ISSN: 0973-4929, Vol. 14, No. (1) 2019, Pg. 99-127

Current World Environment

www.cwejournal.org

Environmental Impact Assessment and Environmental Management Plan: A Case Study of Kachchh, Gujarat, India

HIREN B. SONI,*[1] V. VIJAY KUMAR[2] and PANKAJ N. JOSHI[3]

[1]Department of Environmental Science and Technology (EST), Institute of Science and Technology for Advanced Studies and Research (ISTAR), Vallabh Vidyanagar – 388120, Dist. Anand, Gujarat, India.
[2]Gujarat Institute of Desert Ecology (GUIDE), Opp. Changleshwar Temple, Mundra Road, P.O. Box 83, Bhuj (Kachchh) - 370001 Gujarat, India.
[3]Sahjeevan, 175-Jalaram Society, Vijay Nagar, Hospital Road, Bhuj (Kachchh) - 370001, Gujarat, India.

Abstract

This case study outlines some noteworthy features of the process of Environmental Impact Assessment (EIA) and Environmental Management Plant (EMP) of Deendyal (Kandla) Port Trust (DPT) and Gujarat Mineral Development Corporation (GMDC) lignite mines, Kachchh, Gujarat, India. These key viewpoints incorporate task depiction, options, checking, portrayal of the earth, open cooperation, biophysical impacts, social effects, sway essentialness, total impacts evaluation, observing, and introduction, which are earmarked in annexure in the form of sectors requiring EIA, Ecologically Sensitive Areas (ESA), basic guidelines, and environmental laws. The case study reflects the detailed scenario of physical, biological, and socio-economic profiles of the study areas, which directly or indirectly the environmental as well as ecological characteristics of the proposed project sites. The suggestive steps, recommendations and mitigation measures are also discussed herewith.

Article History

Received: 29 January 2019
Accepted: 02 April 2019

Keywords

Environmental Impact Assessment;
Environmental Management Plan;
Deendayal (Kandla) Port;
GMDC Lignite Mines;
Kachchh;
Gujarat;
India.

Abbreviations

CPCB	Central Pollution Control Board	HAP	Hazardous Air Pollutant
DG Sets	Diesel Generator Sets	OTB	Outer Tuna Buoy
DPT	Deendayal (Kandla) Port Trust	PCB	Polychlorinated Biphenyls
GMB	Gujarat Maritime Board	PPE	Personal Protective Equipment
GPCB	Gujarat Pollution Control Board	SMS	Safety Management System
GUIDE	Gujarat Institute of Desert Ecology	VOC	Volatile Organic Compounds

CONTACT Hiren B. Soni drhirenbsoni@gmail.com Department of Environmental Science & Technology (EST), Institute of Science & Technology for Advanced Studies & Research (ISTAR), Vallabh Vidyanagar - 388120, Dist. Anand, Gujarat, India.

Doi: http://dx.doi.org/10.12944/CWE.14.1.10

Background

Environmental Impact Assessment (EIA) alludes to the monitoring of the effects liable to emerge from a noteworthy task (or other activity) essentially influencing the normal and man-made condition.[1] The official evaluation of the feasible impacts of a proposed strategy, program or venture on the earth; options in contrast to the proposition; and measures to be received to ensure nature.[2] EIA is a procedure for advising chiefs of the potential ecological results of improvement options.[3] It is any adjustment in the physical, common and social condition realized by advancement.[4] The EIA gives the accompanying advantages: "an open door for open interest; expanded assurance of human wellbeing; the manageable utilization of characteristic assets; diminished task costs and deferrals; limited dangers of natural fiascos; and expanded government responsibility".[5]

A far-reaching depiction of all exercises is essential for all EIAs.[2] A gritty venture portrayal helps with deciding the essentialness of effects emerging from a proposed undertaking.[6] Data introduced in an EIA must be clear, justifiable, and important for basic leadership.[7,6] The task portrayal and options ought to be brief and show a high level of wide coherence. Proper visuals, for example, maps, figures, tables and charts are successful methods for imparting specialized data.[8,6] An EIA venture depiction ought to incorporate data as for the task reason, specialized angles, for example, building and plan, and spatial and worldly necessities.[9,6] Changes to extend configuration must be unmistakably recognized and tended to when they are made. On the off chance that changes happen after the EIA is accomplished, a correction to the EIA might be fundamental relying upon the essentialness of the alteration. It is imperative that each alteration and its related effect be surveyed in indistinguishable way from the recently distinguished effects.[8,6]

The motivation behind incorporating choices in the EIA is to recognize and assess substitute activities that achieve comparative objectives and advance reasonable improvement.[10,6] EIAs ought to break down three to six choices.[11,6] Choices ought to be financially achievable with negligible antagonistic ecological effects and time delays.[10,6] Assorted options in contrast to the proposed activity must be incorporated into the EIA. Choices may incorporate both plan and area choices.[10,6] [10]contends that choices will in general reflect tight task targets, organization motivation, and preference to the projected activity. A reason and need articulation ought to be built that would not avoid fewer harming choices or overly support the future activity.

The 'no-activity' elective, which fills in as a gauge for near investigation, should likewise be incorporated where the natural effect of making the proposed move is contrasted with the effect of not making the proposed move.[10,6] [12]archived early the nearness of 'tokenism' in options improvement, taking note of a barrage venture EIA having choices as dyking (embankment), afforestation, departure, and more precise administration of standing structures. [10]called such options 'straw men' expressing they "might be developed, just so they can be torn down, and consequently add to the apparent appeal of the favoured option. This bogus portrayal of exercises lessens the capacity to look at trade offs among real choices in an EIA." Civic association is a decent exercise that can create novel options. Tragically, open interest frequently happens past the point where it is possible to fundamentally affect the plan of choices.[10,6]

Perusing is an underlying stage inside the EIA procedure and fills in as a diagram for the rest of the procedure by laying out the spatial and transient limits of a proposed undertaking and conceivable influenced territories.[13,14] While it is imperative that the perusing procedure catch every single potential effect, it is similarly critical that checking does not result in the incorporation of insignificant data.[15,14] On the off chance that perusing isn't satisfactorily engaged, the subsequent EIA will be unfocused.[16,14] The perusing procedure should examine the space and transient limits for the EIA, the arrangement structure in which the checking is being led, active information resource and holes in data, the timetable of the EIA, and the connection that the checking procedure should the basic leadership process.[17,14] Checking should define the fitting limits for those effects that will be additionally considered. The checking activity ought to incorporate both immediate and optional impacts.[18,14]

Checking should start from the get-go in the EIA procedure and ought to likewise be continuous all through the whole procedure.[19,14] The checking procedure must be adaptable. The procedure must take into consideration further examination and give chances to audit the underlying degree if there are new issues that happened.[19,14] Be that as it may, while it must be adaptable, perusing ought to be done in an orderly way.[17,14] This methodical methodology incorporates right off the bat framing a broad rundown of all worries that emerge from the proposition. The next period of perusing includes taking the underlying rundown of apprehension and lessening it to a rundown of inputs dependent on their potential criticalness.[17,14] This procedure is progressively emotional since it requires setting esteems on the worries.[20,14]

It ought to be clear, when essential, that an arrangement for open contribution in perusing was produced from the get-go simultaneously. This arrangement ought to recognize every single important partner and the techniques to be utilized to scatter and accumulate data.[17,14] The nature of the open doors for open interest in the perusing procedure ought to be assessed. People in general ought to be given adequate data about the proposed venture and appropriately comprehend the task and issues to most likely give educated remarks and take an interest completely all the while.[19,2,14] It is essential that there is proof that every single open remark is considered in the plan of the rundown of concerns. Every single open remark ought to be recorded without judgment or organizing in the underlying phases of the procedure.[17,14]

Models help with distinguishing cause-impact connections. These models incorporate guide overlays, affect agendas, affect lattices and cause-impact systems. Guide overlays show receptors spatially yet do not commonly empower linkages to be made to unequivocal sources. An impact motivation is a standard once-over of impacts for various types of undertakings, which considers the exact distinctive confirmation of impacts, yet it cannot relate impacts to their sources. The impact structure is a two-dimensional matrix subject to the motivation that relates exercises to affected biological segments. Cause-impact systems expand on the effect lattice by including both immediate and backhanded impacts. These techniques give approaches to speak to the potential effects and influenced regions just as permit a progressively formalized and orderly perusing procedure.[21,14]

[20]Bunches accessible techniques to help with checking into three classifications: EIA strategies; open support techniques; and gathering process strategies. EIA techniques incorporate examination of comparable activities, agendas, frameworks, systems, overlays, and ecological demonstrating. These techniques ought not to be utilized only but instead in blend to be significant devices in checking. Open interest systems incorporate open gatherings and hearings, open houses, organizing, hotlines, responsive productions and reviews, warning boards and substance investigation. Gathering process techniques can be utilized to recognize and assess potential effects. These incorporate such procedures as intuitive gathering gatherings, conceptualizing, the Delphi Method (an organized procedure for gathering information from specialists utilizing a progression of polls joined with controlled assessment input) intercession, and model-building workshops.[22] EIA analysts must know about these techniques and models. They ought to evaluate whether proper models were utilized and analyze the basic presumptions and information on which the models were based.[14]

The EIA procedure frequently happens past the point of no return in office basic leadership to think about a complete scope of choices. This can weaken EIA objectives to energize even additional ecologically solid and freely worthy arrangements. Enabling new options and goals to advance in connection to ecological conditions and open inclinations might be an answer.[10,6] Looking into the need of an hour, authors have prepared a case study of Deendayal (Kandla) Port Trust (DPT) and GMDC Lignite Mines, Kachchh, Gujarat, India, in context of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) covering impact of physical, biological and socio-economic factors along with suggestive steps, recommendations and mitigation measures.

Concepts of EIA

Environmental Impact Assessment (EIA)

Definition: EIA is an appraisal of the conceivable positive and negative effect that a proposed undertaking may have on the earth together comprising of social, characteristic (Physical, Chemical, Biological) and monetary viewpoints. Environmental Impact Assessment (EIA) gives chance to distinguish exorbitant and unwanted impacts to alter extends in the structuring stage.[18]

It is an arranging device that is currently commonly acknowledged as a fundamental part of cool-headed basic leadership. The goal of EIA is to predict and address potential ecological issues/worries at a beginning period of task arranging and plan. EIA (Environmental Impact Assessment) or EMP (Environmental Management Plan) should help organizers and government experts in the basic leadership process by distinguishing the key effects/ issues and detailing alleviation measures.

Types

There are two types of EIAs followed to get the environment clearance for the proposed project – Comprehensive EIA and Rapid EIA. The contrast between Comprehensive EIA and Rapid EIA is in the time-size of the information provided. Fast EIA is for speedier evaluation process. While the two sorts of EIA require consideration/inclusion of all noteworthy ecological effects and their relief, Rapid EIA accomplishes this through the gathering of 'one season' (other than rainstorm) information just to decrease the time required. This is worthy just, in the event that it does not settle on the nature of basic leadership. The survey of Rapid EIA entries will indicate whether a complete EIA is justified or not.

