



IL&FS | Environment

TECHNICAL EIA GUIDANCE MANUAL FOR LEATHER/SKIN/HIDE PROCESSING INDUSTRY

Prepared for
The Ministry of Environment and Forests
Government of India



by
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ACRONYMS

AAQ	Ambient Air Quality
BAT	Best Available Technology
BOD	Biological oxygen demand
BOO	Build-Operate-Own
BOT	Build-Operate-Transfer
°C	degree Celsius
CCA	Conventional Cost Accounting
CETP	Common Effluent Treatment Plant
CFE	Consent for Establishment
CO ₂	Carbon dioxide
COD	Chemical Oxygen Demand
Cr	Chromium
Cr ₂ O ₃	Chromium Oxide
Cr ₂ (SO ₄) ₃	Chromium Sulphate
CRZ	Coastal Regulatory Zone
DS	Dissolved Solids
EAC	Expert Appraisal Committee
EBM	Environmental Baseline Monitoring
EcE	Economic-cum-Environmental
EcE	Economic-cum-Environmental
ECI	Environmental Condition Indicators
EIA	Environmental Impact Assessment
EIS	Environmental Information system
EPI	Environmental performance Indicators
EMS	Environmental Management System
EMP	Environmental Management Plan
FCA	Full Cost Assessment
FSS	Fixed Suspended Solids
GC	General Conditions
g/l	grams per litre
H ₂ S	Hydrogen Sulfide
HAPs	Hazardous Air Pollutants
HTL	High Tide Line
HVLP	High Volume Low Pressure
IL&FS	Infrastructure Leasing and Financial Services
IMD	India Meteorological Department

IUE	International Union of Environment
kg	kilograms
l	litre
LDAR	Leak Detection and Repair
LCA	Life Cycle Assessment
LTL	Low Tide Level
m ²	square meter
mg/m ³	milligrams per cubic meters
mg/l	milligrams per litre
MoEF	Ministry of Environment & Forests
MSDS	Material Safety Data Sheets
O&M	Operation and Maintenance
PAP	Project Affected people
QA/QC	Quality Assurance/Quality Control
QRA	Quantitative Risk Assessment
RSPM	Respirable Suspended Particulate Matter
SEAC	State Level Expert Appraisal Committee
SEIAA	State Level Environment Impact Assessment Authority
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
SS	Suspended Solids
TA	Technology assessment
TCA	Total Cost Assessment
TDS	Total Dissolved Solids
TEQM	Total Environmental Quality Movement
TGM	Technical EIA guidance manuals
TSDF	Treatment Storage Disposal Facility
TS	Total Solids
TSS	Total Suspended Solids
USEPA	United States Environment Protection Agency
UT	Union Territory
UTEIAA	Union Territory Level Environment Impact Assessment Authority
UTPCC	Union Territory Pollution Control Committee
VEC	Valued Environmental Components
VOC	Volatile Organic Compound
VSS	Volatile Suspended Solids
WBCSD	World Business Council on Sustainable Development

Mahesh Babu
Chief Executive Officer

Acknowledgement

The Notification issued on the prior environmental clearance process by the Ministry of Environment and Forests (MoEF) on September 14, 2006 delegated substantial powers to the State Level Environment Impact Assessment Authorities (SEIAA) to grant environmental clearance for certain categories of developmental activities/projects. It was felt that proper guidance to the stakeholders would enhance appreciation of environmental impacts of proposed projects and possible mitigation measures. Further, such a guidance would also help ensure that decision making authorities across different States and Union Territories could adopt similar considerations and norms with due weightage for site-specific considerations.

We feel privileged to be part of the interventions being spearheaded by Sh. Jairam Ramesh, Hon'ble Minister, MoEF, Government of India, to mainstream environmental considerations in the decision making process. IL&FS Ecosmart as part of this important initiative, prepared Technical EIA Guidance Manuals for 27 identified development activities. In view of the diversity of 27 developmental activities entrusted to IL&FS Ecosmart Ltd., in consultation with the MoEF, an expert Peer and Core Committee was constituted to review and finalize each of the draft Manuals. The Manuals prepared by IL&FS were technically reviewed and up-dated by the respective sector-specific expert resource persons.

The Manuals designed by the Expert Committee have benefitted from the advise and feedback received from MoEF. The Manuals are designed to provide readers with an in-depth understanding of the environmental clearance mechanism, developmental activity specific environmental impacts with possible mitigation measures, environmentally compliant manufacturing/ production processes and pollution control technologies, etc.

IL&FS Ecosmart hopes that these Manuals are a step forward to realize the MoEF's desired objective of enhancing functional efficiency and effectiveness in the environmental clearance process. We hope the stakeholders will find the Manuals useful.

We take this opportunity to convey our appreciation to the MoEF team under the leadership of Mr. J.M. Mauskar, Additional Secretary, for the technical inputs, guidance and support extended throughout the project period for successful completion of the project. The technical guidance and support extended by the Expert Peer and Core Committee under the Chairmanship of Dr. V. Rajagopalan, former Chairman, Central Pollution Control Board and inputs of the sector-specific resource persons are gratefully acknowledged.


(Mahesh Babu)

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FOREWORD

The Ministry of Environment & Forests (MOEF) introduced the Environmental Impact Assessment (EIA) Notification 2006 on 14th September 2006, which not only reengineered the entire environment clearance (EC) process specified under the EIA Notification 1994, but also introduced a number of new developmental sectors which would require prior environmental clearance. The EIA Notification 2006 has notified a list of 39 developmental sectors which have been further categorised as A or B based on their capacity and likely environmental impacts. Category B projects have been further categorised as B1 and B2. The EIA Notification 2006 has further introduced a system of screening, scoping and appraisal and for the setting up of Environment Impact Assessment Authority (EIAA) at the Central level and State Level Environment Impact Assessment Authorities (SEIAAs) to grant environmental clearances at the Central and State level respectively. The Ministry of Environment & Forests is the Environment Impact Assessment Authority at the Central level and 25 State Level Environment Impact Assessment Authorities (SEIAAs) have been set up in the various States/UTs. The EIA Notification 2006 also stipulates the constitution of a multi-disciplinary Expert Appraisal Committee (EAC) at the Centre and State level Expert Appraisal Committees (SEACs) at State/UT Level for appraisal of Category A or B projects respectively and to recommend grant/rejection of environmental clearance to each project/activities falling under the various sectors to the EIAA/SEIAAs respectively.

Although the process of obtaining environmental clearance consisting of Screening, Scoping and Appraisal and for undertaking public consultation including the process of conduct of Public Hearing has been elaborated under the EIA Notification 2006, the Notification itself provides for bringing out guidelines from time to time on the EIA Notification 2006 and the EC process with a view to bringing clarity on the EC process for expediting environmental clearance. This need was further reinforced after the constitution of SEIAAs and SEACs in various States, who were assigned the task for the first time and for addressing the concerns of standardization of the quality of appraisal and in reducing inconsistencies between SEACs/SEIAAs in granting ECs for similar projects in different States.

The Technical Guidance Manual of "Tannery- Leather/Skin/Hide Processing Industry" sector describes types of process and pollution control technologies, operational aspects of EIA with model TOR of that Sector, technological options with cleaner production and waste minimization techniques, monitoring of environmental quality, post clearance monitoring

protocol, related regulations, and procedure of obtaining EC if linked to other clearances for e.g., CRZ, etc.

For each tannery plant, the project team may research scientific and technical issues, fit methods to small and larger operating units in Indian conditions, demonstrate the methods in particular regions, establish the economic and other benefits of TDS reduction, ensure that hides and skins can be processed into suitable quality leathers and establish an educational and technology transfer program. India's industrial competitiveness and environmental future depends on Industries such as Tannery- Leather/Skin/Hide Processing Industry adopting energy and resource efficient technologies. Recycling and reuse of materials is critical.

To keep pace with changing technologies and needs of sustainable development, the manual would require regular updating in the future. The manual will be available on the MoEF website and we would appreciate receiving responses from stakeholders for further improvements.

I congratulate the entire team of IL&FS Ecosmart Ltd., experts from the sector who were involved in the preparation of the Manuals, Chairman and members of the Core and Peer Committees of various sectors and various Resource Persons whose inputs were indeed valuable in the preparation and finalization of the Manuals.



(Jairam Ramesh)

1. INTRODUCTION TO THE TECHNICAL EIA GUIDANCE MANUALS PROJECT

Environmental Impact Assessment (EIA) is a process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. These studies integrate the environmental concerns of developmental activities in to the process of decision-making.

EIA has emerged as one of the successful policy innovations of the 20th Century to ensure sustained development. Today, EIA is formalized as a regulatory tool in more than 100 countries for effectively integrating environmental concerns in economic development process. The EIA process in India was made mandatory and was also given a legislative status through a Notification issued by the Ministry of Environment and Forests (MoEF) in January 1994. The Notification, however, covered only a few selected industrial developmental activities. While there are subsequent amendments, the Notification issued on September 14, 2006 supersedes all the earlier Notifications, and has brought out structural changes in the clearance mechanism.

The basic tenets of this EIA Notification could be summarized into following:

- Pollution potential as the basis for prior environmental clearance based on pollution potential instead of investment criteria; and
- Decentralization of clearing powers to the State level/Union Territory (UT) level Authorities for certain developmental activities to make the prior environmental clearance process quicker, transparent and effective.

Devolution of the power to grant clearances at the state level for certain category of the developmental activities / projects is a step forward to fulfill the basic tenets of the re-engineering *i.e.*, quicker, transparent and effective process but many issues impede/hinder its functional efficiency. These issues could be in technical and operational as listed below:

Technical issues

- Ensuring level playing ground to avoid arbitrariness in the decision-making process
- Classification of projects which do not require public hearing and detailed EIA (Category B2)
- Variations in drawing the Terms of Reference (ToR) for EIA studies for a given developmental activity across the States/UTs
- Varying developmental-activity-specific expertise requirement for EIA studies and their appraisal
- Availability of adequate sectoral experts and variations in competency levels
- Inadequate data verification, cross checking tools and supporting institutional framework
- Meeting time targets without compromising with the quality of assessments/ reviews
- Varying knowledge and skill levels of regulators, consultants and experts
- Newly added developmental activities for prior environmental clearance, *etc.*,

Operational issues

- State level /UT level EIA Authorities (SEIAA/UTEIAA) are formulated for the first time and many are functioning
- Varying roles and responsibilities of involved organizations
- Varying supporting institutional strengths across the States/UTs
- Varying manpower availability, *etc.*,

1.1 Purpose

The purpose of developing these sector-specific technical EIA guidance manuals (TGM) is to provide clear and concise information on EIA to all the stakeholders *i.e.*, the project proponent, the consultant, the reviewer, and the public. The TGMs are organized to cover following:

Chapter 1 (Introduction): This chapter provides a brief introduction on the EIA, basic tenets of EIA Notification, technical & operational issues in the process of clearance, purpose of the TGMs, project implementation process and additional information.

Chapter 2 (Conceptual facets of an EIA): Provides an overall understanding to the conceptual aspects of control of pollution and EIA for the developmental projects. This basic understanding would set the readers at same level of understanding for proper interpretations and boundaries for identifying the environmental interactions of the developmental projects and their significance for taking mitigative measures. This chapter covers the discussion on environment in EIA context *i.e.*, sustainable development, pollution control strategies, preventive environmental management tools, Objectives of EIA, types and basic principles of EIA, project cycle for Leather/skin/hide processing industry, understanding on type of environmental impacts and the criteria for the significance analysis.

Chapter 3 (Leather/skin/hide processing industry): The purpose of this chapter is to provide the reader precise information on all the relevant aspects of the industry, which is essential to realize the likely interaction of such developmental activities on the receiving environment. Besides, this Chapter gives a holistic understanding on the sources of pollution and the opportunities of the source control.

The specific coverage which provides precise information on the industry include (i) Introduction, (ii) Leather Manufacturing Process -Process of tanning, Input Vs output in the tannery process, (iii) Qualitative and Quantitative Analysis of Rejects-Wastewater, Air emissions, Solid waste, Hazardous materials, (iv) Cleaner Technologies, Minimization, and Recycling / Reuse Options-Cleaner technologies in leather processing, Waste minimization options, Reduction/Recycling/Recovery/Reuse, and (v) Summary of Applicable National Regulations-Tannery effluent standards as provided by CPCB, Pending and proposed regulatory requirements.

Chapter 4 (Operational aspects): The purpose of this chapter is to facilitate the stakeholders to extend clear guidance on coverage of legislative requirements, sequence of procedures for obtaining the EIA clearance and each step-wise provisions and considerations.

The coverage of the Chapter include provisions in the EIA Notification regarding leather/skin/hide processing industry, screening (criteria for categorization of B1 and B2, siting guidelines, etc.), scoping (pre-feasibility report, guidance for filling form 1, identification of valued environmental components, identification of impacts, etc.),

arriving at terms of reference for EIA studies, impact assessment studies (EIA team, assessment of baseline quality of environment, impact prediction tools, significance of impacts), social impact assessment, risk assessment considerations, typical mitigation measures, designing considerations for environmental management plan, structure of EIA report for incorporation of study findings, process of public consultation, project appraisal, decision making process and post-clearance monitoring protocol.

Chapter 5 (Roles and responsibilities of various organizations involved in the process of prior environmental clearance): The purpose of this Chapter is to brief the stakeholders on the institutional mechanism and roles & responsibilities of the stakeholders involved in the process of prior environmental clearance. The Coverage of the Chapter include (i) roles and responsibilities of the stakeholders, (ii) organization specific functions, (iii) constitution, composition and decision making process of SEIAA and (iv) EAC & SEAC and (v) other conditions which may be considered.

For any given industry, each topic listed above could alone be the subject of a lengthy volume. However, in order to produce a manageable document, this project focuses on providing summary information for each topic. This format provides the reader with a synopsis of each issue. Text within each section was researched from many sources, and was condensed from more detailed sources pertaining to specific topics.

The contents of the document are designed with a view to facilitate addressing of the relevant technical and operational issues as mentioned in the earlier section. Besides, facilitates various stakeholders involved in the EIA clearance process *i.e.*,

- Project proponents will be fully aware of the procedures, common ToR for sector-specific EIA studies, timelines, required expertise, monitoring needs, *etc.*, in order to plan the projects/studies appropriately.
- Consultants across India will have similar understanding about a given sector, and also the procedure for EIA studies, so that the quality of the EIA reports gets improved and streamlined
- Reviewers across the States/UTs will have the same understanding about an industrial sector and would able to draw a benchmark to establish the significant impacts for the purpose of prescribing the ToR for EIA studies and also in the process of review and appraisal.
- Public who are concerned about a new or expansion projects, use this manual to get a basic idea about the manufacturing/production details, rejects/wastes from the operations, choice of cleaner/ control technologies, regulatory requirements, likely environmental and social concerns, mitigation measures, *etc.*, in order to seek clarifications appropriately in the process of public consultation. The procedural clarity in the document will further strengthen them to understand the stages involved in clearance and roles and responsibilities of various organizations.
- In addition, these manuals would substantially ease the pressure on reviewers at the scoping stage and would bring in functional efficiency at the central and state levels.

1.2 Project Implementation

The Ministry of Environment & Forests (MoEF), Government of India took up the task of developing sector-specific TGMs for all the developmental activities listed in the re-engineered EIA Notification. The Infrastructure Leasing and Financial Services Ecosmart Limited (IL&FS Ecosmart), has been entrusted with the task of developing these manuals

for 27 industrial and related sectors. Leather/skin/hide processing industry is one of these sectors, for which this manual is prepared.

The ability to design comprehensive EIA studies for specific industries depends on knowledge of several interrelated topics. Therefore, it requires expert inputs from multiple dimensions *i.e.*, administrative, project management, technical, scientific, social, economic, risk, *etc.*, in order to comprehensively analyze the issues of concern and to draw logical interpretations. Thus, Ecosmart has designed a well-composed implementation framework to factor inputs of the experts and stakeholders in the process of finalization of these manuals.

The process of manual preparation involved collection & collation of the secondary available information, technical review by sectoral resource persons and critical review and finalization by a competent Expert Committee composed of core and sectoral peer members.

The MoEF appreciates the efforts of Ecosmart, Expert Core and Peer Committee, resource persons and all those who have directly and indirectly contributed to this manual.

1.3 Additional Information

This TGM is brought out by the MoEF to provide clarity to all the stakeholders involved in the 'prior environmental clearance' process. As such, the contents and clarifications given in this document do not withstand in case of a conflict with the statutory provisions of the Notifications and Executive Orders issued by the MoEF from time-to-time.

TGMs are not regulatory documents. Instead, these are the tools designed to assist in successful completion of an EIA.

For the purposes of this project, the key elements considered under TGMs are: conceptual aspects of EIA; developmental activity-specific information; operational aspects; and roles and responsibilities of involved stakeholders.

