study
- proposal returned for revision and resubmission
- proposal rejected

# Checks and balances on decision-making

- no decision taken until EIA report considered
- findings help determine approval and condition setting
- public comment taken into account
- approvals can be refused or withheld
- conditions can be imposed/ modifications demanded
- written reasons for the decision
- right of appeal against the decision

# Means of implementing the decision include:

- establishing performance conditions
- incorporating them into legal contracts
- requiring preparation of environmental management plans
- incorporating ISO 14001 standards
- overseeing and monitoring compliance with conditions

## 3.2.ENVIRONMENTAL AUDIT

- Environmental audit is defined as basic management tool which comprises a systematic, documented, periodic and objective evaluation of how well organization, management systems and equipments are performing.
- A good environment management policy requires that there should be a constant effort to analyze and monitor various various industrial working system and processes to generate and transmit this information for the inspecting authority such as exercise which generates necessary information on analysis of pollution being generated or will be generated and completion of annual estimate has been termed as environmental audit.
- **An environmental audit is a systematic means of providing environmental management information:**
- (a) To all levels of management;
- (b) For a variety of purposes.
- The term 'environmental audit' is, therefore, used to refer to a number of different information and assessment activities.
- **These can be categorized as:**

**(a) A technical review:** Such an audit will involve the systematic collection of information about the existing and potential impact of the organisation's activities on the environment; it will normally cover compliance with pollution control and waste management legislation. It will not cover management practices.

**(b) A management review:**

This will focus more on the management procedures and record- keeping and will also gather information on compliance with legislation. It may also review procedures in the context of company policies, programmes and other requirements. It will not examine the existing or likely impact of the operation on the surrounding environment from a technical standpoint.

**(c) Due diligence review:** This will examine the likely cost of implementing pollution control and site remediation actions and will take account of existing and future legislation. Such liability reviews are normally carried out in the context of mergers, acquisitions and long range company planning.

**Objectives**:

- Environment audit needs for an industry are internal as well as external value
- External needs serve to achieve compliance standards and establish a report with regulatory bodies for implementation of environment management policies.
- Internal need serves the industry as well as self evaluation tool for the process and technology.
- It helps in pollution control, improves production safety and health conservations of nocturnal resources by the way of ensuring waste prevention and reduction, assessing compliance with regulatory requirement, placing environmental information to the public.

**STEPS OF ENVIRONMENTAL AUDIT:**

**The Regulation specifies that an audit should include at least the following steps:**

i. Planning of the audit activities, including definition of responsibilities for the audit;

ii. Review of the environmental protection policy of the company:

iii. Assessment of the organisation, management and equipment;

iv. Gathering of data and of all relevant information;

v. Evaluation of the overall performance;

vi. Identification of areas for improvement;

vii. Internal reporting to the top management;

**An outline of Environmental management cycle is shown in Fig.1.1:**

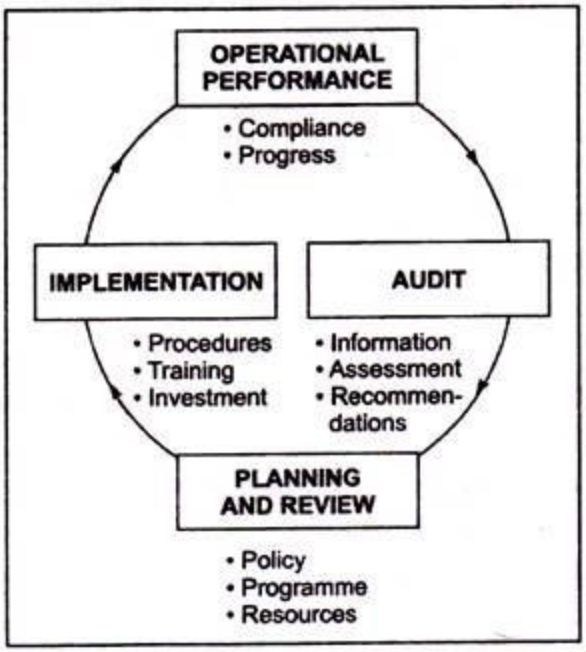



**Fig. 38.1:** Environmental management cycle

**Setting up an Audit Programme:**

**Developing an audit programme requires decisions to be taken on:**

i. The scope of the audit: what information is to be collected;

ii. The frequency with which each site (or issue) is to be audited;

iii. Who is to carry out the audit;

iv. What, if any, information is to be made available to the public.