EIA Cycle and Procedures

The EIA process in India comprises the following stages:

Screening

Screening is done to see whether an undertaking requires ecological leeway according to the statutory warnings.

Checking and Consideration of Alternatives

Scoping is a procedure of enumerating the terms of reference of EIA. It must be finished by the advisor in meeting with the venture defender and direction, if need be, from Impact Assessment Agency (IAA).

Benchmark Data Collection

Baseline information depicts the current ecological status of the recognized venture examine region. The site-explicit essential information ought to be checked for the recognized parameters and enhanced by auxiliary information, if accessible. Data collection includes parameters from three major environmental components such as Physical, Biological, and Social.

Impact Prediction

Impact prediction is a method for 'Mapping or Listing' the natural results of the critical parts of the undertaking and its choices.

Mitigation Measures

Suggestion of alternative measures and suggestions to avoid or minimize the impacts predicted due to the proposed project activities at different levels of sources, line of action and end-point or receiver end.

Public Hearing

Law necessitates that the open must be educated and counseled on the proposed formative task after the finishing of EIA report.

Environment Management Plan (EMP)

Depiction of relief measures including avoidance and control for each ecological segment, which are probably going to be, influenced because of the proposed venture related exercises, which require following procedures:

- The EMP need to address Rehabilitation, Restoration, and Relocation plan.
- Delineation of observing plan for consistence of conditions.
- Delineation of usage plan including planning and asset allotment.

Decision Making

Basic leadership process includes meeting between the venture defender (helped by a specialist) and the Impact Assessment Authority [IAA] (helped by a specialist gathering, if fundamental). The choice on ecological leeway is touched base through various advances including assessment of EIA and Environment Management Plan (EMP).

Assessment of Clearance Condition

Assessing the clearance condition involves periodic monitoring of the implementation or adopting mitigation measures or EMP, suggested by the environment consultant based on the likely impact identified through EIA study. The process of EIA is given in Figure 1.

Terminology

Before getting associated with EIA, it is important to see some essential phrasing to help in the introduction and examination of effect appraisal and readiness of effect explanation.

- Activity: A process of doing something that can have an impact.
- Action: Collection of activities makes an "Action".
- Factor: The cause of a particular impact is termed as "Factor".
- Factor Index: The magnitude of the impact is denoted by a numerical scale termed as

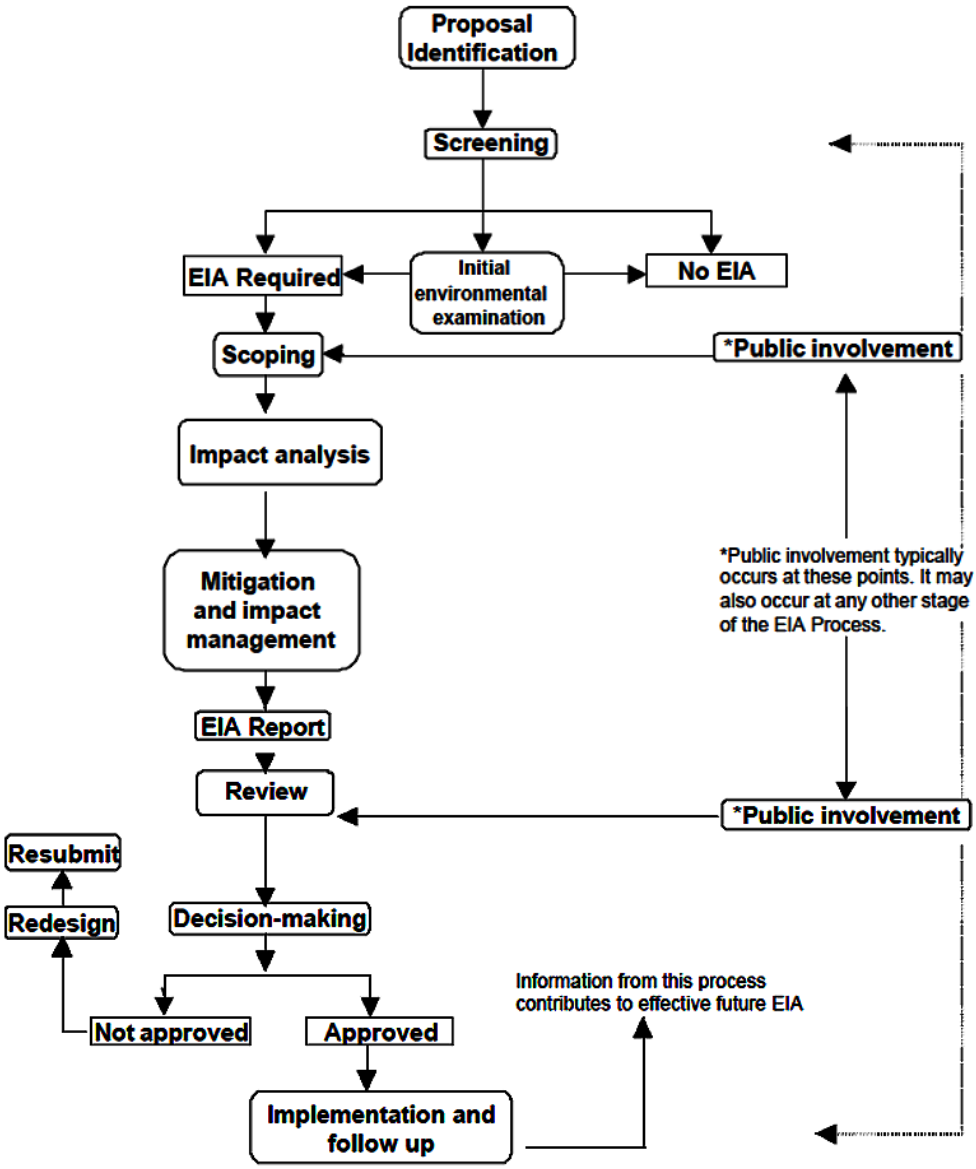

Fig. 1: EIA Process[39]

"Factor Index".

- Grand Index: The summation of all the Factor Indices gives us "Grand Index".
- Environmental Change: The difference observed in the current state from the previous state in the environment is termed as "Environmental Change".

Methodologies

Ad-hoc

These techniques do not structure the issues, which are increasingly manageable to precise examination. A genuine case of a specially appointed strategy is - a group of specialists collected for brief time to direct an EIA. Every master's decisions depend on a novel mix of involvement, preparing, and establishment. These decisions are incorporated into a report.

Overlays

This is a guide based effect evaluation technique. Data for a variety of factors is gathered for standard land units inside the investigation zone, and is recorded on a progression of maps, commonly one for every factor. These maps are overlaid to deliver a composite. The subsequent composite maps describe the region's physical, social, environmental, land use and other important qualities, with respect to the area of the proposed improvement. To research the level of related effects, any number of undertaking choices can be situated on the last guide. Nevertheless, some complex forms can make forecasts about potential living space misfortune.

Checklists

Such techniques are ordinarily used to sort out and present the data. A considerable lot of the more complex strategies and methods frequently use agendas and grids as a beginning stage for investigation. All agendas and grids have boxes or cells that must be loaded up with data about the idea of the effect. Contingent upon the strategy, this data can be clear or evaluative. The most straightforward techniques only decide the likelihood or potential presence of an effect, while others, such as scaling weighting agendas make decisions about the greatness and significance of the effect. There are four general types of checklists:

- Simple Checklist: A rundown of ecological parameters without any rules on 'how they are to be estimated and translated'.
- Descriptive Checklist: It incorporates a recognizable proof of natural parameters and rules 'on the most proficient method to quantify information of a specific parameter'.
- Scaling Checklist: It is like a clear agenda, however with extra data on abstract scaling of the parameters.
- Scaling Weighting Checklist: It is like a scaling agenda, with extra data for the emotional assessment of every parameter regarding the various parameters.

Matrices

Framework strategies recognize associations between different undertaking activities and natural parameters and its segments. They join a rundown of venture exercises with an agenda of natural parts that may be influenced by such exercises.

Networks

Improvement of the calculated models that speak to potential effect pathways as causal chains is at the quintessence of the utilization of the Specific Study Area (SSA). System charts give a way to showing essential, auxiliary, tertiary, and higher request impacts.

Table 1: List of Super-Components and Sub-components for Impact Identification or Statement

Sr. No.	Super-Components	Sub-Components
1.		Atmospheric (Air & Climate)
2.	*Physical*	Noise
3.		Water
4.		Land / Soil
5.		Habitat
6.	*Biological*	Ecosystem
7.		Plants / Vegetation / Flora
8.		Animals / Fauna
9.		Economy
10.		Health
11.	*Socio-Economic*	Natural resources
12.		Cultural & archaeological sites
13.		Infrastructure
14.		Education

Study Components

Environmental status of the project area includes major environmental components such as Physical, Biological, and Socio-economical. Preparation of environmental status of the proposed project area involves first listing of environmental components and/or parameters (Super- and Sub-components) which need to be considered for an impact assessment (Table 1).

Baseline Status of Project Environment

In order to evaluate the probable impact of the future project, the baseline status of the project area needs to be studied in terms of physical, biological, and social components, which are project and area specific. Assessing the baseline status involved secondary and primary data on three environmental components prescribed by deciding authorities (Ministry of Environment, Forest and Climate Change, Government of India) is given in Table 2.

Environmental Management Plan (EMP)

An Environmental Management Plan (EMP), additionally alluded to as an Impact Mitigation Plan (IMP), is normally arranged as a piece of EIA detailing. It deciphers prescribed relief and observing measures into explicit activities to be done by the defender. Contingent on specific necessities, the arrangement might be incorporated into or affixed to the EIA report. The EMP is to be balanced into the terms and conditions indicated in any undertaking endorsement. It at that point frames the reason for effect the board amid task development and activity. Components of EMP

Summary of Impacts

The anticipated unfriendly natural and social effects for which alleviation is required ought to be distinguished and quickly condensed.

Description of Mitigation Measures

Every moderation measure ought to be quickly portrayed with reference to the effect to which it relates and the conditions under which it is required. Description of Monitoring Programme: The observing system ought to obviously demonstrate the linkages between the effects distinguished in the EIA report, estimation markers, location limits (wherever appropriate), and meaning of edges that will flag the requirement for restorative activities.

Institutional Arrangements

Duties regarding relief and observing ought to be plainly characterized, including courses of action for co-appointment between different variables in charge of alleviation.

Implementation Schedule and Reporting Procedures

The planning, recurrence and span of alleviation measure ought to be determined in a usage plan, appearing with mostly undertaking execution. Techniques to give data on the advancement and aftereffects of moderation and checking measures ought to likewise be indicated correctly.

Cost Estimates and Sources of Funds

These ought to be dispensed for both the underlying speculation and repeating costs for actualizing every one of the measures contained in the EMP, incorporated into the all out venture costs, and figured into credit exchanges.