This manual is prepared considering the Notification issued on September 14, 2006 and latest amendment as on 1st December 2009. For recent updates, if any, may please refer the website of the MoEF, Government of India *i.e.*, <http://moef.nic.in/index.php>.

2.

CONCEPTUAL FACETS OF EIA

It is an imperative requirement to understand the basic concepts concerned to the pollution control and the environmental impact assessment in an overall objective of the sustainable development. This Chapter highlights the pollution control strategies and their tools besides the objectives, types & principles of EIA, type of impacts their significance analysis, in order to provide consistent understanding to the reader before assessing the development of activity-specific environmental concerns in Chapter 3 and identification & prediction of significant impacts in order to design mitigation measures as detailed in Chapter 4.

2.1 Environment in EIA Context

“Environment” in EIA context mainly focuses, but is not limited to physical, chemical biological, geological, social, economical, and aesthetic dimensions along with their complex interactions, which affect individuals, communities and ultimately determines their forms, character, relationship, and survival. In EIA context, ‘effect’ and ‘impact’ can often be used interchangeably. However, ‘impact’ is considered as a value judgment of the significance of an effect.

Sustainable development is built on three basic premises *i.e.*, economic growth, ecological balance and social progress. Economic growth achieved in a way that does not consider the environmental concerns, will not be sustainable in the long run. Therefore, sustainable development needs careful integration of environmental, economic, and social needs in order to achieve both an increased standard of living in short term, and a net gain or equilibrium among human, natural, and economic resources to support future generations in the long term.

“It is necessary to understand the links between environment and development in order to make choices for development that will be economically efficient, socially equitable and responsible, as well as environmentally sound.” Agenda 21

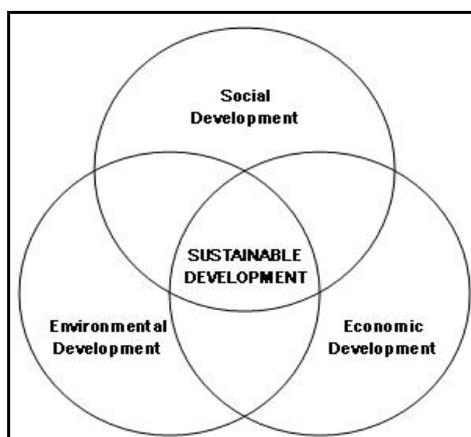


Figure 2-1: Inclusive Components of Sustainable Development

2.2 Pollution Control Strategies

Pollution control strategies can be broadly categorized in to preventive and reactive. The reactive strategy refers to steps that may be applied once the wastes are generated or contamination of receiving environment takes place. The control technology or a combination of technologies to minimize the impact due to the process rejects/wastes varies with quantity and characteristics, desired control efficiency and economics.

Many a number of combination of techniques could be adopted for treatment of a specific waste or the contaminated receiving environment, but are often judged based on techno-economic feasibility. Therefore, the best alternative is to take all possible steps to avoid pollution itself. This preventive approach refers to a hierarchy that involves i) prevention & reduction; ii) recycling and re-use; iii) treatment; and iv) disposal, respectively.

Therefore, there is a need to shift the emphasis from the reactive to preventive strategy *i.e.*, to promote preventive environmental management. Preventive environmental management tools may be grouped into management based tools, process based tools and product based tools. A few of them are given below :

Management Based Tools	Process Based Tools	Product Based Tools
Environmental Management System (EMS)	Environmental Technology Assessment	Industrial Ecology
Environmental Performance Evaluation	Toxic Use Reduction	Extended Producers Responsibility
Environmental Audits	Best Operating Practices	Eco-labeling
Environmental Reporting And Communication	Environmentally Best Practice	Design for Environment
Total Cost Accounting	Best Available Technology (BAT)	Life Cycle Assessment (LCA)
Law And Policy	Waste Minimization	
Trade And Environment	Pollution Prevention	
Environmental Economics	Cleaner Production	
	4-R Concept	
	Cleaner Technology	
	Eco-efficiency	

These tools are precisely discussed in next sections.

2.3 Tools for Preventive Environmental Management

The tools for preventive environmental management can be broadly classified in to following three groups.

- Tools for assessment and analysis - risk assessment, life cycle assessment, total cost assessment, environmental audit / statement, environmental benchmarking, environmental indicators
- Tools for action - environmental policy, market based economic instruments, innovative funding mechanism, EMS and ISO certification, total environmental quality movement, eco-labeling, cleaner production, eco-efficiency, industrial ecosystem or metabolism, voluntary agreements
- Tools for communication - state of environment, corporate environmental reporting

Specific tools under each group are discussed precisely in next sections.

2.3.1 Tools for assessment and analysis

2.3.1.1 Risk assessment

Risk is associated with the frequency of failure and consequence effect. Predicting such situations and evaluation of risk is essential to take appropriate preventive measures. The major concern of the assessment is to identify the activities falling in a matrix of high & low frequencies at which the failures occur and the degree of its impact. The high frequency, low impact activities can be managed by regular maintenance *i.e.*, LDAR (Leak detection and repair) programmes. Whereas, the low frequency, high impact activities (accidents) are of major concern in terms of risk assessment. As the frequency is low, often the required precautions are not realized or maintained. However, the risk assessment identifies the areas of major concerns which require additional preventive measures; likely consequence distances considering domino effects, which will give the possible casualties and ecological loss in case of accidents. These magnitudes demand the attention for preventive and disaster management plans (DMP). Thus is an essential tool to ensure safety of operations.

2.3.1.2 Life cycle assessment

A broader approach followed to deal with environmental impacts during manufacturing is called LCA. This approach recognizes that environmental concerns are associated with every step of processing w.r.t manufacturing of products and also examines environmental impacts of the product at all stages of project life cycle. LCA includes the product design, development, manufacturing, packaging, distribution, usage and disposal. LCA is concerned with reducing environmental impacts at all stages and considering the total picture rather than just one stage of production process.

Industries/firms may apply this concept to minimize the costs incurred on the environmental conservation throughout the project life cycle.

2.3.1.3 Total cost assessment

Total Cost Assessment (TCA) is an enhanced financial analysis tool that is used to assess the profitability of alternative courses of action ex. raw material substitution to reduce the costs of managing the wastes generated by process; an energy retrofit to reduce the costs of energy consumption. This is particularly relevant for pollution prevention options. These options because of their nature, often produce financial savings that are overlooked in conventional financial analysis, either because they are misallocated, uncertain, hard to quantify, or occur more than three to five years after the initial investment. TCA includes all of relevant costs and savings associated with an option so that it can compete for scarce capital resources fairly, on a level playing field. The assessments are often beneficial w.r.t the following:

- Identification of costly resource inefficiencies
- Financial analysis of environmental activities/projects such as investment in cleaner technologies
- Prioritization of environmental activities/projects
- Evaluation of product mix and product pricing

- Bench marking against the performance of other processes or against the competitors

A comparison of cost assessments is given below:

- Conventional cost accounting (CCA): Direct and indirect financial costs and Recognized contingent costs
- Total Cost Assessment (TCA): A broader range of direct, indirect, contingent and less quantifiable costs
- Full Cost assessment (FCA): TCA and External social costs borne by society

2.3.1.4 Environmental audit/statement

Key objectives of an environmental audit include compliance verification, problem identification, environmental impact measurement, environmental performance measurement, conforming effectiveness of EMS, providing a database for corrective actions and future actions, developing companies environmental strategy, communication and formulating environmental policy.

The MoEF, Government of India (GOI) issued Notification on ‘*Environmental Statements*’ (ES) in April, 1992 and further amended in April 1993. As per the Notification, the industries are required to submit environmental statements to the respective State Pollution Control Boards (SPCBs). ES is a pro-active tool for self-examination of the industry to reduce/minimize pollution by adopting process modifications, recycling and reusing of the resources. The regular submission of ES will indicate the systematic improvement in environmental pollution control being achieved by the industry. In other way, specific points in ES may be used as environmental performance indicators for relative comparison, implementation and to promote better practices.

2.3.1.5 Environmental benchmarking

Environmental performance and operational indicators could be used to navigate, manage and communicate significant aspects and give enough evidence of good environmental house keeping. Besides the existing prescribed standards, an insight to identify the performance indicators and prescribing schedule for systematic improvement in performance of these indicators will yield better results.

Relative indicators may be identified for different industrial sectors and be integrated in companies and organizations to monitor and manage the different environmental aspects of the company, to benchmark and compare two or more companies from the same sector. These could cover water consumption, wastewater generation, energy consumption, solid/hazardous waste generation, chemical consumption *etc.*, per tonne of final product. Once these bench marks are developed, the industries which are below the benchmark may be guided and enforced to reach the level and those which are better than the benchmark may be encouraged further by giving incentives, *etc.*

2.3.1.6 Environmental indicators

Indicators can be classified in to environmental performance indicators (EPI) and environmental condition indicators (ECI). The EPIs can be further divided into two categories *i.e.*, operational performance indicators and management performance indicators.

The operational performance indicators are related to the process and other operational activities of the organization. These would typically address the issue of raw material consumption, energy consumption, water consumption in the organization, the quantities of waste water generated, other solid wastes & emissions generated from the organization, *etc.*

Management performance indicators are related to management efforts to influence environmental performance of organizational operations.

The environmental condition indicators provide information about the environment. These indicators provide information about the local, regional, national or global condition of the environment. This information helps an organization to understand the environmental impacts of its activities and thus help in making decision to improve the environmental performance.

Indicators basically used to evaluate environmental performance against the set standards and thus indicate the direction in which to proceed. Selection of type of indicators for a firm or project depends upon its relevance, clarity and realistic cost of collection and its development.

2.3.2 Tools for action

2.3.2.1 Environmental policy

An environmental policy is a statement of an organization's overall aim and principles of action w.r.t the environmental, including compliance with all relevant regulatory requirements. It is a key tool in communicating environmental priorities of the organization to all its employees. To ensure an organization's commitment towards a formulated environmental policy, it is essential that top management be involved in the process of formulating the policy and setting priorities. Therefore, the first step is to get the commitment from the high level of management. The organization should then conduct an initial environmental review and draft an environmental policy. This draft should be discussed and approved by the board of directors. The approved environmental policy statement should then be communicated internally among all its employees and should also be made available to the public.

2.3.2.2 Market-based economic instruments

Market based instruments are regulations that encourage behavior through market signals rather than through explicit directives regarding pollution control levels. These policy instruments such as tradable permits, pollution charge, *etc.*, are often described as harnessing market forces. Market-based instruments can be categorized into the following four major categories, which are discussed below:

- **Pollution Charge:** Charge system will assess a fee or tax on the amount of pollution a firm or source generates. It is worthwhile for the firm to reduce emissions to the point, where its marginal abatement cost are equal to the tax rate. Thus firms control pollution to different degrees *i.e.*, High cost controllers – less; low-cost controllers – more. The charge system encourages the industries to reduce the pollutants further. The collected charges can form a fund for restoration of the environment. Another form of pollution charge is a deposit refund system, where consumers pay a surcharge when purchasing a potentially polluting product, and receive a refund on return of the

product after useful life span at appropriate centers. The concept of extended producers' responsibility brought in to avoid accumulation of dangerous products in the environment.

- **Tradable Permits:** Under this system, firms that achieve the emission levels below their allotted level may sell the surplus permits. Similarly the firms, which are required to spend more to attain the required degree of treatment/allotted levels, can purchase permits from others at lower costs and may be benefited.
- **Market Barrier Reductions:** Three known market barrier reduction types are as follows:
 - Market Creation: Measures that facilitate the voluntary exchange of water rights and thus promote more efficient allocation of scarce water supplies
 - Liability Concerns: Encourage firms to consider potential environmental damages of their decisions
 - Information Programmes: Ecolabeling and energy efficiency product labeling requirements
- **Government Subsidy Reduction:** Subsidies are the mirror images of taxes and, in theory, can provide incentive to address environmental problems. However, it has been reported that the subsidies encourage economically inefficient and environmentally unsound practices, and often lead to market distortions due to differences in area. However, these are important to sustain the expansion of production, in the national interests. In such cases, the subsidy may be comparable to the net social benefit.

2.3.2.3 Innovative funding mechanism

There are many forums under which the fund is made available for the issues which are of global/regional concern (GEF, OECD, Deutch green fund *etc.*) *i.e.*, climate change, Basal convention and further fund sources are being explored for the Persistent Organic Pollutants Convention. Besides these global funding mechanisms, there needs to be localized alternative mechanisms for boosting the investment in environmental pollution control. For example, in India the Government has established mechanism to fund the common effluent treatment plants, which are specifically serving the small and medium scale enterprises *i.e.*, 25% share by the state Government, matching grants from the Central Government and surety for 25% soft loan. It means that the industries need to invest only 25% in first run, thus encouraging voluntary compliance.

There are some more options *i.e.*, if the pollution tax/charge is imposed on the residual pollution being caused by the industries, municipalities, *etc.*, fund will automatically be generated, which in turn, can be utilized back for funding the environmental improvement programmes. The emerging concept of build-operate-transfer (BOT) and build-operate-own (BOO) are an encouraging development, where there is a possibility to generate revenue by application of advanced technologies. There are many opportunities which can be explored, however, what is required is the paradigm shift and focused efforts.

2.3.2.4 EMS and ISO certification

EMS is that part of the overall management system, which includes organizational structure, responsibilities, practices, procedures, process and resources for determining and implementing the forms of overall aims, principles of action w.r.t. the environment. It encompasses the totality of organizational, administrative and policy provisions to be

taken by a firm to control its environmental influences. Common elements of an EMS are the identification of the environmental impacts and legal obligations, the development of a plan for management & improvement, the assignment of the responsibilities and monitoring of the performance.

2.3.2.5 Total environmental quality movement (TEQM)

Quality is regarded as

- A product attribute that had to be set at an acceptable level and balanced against the cost
- Something delivered by technical systems engineered by experts rather than the organization as a whole
- Assured primarily through the findings and correction of mistakes at the end of the production process

One expression of the total environment quality movement (TEQM) is a system of control called Kaizen. The principles of Kaizen are

- Goal must be continuous improvement of quality instead of acceptable quality
- Responsibility of quality shall be shared by all members of an organization
- Efforts should be focused on improving the whole process and design of products

With some modifications, the TQM approach can be applied in improvement of corporate environmental performance in both process and product areas.

2.3.2.6 Eco-labeling

Eco-Labeling is the practice of supplying information on the environmental characteristics of a product or service to the general public. These labeling schemes can be grouped into three types:

- Type I: Multiple criteria base; third party (Govt. or non-commercial private organizations) programme claims overall environmental preferability
- Type II: Specific attribute of a product; often issued by a company/industrial association
- Type III: Agreed set of indices; provide quantified information; self declaration

Among the above, Type I are more reliable because they are established by a third party and considers the environmental impacts of a product from cradle to grave. However, the labeling program will only be effective if linked with complementary program of consumer education and up on restriction of umbrella claims by the producers.

2.3.2.7 Cleaner production

Cleaner production is one of the tools, which has lot of bearing on environmental pollution control. It is also seen that the approach is changing with time *i.e.*, dumping-to-control-to-recycle-to-prevention. Promotion of cleaner production principles involves an insight into the production processes not only to get desired yield but also to optimize on raw material consumption *i.e.*, resource conservation and implications of the waste treatment and disposal.

2.3.2.8 4-R concept

The concept endorses utilization of wastes as by-products to the extent possible *i.e.*, Recycle, Recover, Re-use, Recharge. Recycling refers to using wastes/by-products in the process again as a raw material to maximize production, etc., Recovery refers to engineering means such as solvent extraction, distillation, precipitation, *etc.*, to separate useful constituents of wastes, so that these recovered materials can be used. Reuse refers to the utilization of waste from one process as a raw material to other. Recharging is an option in which natural systems are used for renovation of waste for further use.

2.3.2.9 Eco-efficiency

The World Business Council on Sustainable Development (WBCSD) defines eco-efficiency as “the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with earth’s carrying capacity”. The business implements the eco-efficiency on four levels *i.e.*, optimized processes, recycling of wastes, eco-innovation and new services. Fussler (1995) defined six dimensions of eco-efficiency, which are given below to understand/examine the system:

- **Mass:** There is an opportunity to significantly reduce mass burdens (raw materials, fuels, utilities consumed during the life cycle)
- **Reduce Energy Use:** The opportunity is to redesign the product or its use to provide significant energy savings
- **Reduce Environmental Toxins:** This is a concern to the environmental quality and human health. The opportunity here is to significantly control the dispersion of toxic elements.
- **Recycle when Practical:** Designing for recyclability is important
- **Working with Mother Nature:** Materials are borrowed and returned to the nature without negatively affecting the balance of the ecosystem.
- **Make it Last Longer:** It relates to useful life and functions of products. Increasing the functionality of products also increases their eco efficiency.