It is also necessary to develop an audit protocol: that is, the detailed plan to be used by each auditor when carrying out the audit.

**Scope and Frequency of the audit:**

The scope of the audit will depend on the information that is required by management to monitor environmental performance.

**A full environmental audit will cover:**

(i) Compliance with environmental regulations,

(ii) Implementation of company's environmental policies and procedures,

(iii) Good environmental management practice, and

(iv) Past activities.

In so far as it provides the information to determine an organisation's environmental performance it may be expected to cover not only waste streams from plants but also wider management and operational issues.

**The Eco-Management and Audit Regulation suggests that the following should be covered within the framework of the wider environmental protection system:**

i. Assessment, control and prevention of the impact of the activity concerned on the various sectors of the environment;

ii. Energy management, savings and choice;

iii. Raw materials, management, savings, choice and transportation; water management and savings;

iv. Waste avoidance, recycling, reuse, transportation and disposal;

v. Selection of production processes;

vi. Production planning (design, packaging, transportation, use and disposal);

vii. Prevention and limitation of accidents;

viii. Staff information, training and participation in environmental issues;

ix. External information, public participation and handling of public complaints

- Generally following are the 3 phases when an environmental audit is taken up for an industry:
    - phase: **Preaudit** activity- pertaining to collection of information.
    - phase: Activity **at site** pertaining to evaluation of information collected.
    - phase: **Post audit** activity pertaining to drawing conclusion and identifying areas of improvement if any.

Advantages:

- EA report provides the necessary information on how well the management systems are performing to keep place with sustainable level of development.
- It provides performance evaluation of industrial working facilities and its possible effect in the surrounding.
- It refers to compliance with local, regional and national laws and regulation
- Potential areas for reduction in raw material consumption leads to cost saving
- Provide an upto date environmental data to the inspecting authority.

Public participation in environmental impact assessment is recognised as key to sustainable development. In recent years the need to enhance public participation in Environmental Impact Assessment (EIA), and the efficacy of alternative mechanisms in achieving this goal, have been central themes in the EIA literature. The benefits of public participation are often taken for granted, and partly for this reason the underlying rationale for greater public participation is sometimes poorly articulated, making it more difficult to determine how to pursue it effectively. The reasons for seeking public participation are also highly diverse and not always mutually consistent. There has been limited analysis of the implications of different forms and degrees of public participation for public decision making based on EIA, and little discussion of how experience with public participation in EIA relates to debates about participation in policy making generally. Public participation in policy making to consider how approaches to participation in EIA can be interpreted and valued, and asks what EIA experience reveals about the utility of these models. It argues that the models pay insufficient attention to the interaction that can occur between different forms of public participation; and to the fact that public participation raises issues regarding control over decision making that are not subject to resolution, but must be managed through ongoing processes of negotiation.

#The purpose of EIA should not be just to assess impacts and complete an environmental impact statement (EIS); it is to improve the quality of decisions

# Another purpose of EIA is to **inform the public of the proposed project and its impacts.** Through informing the public the project proponent can make environmentally sensitive decision by being aware of a project's potential adverse impacts on the environment.

Through their participation the project proponent will be able to take advantage of the information that citizens contribute concerning values, impacts, innovative solutions and alternatives.

Public participation in decision making is an essential part of the environmental impact assessment (EIA) process, which has become a widely applicable tool for environmental decision making in the world since 70-75ies, ensuring consideration of environmental concerns within the planning. Different countries practice different levels of public involvement.

## There are four basic reasons why public should be involved in EIA.

- First, public participation is regarded as proper, fair conduct of democratic government in public decision-making activities .
- Second, public participation is widely accepted as a way to ensure that projects meet citizens' needs and are suitable to the affected public
- Third, the project carries more legitimacy, and less hostility, if potentially affected parties can influence the decision-making process
- Finally, the final decision is `better' when local knowledge and values are included and when expert knowledge is publicly examined

Grima (1985) notes that the later that public participation occurs in the EIA process, the higher the risk that public comments will only minimally influence the final decision.