Mitigation

Alleviation is one of the basic parts of EMP process. It plans to keep the unfriendly effects happened inside a satisfactory dimensions. The objectives of mitigation are to:

- find better options and methods for getting things done,
- enhance the ecological and social advantages of a proposition,
- avoid, limit or decrease the likely antagonistic effects, and
- ensure that remaining antagonistic effects are to be kept inside as far as possible.

Elements of Mitigation

The components of moderation are sorted out into a progressive system of activities, such as:

- First (Avoid): unfriendly effects beyond what many would consider possible by utilization of protection measures,
- Second (Minimize or Reduce): unfriendly

Table 2: Checklist of Key Parameters (e.g. Mining Project)

Physical	Biological	Social
Land	Species & Population	Socio-Economic
	Aquatic flora & fauna	
Land-forms including		
coastal zones	Terrestrial flora & fauna	Agricultural land
Lithology and		
Geo-morphology	Marine flora & fauna	Employment / Training
Soil composition and its characteristics	Fishery resources	Housing
Slope stability	Habitats & Communities	Education
Seismicity / Seismic zone characteristics	Terrestrial	
(Forest, Grassland, Desert)	Utilities	
Land cover	Breeding grounds	Amenities
(Water, Sanitation, Electricity, Transportation)		
Engineering and mineral resources	Migratory path	Community health
Buffer zones - Land use		
(10 km radius)	Protected Areas (PAs)	Aesthetic / Cultural
Soil quality & Soil erosion	Species of conservation significance	
(Plant and Animals)	Demography	
Catchment area treatment	Endemic species	Tranquility / Sense of community
Surface Water		Community structure
Shoreline Distance		Religious places, Pilgrimages, and Monuments
Sources (River, Lake, Ponds)		Historical / Archaeological places or structures
Bottom interface		Health and Safety
Flow variation /		
Ocean currents		Physical
Water quality		Psychological
Drainage pattern /		
Water logging		Occupational
Water balance		Parasitic diseases
Flooding		Communicable diseases (Epidemics)
Existing and planned		
future use		Water-borne diseases
Ground Water Potential		Psychological diseases
Water table		Disease vectors
Flow regime		
Aquifer characteristics		
(Recharge rate)		
Existing use and		
Proposed plans		
Atmosphere		
Air quality		
Visibility		
Meteorology (Rainfall, Temperature, Wind characters)		
Noise and Vibration		
Noise sources		
Intensity / Duration / Frequency		

effects to as low as practicable dimensions, and

- Third (Remediate or Compensate): for unfavorable remaining effects, which are unavoidable and can't be diminished further.

Mitigation can be initiated by:

Structural Measures
such as structure or area changes, designing adjustments and scene or site treatment; and

Non-Structural Measures
such as financial motivating forces, lawful, institutional and strategy instruments, arrangement of network administrations, preparing, and limit building.

A three-advance procedure of alleviation can be connected to relate the chain of importance of components amid different phases of EIA process, when they are regularly connected, as under:

Step One (Impact Avoidance)
This step is the best when connected at a beginning period of venture arranging.

Step Two (Impact Minimization)
This stage is normally taken amid effect recognizable proof and expectation to restrict or to diminish the degree, degree, extent, or length of antagonistic effects.

Step Three (Impact Compensation)
This step is typically connected to remediate the unavoidable remaining antagonistic effects.

Approaches to Mitigation
Depending on the timing of the project cycle and the nature of the impacts, number of approaches can be taken to achieve the objectives of the mitigation, such as:

- Developing better choices,
- Making proper changes to extend arranging and plan,
- Carrying out effect observing and the executives, and
- Compensating for plausible effects and probable impacts

The essential information need to be familiarized is given in Annexure 1 to 4.

Case Study – 1
Deendayal (Kandla) Port Trust (Multi-Purpose Special Economic Zone – MSEZ)
Study Area
The port of Kandla, presently known as Deendayal Port Trust (DPT), established in 1931, owes its source to the leader of the then august province of Kutch, Maharao Khengarji III. He needed an all-climate shut port for his kingdom and fabricated a RCC breakwater where boats of about 8.8 meters draft could billet round the year. This pier, which is situated at old Kandla, turned into the core of what in present years was to develop as the Deendayal Port. On January 20, 1952, Pandit Jawaharlal Nehru, the then Prime Minister of India, established the framework stone for the new Port on the Western Coast of India. It was proclaimed a Major Port on April 8, 1955 by Late Shri Lal Bahadur Shashtri,

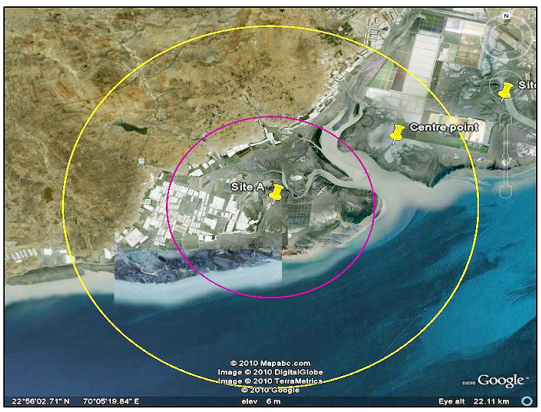

Fig. 2: Site A (MSEZ - I)

Fig. 3: Site B (MSEZ - II)

the then Minister of Transport and the Port Trust was shaped in 1964 under Major Port Trust Act 1963 instituted by Parliament. From that point forward, the Major Port of Kandla has made some amazing progress in turning into the "Port of the New Millennium".

Deendayal Port is situated at Latitude 23.01 N and Longitude 70.13 E on the shores of the Kandla Creek. It is the area of Kutch and is situated on the west of Kandla River, which keeps running into the Gulf of Kutch at a separation of 90 nautical miles from the Arabian Sea. The absolute length of the Kandla Port methodologies Channel is around 23 kms, width of the channel changes from 200 meters to 1000 meters, and the form profundity along the transportation channel is around 10 meters. Route is allowed amid the day and night as indicated by the draft of the ship. Pilot board the boats at Outer fish float (OTB) something like two hours before high tide.

India is an expansive promontory with a coastline of around 7500 km. The country accordingly requires a lively and solid shipbuilding industry for financial just as vital reasons. At present South Korea, Japan and China command the shipbuilding business. In spite of a long coastline, great potential, and accessibility of positive locales for shipbuilding, the nation's offer in the general shipbuilding tonnage on the planet is around 1.12%. Indian shipbuilding is basically focused on "27" Shipyards including "8" Public Sector and "19" Private Sector units. A noteworthy offer of the shipbuilding limit is held by open segment yards. Private Shipyards, however more in number are seriously restricted by limit and size of boats they can fabricate (Figures 2 & 3).

Demand of Shipbuilding

In the ongoing past, the worldwide delivery industry encountered a phenomenal interest. The accompanying variables are in charge of the expansion sought after for boats, worldwide:

1. Overall growth in worldwide sea exchange and dynamic development in waterfront development.
2. Progressive rise sought after of holder dispatches because of fast increment in containerization and boats for transportation of unrefined petroleum and oil based goods because of enormous expansion of refining limit.
3. New guidelines routine prohibiting single frame tankers and required Condition Assessment Program reported by DG Shipping.
4. Scrapping of old boats, particularly mass transporters because of presentation of higher basic norms would result in increment sought after for mass bearers.

The all out estimate of new shipbuilding prerequisite up to 2015 is almost 1000 million DWT. The offer of India in the Global Order Book is about 1.12% and

Table 3: Locations of Shipyards in Gujarat State

Sr. No.	Name of the Shipyard	Location	Status
1	ABG Shipyard Ltd.	Magdalla, Surat	Private
2	Larson & Toubro	Hazira	Private
3	Shipyard of M/S. Soft	Kaladara village	Private
4	Wadia Boat Builders	Billimora	Private
5	Alcock Ashdown (Gujarat) Ltd.	Old Port, Bhavnagar	A Government of Gujarat Unit
6	Alcock Ashdown (Gujarat) Ltd.	Chanch, Near Pipavav	A Government of Gujarat Unit
7	Modest Infrastructure Ltd.	Old Port, Bhavnagar	Private
8	Alang Marine	Ghogha	Private
9	Pipavav Shipyard Ltd.	Pipavav	Private
10	Mandvi Port	Mandvi	GMB Owned Port

the offer of Gujarat concerning the Indian request book is over 60%.

Scenario in Gujarat State

In Gujarat, dispatch/pontoon building is embraced on normal premise at "9" transport/watercraft building yards. The gross shipbuilding limit of the Shipyards in Gujarat is about 1.11 million DWT every year. Limit of the major worldwide shipbuilding yards is nearly reserved till 2011-12. This has made a lucky opening for Indian Shipbuilding industry, especially in the fragment of littler vessels, seaward supply vessels, apparatuses and grapple holding vessels and so forth (Table 3).

Advantages Gujarat Enjoys

Gujarat has about 1600 kms of coastline with the accompanying marine and different parameters, good to set up of shipbuilding yards.

1. Configuration of the coastline with two bays *viz*. the Gulf of the Cambay and the Gulf of Kutch offering normally secured areas.
2. High tidal range in the Gulf of Cambay offering advantage of tidal window, there by diminishing digging requirements for Shipyard activity.
3. Existence of auxiliary businesses to supply steel plates, apparatuses, equipment's, and other frivolous things require for shipbuilding.
4. Rise in seaside and abroad ocean borne exchange at its coast.
5. Good degree to adapt up interest of in fact qualified faculty for the shipbuilding area.
6. Lower work cost.
7. Pro-industry approaches of the State Government.

Table 4: List of Industries established at Kandla

Sr. No.	IMC Limited, Kandla
1.	Indian Farmers Fertilizer Cooperation, Kandla (IFFCO)
2.	Indian Oil Corporation Limited (IOC)
3.	Friends Oil & Chemical Terminal Limited
4.	Bharat Petroleum Industries (BP)

Important Ship Building Yards in Gujarat State (Operational)

Predicative Environmental Impact on Establishing Industries at Kandla Port Trust (Multipurpose Special Economic Zone – MSEZ)

Location: Kandla, Gandhidham, Gujarat, India
Type of Project: Expansion (Shipbuilding activities)
Coordinates: Site A: 22.560 02' 71" N, 70.050 19' 84" E
Site B: 22.590 04' 23" N, 70.110 50' 08"E
Authorities: Gujarat Maritime Board (GMB), Gujarat Pollution Control Board (GPCB), Central Pollution Control Board (CPCB), Deendayal Port Trust (DPT)

General Impacts of Ship Building and Ship Repair on Environment

1. Physical parameters (Air, Water, Soil, Noise)
2. Biological parameters (Flora, Fauna)
3. Socio-economics

Physical Parameters

Air

- Sulfur dioxide (SO2), VOCs, carbon monoxide, particulates, and nitrogen oxides from petroleum product of boilers and heaters and from diesel fuel motors in cranes, generator, and other hardware and overwhelming weight vehicles fumes.
- Formation of aerosols and emission of dust particles due to run-off of heavy weight vehicles.
- The most imperative ecological perspectives

Table 5: Proposed Projects

Sr. No.	Offshore Berthing Facilities
1.	Creation of dry bulk cargo handling facilities
2.	Creation of liquid bulk terminal
3.	Setting up of single point mooring (SPM) and allied facilities
4.	Creation of container terminal
5.	Setting up of bunkering complex
6.	Creation of ship building facilities
7.	Creation of ship repair facilities

concerning those procedures are primarily neighborhood to air as portrayed Important procedures are cutting, shaping, joining, granulating, sandblasting, painting and furnishing.