The competitiveness among the companies and long-term survival will continue and the successful implementation of eco-efficiency will contribute to their success. There is a need to shift towards responsible consumerism equal to the efficiency gains made by corporations – doing more with less.

2.3.2.10 Industrial ecosystem or metabolism

Eco-industrial development is a new paradigm for achieving excellence in business and environmental performance. It opens up innovative new avenues for managing business and conducting economic development by creating linkages among local ‘resources’, including businesses, non-profit groups, governments, unions, educational institutions, and communities. They can creative fostering of dynamic and responsible growth. Antiquated business strategies based on isolated enterprises are no longer responsive enough to market, environmental and community requirements.

Sustainable eco-industrial development looks systematically at development, business and environment, attempting to stretch the boundaries of current practice - on one level. It is as directly practical as making the right connections between the wastes and resources needed for production and at the other level, it is a whole new way of thinking about doing business and interacting with communities. At a most basic level, each organization seeks higher performance within it self. However, most eco-industrial activity is moving to a new level by increasing the inter connections between the companies.

Strategic partnership, networked manufacturing and performed supplier arrangements are all the examples of ways used by the businesses to ensure growth, contain costs and to reach out for new opportunities.

For most businesses, the two essentials for success are the responsive markets and access to cost-effective, quality resources for production or delivering services. In absence of these two factors, virtually every other incentive becomes a minor consideration.

Transportation issues are important at two levels, the ability to get goods to market in an expeditious way is essential to success in this day of just in time inventories. The use of least impact transportation with due consideration of speed and cost supports business success and addresses the concerned in community.

Eco-industrial development works because it consciously mixes a range of targeted strategies shaped to the contours of the local community,.Most importantly, it works because the communities wants nothing less than the best possible in or near their neighborhood. For companies it provides a path towards significantly higher operating results and positive market presence. For our environment, it provides great hope that the waste will be transformed into valued product and that the stewardship will be a joint pledge of both businesses and communities.

2.3.2.11 Eco-industrial park

An eco-industrial park is a community of manufacturing and service businesses seeking enhanced environmental and economic performance through collaboration in managing environmental and resource issues including energy, water and materials. By working together, the community of businesses seeks a collective benefit that is greater than the some of the individual benefits, each company could realize it is an optimized its individual performance only. The goal of an eco industrial park is to improve economic performance of the participating companies by minimizing their environmental impacts.

2.3.2.12 Voluntary agreements

Voluntary environmental agreements among the industries, government, public representatives, NGOs and other concerned towards attaining certain future demands of the environment are reported to be successful. Such agreements may be used as a tool where Government would like to make the standards stringent in future (phase-wise-stringent). These may be used when conditions are temporary and require timely replacements. Also, these may be used as supplementary/ complimentary in implementation of the regulation. The agreements may include:

- Target objectives (emission limit values/standards)
- Performance objectives (operating procedures)

- R&D activities – Government and industry may have agreement to establish better control technologies.
- Monitoring & reporting of the agreement conditions by other agents (NGOs, public participants, civil authority *etc.*)

In India, the MoEF, has organized such programme, popularly known as the corporate responsibility for environment protection (CREP) considering identified 17 categories of high pollution potential industrial sectors.. Publication in this regard, is available with Central Pollution Control Board (CPCB).

2.3.3 Tools for communication

2.3.3.1 State of environment

The Government of India has brought out the state of environment report for entire country and similar reports are available for many of the states. These reports are published at regular intervals to record trends and to identify the required interventions at various levels. These reports consider the internationally accepted DPSIR framework for the presentation of the information. DPSIR refers to

- D – Driving forces – causes of concern *i.e.* industries, transportation *etc.*
- P – Pressure – pollutants emanating from driving forces *i.e.* emission
- S – State – quality of environment *i.e.* air, water & soil quality
- I – Impact – Impact on health, ecosystem, materials, biodiversity, economic damage *etc.*
- R – Responses – action for cleaner production, policies (including standards/guidelines), targets *etc.*

Environment reports including the above elements give a comprehensive picture of specific target area in order to take appropriate measures for improvement. Such reports capture the concerns which could be considered in EIAs.

2.3.3.2 Corporate environmental reporting

Corporate environmental reports (CERs) are only one form of environmental reporting defined as publicly available, stand alone reports, issued voluntarily by the industries on their environmental activities (Borphy and Starkey-1996). CER is just are a means of environmental improvement and greater accountability, not an end in itself.

Three categories of environmental disclosure are:

- Involuntary Disclosure: Without its permission and against its will (env. Campaign, press, *etc.*)
- Mandatory Disclosure: As required by law
- Voluntary Disclosure: The disclosure of information on a voluntary basis

2.4 Objectives of EIA

Objectives of EIA include the following:

- To ensure environmental considerations are explicitly addressed and incorporated into the development decision-making process;
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
- To promote development that is sustainable and optimizes resource use as well as management opportunities.

2.5 Types of EIA

Environmental assessments could be classified into four types *i.e.* strategic environmental assessment, regional EIA, sectoral EIA and project level EIA. These are precisely discussed below:

Strategic environmental assessment

Strategic Environmental Assessment (SEA) refers to systematic analysis of the environmental effects of development policies, plans, programmes and other proposed strategic actions. SEA represents a proactive approach to integrating environmental considerations into the higher levels of decision-making – beyond the project level, when major alternatives are still open.

Regional EIA

EIA in the context of regional planning integrates environmental concerns into development planning for a geographic region, normally at the sub-country level. Such an approach is referred to as the economic-cum-environmental (EcE) development planning. This approach facilitates adequate integration of economic development with management of renewable natural resources within the carrying capacity limitation to achieve sustainable development. It fulfils the need for macro-level environmental integration, which the project-oriented EIA is unable to address effectively. Regional EIA addresses the environmental impacts of regional development plans and thus, the context for project-level EIA of the subsequent projects, within the region. In addition, if environmental effects are considered at regional level, then cumulative environmental effects of all the projects within the region can be accounted.

Sectoral EIA

Instead of project-level-EIA, an EIA should take place in the context of regional and sectoral level planning. Once sectoral level development plans have the integrated sectoral environmental concerns addressed, the scope of project-level EIA will be quite minimal. Sectoral EIA helps in addressing specific environmental problems that may be encountered in planning and implementing sectoral development projects.

Project level EIA

Project level EIA refers to the developmental activity in isolation and the impacts that it exerts on the receiving environment. Thus, it may not effectively integrate the cumulative effects of the development in a region.

From the above discussion, it is clear that EIA shall be integrated at all the levels *i.e.*, strategic, regional, sectoral and the project level. Whereas, the strategic EIA is a structural change in the way the things are evaluated for decision-making, the regional EIA refers to substantial information processing and drawing complex inferences. The project-level EIA is relatively simple and reaches to meaningful conclusions. Therefore in India, project-level EIA studies take place as a large-scale and are being considered. However, in the re-engineered Notification, provisions have been incorporated for giving a single clearance for the entire industrial estate for e.g., Leather parks, pharma cities *etc.*, which is a step towards the regional approach.

As we progress and the resource planning concepts emerge in our decision-making process, the integration of overall regional issues will become part of the impact assessment studies.

2.6 Basic EIA Principles

By integrating the environmental impacts of the development activities and their mitigation early in the project planning cycle, the benefits of EIA could be realized in all stages of a project, from exploration and planning, through construction, operations, decommissioning, and beyond site closure.

A properly-conducted-EIA also lessens conflicts by promoting community participation, informing decision makers, and also helps in laying the base for environmentally sound projects. An EIA should meet at least three core values:

- Integrity: The EIA process should be fair, objective, unbiased and balanced
- Utility: The EIA process should provide balanced, credible information for decision-making
- Sustainability: The EIA process should result in environmental safeguards

Ideally an EIA process should be:

- Purposive- should inform decision makers and result in appropriate levels of environmental protection and community well-being.
- Rigorous- should apply 'best practicable' science, employing methodologies and techniques appropriate to address the problems being investigated.
- Practical- should result in providing information and acceptable and implementable solutions for problems faced by proponents.
- Relevant- should provide sufficient, reliable and usable information for development planning and decision making.
- Cost-effective-. should impose minimum cost burdens in terms of time and finance on proponents and participants consistent with meeting accepted requirements and objectives of EIA

- Efficient- should achieve the objectives of EIA within the limits of available information, time, resources and methodology.
- Focused- should concentrate on significant environmental effects and key issues; *i.e.*, the matters that need to be considered while making decisions.
- Adaptive- should be adjusted to the realities, issues and circumstances of the proposals under review without compromising the integrity of the process, and be iterative, incorporating lessons learnt throughout the project life cycle.
- Participative- should provide appropriate opportunities to inform and involve the interested and affected publics, and their inputs and concerns should be addressed explicitly in the documentation and decision making.
- Inter-disciplinary- should ensure that appropriate techniques and experts in relevant bio-physical and socio-economic disciplines are employed, including use of traditional knowledge as relevant.
- Credible- should be carried out with professionalism, rigor, fairness, objectivity, impartiality and balance, and be subject to independent checks and verification.
- Integrated- should address the interrelationships of social, economic and biophysical aspects.
- Transparent- should have clear, easily understood requirements for EIA content; ensure public access to information; identify the factors that are to be taken into account in decision making; and acknowledge limitations and difficulties.
- Systematic- should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the measures necessary to monitor and investigate residual effects.

2.7 Project Cycle

The generic project cycle including that of leather/skin/hide processing industry has six main stages:

1. Project concept
2. Pre-feasibility
3. Feasibility
4. Design and engineering
5. Implementation
6. Monitoring and evaluation

It is important to consider the environmental factors on an equal basis with technical and economic factors throughout the project planning, assessment and implementation phases. Environmental consideration should be introduced at the earliest in the project cycle and must be an integral part of the project pre-feasibility and feasibility stage. If the environmental considerations are given due respect in the site selection process by the project proponent, the subsequent stages of the environmental clearance process would get simplified and would also facilitate easy compliance to the mitigation measures throughout the project life cycle.

A project's feasibility study should include a detailed assessment of significant impacts, and the EIA include a detailed prediction and quantification of impacts and delineation of Environmental Management Plan (EMP). Findings of the EIA study should preferably be incorporated in the project design stage so that the project as well as the site alternatives is studied and necessary changes, if required, are incorporated in the project design stage.

This practice will also help the management in assessing the negative impacts and in designing cost-effective remedial measures. In general, EIA enhances the project quality and improves the project planning process.

2.8 Environmental Impacts

Environmental impacts resulting from proposed actions can be grouped into following categories:

- Beneficial or detrimental
- Naturally reversible or irreversible
- Repairable via management practices or irreparable
- Short term or long term
- Temporary or continuous
- Occurring during construction phase or operational phase
- Local, regional, national or global
- Accidental or planned (recognized before hand)
- Direct (primary) or Indirect (secondary)
- Cumulative or single

The category of impact as stated above, and the significance will facilitate the Expert Appraisal Committee (EAC)/State Level EAC (SEAC) to take a look at the ToR for EIA studies, as well as, in decision making process about the developmental activity.

The nature of impacts could fall within three broad classifications *i.e.*, direct, indirect and cumulative, based on the characteristics of impacts. The assessment of direct, indirect and cumulative impacts should not be considered in isolation nor can be considered as separate stages in the EIA. Ideally, the assessment of such impacts should form an integral part of all stages of the EIA. The TGM does not recommend a single method to assess the types of impacts, but suggests a practical framework/approach that can be adapted and combined to suit a particular project and the nature of impacts.

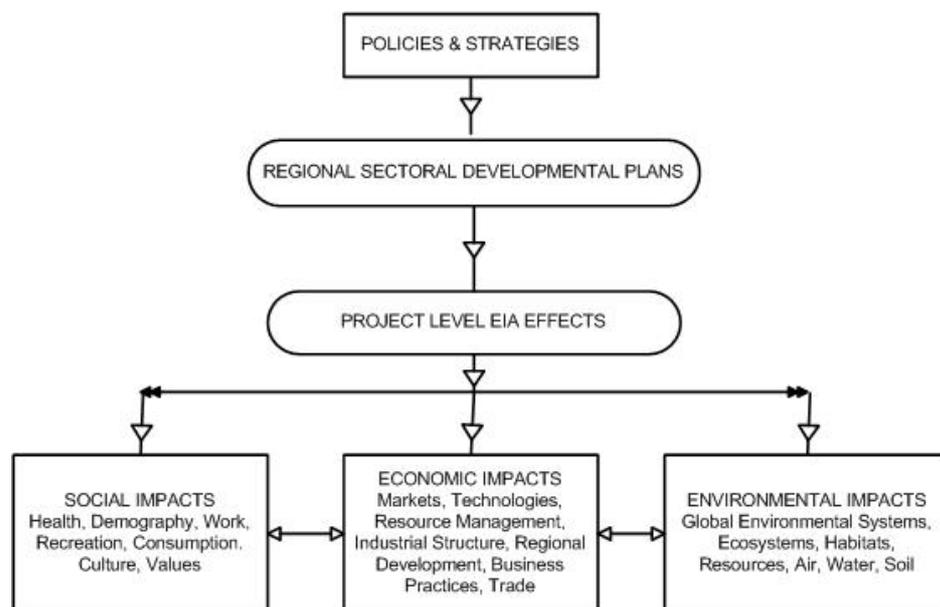


Figure 2-2: Types of Impacts

2.8.1 Direct impacts

Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component. The activities in the Tannery may contaminate the basic environmental media. For example, a discharge of effluents from the leather/skin/hide processing industry into a river may lead to a decline in water quality in terms of high biochemical oxygen demand (BOD) or dissolved oxygen (DO) or rise of water toxins or rise of Total Dissolved Solids (TDS), etc.

2.8.2 Indirect impacts

Indirect impacts on the environment are those which are not a direct result of the project, often produced away from or as a result of a complex impact pathway. The indirect impacts are also known as secondary or even tertiary level impacts. For example, ambient air SO₂ rise due to stack emissions may deposit on land as SO₄ and cause acidic soils. Another example of indirect impact, is the decline in water quality due to rise in temperature of water bodies receiving cooling water discharge from the nearby industry. This, in turn, may lead to a secondary indirect impact on aquatic flora in that water body and may further cause reduction in fish population. Reduction in fishing harvests, affecting the incomes of fishermen is a third level impact. Such impacts are characterized as socio-economic (third level) impacts. The indirect impacts may also include growth-inducing impacts and other effects related to induced changes to the pattern of land use or additional road network, population density or growth rate. In the process, air, water and other natural systems including the ecosystem may also be affected.

2.8.3 Cumulative impacts

Cumulative impact consists of an impact that is created as a result of the combination of the projects evaluated in the EIA together with other projects in the same vicinity, causing related impacts. These impacts occur when the incremental impact of the project is combined with the cumulative effects of other past, present and reasonably foreseeable future projects. Figure 2-3 depicts the same. Respective EAC may exercise their discretion on a case-by-case basis for considering the cumulative impacts.

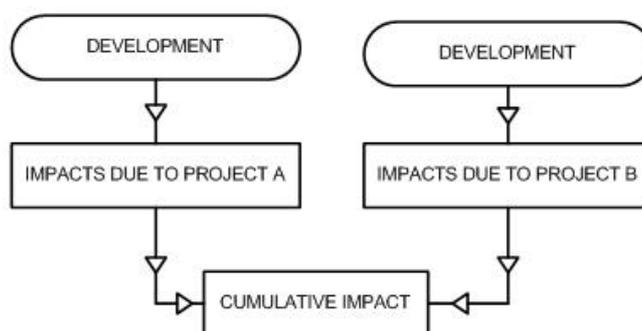


Figure 2-3: Cumulative Impact

2.8.4 Induced impact

The cumulative impacts can be due to induced actions of projects and activities that may occur if the action under assessment is implemented such as growth-inducing impacts and

other effects related to induced changes to the pattern of future land use or additional road network, population density or growth rate (e.g. excess growth may be induced in the zone of influence around a power project, and in the process causing additional effects on air, water and other natural ecosystems). Induced actions may not be officially announced or be part of any official plan. Increase in workforce and nearby communities contributes to this effect.

They usually have no direct relationship with the action under assessment, and represent the growth-inducing potential of an action. New roads leading from those constructed for a project, increased recreational activities (e.g., hunting, fishing), and construction of new service facilities are examples of induced actions.

However, the cumulative impacts due to induced development or third level or even secondary indirect impacts are difficult to be quantified. Because of higher levels of uncertainties, these impacts cannot normally be assessed over a long time horizon. An EIA practitioner usually can only guess as to what such induced impacts may be and the possible extent of their implications on the environmental factors. Respective EAC may exercise their discretion on a case-by-case basis for considering the induced impacts.