## SUMMARY OF OBJECTIVES OF PUBLIC INVOLVEMENT IN EIA

| Stage of EIA process | Objectives of public involvement |
|---|---|
| Screening | Identification of significant impacts<br>• Identification of public's interest and values |
| Scoping | • Identification of priorities for assessment<br>• Encouraging public understanding of the proposed project |
| Assessment | • The public can contribute local knowledge and values to the prediction, evaluation and mitigation of impacts<br>• Improvement in quality and acceptability of EIA report |
| EIA Report Review | Public contribute to evaluation of quality and acceptability of report |
| Decision | Public comment on acceptability of project impacts |
| Monitoring | Public evaluate impacts that occur and support project environmental management process |

# Need of public in EIA

There is a need to increase public sensitivity to environment and development problems to find out solutions and foster a sense of personal environmental responsibility and greater motivation and commitment towards sustainable development. Environmental literacy is the key aspect for sustainable development

- Environmental education for all audiences should be based on the best available scientific information, including the natural, behavioural and social sciences, and taking into account aesthetic and ethical dimensions. It can be achieved by initiating discussions and training to mobilize experience in shaping public behaviour and consumption patterns and making wide use of their methods. Such cooperation would also increase the active public participation in the debate on the environment. Social participation should be encouraged to increase their involvement in environmental and development problems, through joint awareness initiatives and improved interchange with other constituencies in society.
- Environmental education is a must for every human on earth. Environmental impact assessment should immediately be conducted everywhere on earth. Environmental literacy is the only weapon that leads to sustainable development.

# EIA in INDIA

The Indian experience with Environmental Impact Assessment began over 20 years back. It started in 1976-77 when the Planning Commission asked the Department of Science and Technology to examine the river-valley projects from an environmental angle.

This was subsequently extended to cover those projects, which required the approval of the Public Investment Board. Till 1994, environmental clearance from the Central Government was an administrative decision and lacked legislative support. On 27 January 1994, the Union Ministry of Environment and Forests (MEF), Government of India, under the Environmental (Protection) Act 1986, promulgated an EIA notification making Environmental Clearance (EC) mandatory for expansion or modernisation of any activity or for setting up new projects listed in Schedule 1 of the notification. Since then there have been 12 amendments made in the EIA notification of 1994 .

The MEF recently notified new EIA legislation in September 2006. The notification makes it mandatory for various projects such as mining, thermal power plants, river valley, infrastructure (road, highway, ports, harbours and airports) and industries including very small electroplating or foundry units to get environment clearance. However, unlike the EIA Notification of 1994, the new legislation has put the onus of clearing projects on the state government depending on the size/capacity of the project.

In India, EIA was made mandatory in 1994 under the environmental protection act of 1986 with the following four objectives:

1. Predict environmental impact of projects;
2. Find ways and means to reduce adverse impacts;
3. Shape the projects to suit local environment;
4. Present the predictions and options to the decision-makers.

## • Key points to remember:-

- Public participation can benefit the project proponent, the public and the final plan.
- An effective public participation programme does not happen by accident; it must be carefully planned.
- A proactive effort will lead to a more effective process and outcome than a reactive, minimalist approach to public involvement
- It helps in Project Understanding and Reduction of Public Opposition
- Public participation helps in Environmental Protection, Conflict Management, Economical Benefits
- And, **Public involvement should include all the stakeholders.**

## There are three occasions in the course of the EIA procedure where the public can actively participate by submitting statements:

(i) early in the process, after the project developer has submitted its preliminary environmental study,

(ii) after the authority has issued the scoping decision and

(iii) after the environmental report has been published. Consequently, the project developer could be faced with concerns about the project up to a very late stage of the process.

Public participation can be achieved through several techniques:

1. Media techniques: radio, television, newsletters, and advertisements
2. Research techniques: sample polls, community profiles
3. Political techniques: citizen referenda
4. Large-group meetings.