- Erection and equipping require cathodes, gases transportation assets and so on. Ecological viewpoints are emanations to demeanor of welding gasses, and asset usage. What's more, the transportation of plates, profiles, areas and so on by cranes and vehicles might be a natural perspective.
- The natural effects from the structure forms are for the most part nearby encompassing zone and their commitment to the all out ecological execution of a ship in an all out life cycle view might be overlooked contrasted and the effect from the emanation of residue particles from the operational stage.
- The effect of structure forms are noteworthy from neighborhood point of view, however the ecological impacts that are at first of a nearby sort may have long haul impacts, similar to individuals may experience the ill effects of bronchitis or asbestosis.
- The release of gases from cutting and consume off tasks exhibits a risk to the earth just as to the people uncovered. Vital ecological perspectives are worried about Fugitive outflows from affecting tasks can go past the impacting zone, conveyed via air.
- Use of solvents all the while, production of residue amid shot impacting, machining and welding exercises can result in respiratory infection.
- Smaller vessels can be taken a shot at underneath shop rooftops, yet bigger vessels are chipped away at in open regions; on coasting dry-docks or marine railroads. Influencing coarseness utilized in shipyards commonly is a slag, a side effect of ferronickel generation. The constituents of influencing coarseness shift, yet overall incorporate oxides of silicon, iron, aluminum, and calcium. A few corn meals likewise may contain oxides of zinc and magnesium, and follow measures of copper, titanium, sulfur, and oxides of potassium and sodium.
- Asbestos has been utilized on a vast scale for a long time as an insulating and protection material and might be experienced in a wide scope of structures including asbestos concrete loads up, as flame retardant gaskets in pipe work and as flame retardant protection around boilers and heaters.
- The release of gases from cutting and consume off tasks exhibits a risk to the Environment just as to the people uncovered. Critical natural viewpoints are worried about:

1. Hydrocarbons and cargo residues
2. Coatings and paint (PCB, VOCs)
3. Firefighting agents
4. The hull and large steel structures

- Conventional preliminaries and paints contain solvents and shades with overwhelming metals. Numerous solvents contain unstable natural mixes (VOC) as well as Hazardous Air Pollutants (HAPs). More than 180 HAPs are managed under the Clean Air Act. All HAPs and some VOCs are appeared to cause malignant growth, so presentation to specialists is a basic issue. A few HAPs and VOCs additionally add to the development of ground level ozone (exhaust cloud).
- Some instances of leukemia, lymphoma, asthma, and lung malignant growth have been known to happen because of poor site radiation control security and the board rehearses.

Water

- The most essential natural perspectives concerning those procedures are for the most part nearby angles with connection to water as depicted. The effect on the earth depends anyway on which advances are being utilized, for example, recently created procedures like submerged plasma welding, electron bar welding, rubbing blend welding, and laser cutting. Scraps (heavy metal) from welding & cutting may harmful to water environment and affect water quality leads to changes aquatic biota cycle.
- Due to body surface cleaning, paint evacuation, changes of zinc anodes, and paint application imperative ecological viewpoints are:
- Releases to water (overwhelming metals,

paint profluent, flush down water)

- Risks to marine condition: Because without TBT paints don't viably control fouling,
- They increment the danger of boats presenting intrusive, non-local species that can cause monetary and ecological biological community harm, including the breakdown of an area's fisheries. Moreover, little information exists on the potential unending or long haul dangers to the marine condition of without tin items.
- Dissolved oxygen is essential for the survival of sea-going life, and is a decent marker of water quality. At the point when a lot of natural waste taints water, microorganisms utilize more oxygen to disintegrate the waste, causing a drop in the oxygen level. This procedure of eutrophication happens most.
- Direct discharge of pollutants, as well as wastewater and shipping yard runoff, can cause localized pollution hotspots along the coasts. These pollutants sometimes reduce the oxygen in coastal waters to levels that cannot support life.
- Regular releases of fuel, sewage, and rubbish from maritime ships likewise add to sea contamination.
- Impact on recreational utilization of riverbanks, shorelines, coasts, and wetlands incorporate impedance with recreational exercises, for example, calculating, sculling, plunging and washing and strolling because of the wellbeing and dangers sleek water presents to riverbank, coast, wetland, or shoreline.
- Oil spills from tankers and seaward oilrigs are a noteworthy danger to sea life, influencing everything from phytoplankton, green growth and coral reefs, fish, and marine well-evolved creatures. Oil slicks amid fitting activities may defile the waters encompassing the shipyard. Overflow water is probably going to catch oils and garbage that has collected on the dock territory.
- In expansion, enormous gatherings of disposed of plastic and other constant trash routinely damage or execute feathered creatures, fish, and other ocean life.
- The bottoms of vessels that have drawn out seawater contact regularly are covered with "against fouling" paints containing synthetic substances that transfer of coarseness a basic monetary and ecological issue for shipbuilding and fix offices.
- Heavy metals and coincidental releases from spills and capacity tank spillages may likewise pollute groundwater.
- The remaining zone of the shipyard will bolster subordinate exercises including tank ranches; repress the connection of fouling life forms to structures. The dynamic fixings regularly found in hostile to fouling paints are metal-based, for example, cuprous (copper) oxide, or tributyltin (TBT).
- Metals can enter the water through release of hostile to fouling paint chips and paint expulsion materials amid vessel upkeep exercises.
- Galvanizing and other metal planning showers will release corrosive/soluble base and metals loaded waters.

Soil

- The paints that are used might be spilled on the ground during building process and it might contaminate the soil.
- Process like Galvanization and other metal preparation will release wastewater that might get mixed with the surrounding soil and contaminate it.
- The impact of raw petroleum washing on erosion ought to be assessed including the impact of a film of oil on steel, the adequacy of various kinds of unrefined petroleum clothes washers, and the effect of raw petroleum washing on rust scale partition from steel surfaces which influences soil profile and soil biota.
- The iron may get rusted and will lead to increase in iron concentration of the soil.
- Various oils are used in the engines, during production they may get leaked from tankers and will contaminate the soil.
- Various heavy metals are used in shipbuilding, and this might lead to soil contamination.
- Spent coarseness should be tried for lethality. In the event that it is viewed as dangerous, it must be overseen and discarded as unsafe waste. The probability that coarseness will come up short the tests relies upon how it has been utilized.

- Grit that has been utilized to evacuate against fouling base paints is bound to come up short the tests than coarseness that has been utilized to strip topside surfaces.
- Sludge from wastewater treatment, perhaps with a substantial metal substance.
- There is a high rate of slips, excursions, and falls at shipyards because of uneven surfaces, shaky walkways and wet decks.
- As vessels are being developed in numerous dimensions, falling items are a peril. Also, faculty can be hit by falling/moving items amid manufacture.
- Poor the executives of materials waste, and releases from creation introduce a potential danger of soil tainting.
- The adequacy of coal tar and unadulterated epoxy coatings ought to be assessed in a domain that incorporates microbial affected erosion.

Noise

- During the building process, various machines as driller, cutter, etc. are used which produce very high noise that might harm the workers and people living in surrounding area.
- Various vehicles will be used for transport of raw material, the will also add up to the overall noise pollution.
- Pneumatic hammers, gouging devices, and chipping machines are wellsprings of huge commotion presentation in shipyards.
- Falls from stature like (from cranes) happen on shipyards while vessels are being built. As vessels are being built in numerous dimensions, falling articles are a perilous material.
- Noise contamination and vibrations, which influence the nature of the earth for example working conditions for the team and travelers and outside.

Socio-Economic Parameters

- Land Acquisition: The land used for the ship building industry will result in usage of the land that was previously occupied by the local people. They will need to be resettled before commencing the project.
- Fishing Activities: The local people are fisherman, and do fishing for their food as well as earning. Therefore, establishment of shipbuilding industry will lead to disturbance in their daily activity as well as will hamper their livelihood. It will also bring changes in the number of fishes that are present in the water due to waste generated.
- Access to the road: During the construction phase, many vehicles will be using the road facility, so it will generate lot of traffic, and in turn affect the movement of the local people.
- Employment: Local people not capable of working in the industries will be adversely affected, and the local people migrated to another place for getting work. Because of revenue contract system, local people cannot get employment and the laborer from different states is coming and interfere culture of local community.

Biological Parameters

Bay of Kachchh (hereinafter named as Gulf) which possesses a region of 7300 km2 is organically a standout amongst the most gainful and enhanced living spaces along the west shoreline of India. The high tidal convergence covers huge low lying zones of around 1500 km2 involving a system of rivers, boggy salt marshes and rough locales which give suitable condition to a wide assortment of marine biota. The southern shore has various Islands and channels, which harbor immense regions of mangroves and coral reefs with living corals. The northern shore, which is transcendently sandy or sloppy stood up to by various reefs and brooks, additionally supports substantial stretches of mangroves. An assortment of marine riches existing in the Gulf incorporates green growth, mangroves, corals, wipes, mollusks, prawns, angles, reptiles, fowls, and warm-blooded animals. To secure the rich biodiversity of the Gulf, a few intertidal mudflats and coral reefs along its southern shore are announced as Marine National Park and Marine Sanctuary. Modern and different advancements along the Gulf have quickened as of late with the foundation of two oil refineries. Furthermore, the ports at Okha, Kandla, Navlakhi, Mundra and Jakhau handle an assortment of payload and are in charge of significant ship traffic in the Gulf. Extra three noteworthy ports are arranged separated from the extension projects of the current ports. A few hostage piers are likewise under thought. Four SPMs are as of now operational

two each at Vadinar and Sikka and one worked by Indian Oil Corporation Ltd. also, Reliance Petroleum Ltd. individually. Another two SPMs will be set up by 2002 between Vadinar and Sikka by Bharat Oman Refineries Ltd. what is more, ESSAR Oil Ltd. As these SPMs will be utilized for import of unrefined petroleum, traffic of raw petroleum and oil-based commodities is relied upon to go up considerably throughout the following couple of years.