2.9 Significance of Impacts

This TGM establishes the significance of impacts first and proceeds to delineate the associated mitigation measures. So the significance here reflects the ‘worst-case scenario’ before mitigation is applied, and therefore provides an understanding of what may happen if mitigation fails or is not as effective as predicted. For establishing significance of different impacts, understanding the responses and interaction of the environmental system is essential. Hence, the impact interactions and pathways are to be understood and established first. Such an understanding will help in the assessment process to quantify the impact as accurately as possible. Complex interactions, particularly in the case of certain indirect or cumulative impacts, may give rise to non-linear responses which are often difficult to understand and therefore their significance difficult to assess. It is hence understood that indirect or cumulative impacts are more complex than the direct impacts. Currently the impact assessments are limited to direct impacts. In case mitigation measures are delineated before determining significance of the effect, the significance represents the residual effects.

However, the ultimate objective of an EIA is to achieve sustainable development. The development process shall invariably cause some residual impacts even after implementing an EMP effectively. Environmentalists today are faced with a vital, not-easy-to-answer question—“What is the tolerable level of environmental impact within the sustainable development framework?” As such, it has been recognized that every ecosystem has a threshold for absorbing deterioration and a certain capacity for self-regeneration. These thresholds based on concept of carrying capacity are as follows:

- Waste emissions from a project should be within the assimilative capacity of the local environment to absorb without unacceptable degradation of its future waste absorptive capacity or other important services.
- Harvest rates of renewable resource inputs should be within the regenerative capacity of the natural system that generates them; depletion rates of non-renewable inputs should be equal to the rate at which renewable substitutes are developed by human invention and investment.

The aim of this model is to curb over-consumption and unacceptable environmental degradation. But because of limitation in available scientific basis, this definition provides only general guidelines for determining the sustainable use of inputs and outputs. To establish the level of significance for each identified impact, a three-stage analysis may be referred:

- First, an impact is qualified as being either negative or positive.
- Second, the nature of impacts such as direct, indirect, or cumulative is determined using the impact network
- Third, a scale is used to determine the severity of the effect; for example, an impact is of low, medium, or high significance.

It is not sufficient to simply state the significance of the effect. This determination must be justified, coherent and documented, notably by a determination methodology, which must be described in the methodology section of the report. There are many recognized methodologies to determine the significance of effects.

2.9.1 Criteria/methodology to determine the significance of the identified impacts

The criteria can be determined by answering some questions regarding the factors affecting the significance. This will help the EIA stake-holders, the practitioner in particular, to determine the significance of the identified impacts eventually. Typical examples of such factors include the following:

- Exceedance of a Threshold: Significance may increase if a threshold is exceeded. e.g., Emissions of PM10 exceed the permissible threshold.
- Effectiveness of Mitigation: Significance may increase as the effectiveness of mitigation measures decreases. e.g., control technologies, which may not assure consistent compliance to the requirements.
- Size of Study Area: Significance may increase as the zone of effects increases.
- Incremental Contribution of Effects from Action under Review: Significance may increase as the relative contribution of an action increases.
- Relative Contribution of Effects of Other Actions: Significance may decrease as the significance of nearby larger actions increase.
- Relative Rarity of Species: Significance may increase as species becomes increasingly rare or threatened.
- Significance of Local Effects: Significance may increase as the significance of local effects is high.
- Magnitude of Change Relative to Natural Background Variability: Significance may decrease if effects are within natural assimilative capacity or variability.
- Creation of Induced Actions: Significance may increase as induced activities also highly significant.
- Degree of Existing Disturbance: Significance may increase if the surrounding environment is pristine:

For determining significance of impacts, it is important to remember that secondary and higher order effects can also occur as a result of a primary interaction between a project activity and the local environment. Wherever a primary effect is identified, the

practitioner should always think if secondary or tertiary effects on other aspects of the environment could also arise.

The EIA should also consider the effects that could arise from the project due to induced developments, which take place as a consequence of the project. Ex. Population density and associated infrastructure and jobs for people attracted to the area by the project. It also requires consideration of cumulative effects that could arise from a combination of the effects due to other projects with those of other existing or planned developments in the surrounding area. So the necessity to formulate a qualitative checklist is suggested to test significance, in general.

3.

ABOUT LEATHER / SKIN / HIDE PROCESSING INDUSTRY INCLUDING PROCESS AND POLLUTION CONTROL TECHNOLOGIES

3.1 Introduction

The use of leather goes back to the pre-historic times. The principal raw material is the hide or skin of animals including—to a small extent—that of reptiles, fish and birds. The tannery operation involves converting the raw skin, a highly putrescible material, into leather, a stable material, which can be used in the manufacture of a wide range of products. The whole process involves a sequence of complex chemical reactions and mechanical processes. Performing various steps of pre- and post-treatment, generates a final product with specific properties: stability, appearance, water resistance, temperature resistance, elasticity and permeability for perspiration and air, *etc.*

Leather is an intermediate industrial product, with numerous applications in down-stream sectors of the consumer products industry. For the latter, leather is often the major material input, and is cut and assembled into shoes, clothing, leather goods, furniture and many other items of daily use. Different applications require different types of leather.

The tanning of hides and skins also generates other by-products, which find outlets in several industrial sectors such as—dog biscuits and other animal food production, fine chemicals including photography and cosmetics, soil conditioning and fertilizers. The process of making leather has always been associated with odour and water pollution. As it seemed to be an inevitable consequence of the activity at the time, in some cultures people engaged in this industry rarely enjoyed a high social status. Most of the basic stages of leather making are still the same, but the tanning industry has undergone important changes. Several major improvements were made for environmental protection.

A considerable potential impact of tanning and associated activities on air, surface and ground water, soil and other natural resources arises from the chemicals applied, the raw materials used, the effluents, wastes and off-gases release generated in the process. Therefore, provisions for pollution control, waste generation and disposal, chemical safety, accidents, raw material/ water/ energy consumption are essential.

Tanning industry is one of the oldest industries in India and ranks amongst the five top-most export oriented industries of the country. The total value of leather and leather products export and Indian market was estimated around US \$ 8 billion for the year 2008. The main centers of tanning industry are located in the States of Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Bihar, Gujarat, Maharashtra, Karnataka, Punjab, Rajasthan and West Bengal. There are about 2000 tanneries spread all over India. The total processing capacity is about seven thousand tonnes per year. About 75% of the tanneries are in cottage and small-scale sector, about 20% in the medium and only about 5% in the medium/large sector.

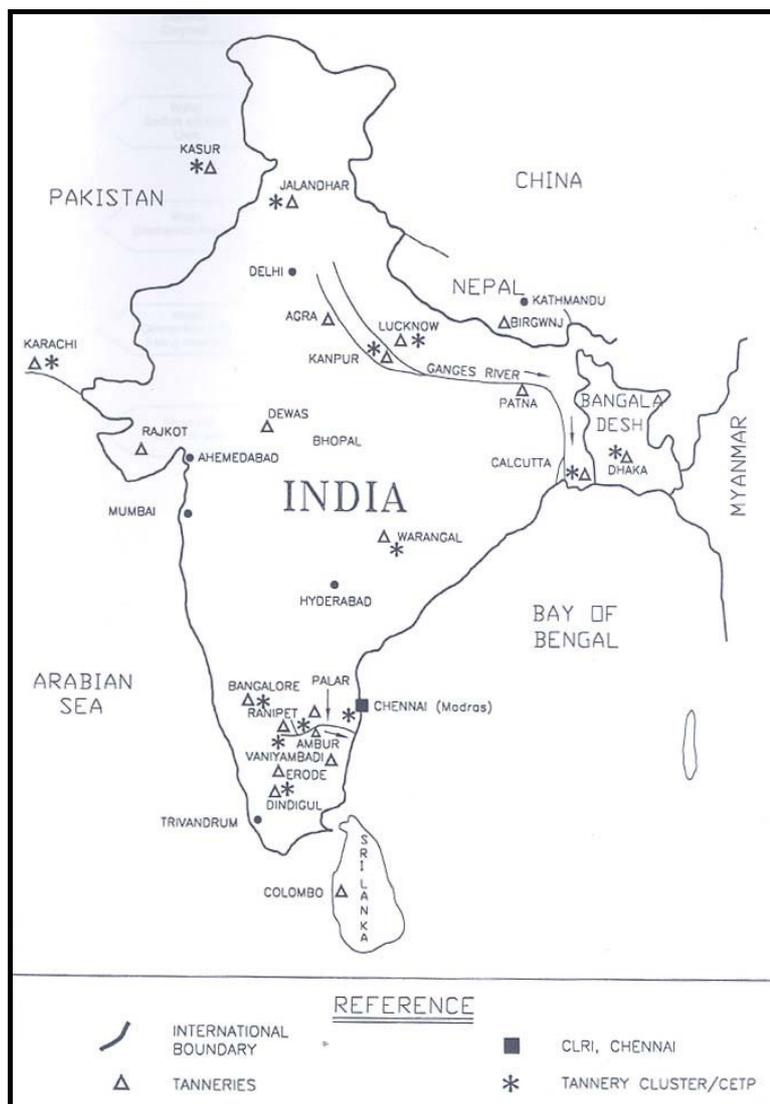


Figure 3-1: Location of Tanneries in India

3.2 Leather Manufacturing Process

Animal skin consists of epidermis, a layer of fatty tissue called areolar and inner corium. The semi-soluble protein, called ‘collagen’ present in corium is converted into highly durable leather through tanning operations. Skin of cows and buffaloes is called hide. Skin of goats and sheep is called skin. In India, 80% of hide available is from animals that died naturally due to ban on cow slaughter in many parts of the country. Goat and sheep skins, however, are by products of meat industry. Hides are 1-3 square meter (m²) in size and weigh about 10-20 kilograms (kg). Skins are smaller in size, 0.4 – 0.5 m² and lighter in weight around 1-2 kg. Slaughter hides and skins contain 60-70% of moisture, which make them liable to bacterial attack, which in turn decomposes the hides and skins.

The preservation of hides and skins in a tannery can be split into following four main categories:

- Preservation of hides and skins storage
- Beam house operations

- Tanning operations
- Post-tanning and finishing operations

Furthermore, tanneries employ abatement techniques for the treatment of wastewater, solid waste and air emissions generated during these processes. Operations carried out in the beam house, tanyard, and post-tanning areas are often referred to as wet processes, as they are performed in processing vessels such as drums. After post-tanning, the leather is subjected to dry finishing operations.

Processes employed in each of the above categories change depending on the raw materials used and the final desired products. Hence the environmental impacts vary from tannery to tannery and a more detailed assessment is necessary at each unit/site.

3.2.1 Process of tanning

The process of converting raw hides and skins into leather is called tanning. The operations falling in pre-tanning, tanning and post-tanning operations are depicted in the figure below:

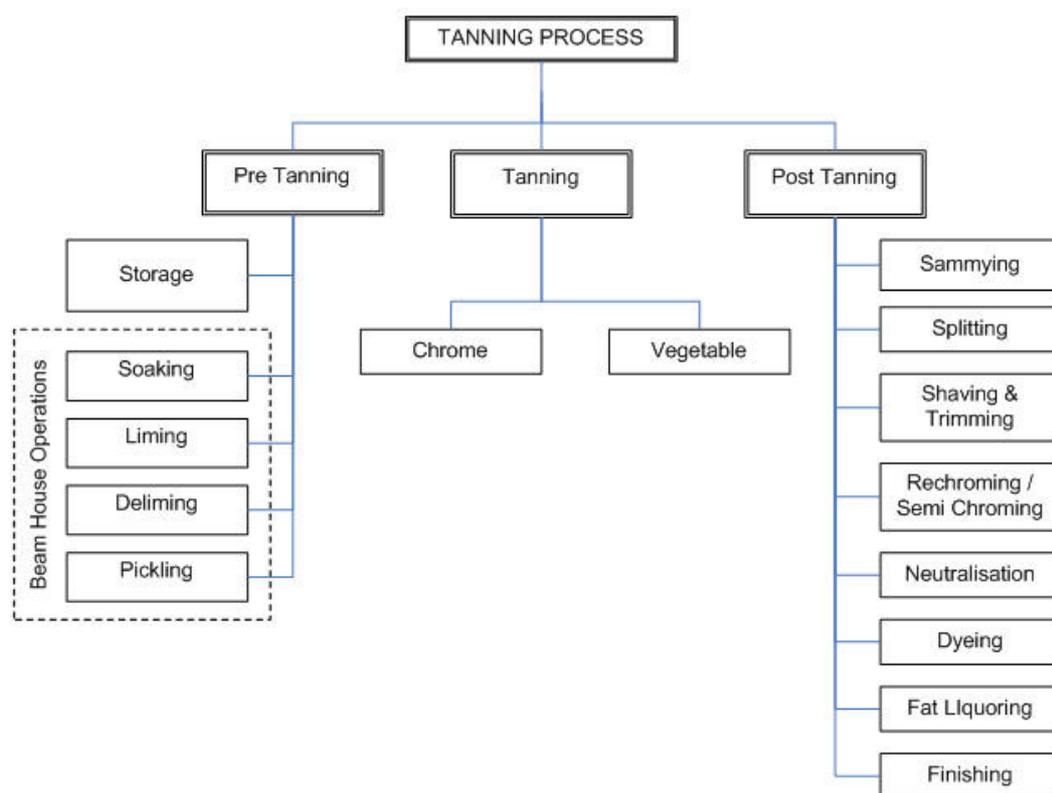


Figure 3-2: Tanning Process

Brief process description of each step is discussed in the sections below:

3.2.1.1 Pre-tanning operations

a) Raw hides/skins

Usually, the hides/skins consist 65% of the water and 30-35% proteins and fat. Because of the high amount of moisture in the hides/skin, there will be bacterial degradation. In order to prevent this bacterial activity, the moisture content should be brought down to less than 30%. This dehydration is usually done by applying common salt (*i.e.*, Sodium Chloride) to the hides/ skins to the tune of 30-45% by weight.

b) Sorting

Hides and skins are sorted into several grades by size, weight, or quality.

c) Trimming

Trimming is generally carried out during the sorting process. Some of the edges (legs, tails and heads, *etc.*) of the raw hides and skins can be cut off. Usually this is done in the abattoir, but it can also be carried out in tanneries.

d) Curing and storing

Curing is a process that prevents the decomposition of hides and skins from the time they are flayed in the abattoir until the processes in the beam house begin. Whenever a raw material cannot be processed immediately ("green"), it must be cured. Popular methods of long-term preservation are salting and drying. Methods for short-term preservation (2-5 days) are cooling, using crushed ice or refrigerated storage, and biocides. Curing is done in the abattoir, at the hide market, or at the tannery. In certain cases it might be necessary to repeat the step in the tannery, e.g., chilled hides can be salted for longer storage or if salting was not efficient enough.

Hides and skins are generally stored on pallets in ventilated or air- conditioned and/or cooled areas, depending on the method of curing chosen. From storage the hides and skins are taken to the beam house.

e) Soaking

The main purpose of this process is to remove the salt used during curing, re-hydrating the material and to get rid of unwanted materials such as dung, blood, soil, *etc.* The duration of soaking may range from several hours to a few days. Depending on the type of raw materials used, soaking additives such as surfactants, enzyme preparations and bactericides can be used.

The process of soaking can be classified into three stages

- Dirt Soaking – In dirt soaking, 300-400 % of water is used to remove the unwanted materials
- Main Soaking – The purpose of main soaking is to re-hydrate the material. In this operation, water, non-anionic wetting agent (0.2 % concentrated Soda ash (0.2% concentrated) and preservatives (0.0 5% concentration) are used.
- Final soaking – Only water is used for the washing purpose in this operation

Major part of salt associated with preservation of skin/ hides is removed during the soaking operation.

f) Liming

The purpose of this operation is to facilitate the removal of hair, flesh, fat (partially), inter-fibrillary protein and to open-up the fibrous structure for osmotic swelling. The process of liming can be broadly classified into two parts *i.e.*, dehairing and re-liming

- Dehairing – Lime (8-10 %) along with Sodium Sulphide (3 %) is applied to the skin to remove hair
- Re-liming – To open up fibrous structure, lime, soda ash, caustic soda, *etc.*, are applied. The pH of the skin being processed will rise to 12- 12.5.

g) Fleshing

The excess fleshing is removed manually or by using fleshing machines. The quantity of wet fleshings is in the range of 10-15% of the weight of raw hides/skins

h) De-liming

This is a process to adjust the pH in between 8-8.5 in order to enhance the enzymatic activity, which converts some of the proteins into soluble forms. pH correction *i.e.*, from 12-12.5 to 8-8.5 are done by using ammonium chloride in case of soft leather and ammonium sulphate in case of hard leather.

i) Pickling

Pickling is a process of correcting the pH suitable to the tanning operation and to prevent swelling of the leather *i.e.* dehydration of the leather. In this process, water (80%), salts (8-10%), formic acid (0.28- 0.3%), sulphuric acid (0.75 – 2% based on thickness) are applied.

PH CORRECTION: for vegetable tanning, a pH in between 4 and 4.5 is maintained whereas, pH in between 2.5 and 7.3 is maintained in case of chrome tanning.