***Thus, Public Participation promotes democratization of EIA process, transparency and acceptability of the project.***

## *Unit 2* ***EIA METHODOLOGY***

## *Ad hoc* methods

Ad hoc methods indicate broad areas of possible impacts by listing composite environmental parameters (Ex: flora and fauna) likely to be affected by the proposed activity.
These methods involve assembling a team of specialists who identify impacts in their area of expertise. Here, each parameter is considered separately and the nature of impacts (long term or short term, reversible or irreversible) are considered.
These methods give a rough assessment of total impact while giving the broad areas and the general nature of possible impacts. In this method, the assessor relies on an intuitive approach and makes a broad-based qualitative assessment. This method serves as a preliminary assessment and helps in identification of important areas like:

- Wildlife
- Endangered species
- Natural vegetation
- Exotic vegetation
- Grazing
- Social characteristics
- Natural drainage
- Groundwater
- Noise
- Air quality
- Visual description and services
- Open space
- Recreation
- Health and safety
- Economic values and
- Public facilities

Types of Ad hoc method are:

- Opinion poll
- Expert opinion and
- Delphi methods

This method is very simple and can be performed without any training. It does not involve any relative weighting or any cause-effect relationship.
It provides minimal guidance for impact analysis while suggesting broad areas for possible impacts. Moreover, it does not even state the actual impacts on specific parameters that will be affected.
The drawbacks of this method are listed below:

- It gives no assurance that a comprehensive set of all relevant impacts have been studied
- Analysis using this method lacks consistency as it different criteria are selectively evaluated by different groups
- It is blatantly inefficient as it requires a considerable effort to identify and assemble a panel for each assessment.

## Checklist

Checklists consist of a list of environmental parameters to be investigated for potential impacts. They therefore ensure complete coverage of environmental aspects to be investigated. Checklists may or may not include guidelines about how impact-relevant parameters are to be measured, interpreted, and compared. A typical checklist might contain entries such as:

1. Earth: mineral resources; construction material; soils; land form; force fields and background radiation; unique physical features;
2. Water: surface (rivers, lakes and reservoirs, estuaries); coastal seas and ocean, underground; quality; temperature; recharge; snow, ice, and permafrost;
3. Atmosphere: quality (gases, particles); climate (micro, macro); temperature;
4. Flora: trees; shrubs; grass; crops; microflora; aquatic plants; endangered species; barriers; corridors;
5. Fauna: birds; land animals including reptiles; fish and shellfish; benthic organisms; insects; microfauna; endangered species; barriers; corridors;
6. Land use: wilderness and open space; wetlands; forestry; grazing; agriculture; residential; commercial; industrial; mining and quarrying;
7. Recreation: hunting; fishing; boating; swimming; camping and hiking; picnicking; resorts.

Obviously, checklists do carry a geographical, as well as cultural, bias or, if universal in intent, carry a large number of mutually exclusive categories. They are usually also implicitly oriented towards certain categories of projects, related to the history of their development. Further, their elements may be interrelated (for example, the categories of water bodies and their relevant properties in the example above) such that the linear presentation in the listing has to be interpreted as a hierarchical or even multi-dimensional system in many cases.

Various sub-categories of approaches can be identified, based on checklists:

- Simple checklists, consisting of a simple list of environmental parameters.
- Descriptive checklists, including guidelines on the measurement of parameters (e.g., De Santo, 1978; Schaenman, 1976).
- Scaling checklists, including information basic to the (subjective) scaling of parameter values. Important concepts include the {\em threshold of concern}, the duration of an impact, and whether it is reversible or irreversible (e.g., Sassaman, 1981).
- Questionnaire checklists, containing a series of linked questions, which guide the user through the process. The possible answers are provided as multiple-choice, making the process easy to use even for less experienced persons.
- Environmental Evaluation System (EES): Checklist based, including scaling and weighting (Dee et al., 1979; Lohani and Kan, 1982).
- Multi-attribute Utility Theory. Similar to the weighting method used in the EES procedure, developed by Batelle Columbus Laboratories in the USA, it is basically a decision support (weighting) method that can also be used in conjunction with other approaches to derive the impacts (Keeney and Raiffa, 1976; Keeney and Robilliard, 1977; Kirkwood, 1982; Collins and Glysson, 1980).