The other major mechanical advancements around the Gulf incorporate a soft drink slag industry at Mithapur, a concrete plant, a warm power plant and a manure production line at Sikka and a bond complex at Mundra. A large number of these businesses utilize the Gulf either straightforwardly or in a roundabout way to draw seawater for cooling, to discharge wastewater including the arrival coolant and fare/import of materials. Likewise, there are a few medium and little scale enterprises and saltpans, which utilize the Gulf in an assortment of ways.

a. Flora

Apart from agricultural land, the study area has only sparse vegetation. Natural vegetation in the study area is desert thorn forest, with Prosopis juliflora, the dominant species. Typical open scrub forest mainly constitutes thorny, stout species of Prosopis juliflora, Acasia sp., Euphorbia sp., and Cassia auriculiformis. The coastal area has small patches of mangrove forest. Sand dunes are also found very close to the coast.

b. Fauna

As Kandla is a port close to Arabian Sea, the water is reach in variety of fishes that are used by the local fishermen as food as well as an income source, establishment of shipbuilding industry over here will greatly reduce the number of fishes in the water indirectly affecting the local fishermen's. Previously fishermen used to get the fishes at short distance from the cost, but due to the establishment of the industries the distance might increase and the fishermen will have to travel more distance in the sea to get food.

Attributable to its evolving condition, the examination region harbors couple of natural life types of some environmental hugeness. Nevertheless, the seaside zones, which have numerous saltpans, islands, and intertidal beachfront frameworks with mangroves, offer positive conditions for bolstering, reproducing, and safe house to an assortment of winged animals. An examination completed amid November 1999 uncovered high avifaunal assorted variety in this district and recorded 140 flying creature species, of which 85 were earthbound and 55 oceanic. Out of these, 71 were inhabitant species, 44 transients, and 25 occupant vagrant. In view of locating, 21 species were accounted for to be plenteous, 42 normal, 51 uncommon, and 26 uncommon. A portion of the winged creature species located amid the overview was grey herons, pond herons, large and small egrets, and black ibis.

Environment Management Plan (EMP)

1. Water

- No disposal of waste into marine water
- Establishment of water treatment facility
- Implementation of water quality monitoring program
- Proper drainage system for proper discharge of wastewater
- Recycle water to decrease raw water requirement as well as decrease pollution.
- Raw materials and other stuffs those are likely to undergo surface runoff during monsoon, needs to be properly covered or to be kept in sealed containers.
- Proper sanitation facilities for the workers working in the industry
- Proper measure to make sure that the water used in the industry should not come in contact with potable water.
- Regular checkup of pipelines for leaks, to make sure that the oil and other chemicals are not mixed with the marine water as well as the potable water.
- Proper labeling of hazardous waste to prevent accidents
- Full-scale and model testing of wash impacts, including investigation of the ecological results

Air

- Establishment of Ambient air quality monitoring program
- Use of low VOCs paints to decrease air pollution
- Use of proper equipment to decrease air

pollution as possible
- Transportation management plan to decrease vehicular emission
- The waste should not be burned.
- Chimneys of proper height need to be made.

Noise
- Use of sound absorber to decrease noise.
- Use of machines that produce low noise.
- Proper maintenance of vehicles and machine to decrease noise.
- Manage vehicular traffic to decrease noise coming from vehicles.
- Give proper equipment's to the workers to protect them from damage caused due to loud noises from machinery
- Manage a working time to ensure that local people are not disturbed.
- Follow guidelines made by the CPCB to ensure less noise pollution.
- Sound proof cabins for the operators working at noise environment.
- Reduction of clamor from gas turbine drive frameworks is an issue for fast ships. Nonetheless, the fundamental driver of commotion and vibrations in boats is cavitation on the propeller. Cavitation happens mostly due to the non-uniform wake field in which the propeller works.
- Developments of commotion forecast strategies dependent on SEA and FEM.
- A sound upkeep the executives framework is an indispensable piece of a security the board framework (SMS) and is a piece of the necessity for getting and keeping up ISM accreditation

Soil
- Soil that is excavated for use needs to be properly stored to avoid surface runoff.
- Proper disposal facilities for wastewater to make sure that it doesn't percolate in the soil affecting the ground water.
- Regular sample collection for checking the soil quality.
- Land filling site should be properly treated to avoid contamination.
- Land to be used should not be taken from agriculture or forest.
- Green belts need to be made according to standard guidelines to ensure erosion does not take place.
- Mangroves should be grown at places to ensure protection form flood.
- Separate vehicles parking should be allocated.
- Heavy vehicles should use alternate route to ensure less damage to road.
- Containers should be checked for leakage to avoid spills on land. Normal examination ought to be completed of all mass control nearby to forestall spillage.
- Domestic waste generated, either to be reused or gathered at a common place to be further processed.
- Afforestation program should be undertaken
- Development of plan criteria for counteractive action of contamination because of establishing and crash.
- Design of ship bodies for erosion aversion/ decrease and for simplicity of examination and upkeep.
- Better squander the executives (for example

Fig. 4: Tree Plantation on Back-filled Region at Mata No Madh Lignite Mines

Fig. 5: Mining Activities at Mata No Madh Lignite Mines

Table 6: Details of the Project Environment

Village	Mata No Madh, Lifri, Dhedrani		
Taluka	Lakhpat		
District	Bhuj (Kachchh)		
State	Gujarat		
Nearest Railway Station	Bhuj (100 km)		
Nearest Air Port	Bhuj (100 km)		
Lease Area	1752-61-56 Hectare		
Lease Coordinates	Latitude : 23°29'00" to 23°32'00"		
	Longitude : 68°56'00" to 68°59'00"		
Commencement Period	Year 1999-2000		
Mineral Mined	Lignite		
Mineral Reserves	48.92 million tone's		
Mineable Reserves	33.90 million tones		
Overall Ratio	1 : 9.49 {Lignite (T) : Overburden (M3)}		
Exploration Agencies	Commission of Geology and Mining (GMDC)		
Total Length of Exploration	12754 m		
Total Exploration Area	6.48 km2		
No. of Exploration Boreholes	248 within lease area		
Method of Excavation	Opencast Mining, Using Hydraulic excavators and dumper combination along with ancillary equipment such as Dozer,Water Sprinkler, Motor Grader etc.		
	Period	Series	Formation
Local Geological Formation	Recent	Alluvium	Top Soil Cover
	Oligocene	Nari	Sandstone
	Miocene	Gaj	Siliceous Limestone, Marls
	Up Eocene	Kirthar	Nummullitic Limestone & Calcareous Clay
	Later Eocene	Laki	Clay, Shale, Carbonaceous Shale, Clay, Lignite, Siderite.
	Eocene	Ranikot	Lithomarge Clay, Bauxite Lateritic Variegated Clays.
	Up Cretaceous		Deccan Trap
	Jurassic		Sandstone
Usage of Lignite	Lignite is directly used in Thermal Power Plants, Textile Industries, Paint Industries, Soda Ash industries, Roof and Tiles Industries, Cement Industries etc.		
Lignite Production (in Mt.)	1st May'2009 to 15th May'2009	1st May'2010 to 15th May'2010	1st May'2011 to 15th May'2011
	127066.32	148105.73	135827.3
Lignite Quality supplied during period from 1st to 15th May'11	Content	Received Base Analysis (Mean %)	
	Total Moisture	33.44	
	Ash	23.83	
	Volatile Matter	26.91	
	Fixed Carbon	15.82	
	Calorific Value Kcal/Kg	2892.65	
Customers	Nirma Limited, Indian Rayon And Industries Ltd., Saurashtra Chemicals Ltd., S.A.L. Steel Limited, Rainbow Papers Ltd., Jaypee Gujarat Cement Pvt. Ltd., Euro Ceramics Ltd., CIL-Nova Petrochemicals Ltd., Welspun Corporation Ltd. (Plate & Coil Mill division), Omkar Textile Mills Ltd.		

rules on following the reusing of waste material like oil, spent solvents, batteries, oil channels, fluid waste)

- To accomplish an earth worthy transfer of waste, it is basic that each Port State give sufficient gathering offices in the entirety of its ports with the goal that waste can be gotten and treated.
- Reduction of harmful substances during maintenance.

Socio-Economic Profile

- Local people who cannot work in the industry should be rehabilitated at proper places.
- Local people capable of working in the industries should be recruited to decrease transport of work force.
- Industrial Township to be made at a safe distance away from the society to make sure they are not adversely affected.
- Green Belt to be made near the township to ensure less polluted atmosphere.
- Regular Occupational health checkup.
- Roads should be constructed for local people to travel easily.
- Training of workers on appropriate waste control and transfer techniques, upkeep guidance, and better work conditions. Awareness program should be carried out as per for local people knowledge about generation of waste and management.
- Good housekeeping ought to be kept up consistently in all regions.

Occupational Health and Safety Improvements

- Provision of individual defensive hardware (PPE) that is fit for the undertaking to anticipate damage and keep up cleanliness guidelines. Staff ought to be prepared in the right determination, use, and support of PPE. PPE ought to be assessed consistently and kept up or supplanted as important.
- Train laborers in right utilization of apparatus and wellbeing gadgets.
- Install mechanical lifting helps where conceivable and pivot work assignments to decrease dull exercises.
- Separation of individuals from moving gear: Install walkways to isolate individuals from vehicles or moving parts to decrease danger of crash.
- To decrease the danger of commotion presentation seclude boisterous gear and turn assignments to limit time spent in an uproarious region over an eight-hour duration and give individual defensive hardware where individuals need to enter loud zones.
- Provide proper fall capture gear.
- Is firefighting and medical aid gear accessible?
- Check the age and state of gear search for indications of mileage, corruption, holes, and breaks.
- Check that strong waste stockpiling and transfer (stockpiling hardware) is in a decent condition.
- Check that squander capacity zones are clear of trash and that skips are secured to avoid squander getting away, for instance, watch that squander compartments have covers, or are put away in a territory with a rooftop.
- Have the premises been examined as of late by the administrative specialists for wellbeing and condition? What were their discoveries?
- Check for programmed protects on apparatus to counteract incidental damage.
- Check that wages and working hours are steady with the normal for the area and national guidelines.
- Does the association have protection set up to cover the review of debased items? Have there been any ongoing item review

Table 7: List of Common Tree Species reported in and around Mine Project Area (MPA)

S.No.	Plant Species	Local Name
1.	*Acacia leucophloea*	Hirmo, Haramu
2.	*Acacia nilotica*	Deshi Baval, Bavar
3.	*Acacia senegal*	Kher, Gorad
4.	*Balanites aegyptica*	Hingor, Hingod
5.	*Commiphora wightii*	Gugal
6.	*Cordia perrottetii*	Adbau Gundi, Jangli Gundi
7.	*Maytenus emarginata*	Vikalo, Vigo
8.	*Prosopis juliflora*	Vilayati Baval
9.	*Prosopis cineraria*	Kandhi, Khajdo, Kando
10.	*Salvadora oleoides*	Mithi Zar, Mithi Pilujo Zad
11.	*Salvadora persica*	Khari Zar, Pailu
12.	*Tamarix aphylla*	Lai

episodes?