PREVENTION OF SWELLING: the salts to the tune of 8-10% are used in this process, to prevent the swelling. Thus the dehydration takes place.

3.2.1.2 Tanning operations

The tanning process is of two types *i.e.*, chrome tanning and vegetable tanning. Of the total leather production in India, more than 80% is based on chrome tanning and the rest is based on vegetable tanning.

a) Chrome tanning

Basic chromium sulphate [$\text{Cr}_2(\text{SO}_4)_3$] (7-10 %) containing 25% Cr_2O_3 and sodium sulphate (25- 30%) is used in chrome tanning. Part of the pickle bath is used for chrome tanning operation. The pH is increased to 3.8-4.0 at the end of chrome tanning process which is called basification. The semi-finished leather after chrome tanning is called wet blue.

b) Vegetable tanning

Plant extracts are used for the purpose of tanning in this process. The pH falls down from 4- 4.5 to 3-3.5. Though this process is free of any heavy metal use, the leather developed from this process has comparatively weaker capacity of heat resistance and dye-holding.

3.2.1.3 Post-tanning operations

Post-tanning operations comprise of re-chroming of semi-finished wet blue leather, neutralization, dyeing, fat liquoring and finishing. In case if post-tanning of vegetable tanned semi-finished leather, the operations involved are semi-chrome tanning, neutralization, dyeing, fat liquoring and finishing. However the operations vary depending upon the final product.

- Sammying: It is a mechanized process followed to remove excess moisture in the wet blue.
- Splitting: After sammying, the material is split into required thickness using splitting machine
- Shaving and Trimming: The semi-finished leather is leveled using the shaving machine.
- Re-chroming: Depending on the quality of wet blue, re-chroming is carried out to improve the chromium content in the leather.
- Semi-chroming: In case of vegetable tanned semi-finished leather, chrome tanning is given depending on the final leather quality.
- Neutralization: pH is adjusted to 4.5-6.5
- Dyeing: The leather is coloured using dyes such as anionic dyes, acid dyes, direct, metal complex compounds and basic dyes.
- Fat-liquoring: Natural/synthetic oils are applied for fat liquoring, thereby imparting softness to the leather
- Finishing: Phenolics, melamine, acrylics, polymers, naphthalene, *etc.*, are used for finishing to impart fullness to the leather.

3.2.2 Input Vs output in the tannery process

- The major inputs such as water, chemicals in each sectional operation starting from soaking, liming, fleshing, deliming, pickling, vegetable/chromium tanning, *etc.*, till finishing are shown as a part in the process flow diagram in Figure 3-3.
- The mode of operation and equipment used such as pits, paddle, drums, type of machine operations are also indicated as a part in the process flow diagram in figure 3-3.
- The waste discharges from each sectional operation such as wastewater fleshings, waste trimmings and the major constituents in the wastewater in terms of TDS, COD, BOD are also given in Figure 3-3.

Leather / Skin / Hide Processing Industry (Tannery)

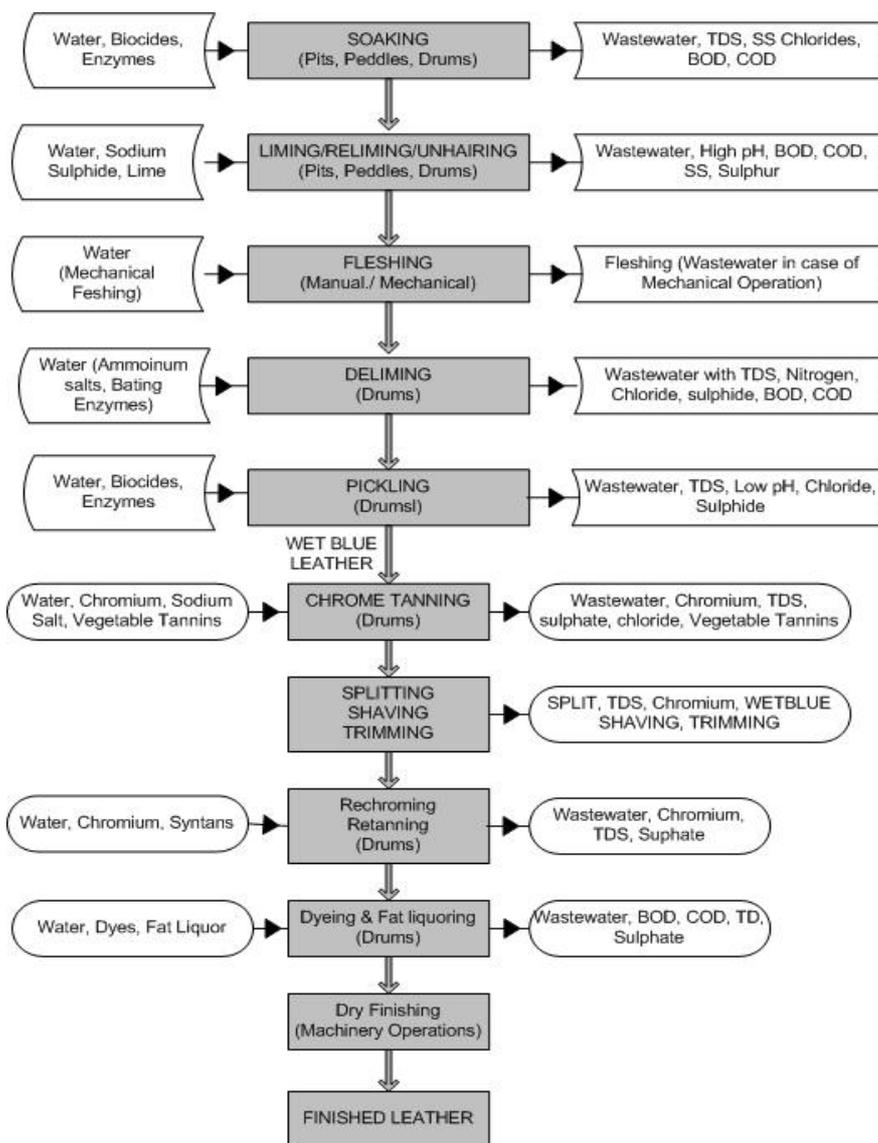


Figure 3-3: Input vs. Output in the Tanneries

Source: CPCB

3.3 Qualitative and Quantitative Analysis of Rejects

Environmental issues associated with tanning and leather finishing include the following:

- Wastewater
- Air emissions
- Solid waste
- Hazardous materials

3.3.1 Wastewater

A. Water usage

Water plays a vital role in tannery operations. Approximately 30-40 litre (L) of water is used for processing one kilogram (kg) of raw hide/skin into finished leather. Most of the Indian tanneries which are located near the riverbanks or natural water bodies draw

surface water. Ground water from their own open wells/tubewells existing within their premises is also used by some tanneries. Most of the traditional tanneries store water in open cement lined pits and ground level tanks. Water from these storage tanks would be pumped directly to the process zones.

B. Wastewater generation and characteristics

Volume of wastewater (effluent) and its characteristics vary from tannery to tannery. They may also vary within the same tannery from time to time. The wastewater from beam house process viz. soaking, liming, deliming, *etc.*, are highly alkaline, containing decomposing organic matter, hair, lime, sulphide and organic nitrogen with high BOD and COD. The wastewater from tanyard process viz. pickling, chrome tanning are acidic and coloured. Effluent from vegetable tanning contains high organic matter. The chrome tanning wastes contain high amounts of chromium mostly in the trivalent form. The characteristics of combined wastewater before treatment and after treatment are given in Table 3.1.

Table 3-1: Characteristics of Wastewater

SL No.	Parameters	Average concentration in mg/litre (Before Treatment)	Average concentration in mg/litre(After Pre-treatment)
1.	BOD	1850	700
2.	COD	4500	3000
3.	Chloride	5500	1200
4.	SS	3750	1500
5.	Total Cr	165	38

Source: Minimal National Standard for Tanneries: COINDS/35/1991-92, CPCB, Delhi

The pollution load per tonne of hides and skins process is given in Table 3-2

Table 3-2: Pollution Load per tonne of Hides/Skins Processed

S.No.	Pollution Parameter	Pollution Load (kg)
1	Volume (m ³)	40
2	BOD	70
3	COD	180
4	Chlorides (Cl)	270
5	Dissolved Solids	600
6	Suspended Solids (SS)	100
7	Sulphides (S)	4
8	Chromium (Cr)	30

Note: Composite Wastewater (no Segregation)

Source: Central Leather Research Institute

Process-wise generation of wastewater and their characteristics are explained in Table 3-3:

Table 3-3: Characteristics of Tannery Effluent

Parameter	Soaking	Beam House Operation (Liming, Reliming, Fleshing, Deliming)	Pickling & Chrome Tanning	Wet finish - Rechroming Dyeing & Fat Liquor	Composite (Including Washings)
Volume of the effluent in litres /ton of hides/skins	6000 - 9000	6000 – 10000	1500 – 3000	3000 – 5000	30000 – 40000
pH	7.5 - 8.0	8 - 12	2.2 – 4.0	3.5 - 4.5	7.0 - 9.0
BOD 5 day at 20°C (Total)	1100 - 2500	2000 - 8000	400 - 800	1000 – 2000	1200 – 3000
COD (Total)	3000 - 6000	3000 – 15000	1000 - 3000	2500 – 7000	2500 – 8000
Sulphide (as S)	-	50 – 200	-	-	30 – 150
Total Solids (TS)	35000 - 55000	6000 - 20000	30000 - 60000	4000 – 10000	15000 – 25000
Dissolved Solids (DS)	32000 - 48000	5000 – 15000	29000 - 58000	3400 – 9000	13000 – 20000
Suspended Solids (SS)	3000 - 7000	3000 – 15000	1000 - 2000	600 – 1000	2000 – 5000
Chlorides (as Cl)	15000 - 30000	3000 – 6000	15000 - 25000	500 – 1000	6000 – 9500
Total Cr	-	-	1500 - 3000	30 – 60	80 – 200
<ul style="list-style-type: none"> ▪ All values except pH are expressed in mg/L ▪ Volume of wastewater applicable for hides (cow & buffalo) and goatskins and not for wool sheepskins 					

Source: Central Leather Research Institute

3.3.1.1 Effluent treatment

Techniques for treating effluent from tanneries include source segregation and pre-treatment for removal/ recovery of chromium; grease traps, skimmers or oil water separators for separation of floatable solids; filtration for separation of filterable solids; flow and load equalization; sedimentation for suspended solids reduction using clarifiers; biological treatment, typically aerobic treatment, for reduction of BOD; biological nutrient removal for reduction in nitrogen and phosphorus; chlorination of effluent where disinfection is required; dewatering and disposal of residuals in designated hazardous waste landfills. The typical wastewater treatment process flow diagram is shown in Figure 3-4. The following additional engineering controls may be required in addressing the specific pollution control parameters:

Leather / Skin / Hide Processing Industry (Tannery)

- Advanced metal removal using membrane filtration or other physical/ chemical treatment technologies
- Reduction in effluent toxicity using appropriate technology (such as reverse osmosis (RO), ion exchange, activated carbon, *etc.*),
- Reduction of TDS in the effluent using RO or evaporation, and
- Containment and neutralization of odour nuisance.

Management of industrial wastewater and examples of treatment approaches are discussed in the General EHS Guidelines. Through use of these technologies and good practice techniques for wastewater management, facilities should meet the Guideline Values for wastewater discharge.

Leather / Skin / Hide Processing Industry (Tannery)

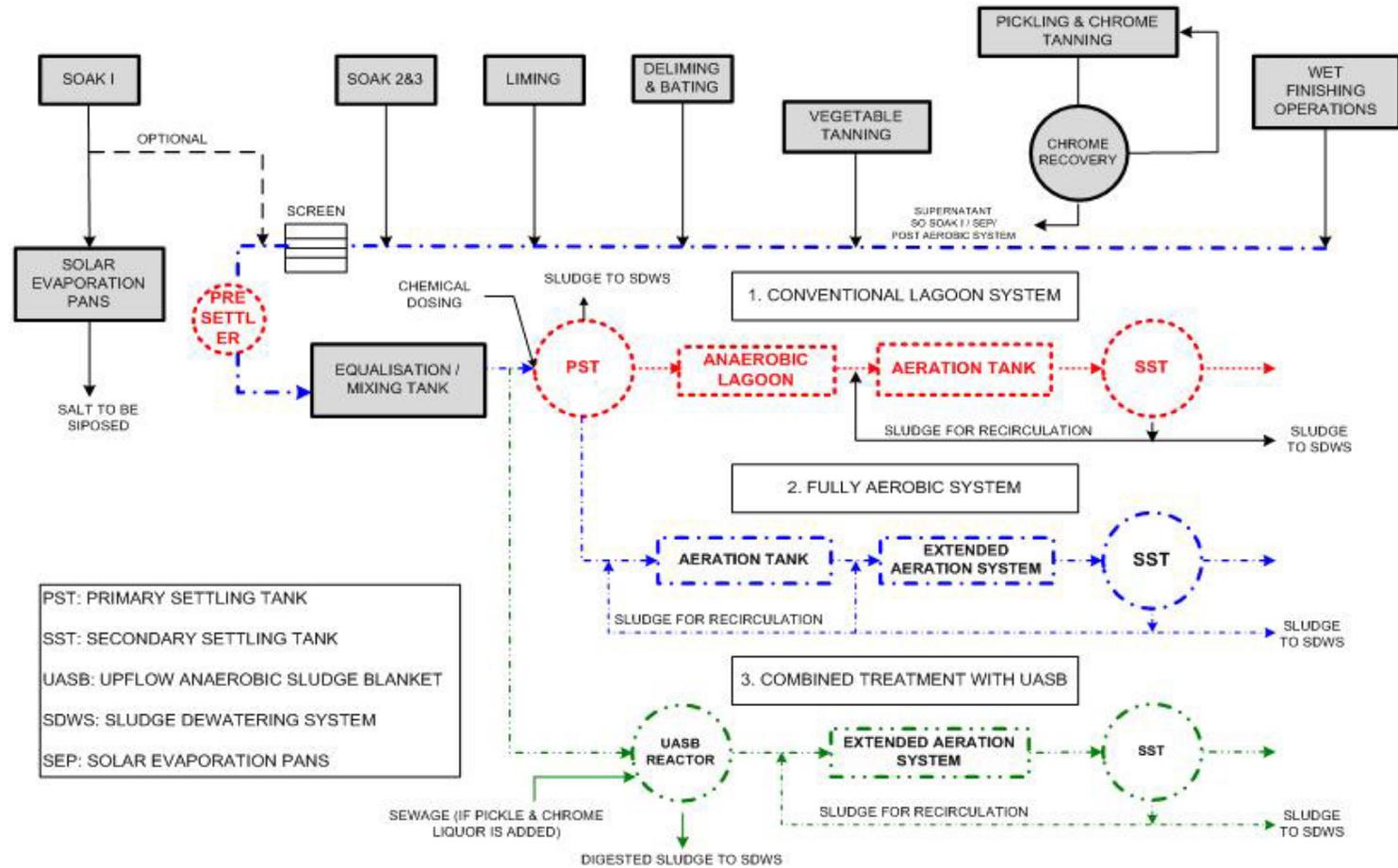


Figure 3-4: Tannery Effluent Treatment System

Source: Central Leather Research Institute, Chennai.

3.3.2 Air emissions

Air emissions from tanning facilities include the following:

Table 3-4: Sources of Air Emissions and Preventive Methods

Emission to Air	Source Operations in Tannery	Suggestive Methods of Prevention
Organic Solvents	Degreasing Finishing	<ul style="list-style-type: none"> ▪ Usage of water-based formulations for spray dyeing ▪ Usage of roller coating techniques or curtain coating machines wherever applicable ▪ Usage of spraying units with economizers and high volume / low-pressure spray guns ▪ Avoid usage of internationally banned solvents ▪ Usage of wet scrubbers, activated carbon adsorption, bio-filters (to remove odors), cryogenic treatment, and catalytic or thermal oxidation.
VOCs	Spray-finish Machines Dryers	
Sulfides	Beam house and Effluent treatment	<ul style="list-style-type: none"> ▪ Maintain a basic pH over 10 in the equalization and sulphide oxidation tanks. ▪ Avoid breeding anaerobic conditions in sulphate containing materials. ▪ Add manganese sulphate to treated effluent. ▪ Use adequate ventilation
Ammonia	Beam House Delimiting Dehairing Drying after dye-penetration	<ul style="list-style-type: none"> ▪ Adequate ventilation followed by wet scrubbing
Dust	Storage handling of powdery chemicals Dry shaving Buffing Dust removal machines Milling drums, Stalking	<ul style="list-style-type: none"> ▪ centralized system ▪ employing cyclones ▪ Usage of scrubbers/bag filters, as needed.