**Advantages of Checklist**

There are several major reasons for using checklists:

•They are useful in summarizing information to make it accessible to specialists from other fields, or to decision makers who may have a limited amount of technical knowledge;

•scaling checklists provide a preliminary level of analysis; and

•weighting is a mechanism for incorporating information about ecosystem functions.

**Disadvantages of Checklist**

Westman (1985) listed some of the problems with checklists when used as an impact assessment method:

1. They are too general or incomplete.

2. They do not illustrate interactions between effects

3. The number of categories to be reviewed can be immense, thus distracting from the most significant impacts.

4. The identification of effects is qualitative and subjective.

**Matrices**

Matrix are two-dimensional tables which facilitate the identification of impacts arising from the interaction between project activities and specific environmental components. • They are essentially expansions of checklists that acknowldge the fact that different component of development project (e.g. Construction, operation,decommissioning, buildings, access road) • The entries in the cell of the matrix can be either qualitative or quantitative estimates of impact.

A more detailed approach is given in matrices, where project activities are cross-tabulated with environmental components. Also matrices can be made quite simple or be developed into a stage with a large amount of information. The strength of the matrix approach is the usefulness in designing further studies, the inexpensive nature (also true for checklists) and their comprehensiveness. Impact matrices combine a checklist of environmental conditions likely to be affected with a list of project activities, the two lists arranged in the form of a matrix. The possible cause--effect relationships between activities and environmental features are then identified and evaluated cell by cell. Matrices can be very detailed and large, the classical Leopold matrix contains 100 by 88 cells, and is thus somewhat cumbersome to handle

Types of Matrix

• Simple Matrix • Time dependent matrix • Magnitude Matrix • Quantified Matrix (Leopold Matrix) • Weighted Matrix

Limitations may be an inability to handle indirect impacts and temporal aspects, a potential rigidity of categories, an a difficulty to get an overview when many variable are included. In many cases numbers of magnitude and severity of impact are included on a very poor basis ("this feels larger than the other"). Thus many matrices used give much less and lower quality information than thought on first impression.

**Advantages**

• This method has the advantage of allowing various alternatives to be compared numerically.

• The method also doesn't consider indirect impact.

## Overlays

Overlay methods use a set of physical or electronic maps, of environmental characteristics and possible project impact upon them, that are overlaid to produce a composite and spatial characterization of project consequences .Modern geographical information systems such as GRASS, developed for EIA by the US Army Corps of Engineers, use graphic workstations to implement overlay techniques using digital cartographic material and the more versatile logical interactions between spatial features.

- This method depends on a set of maps of a project area's environmental characteristics covering physical, social, ecological and aesthetic aspects
- It enables separate mapping of critical environmental features at the same scale as project's site plan (Ex: wetlands, steep slopes, soils, floodplains, bedrock outcrops, wildlife habitats, vegetative communities, cultural resources, etc)
- In the old technique, environmental features were mappped on transparent plastic in different colours
- Modern technique of the same activity is done using computer software, hardware, data and skilled people. It is called GIS (Geographic Information Systems)

The advantages of this method are:

- It is easy to understand and use
- It has a good display and
- It is good for setting site selection

Limitations of Map overlays:

• Maps tend to overs implify.

• Specific interrelationships between Specific interrelationships between environmental factors are not readily obtainable.

• Although "before" and "after" Although "before" and "after" conditions is possible , it cannot describe ecosystem dynamics through t ime

## Networks and diagrams

Networks are designed to explicitly consider higher order, i.e., secondary and even tertiary consequences in addition to the primary cause--effect relations addressed by the methods above. They consist of linked impacts including chained multiple effects and feedbacks (Sorensen, 1971; Sorensen, 1972; Gilliland and Risser, 1977; Lavine et al., 1978). IMPACT is a computerized version of network techniques, developed by the US Forest Service (Thor et al., 1978).