- Have there been any ongoing occurrences on location, for example, fatalities, fires/blasts, spills? Is protection set up to cover such occurrences?
- Operational methodology to oversee ecological, wellbeing and dangers.
- Monitoring programs.
- Improvement goals, targets, and task plans.
- Training for staff.
- Regular assessments, checks and reviews with records to exhibit accomplishment of the required dimension of execution against legitimate necessities and improvement activity.
- Emergency plans for condition, wellbeing and security mishaps, or cleanliness resistance.
- Management audit/showed contribution in condition, wellbeing, security, and cleanliness the board.

Case Study – 2

Mata No Madh Lignite Mines (GMDC)

Study Area

The Gujarat Mineral Development Corporation Limited (GMDC) is a state Government undertaking

Table 8. List of Faunal Species recorded in and around Mine Project Area (MPA)

S. No.	Species Name	Common Name
A	**Reptiles**	
1.	*Acanthodactylus cantoris*	Indian Fringe Toad Lizard
2.	*Calotes versicolor*	Indian Garden Lizard
3.	*Sitana ponticeriana*	Fan-Throated Lizard
B	**Birds**	
1.	*Acridotheres tristis*	Common Myna
2.	*Bubulcus ibis*	Cattle Egret
3.	*Centropus sinensis*	Crow pheasant or Greater Coucal
4.	*Coracias benghalensis*	Indian Roller
5.	*Corvus splendens*	House Crow
6.	*Dicrurus macrocercus*	Black Drongo
7.	*Francolinus pondicerianus*	Grey Partridge or Francolin
8.	*Galerida cristata*	Common Crested Lark
9.	*Halcyon smyrnensis*	White breasted Kingfisher
10.	*Lonchura malabarica*	White-throated Munia
11.	*Merops orientalis*	Green Bee-eater
12.	*Nectarinia asiatica*	Purple Sunbird
13.	*Passer domesticus*	House Sparrow
14.	*Pavo cristatus*	Indian Peafowl
15.	*Pycnonotus cafer*	Red-vented Bulbul
16.	*Pycnonotus leucotis*	White-eared Bulbul
17.	*Saxicoloides fulicata*	Indian Robin
18.	*Streptopelia decaocto*	Eurasian Collared Dove
19.	*Streptopelia senegalensis*	Little Brown or Laughing Dove
C	**Mammals**	
1.	*Canis aureus*	Jackal
2.	*Funambulus pennantii*	Five-Striped Palm Squirrel
3.	*Gazella bennettii*	Indian Gazelle (Chinkara)
4.	*Hystrix indica*	Indian Porcupine
5.	*Lepus nigricollis*	Desert Hare
6.	*Sus scrofa*	Wild Pig

exploration and exploitation corporation operating number of Lignite, Bauxite, Fluorspar mines in the state. It was set upin the year 1963, with the command to create real mineral assets in the State of Gujarat. GMDC is engaged in tapping lignite at Mata-Na-Madh village of western Kachchh region. Amid the period 2007-08, the mine delivered 6.64 lac MT, which is higher by 1.62 lac MT when contrasted with earlier year's creation 5.02 lac MT. As a part of the summer training program in 1999, this lignite lease area of Mata-No-Madh was visited to understand the mining activities and surrounding environmental status. This part of the report detailed the environmental condition of the project area and likely impacts and possible mitigation measures (Figures 4 & 5).

Mine Project Details

Details of the nature of the project environment area are given (Table 6, Figures 4 & 5).

Baseline Status of Flora & Fauna of the Project Area

List of common tree species, reptiles, birds, and mammals observed are given in the following tables. This list includes 12 species of trees, three species of reptiles, 20 species of birds and 6 species of mammals (Tables 7 & 8).

General Environmental Impacts due to Mining Activities

Physical

Lands and Soil

- Loss of land due to mineral excavation in the form of mine pits and waste dumps
- Loss of land due to development of infrastructure facilities like mine office, roads, sheds, labor resident, power office, parking place for vehicles used for transportation of minerals
- Change in the natural landscape due to the above project related activities
- Loss of forestland due to Deforestation to extract lignite and other activities
- Loss of fertile top soil
- Contamination of soil due to dust deposition from the mine lease

Hydrology / Water Resources

- The major unfavorable effects are changes in ground water stream designs, bringing down of water table; changes in the hydrodynamic states of waterway/underground energize basing, decrease in volumes of surface release to water bodies/streams.
- Disruption and redirection of water courses/ wastes, tainting of water bodies.
- Affecting the yield of water from bore wells and burrowed wells, land subsidence and so on.

Water Quality

- The significant effects are water contamination because of disintegration, oils, and oil.
- Contamination of water bodies because of release of mine water/effluents, contamination from sewage effluents.
- Sedimentation of streams and other put away water bodies, leachates from wash-off from dumps.
- Solid squander transfer destinations, broken rocks, lethal squanders, saltiness from mine flames, corrosive mine seepage and so on.

Air Quality

- The main undesirable impact is the elevated concentration of dust emission due to lignite excavation.
- Dust emission due to transportation of excavated earth materials from the mine pits.
- Dust emission due movement of vehicles.
- Sulfur present in lignite while comes in contact with air oxidation of sulfur takes place and produce fumes.
- The significant effects are water contamination because of disintegration, oils, and oil.
- Cossntamination of water bodies because of release of mine water/effluents, contamination from sewage effluents.
- Sedimentation of streams and other put away water bodies, leachates from wash-off from dumps.
- Solid squander transfer destinations, broken rocks, lethal squanders, saltiness from mine flames, corrosive mine seepage and so on.

Noise and Vibrations

- The major unfriendly effects amid pre-mining and mining stages are age of repulsive dimensions of commotion and vibrations because of mining and vehicle developments.

Biological

Flora

- Loss of vegetation cover and plant diversity due to deforestation
- The plants that grow around mine will be affected by the dust that comes out from the mines.
- The dust will cover the leaves and reduce the photosynthesis.
- The top soil is removed leading to decrease in nutrient content and affect the vegetation growth.
- The polluted water affects the growth of plants

Fauna

- Loss of forest directly impact on the animals depend on the forest habitat
- Mining impact the faunal groups reported in and around the mine lease area
- Contamination of water resource impact on aquatic vegetation and faunal species mainly amphibians and aquatic birds
- Contamination of water and disturbance to the water resources affect the other animal species depend on the water resources of the mine lease area
- The polluted air will indirectly affect the animals.
- Animals get disturbed due to frequent movements of vehicles and they move out of their original habitat.
- Animals mortality may occur due heavy vehicle movements
- Overall impact on faunal diversity of the project area

Socio-Economic

The following areas the likely impact on social components due to mining.

- Loss of natural resources like: grazing area, agriculture land, water
- Health problems may occur due to air and water pollution
- Loss of agriculture land affect income and livelihood

Environmental Management Plan (EMP)

Land and Soil Scape

- Optimal way of land use to minimize impacts cause due to land lease area
- All the infrastructures need to be developed within the project area without taking additional lands,
- Use of existing roads for project related activities to minimize additional land requirements and change in the landscape
- Top soil should be removed and conserved for plantation activities.
- Proper afforestation for renewal of soil quality.
- Proper plantation on slopes of dump to avoid surface runoff.

Water

- The project should be designed and planed spatially to avoid impact on local hydrological regimes of both surface and ground water.
- Proper water budgeting need to develop to minimize impact on local water resources
- All the storm water generated in the mine pits need to be stored in separate pit and filtered before release in to natural water course
- The project proponent should develop its own water resources for the use of project related activities by construction of open well, bore wells and dams
- Roof water harvesting systems need to be developed wherever possible to generate excess water resource
- Plantation should be developed on the external dumps to avoid runoff water which contaminate other natural water bodies
- Plantation on the dumps avoid dust emission due to heavy wind

Air

- Implementation of ambient air quality monitoring program.
- Dust suppression by using heavy dust sprinklers on the road.
- Dust extraction facilities.
- Mineral handling plants to be properly covered.

- Transportation to be properly covered.
- Vegetation should be grown to avoid air pollution
- Avenue plantations need to be developed along the road side to control the dust emission due to vehicle emission
- This avenue plantation can also help in control noise and absorb gasses emission generated due to vehicles

Noise and Vibrations

- Provision of ear plug for workers working in the mines
- Use of clamor reduction cushioning in fixed plant establishment.
- Use of noise absorbing devises.
- Location of residential colony should be away from the mine.
- Buildings should be made in such a way that they are not affected by the vibrations.
- Use of improved blasting facilities.

Socio-Economic

- Compensation to each family for house and land obtained.
- Employment for the local people.
- Proper training programs for the workers
- Green Belt to be made near the township to ensure less polluted atmosphere.
- Regular Occupational health checkup.
- Roads should be constructed for local people to travel easily.
- Training of representatives on appropriate waste control and transfer systems, upkeep guidance and better work conditions.
- Awareness program should be carried out as per for local people knowledge about generation of waste and management.
- Good housekeeping ought to be kept up consistently in all territories.

Occupational Health and Safety

- Mock safety drill
- Blasting during normal working hours only.
- Personal Protective Equipment's should be provided.
- Proper Sanitation facilities for the employees
- Proper medical facilities for the employees.
- Regular medical checkup of the workers.

Discussion

Environmental Description

The ecological depiction or standard investigations of both examination locales were researched exactly and precisely in setting of EIA and EMP, planned to set up the current situation with the earth in that, considered the progressions came about because of characteristic occasions and from other human exercises.[23,24] This diminished the precision of resulting forecasts and moderation measures.[24] Every important part of both the biophysical and financial condition and their connections were portrayed in adequate detail to direct quality effect forecast.[25,24]

The biophysical natural depiction incorporated a portrayal of the geographical and land highlights (incline; grade; soil; penetrability; mineral substance; load bearing limit; radiological attributes; critical topographical and geological highlights (for example land quality, disintegration); hydrological highlights (compound, physical and natural parameters of surface, ground, and sea water, wellsprings of water supplies, seepage bowls, and amount of water sources); air, atmosphere, and climate conditions; and widely varied vegetation (relevant living spaces, jeopardized species, biological communities and connections among species).[25,24]

The financial ecological portrayal included personal satisfaction information (salary, work and business/ industry patterns, recreational chances, and general wellbeing status); a network profile (asset use, land use, townscape, transportation systems, framework, commotion, populace thickness, and socioeconomics); and a depiction of critical locales (indigenous, recorded, profound, archaeological, and cultural).[25,24]

A portrayal of the venture condition connections included changes that were occurred in the earth paying little heed to the undertaking; a situation characterized in fleeting and spatial terms; a depiction of the associations between task impacts; a portrayal of the collaborations with impacts of different activities; and a portrayal of the current wellbeing of the biological community (profitable, conveying, and assimilative capacity).[25,24]