Emissions of sulfur dioxide may occur during bleaching, post-tanning operations, or carbon dioxide (CO₂) delimiting, but they are not typically a significant source of emissions.

Table 3-5: Odour Emissions to Air

Odorous Emissions to Air	Source Operations in Tannery	Suggestive Methods of Prevention
NH ₃	Beam house operations	<ul style="list-style-type: none"> ▪ Prompt curing of raw hides ▪ Reduce the time that sludge remains in the thickener, dewater thickened sludge by centrifugation or filter press, and dry the resulting filter cake. Sludge
H ₂ S	Beam house operations ETP collection tanks ETP Primary Treatment Units	

	ETP Sludge Dewatering System ETP Anaerobic Lagoons	containing less than 30 % solids may generate especially strong odors ▪ Ventilate tannery areas and control exhaust from odorous areas (e.g., where wastewater sludge is thickened and dewatered), through use of a biofilter and / or a wet scrubber with acid, alkali, or oxidant
VOCs	Finishing Operations	
CH ₄	ETP Anaerobic Lagoons	

Source: Draft report of the Expert Committee on Odor Pollution and its Control, July 2007, CPCB

3.3.3 Solid waste

Solid waste includes salt from raw skin / hide dusting; raw skin / hide trimmings; hair from the liming / dehairing process, which may contain lime and sulfides; and fleshing from raw skins / hides. Other solid waste from tannery industry includes wet-blue shavings, containing Cr₂O₃; wet-blue trimming, which is generated from finishing processes and contains Chromium oxide (CrO), syntans, and dye; and buffing dust, which also contains CrO, syntans, and dye. The reducing characteristics of tannery sludge stabilize Cr(III) with respect to Cr(VI), due to the presence of organic matter and sulfides.

Prevention and control measures for solid waste include the following:

- Reduce inputs of process agents (particularly precipitation agents in wastewater treatment) to the extent practically applicable
- Segregate different waste / residue fractions to facilitate recovery and re-use (e.g., to manufacture pet toys, pet food, leather fiberboard)
- Recycle sludge as compost / soil conditioner or in anaerobic digestions for energy generation. Process sludge may be used for composting / agriculture after appropriate assessment for contaminants and potential impacts to soil and groundwater

Fleshings could be degraded through bio-methanation process – CLRI research findings are encouraging.

3.3.4 Hazardous materials

Tanning and leather finishing processes involve the use of a variety of hazardous chemicals. Guidance on the management of hazardous materials, including handling, storage, and transportation, shall be adopted as provided in the General EHS Guidelines.

3.4 Cleaner Technologies, Minimization, and Recycling / Reuse Options

3.4.1 Cleaner technologies in leather processing

The International Union of Environment (IUE) Commission understands that cleaner technology can be defined as the environmentally and economically best practicable technology (BATNEEC, best available technology not entailing excessive cost). Clean technology may be defined in terms of minimum environmental impact, towards which the industry is striving.

Cleaner technologies and waste minimization in leather processing based on the IUE Commission report for world leather sector are listed as follows:

a) Background

The following factors have to be taken into account when considering the application of cleaner technologies:

- The condition of the raw stock received by the tanning industry has a direct effect on the resulting cleaner technologies that can be applied.
- Good farming practices are encouraged so that hides and skins do not suffer from ectoparasite infestation or damage inflicted by barbed wire, horns or other outside influences. Such damage has to be masked by the tanners involving extra processes using additional material resources and often creating added waste disposal problems (e.g. buffing dust, shavings, *etc.*)
- The amount of dung attached to an animal hide or skin as a direct result of poor farming practices also uses more natural resources and creates additional loadings on the effluent and the solid wastes treating which becomes the responsibility of the tanner.
- Damage to the hide or skins, such as poor flaying practice at the abattoir, may also create increased waste disposal problems for the tanner.

The IUE Commission is concerned to take into account the technologies currently applied by the most advanced tanneries and not just to consider the latest developments from research units.

The general recommendations have to be adapted to local conditions and under the supervision of a leather specialist and taking into account the requirements of the production.

b) Preservation of fresh or cooled hides and skins

Fresh or uncured raw stock is available to tanneries in many countries. Whenever possible, treatment of fresh hides and skins is the best solution to reduce salt pollution. Time elapsing between slaughtering and further treatment (whether curing itself or the initiating of wet processing in the tannery) must not exceed a few hours. When an abattoir and a tannery are operationally linked, fresh raw stock may be used. In such cases, proper measures may be taken to handle excess raw stock available with the abattoir.

Beyond this period, it is necessary to cool the raw stock, either in ice or cold air. Cold air is necessary if hides are transported over long distance. Storage below 4°C yields good preservation up to three weeks, under ideal conditions, although some dehydration may be expected. This system of retaining raw stock quality is used in Europe, by transporting raw stock in refrigerated lorries, but it is recognized that this may not be feasible or economical in developing economies. Raw stock may be preserved in ice, but storage is more problematical than chilling, due to melting of the ice, run-off of water and the potential for bacterial growth on wetted pelt.

c) Drying

Shade drying of small skins is a low cost environmentally acceptable process in some climates. Controlled air-drying using heat pump or other system is suitable for any climate.

d) Dry salting

Dry salting combining salt curing and shade drying can minimize the amount of salt used for preservation of skins and hides.

e) Use of antiseptics

The use of antiseptics with low effect on the environment impact and toxicity can help to increase storage time of fresh or chilled hides and skins. Suitable preservatives that are used around the world include: TCMTB, Isothiazolone products, potassium dimethyl dithiocarbamate, sodium chlorite, benzalkonium chloride, sodium fluoride and boric acid. Their use must be regularly reviewed, to reflect changing legislation, because they will be discharged in the effluent.

Some of these agents that may have both bacteriacidal and fungicidal properties, are also appropriate for soaking, pickling and wet-blue preservation.

f) Partial salt elimination

It is possible to eliminate up to 10 % of the salt added to hides and skins for preservation, by using hand shaking, mechanical brushes or a suitable drum. The salt can be reused in pickle processes after dissolution and removal of solids. However, it must not be used for curing purposes because it is too contaminated with bacteria, particularly halophilic or halotolerant bacteria, which can cause so called red heat.

This method of salt recovery gives a partial answer to the salt pollution problem. Neither brine curing nor salt curing can be considered as cleaner technologies, even if pre-fleshing hides reduces this waste. It is recognized that salt curing is one of the greater contributors to the environmental impact of tannery operations, Even recovering some of it has limited benefits, because its reuse is extremely limited, its ecological disposal is difficult.

Beamhouse processing

The new generation of drums and processors facilitate efficient draining and washing, and allow the routine use of low floats for processing, thereby resulting in significant savings in water consumption.

g) Soaking

The consumption of fresh water can be minimized by using a counter current system of washing to concentrate the salt (if present) and other soluble materials, such as dirt and blood.

Additional cleaner technology that can be applied at this stage is the fleshing of green hides after soaking. It yields a lower quantity of fleshings, with a neutral pH. Green fleshings are more valuable than limed fleshings with regard to tallow recovery, because the green fleshings are not subjected to the hydrolyzing liming process. In this way, the amount of recovered tallow is greater and the content of undesirable free fatty acids is much lower, so the quality is better.

An associated problem with this approach is the presence of dung on hides, which causes the fleshing blade to cut into hide, thereby damaging the pelt in an economically unacceptable way. Removal of dried-on dung by methods other than soaking is difficult.

However, dung removal is a pre-requisite to processing. The problems associated with dung contamination may be pre-empted by utilization of hides and skins from animals that have been reared through a quality assurance or clean hide scheme. These schemes generally require animal husbandry practices that minimize dung contamination.

h) Classical unhairing-liming process

The enzymatic treatment of hides and skins can be considered as a cleaner technology only if the amount of sodium sulphide is reduced substantially. However it is not yet possible to totally replace sodium sulphide in processing skins and hides. There are other agents available that reduce the amount of sulphide in liming, e.g., organic sulphur compounds (mercaptoethanol, salts of thioglycolic acid, formamidine sulphuric acid) and amines based proprietary products.

However, it should be borne in mind that all hair dissolving processes will contribute to the COD/BOD of tannery effluents.

i) Hair saving unhairing-liming methods

For traditional skin production, painting and sweating may be considered the cleaner technologies. Recovery of hair before dissolution, either when it is separated during the liming, or at the end of a hair saving process, can lead to a COD reduction of 15 to 20 % for the mixed tannery effluent, and a total nitrogen decrease of 25 to 30 %.

It is an advantage to filter off the loosened hair as soon as possible and higher COD and nitrogen reduction can be obtained. This process can be considered as a cleaner technology if the hair is utilized, even as a nitrogen source.

There are several established methods of hair saving, routinely used in the industry. However it is recognized that they do not provide a complete effect, since each incorporates a hair dissolving step, to deal with residual short hairs.

j) Direct recycling of liming float

Direct recycling can be applied when there is a good control level in the tannery. Resulting advantages are savings in usage of sodium sulphide (up to 40 %) and lime (up to 50 %). It can give a decrease of 30 to 40 % of the COD and 35 % of the nitrogen for the mixed effluent.

The quality of the leather produced can be affected negatively through this recycling process, unless the unhairing and opening up processes are used in two steps. This is because the suspended melanin and undissolved cuticle fragments from the dissolved hair (referred to as scud) are driven into the grain by mechanical action, making it dirty.

This cleaner technology is industrialized in several large bovine tanneries for shoe upper leather. The success depends on how the hair is removed and how well the recycled liquors are cleaned up before they are recycled.

k) Splitting limed hides

Faced with the difficulties of upgrading the chromium-tanned split waste, splitting in the limed hides can be considered as a cleaner technology as it saves chromium and yields a by-product that can be easily recovered for food casings or for the production of gelatin.

l) CO₂ deliming

Up to 40 % of a tannery's production of ammonia and nitrogen comes from the use of ammonium salts during the deliming process. CO₂ deliming can be considered as a cleaner technology giving good results on light bovine pelts (thickness less than 3 mm). For thicker hides, it is necessary to increase float temperature (up to 35°C) and/or process duration and/or to add small amounts of deliming auxiliaries. In order to effectively eliminate the creation of hydrogen sulphide as pH of the deliming solution falls, 0.1% hydrogen peroxide can be used to scavenge residual sulphide. The grain enamel should be allowed to delime for perhaps five minutes, to guard against oxidation damage, then the peroxide can be added safely.

If the pH falls below 7, in case of black or red hides they may appear dirty due to the retention of melanin in the depleted grain layer.

If the pH of CO₂ deliming float is lower compared to common procedure, special bates can be used. Also, bates with a lower content of ammonium are available.

m) Other ammonium-free deliming

Ammonium-free deliming agents, such as weak acids or esters, can totally or partially replace ammonium salts used for conventional deliming. However, in comparison with CO₂ deliming the resulting COD is often higher, due to the contribution from the reagent. Cost and slowness of reaction make them less viable

Tanning operations

Chromium tanning salts are used today in 85 % of tanning processes around the world. Only the trivalent form is used for tanning operations and this chemical cannot be replaced by another, to give the same quality of leather.

An argument for continuing to use basic Chromium(III) sulphate is the ease of managing its discharge into the environment and its low environmental impact. Chromium(IV), a recognized carcinogen is not used in the leather manufacturing process.

n) Reduced salt use in pickling floats

When pickling and tanning steps are separated, the recycling of pickling floats can save up to 80 % normal salt and 20 to 25 % of the pickling aid. When they are conducted as one step, the neutral electrolyte can still be recycled in the spent and liquor and reused for pickling. However, in the absence of analytical data, it must be assumed that much of the formate in the system will be bound to chromium, either on the leather or in the solution.

For wool-on sheepskins, using long floats over 150 %, recycle of pickling and tanning liquors is a current and routine practice. It is also feasible to recycle bating floats.

Salt concentrations in pickling floats can also be reduced by using non-swelling acids, which however might affect the leather character.

o) Degreasing operations

Solvent degreasing is still in use. This practice can lead to a cleaner technology when the solvent is recovered, the extraction brines are recycled, and the natural grease is recovered

for commercial use. Discharge of solvents is unavoidable with solvent degreasing, but alternative technologies can be applied for the high quality skin production.

On wool-on lambskins, it is a common practice to undertake a dry solvent extraction when crusted.

The use of non-solvent methods implies the use of higher amounts of surfactants. Ethoxylated fatty alcohols should be recommended instead of the more widely used ethoxylated alkylphenols, because they are more easily degraded and the use of the later are to be restricted in the EU. The COD from aqueous treatment may amount as much as 200,000 milligrams per litre (mg/l), due to the content of natural grease and surfactants (1 grams per litre (g/l) of natural grease is about 2,900 mg/l COD, and 1 g/l ethoxylated alkylphenol is about 2,300 mg/l COD).

To ensure complete mobilization, aqueous degreasing would, ideally, be carried out at a temperature above the melting point of the grease. However, the melting point of the grease is normally very close to the shrinkage temperature of the skin. For example, the melting point of sheepskin grease is approximately 42°C, whereas the shrinkage temperature of sheepskin pickled pelt is approximately 50°C. Therefore, the risk of heat damage to the pelt precludes the use of temperatures above the melting point of the grease. The grease may also be contained within lipocytes, further limiting its dispersal.

The aqueous degreasing of pigskins may be assisted by the use of proteolytic enzymes to degrade the lipocyte and, thus, mobilize the grease. However, this may not be possible for sheepskins where the fibre structure is more susceptible to the proteolytic activity of the enzyme.

p) Wet-white pre-tanning

The rationale behind this notion is to pre-tan or pre-treat the hide, in order to be able to split and shave prior to chrome tanning, so that less tanned waste is created. The rationale is to confer resistance to the frictional heating of the pelt surface during shaving. Ideally, the pre-treatment should be reversible, so that chrome tanning is conducted on unchanged pelt.

This process, can be considered as a cleaner technology if the chemicals used are neither toxic nor cause adverse environmental impact. Aluminum (III), titanium (IV) and zirconium (IV) have been suggested for this role. They are not listed as hazardous, although restricted in several countries, but their degree of reversibility depends on how they have been applied. Aldehydic tanning agents can be considered as leading to a cleaner process, according to local regulations, but their reactions are completely irreversible, so contribute to a different character in the leather. Syntans are an option, because their action is more reversible.

The alternative approach is to change the properties of the pelt, to make it less prone to distort when the surface is struck by the shaving blade. This can be achieved by reducing the ability of the fibre structure to slip over itself: this is best achieved with hydrated silica, used in the fabric industry for the same purpose. Silica interacts weakly with collagen, in a non-tanning manner, and the effect can be reversed: any discharged silica has negligible environmental impact.

q) Direct recycling of chromium-tanning floats

When applied under strict control; this can markedly limit chromium from tanning in the effluent. Savings can be obtained from the process, by a reduction of 20 % of the chromium used in a conventional tannery process, and up to 50 % for wool-on sheepskins, and substantial reduction in the amount of salt used, since it too is recycled.

Excess chromium-containing liquor that cannot be easily recycled may be precipitated and then recycled. Usually such reuse produces wet blue that is a little different in colour.

Acidifying recycled liquor to pH 1 can revert the chrome species to those in fresh chrome liquor

r) Recovery after precipitation

When large quantities of chromium-bearing floats are recovered, recycling after precipitation is another solution for chromium recovery. Precipitants that might be used include sodium carbonate, sodium hydroxide, and magnesium oxide. The greatest sludge density is obtained using magnesium oxide. The addition of polyelectrolyte can improve flocculation.

Sludge obtained after sedimentation and optional filtration is dissolved in sulphuric acid again, to control the desired basicity in the product. In order to ensure complete solubilisation of the chrome sludge, the reaction should be conducted at $>70^{\circ}\text{C}$. For conventional tanning, it is possible, with this process, to obtain a clarified effluent, with less than 10 mg/l of chromium, which might be reused for the next pickling or tanning float. The clarified effluent can also be reused for first soaking float.

Using recovered chrome for tanning results in wet blue that is slightly paler than conventional production. Further the re-use of precipitated chromium will lead to an increase in the neutral salts in the effluent.

s) High exhaustion tanning process

In order to reduce chromium concentration in the waste float, high exhaustion chromium salts, adapted basification products and/or temperature increase can be used. In essence, all proprietary options are based on higher astringency, by employing higher pH in basification, but most importantly elevated temperature.

t) Chromium-free tanning

In most cases, chromium tanning should be considered as the best available technology. Many alternative formulations have been proposed but none can exhibit the versatility of Chromium_(III) for making a wide variety of leathers. Also the hypothermal stability of chrome leather is a prerequisite for many modern applications of leather.