Limitations of Networks

• A network may be an unnecessary and A network may be an unnecessary and generalization of reality unless relationships b i di id l between i ndi vidua l ecosystem components are ade q y uatel y understood.

• Individual ecosystem or social system elements may not be easily recognized or elements may not be easily recognized or found in the diagram, especially as the level of dETail increases.

• Networks cannot describe temporal aspects 16/34 of ecosystem dynamics

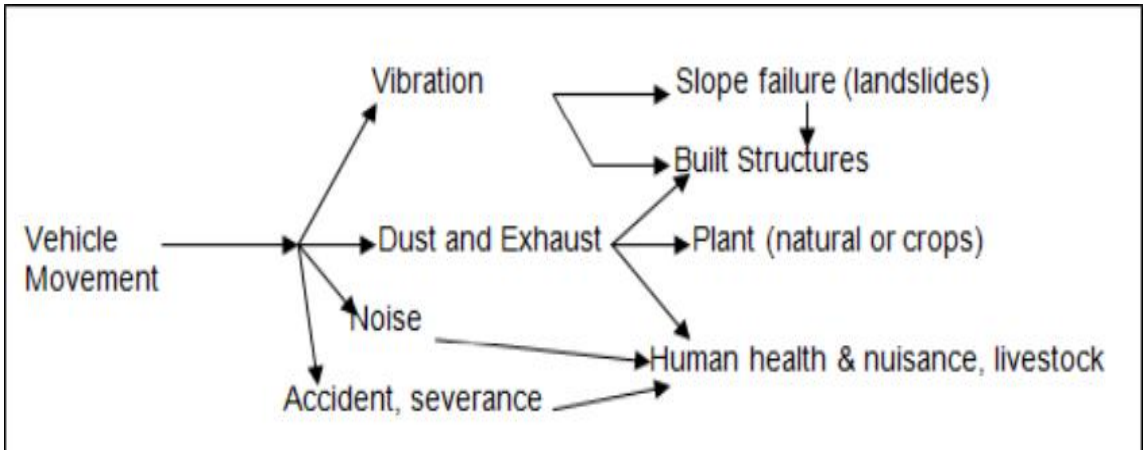
Advantages:

- It links action to impact
- It is useful to check second order impacts in a simplified form
- It handles direct and indirect impacts

The disadvantages of this method are:

- It becomes overly complex if used beyond simplified version
- It is completely qualitative in nature

Example of network method:

- 

## Cost--benefit analysis

Cost--benefit analysis (CBA), in a narrow sense, is an attempt to monetize all effects for direct comparison in monetary terms. While providing a clear answer and basis for the comparison of alternatives, the monetization of many environmental problems is sometimes extremely difficult and thus can affect the usefulness of the method considerably.

Numerous approaches to help monetize environmental criteria have been developed. Some of the more frequently used include the *cost of repair*, i.e., the estimated cost to restore an environmental system to its original state, or the *willingness to pay*, based on direct or indirect (e.g., travel cost) approaches to assess the value, for example, of park land or wilderness. Approaches and problems, as well as the underlying economic theories, are discussed (e.g., in Cottrell, 1978; Kapp, 1979; or Burrows, 1980). An excellent and critical treatment of cost--benefit analysis, and evaluation in environmental planning in general, can be found in McAllister, 1980. A discussion of the principles of environmental extensions to traditional cost--benefit analysis is given in Hufschmidt, James, Meister et al., 1983.

Examples of cost--benefit approaches to environmental impact assessment include:

- the UNEP Test Model of extended cost--benefit analysis (Lohani and Halim, 1987), mainly oriented towards the natural resource base of a project. The basic format of the approach includes:
  - essential project description setting the physical and economic parameters for the analysis;
  - itemizing resources used in the project, those indirectly affected, and residues created;
  - resources exhausted, depleted, or that have deteriorated;
  - resources enhanced;
  - required additional project components;
  - formulation of the integrated cost--benefit presentation, summary and conclusions.
- the cost--benefit analysis of natural system assessment, developed by the East-West Centre in Hawai