Biophysical Impact Analysis

A biophysical affect examination includes no less than two conjectures. One figure predicts how the biophysical parts will change and advance normally. The second estimate predicts how the segments will react to the proposed task.[26] Techniques or devices used to investigate and figure the biophysical effects ought to be unmistakably expressed. This permits all worried to decide if the proper strategy or model was utilized in effect gauging. The estimating system picked ought to rely upon the normal utilization of the information, the nature of the task and the accessibility and nature of information. Along these lines, the biophysical affect examination ought to be straightforward, express and simple to repeat.[26] Investigations on biophysical impact was completed to examine immediate, backhanded, intuitive, total, transitory, changeless, long haul, and transient effects on all distinguished VECs. Effect, as recently characterized by,[4] is "any adjustment in the physical, normal or social condition achieved by advancement." Impacts were not limited to the venture limits dictated by people. For instance, water and air contamination, other than influencing territories inside the task site, additionally influenced zones downstream or down wind. Consequently, impacts were analyzed past the undertaking site. These effects were recognized in the checking procedure.[26]

The biophysical investigation considered undertaking impacts just as the proposed territory's common changes. Suitable accentuation was given to the most extreme, unfriendly effects of the task with lesser accentuation gave to less noteworthy effects. The positive and negative impacts of elective intercessions on VECs were expressed unequivocally.[26]

Social Impact Assessment

The Social Impact Assessment (SIA) is a critical segment of the EIA procedure that decides plausible social, social, financial, legacy, and wellbeing impacts, of a proposed venture on influenced people, gatherings, and networks. Today, SIA has increased acknowledgment that is more extensive since it is currently performed via prepared social researchers that utilize sociology strategies. To foresee the foreseen social effects of an undertaking, sociologists gather information at various phases of a venture utilizing factors. In spite of the fact that utilizing a variable rundown as an agenda is not prompted, in light of the fact that extraordinary, yet essential factors might be found in the SIA procedure, a rundown can give a beginning stage to commentators.[27,28]

The methodology taken relies upon the objectives and setting of the task and of the SIA. The predominant models are the specialized model and the political (or participatory) demonstrate. The specialized model infers that a SIA is an activity proposed to add to a normal examination, and is established on judicious choices, data, and science. The political model proposes that an open, participative process prompts better choices, as choices are not esteem unbiased and ought not endeavor to be esteem impartial.[29,28]

Impact Significance

Deciding effect criticalness is a troublesome errand constrained by a fragmented comprehension of the term essentialness, poor information, esteem decisions, and complex process collaborations that trade off assessmen.[30,31,32] No uniform meaning of criticalness exists.[33] In this way, EIAs are allowed to incorporate both subjective and quantitative techniques for assessing sway criticalness.[34,32] Centrality assurance limits and criteria must be characterized and substantiated.[35,32]

The essentialness assurance approach process was unequivocally depicted and detectable.[35,32] A precise and reproducible methodology was utilized whether the methodology was abstract or target.[36,32] Legitimization of the technique for assessing sway hugeness incorporated since it uncovered if the EIA was adequate. The strategy for deciding noteworthiness included the utilization of solid, intelligent, diagnostic, and logically stable strategies.[37,32]

The EIA involvement in India demonstrates that the absence of convenient accessibility of solid and valid natural information has been a noteworthy bottleneck in accomplishing the full advantages of EIA. Nature being a multi-disciplinary subject, a huge number of organizations is engaged with accumulation of ecological information. In any case, no single association in India tracks accessible information

from these offices and make it accessible in one spot in a structure required by ecological effect evaluation specialists. Further, ecological information is not accessible in upgraded structures that improve the nature of the EIA. This makes it harder and additional tedious to create EIAs and get convenient ecological clearances from controllers.[40]

In a few occurrences where open interest is required by EIA enactment, such cooperation could be constrained. For instance, the law in India necessitated that a formal proceeding is directed. Nevertheless, NGOs regularly considered the formal proceeding as organized procedure that seemed to include nationals when the choice had just been made.[41]

The Environmental Conservation Act (1995) required natural freedom for advancement ventures, yet it additionally maintained whatever authority is needed to the legislature to forgo the leeway prerequisite. This gave the motivation to extend advocates to apply impact to ardent this necessity. Since open interview and open support were constrained, these two powers for were blocked from countering the illicit impact, and they were hindered from giving a motivator to the successful distinguishing proof and relief of potential natural effects.[42]

Conclusion

In the course of the last many years, EIA has turned into a universally acknowledged and built up apparatus for ecological administration. Amid this time, EIA techniques have been fortified and EIA limit has been enhanced in a wide range of settings, including created, creating, and transitional economies. There is no uncertainty that, particularly in progressively develop EIA frameworks; EIA has had any kind of effect to examples of advancement through structure alterations, institutional learning, and partner association. The nature of choices including EIA has enhanced because of the expanded utilization of adjustment or moderation, the utilization of progressively stringent conditions upon authorizations and, occasionally, the non-usage of possibly ecologically harming proposition, which may beforehand have been affirmed.

Nevertheless, there has been developing disappointment over the way that EIA's impact over improvement choices is generally constrained and that it has all the earmarks of being missing the mark concerning its maximum capacity. Indeed, even its most prompt points of guaranteeing that the probable ecological outcomes of advancements are appropriately considered; and improved where essential are just being met to a certain point. The accomplishment of its substantive point, adding to increasingly feasible examples of movement, albeit hard to evaluate, gives off an impression of being considerably progressively tricky. This might be mostly because this point is not well characterized in itself yet it likewise sells out an inability to join into EIA frameworks any reasonable method of reasoning for attempting to such an end.

A scope of explicit measures has been prescribed to fortify EIA frameworks and many have been received throughout the years. These have commonly centered around presenting or reinforcing proper procedural prerequisites, supported by limit building estimates identified with direction, preparing and examine. The case for formal instruments that guarantee 'development' of EIA in connection to singular undertakings, for example, linkage with natural administration frameworks, has like-wise been made. Nevertheless, these measures stay constrained in their impact, and EIA for the most part keeps on achieving just moderately unobtrusive alterations of improvement proposition.

This frustrating execution has prompted expanding addressing about the idea of EIA and an acknowledgment that it is on a very basic level pragmatist approach is out of venture with the substances of basic leadership. This has started to concentrate consideration on basic leadership settings themselves, and recommends that EIA be all the more firmly adjusted to the procedures that it tries to impact. On a positive note, viability considers additionally propose that EIA as of now identifies with basic leadership in progressively backhanded ways, inferring that EIA is yielding more extensive advantages than those just connected with explicit task choices.

The proceeding with desire that EIA ought to add to the more extensive undertaking of achieving supportable improvement has given EIA its most vital feeling of direction however this has not

been made an interpretation of obviously into EIA structures, standards or philosophies. Setting about this errand would be methods for restoring the establishing motivations behind EIA and giving it an increasingly determinative position in undertaking arranging forms. For instance, it is likely time to reevaluate the idea of 'unequivocal obligatory necessity' (Section 2) and give EIA a statutory reason.[38] Much could be accomplished by expanding the load given to ecological assets and limits in existing EIA frameworks. A similar end could be accomplished by guaranteeing that EIA was connected to clear 'naturally practical improvement' targets. The adequacy of EIA would be reinforced if a particular point was to convey 'no net natural weakening' and, if this could not be illustrated, to require the utilization of the prudent standard in basic leadership. There is no uncertainty that, if the general population and lawmakers will the closures, EIA can give substantially more viable methods for drawing in with arranging forms and of accomplishing increasingly reasonable examples of advancement.

The EIA procedure is an interdisciplinary and multi-step method to guarantee that natural contemplations are incorporated into choices with respect to ventures that may affect the earth. Essentially characterized, it is a formal procedure use to foresee the ecological results of any formative venture. From the above examination, unmistakably before usage of a specific venture, which has potential danger to condition just as to human life, an appropriate investigation has been made. Along these lines, it guarantees that the potential issues are predicting and tended to at a beginning period at in the task arranging and planning.[43] Based on the suggestive steps, recommendations and mitigation measures in EIA and EMP reports, the action plan was prepared and implemented with an immediate effect by Gujarat Maritime Board (GMB) at Deendayal (Kandla) Port Trust (DPT), and Gujarat Mineral Development Corporation (GMDC) at *Mata-No-Madh* Lignite Mines, Kachchh, Gujarat, India, to minimize the impact of expansion activities on physical, biological and socio-economic factors therein.

Acknowledgement

Author is thankful to Dr. G.A. Thivakarn, Principal Scientist, Gujarat Institute of Desert Ecology (GUIDE), Bhuj (Kachchh), Gujarat, Dr. Justus Joshua, Director, and Dr. S.F. Wesley Sunderraj, Principal Scientist, Green Future Foundation (GFF), Tiruchiraplli, Tamil Nadu, and Dr. Nischal M. Joshi, Senior Manager, Gujarat Ecology Commission (GEC), Government of Gujarat, Gandhinagar, for providing valuable suggestions in preparing this manuscript.

Conflict of interest

Authors declare 'no conflict of interest' in publishing this case study.

Funding Source

Author renders an immense gratitude to Deendayal (Kandla) Port Trust (DPT) and Gujarat Mineral Development Corporation (GMDC), Kachchh, Gujarat, for providing a financial assistance for logistics, travelling and other necessary facilities.

References

1. Wood C. 1995. Environmental Impact Assessment: A Comparative Review. London: Longman Higher Education (ISBN-13: 978-0582369696)
2. Gilpin A. 1995. Environmental Impact Assessment (EIA): Cutting Edge for the Twenty-First Century. Cambridge University Press, Cambridge, U.K. 182 P. (ISBN-10: 0521429676)
3. Duinker P.N., Baskerville G.L. 1986a. A systematic approach to forecasting in environmental impact assessment. *Journal of Environmental Management*. 23: 271-290.
4. Raymond K., Coates A. 2001. Guidance on EIA: EIS Review. Accessed online on February 7, 2004 at: http://europa.eu.int/comm/environment/eia/eia-guidelines/g-review-full-text.pdf
5. Canadian Environmental Assessment Agency (CEAA). 2004. Basics of Environmental Assessments. Accessed online on February 7, 2004 at: http://www.ceaa-acee.gc.ca/010/basics_e.htm#1
6. Anderson C., Glynn T., Shuyang F. 2003.

Considering Project Description in EIA: A Guide for Novice Reviewers. Unpublished manuscript prepared for the class ENVI5001: Environmental Impact Assessment, Dalhousie University, Halifax, NS.