Vegetable tanning is the traditional alternative to chrome tanning, conducted by a dry drum process, or in closed circuit vats, it can minimize waste and must be included in these considerations. Due to the high pollution load and slow biodegradability conventional vegetable tanning cannot be considered more environmentally friendly than chrome tanning. Vegetable tanning has limited application, because of the low hypothermal stability, the filling effect and the hydrophilicity of the resulting leathers. Recovery of vegetable tanning floats by ultrafiltration is used in several European tanneries and the recovered tannins may be used in the tanning process.

Tanning with organic tanning agents, using polymers or condensed plant polyphenols with an aldehydic crosslinker, can produce mineral-free leather, matching the high hydrothermal stability of chrome leather. However, they do not have the same characteristics as chromium-tanned leather, because they are much more filled and hydrophilic.

Metal-free leathers are being successfully used to produce high-quality, specialty leathers, for example, automotive leathers with good thermal stability.

Semi-metal tanning can produce chrome-free leather, with equally high hydrothermal stability. It is a combination of a metal salt, preferably but not exclusively Aluminum_(III), and a plant polyphenol containing pyrogallol groups, often in the form of hydrolysable tannins.

A life-cycle analysis of each process needs to be taken into account.

Post-tanning operations

When the use of chromium is required for retanning operations, the same consideration should be given as for chrome tanning. Absence of environmentally unsound dyestuffs especially those containing benzidine and other banned aromatic amines and of halogenated oils in fat liquors, form essential elements of cleaner processing. High level of exhaustion for syntans, dyes and fat liquors are also to be considered in each case, the chemical principles and conditions for reaction with the leather must be optimized.

Finishing operations

The use of water-based finishing is fundamental for a cleaner process, but the inherent need to use crosslinkers should be kept in mind. Chemicals used in finishing must not contain any environmentally undesirable heavy metals or other restricted products. Water-based formulations (containing low quantities of solvent) are available for spray dyeing. Finishing products have to meet the current limits imposed by environmental and workers health regulations. The equipment used is extensive. Roller coating or curtain coating machines are more desirable from the environmental point of view, but they cannot be used for all type of leather. For other types, spraying units with economizers and High Volume Low Pressure (HVLP) spray guns can reduce discharges to the environment.

3.4.2 Waste minimisation options

3.4.2.1 Recycling

Recycling technologies have been used for long time in vegetable tanning processes, indeed the conventional counter-current method incorporates recycling as fundamental element of the technology.

Simple recycling technologies need some control to prevent any deviation in the tannery process. A laboratory with basic analytical equipment is desirable.

3.4.2.2 Beam house process

To reduce the volume of saline effluents, particularly if the segregated float needs to be evaporated or specifically processed, it is possible to reuse the soaking float in a counter

current method, analogous to vegetable tanning. Here, the pelts progress into cleaner float and the contaminated floats move towards the dirt soak. Only the dirt soak liquor, in which dirt and salt are accumulated are discharged to waste and treatment. This decreases the amount of water to be evaporated, when salinity is restricted, and reduces the presence of biocides in effluent. However it does not solve the problem of what to do with the dirt soak solution. Lagooning where feasible reduces the volume, but salt remains.

The unhairing-liming float can also be reused for the next process. It must be taken into account that the recovery rate of the liming float should not exceed 75 % in order to limit the nitrogen concentration. Besides recycling materials (pumps, fine screening, storage tanks), it is sometimes necessary to warm the float before reuse and also to screen or skim it in order to eliminate undesirable floating solids and to remove hair and grease from the surface. Without any sedimentation, an industrial recycling process can save 35 to 40 % of sodium sulphide and 40 to 45 % of the lime (with classical process quantities of 2.5 %). Excessive quantities of lime should be avoided during the process. It is worth to recall in this regard that the theoretical requirement for bovine hide is about 1.2%.

3.4.2.3 Tanning process

a) Degreasing float

When sheepskins are solvent degreased, recycling of the residual solvent after distillation is currently operated. Furthermore, the extraction brine is also easy to reuse for saving of sodium chloride.

b) Pickling float

Recycling of pickling float has been proven to be highly satisfactory in terms of salt savings and partly for acid savings. There is no great difficulty if density and acidity of the float can be regularly controlled.

c) Tanning float

The most common practice is to carefully collect the residual tanning float, to filter it, to adjust its acidity, and to reuse it as a new tanning float before adding fresh chromium salts. The recovered volume may be more than required for subsequent tanning operations, but it is possible to reuse the liquor in post-tanning processes.

Another possibility is to use the tanning float for a pre-tanning process. In this case, 60 % of the residual chromium can be recovered.

When pickling and tanning are carried out in the same float, it is also possible to collect the residual tanning float, to filter and acidify it and reuse it as a pickling float.

3.4.2.4 Post-tanning process

It is much less feasible to recycle post-tanning floats since the chemical condition required for the steps may be different and steps tend to be conducted sequentially in the same float. Therefore, the problem of contamination is compounded, especially since these steps vary greatly, even in a single tannery. Thus recycling technology cannot be recommended.

3.4.3 Reduction/Recycling/Recovery/Reuse

Leather production is a water-intensive industry. Therefore measurement and control of consumption are an important and essential point in water management.

In many countries water has become a scarce commodity and the costs for the consumption and discharge of water increases regularly. Water has to be managed properly and several options are available to minimize the overall consumption of water.

Reduction

The first step is the reduction of water consumption with strict measurement and control of consumption. Low float processing, batch-type washing instead of rinsing and combining processes (compact recipes) are practical examples of technologies to reduce water consumption by 30% or more. However, lower volume of water results in higher concentration of pollutants, but that will be partially offset by the greater efficiency of shorter float process steps. Limitations to reducing float length must be borne in mind, since not all processes benefit from reduced float length.

Recycling

Certain specific processes are suitable for recycling of floats, although in most cases installations for treatment are necessary. Examples are; soaking, liming, unhairing, pickling and chrome tanning liquors, which can reduce the overall water consumption by 20-40%.

Recovery/Reuse

Biologically treated effluent offers the opportunity of replacing a certain amount of the process floats such as, the beam house process floats, with treated water. Depending on the type and efficiency of the treatment process additional operations might be necessary, such as filtration and disinfection, to meet the required water quality standards.

Membrane systems provide the possibility of reusing treated effluents provided that most of the residual organic matter is removed and disposal of the concentrate is achievable.

3.4.3.1 Reduction

Reduction in chemical use

Processes should be optimized with regard to chemical use to minimize waste. Reduced floats allow reduction in chemical use (liming, deliming and pickling). However, due regard should be given to the chemical and biochemical principles of processing in order to avoid unnecessary excessive chemical use. For example, lime, sulphide, salt, chrome, dyes, lubricants, *etc.*

Tannery solid by-product management

The general recommendations on tannery solid by-product management are based on the IUE Commission recommendations, these recommendations have to be adapted to suit the local conditions and under the supervision of an expert.

3.4.3.2 Recovery and reuse

A. Green fleshings

Green fleshings can be used in rendering plants for the recovery of grease and meat meal. These products must be clean, and contain minimal quantities of minerals.

More importantly, green fleshings are a valuable source of high quality tallow (a type of animal oil) – a basic commodity with added value. In contrast to limed fleshings, green fleshings need little pH adjustment prior to enzyme processing. They produce much higher yield and the quality is good, because the fleshings are not previously subjected to prolonged alkaline treatment.

B. trimmings

The green and limed trimmings can be used with limed splits for tallow or gelatin production.

Gelatin production

Gelatin production by a specialized, purpose built process facility represents a major utilization opportunity for lime splits, not suitable for tanning. The process involves lime hydrolysis. Soluble gelatin is extracted in a series of hot water batches of increasing temperature at controlled pH. Different stages of purification, demineralization, concentration and sterilization are then required prior to final drying. The gelatin product is used by the food, photographic and pharmaceutical industries. Lower quality gelatin or glue can be produced by acid hydrolysis and hot water extraction.

i. Sausage casings

Specialized manufacturers use limed splits to produce high quality sausage casings. The casing manufacturer will impose restrictions on the process chemicals used in the beam house.

ii. Pet chews

Delimed hide splits can be dried in moulds of various shapes, to produce dog chews.

Composting: Limed splits, high in nitrogen, low in carbon, will compost readily.

iii. Grease from degreasing process

Fat liquors from the degreasing process can be used as a component of low grade fat liquors through a sulphitation process.

iv. White splittings

As for lime splits, the wet white process produces splits that can be partially denatured to produce gelatin or collagen additives. However their use in human food production is restricted.

v. White shavings

Wet white chemistry options can create environmentally friendly tanned waste; aldehyde tanned, syntan tanned, marginally vegetable tanned materials have little associated hazard. These shavings are particularly suitable for use as fertilizer or as a source for collagen hydrolysate. Aluminum containing shavings can be applied to non-acidic agricultural land, according to local regulations.

C. Limed fleshings

i. Methane production

Untanned wastes mixed with farming, domestic and fish wastes can be used for methane production; full-scale plants are in operation in Denmark and Sweden.

Waste fleshings mixed with tannery sludge are digested to produce methane by grinding to 10 millimetres (mm) and warming to allow microbiological activity, with increased fat or grease content resulting in increased methane production. The volume of gas evolved (comprising 75% methane) is estimated to be 615 L/kg of organic material introduced into the digester, after 25 to 30 days at 35°C. The residual solid phase is suitable for composting according to chromium content and can be applied directly to agricultural land as a soil improver. This technique is especially suited to warmer countries, where the necessary heat input is minimal. The input mix material for this system must have at least 70% of organic matter content to operate successfully. An industrial scale plant is in operation in India.

In Denmark, ferrous metal salts are added directly to the reaction vessel of the bio-gas reactor to avoid the generation of noxious and corrosive gases.

ii. Grease and protein recovery

Hydrolysis leading to the recovery of animal grease and proteins can be achieved in two ways; either by a liquid hydrolysis (acid or alkali catalyzed), or by enzymatic digestion at 35°C. Following hydrolysis or digestion, the emulsion must be heated to at least 50°C to separate the fat, protein and water components into separate phases. The protein phase contains 5 to 10% protein.

Limed fleshings must be acidified before enzyme treatment. They produce a low yield of tallow, because it is considerably hydrolyzed by the liming process. In addition, the quality is low because of the high content of free fatty acid from that hydrolytic reaction.

Gaseous by-products of the process are H₂S, mercaptans and odour, and it is therefore essential to exhaust these via a water wash or a scrubber system containing sodium hydroxide and sodium hypochlorite. However, in some places, the exhaust gases are passed into the air intakes of the boilers used for energy production, thereby eliminating the need for a scrubber. In some cases, a ferrous metal scrubber may be needed prior to the boiler to capture sulphides.

In respect of the capital and running costs, it is estimated that for economic viability, 10 tonnes of material must be processed per day.

A second process technology involves treatment with hydrogen peroxide and sulphuric acid at 35-40°C. For this, the fleshings must first be chopped to a particle size of 50-200

mm. The process produces two phases that can be separated by mechanical de-watering; grease separates from the liquid phase, the yield being 10 to 12.5% of the original fleshings mass. A protein phase (20-25% dry solids) is also obtained and this can be used either as animal foodstuff after drying, or as fertilizer. Again, a minimum quantity of 10 tonnes per day needs to be processed for economic viability.

Composting: A mixture of waste fleshings and an appropriate bulking agent (also carbon source), with aeration, leads to compost production

iii. Recovered hair

There are a number of reported promising uses for the recovered hair from hair-save processes. These include: felt production, slow degrading plant containers, keratin hydrolysate, cosmetics and pharmaceutical products (*i.e.*, shampoo, amino acids, *etc.*)

Composting: Hair recovered through a hair-save process can be incorporated into existing composting processes, as it is a valuable source of nitrogen and organic carbon.

Fertilizer: Hair can be directly used as slow release source of organic nitrogen and carbon for fertilizing purposes.

Recovered hair from pigskins: Hair from pigskins is a valuable material that is used for brushes and other consumer products.

D. Blue Splits and Shavings

Leather board manufacture

Companies are producing leather board from bovine chrome and vegetable shavings and splittings in several countries, although only shavings satisfying strict quality requirements are accepted for processing. The leather fibres are mixed with latex, and after coagulation, the mixture is de-watered, pressed and dried. The final product is obtained either as separated sheets or as a continuous material.

Chemical hydrolysis

One industrial gelatin manufacturing process blends the shavings with magnesium oxide and subsequently extracts 50% of the gelatin content with boiling water. Chromium-containing slurry ('scutch') is generated as a waste.

Protein extraction can be improved with magnesium oxide assisted by enzymes. Liquid proteins can be used for industrial applications. The chrome cake can be recovered for chrome liquor production. Other alkaline agents, such as lime and sodium hydroxide are used industrially.

Acid hydrolysis utilizes concentrated sulphuric acid with steam injection. The hydrolysate is neutralized with phosphates and supplemented with organic additives to produce a fertilizer.

The hydrolysate can also be used for different industrial applications, such as in retanning operations in tanneries, as a coagulating agent in the rubber industry, as complementary products for surfactants and as plasticiser in concrete production.

Thermal treatment

Various laboratory and industrial trials have demonstrated that chromium-containing leather waste may be thermally treated to produce an ash containing approximately 50% chrome oxide, which is similar in nature to the mineral ore feedstock, sodium chromite, used by the chromium chemicals manufacturing industry. Sodium chromite, converted into chromate, is the precursor of most chromium chemicals, including chrome tanning agents.

Enzymatic treatment

Enzymatic digestion of shavings results in a high quality and valuable hydrolysate or gelatable protein and a protein contaminated chromium sludge. The hydrolysate can be used in retanning agents, as foam stabilizers, in the chipwood industry and gypsum industry. The chromium sludge can be reused in a dichromate reduction plant for the production of $\text{Cr}_2(\text{SO}_4)_2$. Full-scale factories processing shavings have been in operation in the Czech Republic and USA.

Brick making

Mixing of limited amounts of chrome shaving into clay for brick making is carried out in South America.

Vegetable tanned waste

Vegetable tanned shavings and trimmings may be used in leather board or fertilizer production by roasting or a wet fermentation process.

Wastewater sludge

Wherever possible, the chromium from spent tanning liquors should be recovered and reused or used in other industry (e.g. steel). Alternatively, high exhaustion chrome tanning systems should be used. Either method will minimize the mass of chromium discharged.

The organic content of a soaking sludge can be reduced by 65 % in a UASB (up flow anaerobic sludge blanket) process.

Usual incineration of sludge (with or without leather waste), although technically feasible, will have limited application due to the economy of scale, and due to associated environmental problems (air pollution and possibility of chromium oxidation).

There is no risk-based justification for banning the application of chromium-containing wastes to agricultural land. However, the chromium content of sludge applied to land must be limited in order to comply with existing regulations and requirements.

Mixing the sludge with clay and bricketting, solidification with fly ash and cement would minimize leaching of chromium.

By-products yet to be utilized

- Buffing dust
- Crust and finished leather waste
- Finishing resins

- Chrome precipitated from post-tanning operations

Viable uses for all the above wastes need to be established.

3.5 Summary of Applicable National Regulations

There are well-defined regulatory requirements which imply that the government must regulate various aspects of the operations and construction of leather / skin / hide processing industries to reduce their environmental and social impacts.

3.5.1 General standards for discharge of environmental pollutants

General standards for discharge of environmental pollutants as per CPCB is given in **Annexure I**.

3.5.2 Tannery effluent standards as provided by CPCB

Table 3-6: Tannery Effluent Standard (After Primary Treatment): Disposal Channel/Conduit Carrying Wastewater to Secondary Treatment Plant

Type of Tanneries	Parameter	Concentration limit not exceed, mg/l (except pH)
Chrome tanneries / Combined chrome and vegetable tanneries	PH	6.5 – 9.0
	SS	Not to exceed 600
	Cr concentration after treatment in the chrome waste water stream	45
Vegetable tanneries	pH	6.5 – 9.0
	SS	Not to exceed 600

NOTE: The above standards will apply to those tannery units, which have made full contribution to a CETP comprising secondary treatment. Those who have not contributed will be governed by earlier Notification No.. S.O. 64 (E) dated January 18, 1988.