Attempts to overcome some of the weaknesses of CBA have led to numerous extensions and modifications, such as the *Planning Balance Sheet* (PBS) or the {\em Goals Achievement Matrix} (GAM). The Planning Balance Sheet (Lichfield et al., 1975) stresses the importance of recording all impacts, whether monetizable or not, and analyzing the distribution of impacts among different community groups. Thus it adds the analysis as to whom cost and benefits accrue to the basic concept of CBA. The Goals Achievement Matrix (Hill, 1968; Hill and Werczberger, 1978) defines and organizes impacts according to a set of explicit goals that the (public) action is attempting to meet and identifies consequences to different interest groups. It is also designed to accommodate non-monetizable impacts, and uses a set of non-monetary value weights for computing a summary evaluation; it is thus similar to CBA.

## Modeling

Systems analysis and modeling are among the few techniques that allow consideration of multi-dimensional problems that involve multiple (and usually conflicting) objectives, multiple criteria, multiple purposes and users, as well as interest groups.

Basically, modeling attempts to replicate a real-world situation, so as to allow experimentation with the replica in order to gain insight into the expected behavior of the real system. Models, implemented on computers, are extremely powerful tools of analysis, though they are often demanding and complex.

Modeling has been used extensively in developed countries, but its use for impact assessment in developing countries has been rather limited because of constraints on resources, especially in expertise and data.

The two main problems, namely, lack of expertise and lack of data, are good reasons to look into the use of computers, in particular into new technologies such as expert systems, interactive modeling, and dynamic computer graphics. The basic idea behind an expert system is to incorporate expertise, i.e., data, knowledge and heuristics relevant to a given problem area into a software system.

Environmental impact assessment usually deals with rather complex problems that touch upon many disciplines, and rarely will an individual or a small group of individuals have all the necessary expertise at their disposal. The expert systems component of an EIA system can help to fill this gap and at the same time take over the role of a tutor. For recent surveys of the role and potential of expert systems technology in environmental planning and assessment, see Ortolano and Steineman, 1987; Hush on, 1987; Gray and Stokoe, 1988; Beck, 1990.

The same line of argument holds for the missing data. A forecast of likely consequences and impacts has to be based on some kind of model. Whether that is a mental model, a set of ``rules of thumb'' or heuristics an expert might use, or a formal mathematical model, the necessary information must be somehow inserted in the (mental or mathematical) procedure. If no specific data are available, one looks for similar problems for which information or experience exists and extrapolates and draws upon analogies. This role is usually filled by the expert's knowledge, or by handbooks and similar sources of information (Golden et al., 1979; Canter and Hill, 1979). Such information, however, can also be incorporated in a model or its interface, or be made available through dedicated data bases connected to the models for the automatic downloading of parameters required. In a similar approach, basic parameters such as chemical properties relevant to environmental fate and transport calculations, for example, can be provided to the respective models through auxiliary models or estimation techniques (Lyman et al., 1982; Lyman et al., 1984).

## What Is an Environmental Impact Statement (EIS)?

***An EIS is a document that describes the impacts on the environment as a result of a proposed action.*** The EIS documents the information about and estimates of impacts derived from the various steps in the process.Prevention is better than cure; an EIS revealing many significant unavoid able adverse impacts would provide valuable information that could contribute to the abandonment or substantial modification of a proposed development action. Where adverse impacts can be successfully reduced through mitigation measures, there may be a different decision. An **environmental impact statement** (**EIS**), under United States environmental law, is a document required by the 1969 National Environmental Policy Act (NEPA) for certain actions "significantly affecting the quality of the human environment"

## Purpose of an EIS

An Environmental Impact Statement (EIS) is a document prepared to describe the effects for proposed activities on the environment. "Environment," in this case, is defined as the natural and physical environment and the relationship of people with that environment. This means that the "environment" considered in an EIS includes land, water, air, structures, living organisms, environmental values at the site, and the social, cultural, and economic aspects. An "impact" is a change in consequence that results from an activity. Impacts can be positive or negative or both. An EIS describes impacts, as well as ways to "mitigate" impacts. To "mitigate" means to lessen or remove negative impacts.