7. Sadler B. 1996. International Study of the Effectiveness of Environmental Assessment. Final Report - Environmental Assessment in a Changing World: Evaluating Practice to Improve Performance. Department of Environment and Heritage, Australian EIA Network. Accessed online on February 3, 2003 at: http://www.erin.gov.au/assessments/eianet/eastudy/final/chapter1.html
8. Committee for Environmental Protection (CEP). 1999. Guidelines for Environmental Impact Assessment in Antarctica. Norway: Council of Managers of National Antarctic Programs, Hobart.
9. Morris P., Therivel R. (Eds.) 1995. Methods of Environmental Impact Assessment. Vancouver: UBC Press. (ISBN-10: 0774805269)
10. Steinemann A. 2000. Improving alternatives for environmental impact assessment. Environmental Impact Assessment Review. 3 (21). Accessed online on January 12, 2003 at: www.elsevier.com/locate/eiar
11. Jain R., Urban L.V., Staey G.S., Balbach H. 2002. Environmental Assessment, 2nd Ed. Hightstown, NJ: McGraw-Hill Press. (ISBN-10: 0070323690)
12. Priddle G.B. 1977. Problems of Communicating Environmental Assessment Information to Decision Makers. In: Plewes, M. and Whitney, J.B.R., Environmental Impact Assessment in Canada: Processes and Approaches, Pub. No. EE-5, Institute for Environmental Studies, University of Toronto, Toronto, Canada, 199.
13. Economic and Social Commission for Asia and the Pacific (ESCAP). 1985. Environmental Impact Assessment: Guidelines for Planners and Decision Makers. United Nations, Bangkok, Thailand.
14. Huang Y., Lara V., Morse J. 2003. Scoping in Canadian Environmental Impact Assessment: A Guide for Reviewers. Unpublished manuscript prepared for the class ENVI5001: Environmental Impact Assessment, Dalhousie University, Halifax, NS.
15. Ross W.A. 1987. Evaluating Environmental Impact Statements. *Journal of Environmental Management*. 25: 137-147.
16. Marshall N., Roberts R. 1997. Praxis papers: theory into action; that thing called…public involvement. *Plan Canada the Journal of the Canadian Institute of Planners*. 37 (3): 2.
17. United Nations Environment Programme (UNEP). 2002. Environmental Impact Assessment Training Resource Manual. Second Edition. United Nations Environment Programme Publisher. Accessed online on February 7, 2004 at: www.unep.ch/etu/publications/EIA_2ed/EIA_E_top5_body.pdf
18. Westman W.E. 1985. Ecology, *Impact Assessment and Environmental Planning*. John Wiley and Sons Inc., New York, NY. (ISBN-10: 0471808954)
19. Ross W.A. 1987b. Scoping in Canadian Environmental Assessment Reviews. United Nations Seminar of Environmental Impact Assessment, Warsaw, Poland.
20. Wolfe L.D.S. 1987. Methods for Scoping Environmental Impact Assessments: A Review of the Literature and Experience. Federal Environmental Assessment Review Office, Vancouver, BC.
21. Julien B., Fenves S.J., Small M.J. 1992. An Environmental Impact Identification System. *Journal of Environmental Management.* 36: 167-184.
22. Adler M., Zigilo E. (Eds.) 1996. Gazing into the Oracle The Delphi Method and its Application to Social Policy and Public Health. Jessica Kingsley Publishers. (ISBN: 978-1-85302-104-6)
23. Glasson J., Therivel R., Chadwick A. 1994. Introduction to Environmental Impact Assessment: Principles and Procedures, Process, Practice and Prospects. 2nd Edition. London, UK: UCL Press. (ISBN: 1-857-28118-7)
24. Canning C., Owen R., Wendorf C. 2003. Considering the Description of Environment (Including Baselines) in EIA: A Guide for Novice Reviewers. Unpublished manuscript prepared for the class ENVI5001: Environmental Impact Assessment, Dalhousie University, Halifax, NS.
25. European Commission. 2001. Guidance on

EIA. EIS Review. Directorate General of the Environment for the European Commission. Accessed online on February 7, 2004 at: http://www.ermuk.com

26. Côté M., Mkhabela M., Stockermans D. 2003. Considering biophysical impact analysis and forecasting in EIA. Unpublished manuscript prepared for the class ENVI5001: Environmental Impact Assessment, Dalhousie University, Halifax, NS.
27. Burdge R.J. 1998. A Conceptual Approach to Social Impact Assessment. Revised Edition. Middleton, WS: Social Ecology Press. (ISBN: 0-941042-17-0)
28. Bigney K., Isaacman L., Jiang X. 2003. Considering Social Impact Assessment in EIA: A Guide for Novice Reviewers. Unpublished manuscript prepared for the class ENVI5001: *Environmental Impact Assessment*, Dalhousie University, Halifax, NS.
29. Lang R., Armour A. 1981. The Assessment and Review of Social Impacts. Ottawa, ON: Federal Environmental Assessment and Review Office. 163.
30. Miller C.M., Bever M.B. 1980. Assessing the environmental impacts of resource recovery facilities. *Environmental Impact Assessmen*t *Review*. 1 (1):37-52.
31. Duinker P.N., Beanlands G.E. 1986b. The significance of environmental impacts: an exploration of the concept. *Environmental Management*. 10 (1): 1-10.
32. Curran K., Ho J., Long S. 2003. Considering Impact Significance in EIA: A Guide for Novice Reviewers. Unpublished manuscript prepared for the class ENVI5001: *Environmental Impact Assessment*, Dalhousie University, Halifax, NS.
33. Haug P.T, Burwell R.W, Stein A., Bandurski B.L. 1984. Determining the significance of environmental issues under the National Environmental Policy Act. *Journal of Environmental Management*. 18: 15-24.
34. Fedra K. 1991. A computer-based approach to environmental impact assessment. International Institute for Applied Systems Analysis Reprint RR-91-13. Luxemburg: Austria. 40.
35. Gibson R.B. 2002. Specification of sustainability-based environmental assessment decision criteria and implications for determining "significance" in environmental assessment. Canadian Environmental Assessment Agency. Accessed online on February 10, 2003 at: http://www.ceaa-acee.gc.ca/0010/0001/0001/significance_e.htm
36. Mathews W.H. 1975. Objective and subjective judgments in environmental impact analysis. *Environmental Conservation.* 2 (2): 121-131.
37. Thompson M.A. 1988. Determining impact significance in EIA: A review of 24 methodologies. *Journal of Environmental Management.* 30: 235-250.
38. Caldwell L.K. 1998. The National Environmental Policy Act: An agenda for the future. Bloomington, In: Indiana University Press.
39. Ogola P.F.A. 2007. Environmental Impact Assessment: General Procedures. Lake Naivasha: UNU-GTP and Kenya Electricity Generating Company Ltd (KenGen).
40. Encyclopedia. 2015. www.en.wikipedia.org/wiki/EIA. Retrieved on August 9, 2015.
41. Naber H. 2012. *Environmental Impact Assessment.* Washington, DC: World Bank.
42. World Bank. 2006. Bangladesh Country: Environmental Analysis. Washington, DC: World Bank.
43. Bandyopadhyay J. and V. Shiva. 1985. The Conflict over Limestone Quarrying in Doon Valley, Dehradun, India. *Environmental Conservation.* 12 (2): 131-139.

Appendix

Annexure

List of Sectors requiring EIA

1. Aerial ropeways
2. Air ports
3. All ship breaking yards including ship breaking units
4. Asbestos milling and asbestos based products
5. Building and large construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions
6. Cement plants
7. Chemical fertilizers
8. Chlor-alkali industry
9. Coal wisterias
10. Coke oven plant
11. Common effluent treatment plants (CETPs)
12. Common hazardous waste treatment, storage and disposal facilities
13. Common municipal solid waste management facility
14. Distilleries
15. Highways, railways, transport terminals, mass rapid transport systems
16. Induction/arc furnace/cupola furnace/ submerged arc furnace/crucible furnace/re-heating furnace of capacity more than 5 Tone per heat
17. Industrial estates/ parks/ complexes/areas, export processing zones, special economic zones, biotech parks, leather complexes
18. Integrated paint industry
19. Isolated storage & handling of hazard chemical (as per threshold planning quality indicated in column 3 of schedule 2 & 3 of MSIHC rules 1989 amended 2000)
20. Leather/skin/hide processing
21. Metallurgical industries (ferrous and non-ferrous)- both primary and secondary
22. Mineral beneficiation including pelletisation
23. Mining of minerals including Opencast/ Underground mining
24. Nuclear power projects and processing of nuclear fuel
25. Offshore an d onshore oil and gas exploration, development and production
26. Oil and gas transportation, (crude and refinery/ petrochemical products) passing through national parks/ sanctuaries/coral reefs/ ecological sensitive areas including LNG terminal.
27. Pesticides industry and pesticide specific intermediates (excluding formulations)
28. Petrochemical based processing (processes other than cracking and reformation and not covered under the complexes)
29. Petro-chemicals complexes (industries based on processing of petroleum fractions and natural gas and/or reforming to aromatics)
30. Petroleum refining industries
31. Ports, harbors, jetties, marine terminals, break waters, dredging
32. Pulp and Paper industry excluding manufacturing of paper from wastepaper and manufacture of paper from ready pulp without bleaching
33. River Valley, Hydra, Drainage, and Irrigation projects
34. Sugar industry
35. Synthetic organic chemicals industry (dye and dye intermediate; bulk drugs and intermediates excluding drug formulation; synthetic rubber; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)
36. Textile – cotton and manmade fibers
37. Thermal power plant
38. Township and Area development projects
39. Townships and area development projects
40. Additional Sectors

a. Automobiles and Auto Components
b. Electroplating and Metal Coating
c. Electrical and Electronics including component industry
d. Glass and Ceramic Industry
e. Food Processing

Annexure

List of Ecologically Sensitive Areas (ESA)

1. Archaeological monuments
2. Area of scientific and geological Interest
3. Biosphere reserves
4. Border areas
5. Coastal areas rich in all manmade breeding grounds of specific species

6. Gulf areas
7. National parks and sanctuaries
8. Natural lakes and swamps
9. Sessile zones
10. Tribal settlements

Annexure

Basic Guidelines

1. No forestland should be converted into non-forest activity (Forest Conservation Act 1980).
2. No prime agricultural land should be converted into industrial site.
3. Acquired land should be sufficiently large to accommo¬date appropriate treatment plants and also to store and recycle effluents. Reclaimed wastewater may be used to raise green belt and create water body for aesthetics, recreation, and aquaculture.
4. The green belt should be ½ km wide around the industry.
5. The green belt distance between two adjoining large-scale industries should be 1 km.
6. Enough space should be provided for storage of solid waste.
7. Layout and farm of industry should be attractive (scenic beauty).
8. Industrial Township should be created at a proper distance.
9. Each industry should install their ambient air quality measuring station (AAQMS) within 120-degree angle between each station.

Annexure

List of Environmental Laws

1. Environment (Protection) Act, 1986
2. Environment Protection Amendment Rules, 1986
3. Hazardous Waste (Management & Handling) Rules, 1989
4. Manufacture, Storage and Import of Hazardous Chemicals (Amendment) Rules, 1984
5. The Air (Prevention & Control of Pollution) Act, 1981
6. The Factories Act, 1948
7. The Forest Conservation Act, 1980
8. The Notification on Environment Impact Assessment, 1994
9. The Public Liability Insurance Act, 1991
10. The Water (Prevention & Control of Pollution) Act, 1974
11. The water (Prevention & Control of Pollution) Cess Act, 1977.