Therefore, an Environmental Impact Statement, or EIS, is a document that describes the impacts on the environment as a result of a proposed action. It also describes impacts of alternatives as well as plans to mitigate the impacts.

### Layout

An EIS typically has four sections

- An Introduction including a statement of the **Purpose and Need** of the **Proposed Action**.
- A description of the **Affected Environment**.
- A **Range of Alternatives** to the proposed action. Alternatives are considered the "heart" of the EIS.
- An **analysis** of the environmental impacts of each of the possible alternatives. This section covers topics such as:

- Impacts to **threatened or endangered species**
- **Air and water quality** impacts
- Impacts to **historic and cultural sites, particularly sites of significant importance to Indigenous peoples.**

- **Social and Economic impacts** to local communities, often including consideration of attributes such as **impacts on the available housing stock, economic impacts to businesses, property values, aesthetics and noise** within the affected area
- **Cost and Schedule Analyses** for each alternative, including costs and timeline to mitigate expected impacts, to determine if the proposed action can be completed at an acceptable cost and within a reasonable amount of time

While not required in the EIS, the following subjects may be included as part of the EIS or as separate documents based on agency policy.

- **Financial Plan** for the proposed action identifying the sources of secured funding for the action. For example, the Federal Highway Administration has started requiring states to include a financial plan showing that funding has been secured for major highway projects before it will approve an EIS and issue a Record of Decision.
- An **Environmental Mitigation Plan** is often requested by the Environmental Protection Agency (EPA) if substantial environmental impacts are expected from the preferred alternative.
- **Additional documentation** to comply with state and local environmental policy laws and secure required federal, state, and local permits before the action can proceed.

Every EIS is required to analyze a **No Action Alternative,** in addition to the range of alternatives presented for study. The No Action Alternative identifies the expected environmental impacts in the future if existing conditions were left as is with no action taken by the lead agency. Analysis of the No Action Alternative is used to establish a baseline upon which to compare the proposed "Action" alternatives. Contrary to popular belief, the "No Action Alternative" doesn't necessarily mean that nothing will occur if that option is selected in the Record of Decision. For example, the "No Action Alternative" was selected for the I-69/Trans-Texas Corridor Tier-I Environmental Impact Statement. In that Record of Decision, the Texas Department of Transportation opted not to proceed with building its portion of I-69 as one of the Trans-Texas Corridors to be built as a new-terrain route (the Trans-Texas Corridor concept was ultimately scrapped entirely), but instead decided to proceed with converting existing US routes to I-69 by upgrading those roads to interstate standards.

**EIS Requirements**

Federal laws and regulations require the federal government to evaluate the effects of its actions on the environment and to consider alternative courses of action. The National Environmental Policy Act of 1969 (NEPA) specifies when an environmental impact statement (EIS) must be prepared. NEPA regulations require, among other things, federal agencies to include discussion of a proposed action and the range of reasonable alternatives in an EIS. Sufficient information must be included in the EIS for reviewers to evaluate the relative merits of each alternative. Council for Environmental Quality (CEQ) regulations provide the recommended format and content of Environmental Impact Statements.

# Strengths

By requiring agencies to complete an EIS, the act encourages them to consider the environmental costs of a project and introduces new information into the decision-making process. The NEPA has increased the influence of environmental analysts and agencies in the federal government by increasing their involvement in the development process. Because an EIS requires expert skill and knowledge, agencies must hire environmental analysts. Unlike agencies who may have other priorities, analysts are often sympathetic to environmental issues. In addition, this feature introduces scientific procedures into the political process.[7]

# Limitations

The differences that exist between science and politics limit the accuracy of an EIS. Although analysts are members of the scientific community, they are affected by the political atmosphere. Analysts do not have the luxury of an unlimited time for research. They are also affected by the different motives behind the research of the EIS and by different perspectives of what constitutes a good analysis. In addition, government officials do not want to reveal an environmental problem from within their own agency.[7]

Citizens often misunderstand the environmental assessment process. The public does not realize that the process is only meant to gather information relevant to the decision. Even if the statement predicts negative impacts of the project, decision makers can still proceed with the proposal.[3]