Source: EPA Notification [G.S.R 742(E) dt. 30th Aug; 1990]

Table 3-7: Tanneries – Effluent Standards

Pollutant	Concentration in mg/l, except pH	Quantum per raw hide processed
PH	6.5 – 9.0	-
* BOD (at 27°C, 3 days)	100	-
Suspended Solids	100	-
Sulphides (as S)	1	-
Total Cr (as Cr)	2	-
Oil and Grease	10	-

Pollutant	Concentration in mg/l, except pH	Quantum per raw hide processed
Wastewater generation	-	28 m ³ / tonne
* for effluent discharged into inland surface waters BOD limit shall be made stricter to 30 mg/l by the concerned SPCB		

Source: EPA Notification [G.S.R.415 (E), 5th May 1992]

3.5.3 Pending and proposed regulatory requirements

Action points proposed by the CPCB in the CREP document for the tannery industries for the following:

- **Chrome Recovery**
 - All chrome tanning units in the county should have the Chrome Recovery Plant either on individual basis or on collective basis in the form of Common Chrome Recovery Plant and use the recovered chrome in the tanning process.
 - Common Chrome Recovery Plant is to be installed and commissioned at Kanpur, for which the feasibility report has already been prepared.
 - Recovered chromium is to be utilized in tanning process.
- **Waste Minimization Measures**
 - Waste minimization circles should be formed in all the clusters of tanneries in the country to implement waste minimization measures and for adoption of clean technologies.
 - Efforts should be taken to implement the waste minimization measures in all the tanneries in the country and gradually made obligatory with time to the tannery units
- **Reduction of Water Consumption in Tanneries**
 - All tanneries should install water meters and flow meters to measure actual consumption and wastewater discharge
 - Water consumption rates should be brought down to 28 m³/tonnes of hides by taking all waste minimization measures.
- **Compliance of Standards - All Common Effluent Treatment Plants (CETP) and Effluent Treatment Plants (ETP) should take the following measures**
 - Employ qualified and well-trained staff for operation and maintenance (O&M) of the ETP/CETPs
 - Installation of automatic monitoring instruments
 - Interlocking of manufacturing processes with the ETP operation
 - Separate energy meters for ETPs/CETPs
 - Open anaerobic lagoons should be converted into closed systems with gas recovery
 - For health and safety of workers in the industry and the ETP/CETP, guidelines developed by the CPCB should be implemented
 - All major tannery units should take up environmental auditing on an yearly basis
 - Major tannery units and CETPs should attempt to obtain ISO-14000 certification
 - Tannery units and CETP management should take up modifications/ upgrade of the CETPs/ETPs wherever necessary

- TDS Management - All the tannery units to adopt the following:
 - Manual/mechanical desalting
 - Use of cleaner technology for less use of salt
 - Refrigerated transportation of hides
 - High rate transpiration system for effluent treatment
 - Treated wastewater be mixed with the sewage and the treated effluent be used on land for irrigation
- Solid Waste Management - All the tannery units to adopt the following:
 - Utilization of process sludge/solid waste for by-product recovery
 - Resource recovery from process sludge and ETP sludge in the form of biogas
 - Cr recovery from tanned leather shavings
 - Safe disposal of hazardous sludge and non-hazardous solid waste
- Salt from Evaporation Ponds - All the tannery units to adopt the following:
 - Reuse of recovered salts
 - Quality improvement of recovered salts for reuse
 - Safe land disposal
 - Sea disposal
- Use of Boron-bearing compounds should be discouraged
- Ground water quality monitoring to be strengthened
- Sulphur recovery from sulphide-bearing effluents to be explored
- Implementation of recommendation of the Task Force on Leather Tannery units constituted by the MoEF, Government of India in a phased manner.

4. OPERATIONAL ASPECTS OF EIA

Prior environmental clearance process has been revised in the Notification issued on 14th September, 2006 into following four major stages *i.e.*, screening, scoping, public consultation and appraisal. Each stage has certain procedures to be followed. This section deals with all the procedural and technical guidance for conducting objective-oriented EIA studies, its review and decision-making. Besides, the Notification also classifies projects into Category A and Category B, which requires prior environmental clearance from MoEF and SEIAA/UTEIAA respectively.

Consistency with other requirements

- Clearance from other regulatory bodies is not a pre-requisite for obtaining the prior environmental clearance and all such clearances will be treated as parallel statutory requirements.
- Consent for establishment (CFE) and prior environmental clearance are two different legal requirements, a project proponent should acquire. Therefore, these two activities can be initiated and proceeded with simultaneously.
- If a project falls within the preview of Coastal Regulatory Zone (CRZ), then the project proponent is required to take separate clearances from the concerned authorities.
- Rehabilitation and Resettlement (R&R) issues need not be dealt under the EIA Notification as other statutory bodies deal with these issues. However, socio-economic studies may be considered while taking environmental decisions.

4.1 Coverage of Tanneries under the Purview of Notification

All leather/skin/hide processing industry including expansion and modernization require prior environmental clearance. Based on pollution potential, these projects are basically classified into Category A and Category B:

- Category A: New tanneries projects outside the industrial area or expansion of existing units outside the industrial area.
- Category B: All new or expansion of projects located within a notified industrial area/estate.

Besides, there are general as well as specific conditions, when it applies, a Category B project will be treated as Category A project. These conditions are discussed in subsequent sections.

The sequence of steps in the process of prior environmental clearance for Category A and Category B projects are shown in Figure 4-1 and 4-2 respectively. The timelines indicated against each stage are the maximum permissible time lines set in the Notification for said task. In case the said task is not cleared /objected by the concerned Authority, within the specified time, said task is deemed to be cleared, in accordance to the proposal submitted by the proponent. Each stage in the process of prior environmental clearance for the leather/skin/hide processing industry is discussed in subsequent sections.

In case of expansion or modernization of the developmental Activity:

- Any developmental activity, which has an EIA clearance (existing projects), when undergoes expansion or modernization (change in process or technology) with increase in production capacity or any change in product mix beyond the list of products cleared in the issued clearance is required to submit new application for EIA clearance.
- Any developmental activity, which is listed in Schedule of the EIA Notification and due to expansion due of its total capacity, if falls under the purview of either Category B or Category A, then such developmental activity requires clearance from respective authorities.

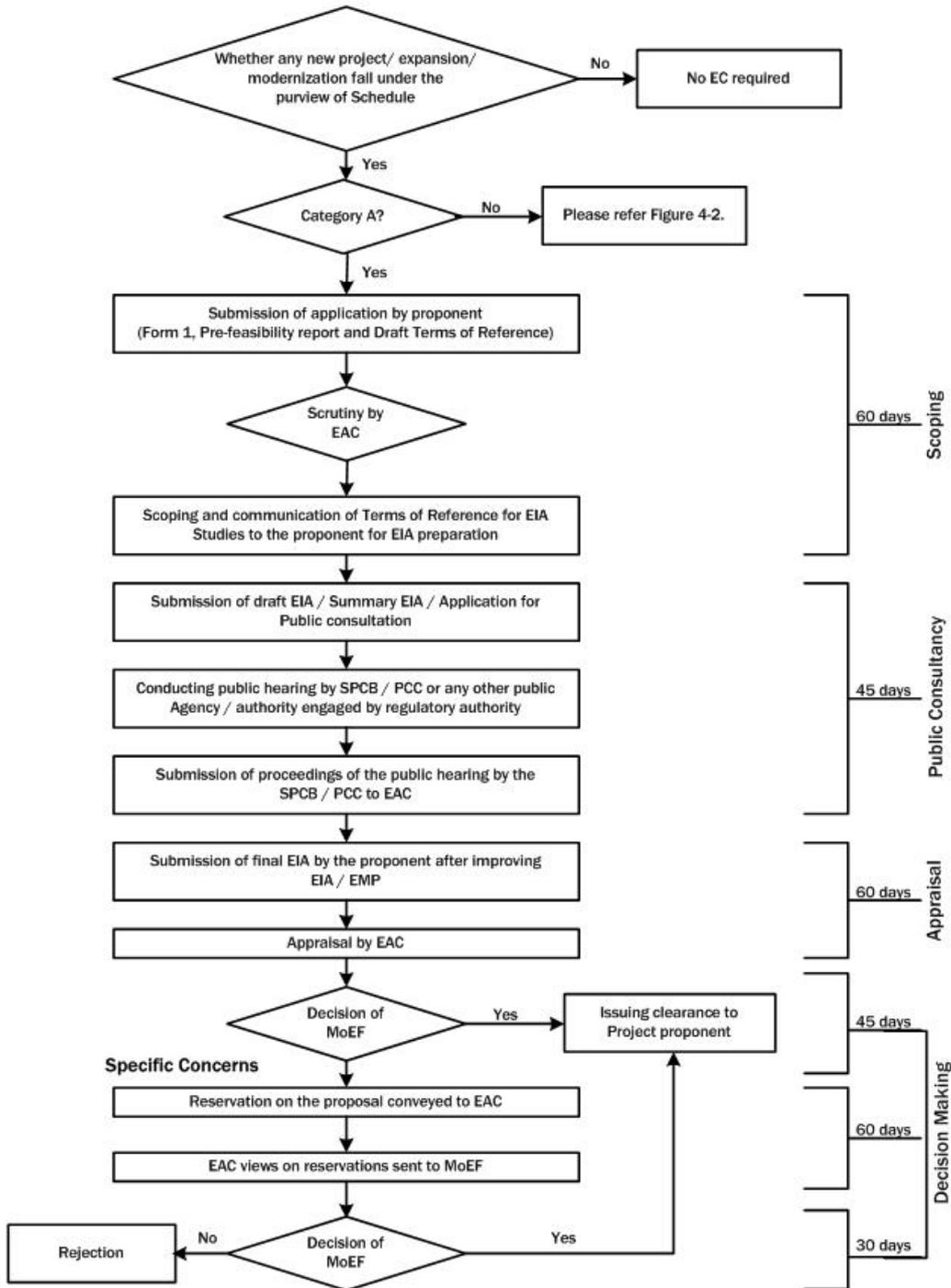


Figure 4-1: Prior Environmental Clearance Process for Activities Falling Under Category A

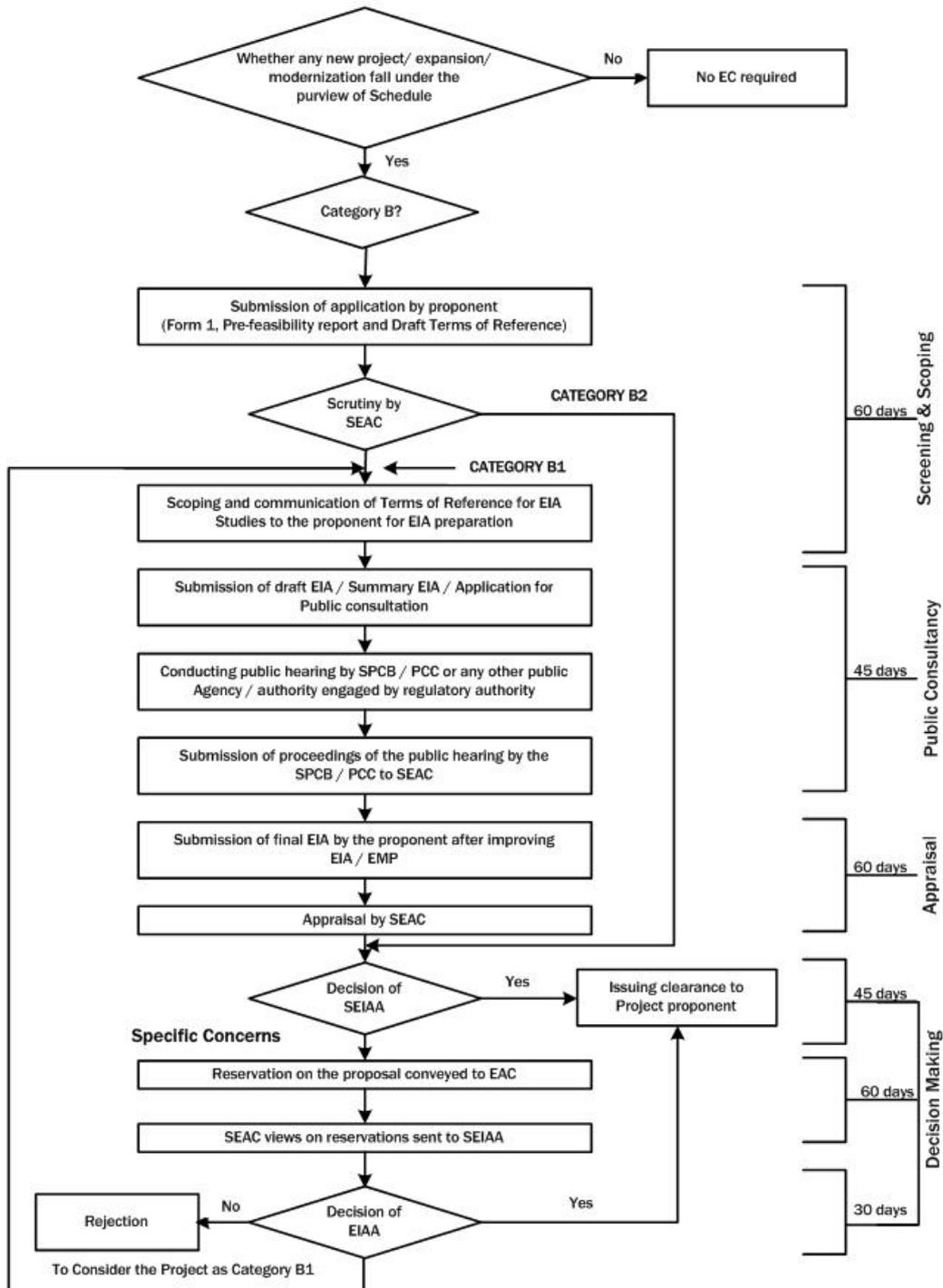


Figure 4-2: Prior Environmental Clearance Process for Activities Falling Under Category B

4.2 Screening

Screening of the project shall be performed at the initial stage of the project development so that proponents are aware of their obligations before deciding on the budget, project design and execution plan.

This stage is applicable only for Category 'B' developmental activity *i.e.*, if general conditions are applicable for a Category B project, then it will be treated as Category A project. Besides, screening also refers to the classification of Category B projects into either Category B1 or Category B2. Category B1 projects require to follow all the stages, that are applicable for a Category A project, but are processed at the SEIAA/UTEIAA. Category B2 projects, on the other hand, do not require either EIA or public consultation.

As per the Notification, classification of the Category B projects falls under the purview of the SEAC. This manual provides certain guidelines to the stakeholders for classification of Category B1 and Category B2.

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4.2.1 Applicable conditions for Category B projects

General conditions

- Any leather/skin/hide processing project usually falling under Category B will be treated as Category A, if located in whole or in part within 10 km from the boundary of:
 - Protected areas notified under the Wild Life (Protection) Act, 1972
 - Critically polluted areas as notified by the CPCB from time to time
 - Eco-sensitive areas as notified under Section 3 of the E(P) Act, 1986, such as Mahabaleshwar, Panchgani, Matheran, Panchmarhi, Dahanu, Doon valley and
 - Inter-State boundaries and international boundaries – provided that the requirement regarding distance of 10 km of the inter-state boundaries can be reduced or completely done away with by an agreement between the respective States/UTs sharing the common boundary in case the activity does not fall within 10 km of the areas mentioned above
- If any of the conditions listed in above general condition applies, then a Category B project will be treated as Category A
- The SEIAA shall base its decision on the recommendations of a State/UT level SEAC for the purpose of environmental clearance.
- In the absence of a duly constituted SEIAA or SEAC, a Category B project shall be appraised at the Central level *i.e.*, at the MoEF
- The EAC at the State/UT level shall screen the projects or activities in Category B. SEAC shall meet at least once every month

- If any Category B leather/skin/hide processing project/activity, after proposed expansion of capacity/production, falls under the purview of Category A in terms of production capacity, then clearance is required from the Central Government.

Specific Conditions

- If any Industrial Estate / Complex / Export Processing Zones / Special Economic Zones / Biotech parks / Leather Complex with homogeneous type of industries such as leather / skin / hide / processing industry or those industrial estates with pre-defined set of activities (not necessarily homogeneous) obtains prior environmental clearance, individual industries including proposed industrial housing within such estates/complexes will not be required to take prior environmental clearance, so long as the terms and conditions for the industrial estate / complex are complied with (such estates/ complexes must have a clearly identified management with the legal responsibility of ensuring adherence to the terms and conditions of prior environmental clearance, who may be held responsible for violation of the same throughout the life of the complex / estate.)

4.2.2 Criteria for classification of Category B1 and B2 projects

The classification of Category B projects or activities into B1 or B2 (except the project or activities listed in item 8(b) in the schedule to the EIA Notification, 2006) will be determined based on whether or not the project or activity requires further environmental studies for preparation of an EIA for its appraisal prior to the grant of environmental clearance. The necessity of which will be decided, depending upon the nature and location specificity of the project, by SEAC after scrutiny of the applications seeking environmental clearance for Category B projects or activities.

The projects requiring an EIA report shall be included in Category B1 and remaining projects will fall under Category B2 and will not require an EIA report and public consultation.

4.2.3 Application for prior environmental clearance

- The project proponent, after identifying the site and pre-feasibility study, is required to apply for the prior environmental clearance in Form 1 given in **Annexure II**. The proponent has to submit the filled in Form 1 along with the pre-feasibility report and draft ToR for EIA studies to the concerned Authority i.e. MoEF, Government of India for Category A projects and the SEIAA in case of Category B projects. Please refer subsequent sections for the information on how to fill the Form 1, contents of pre-feasibility report and draft ToR for leather/skin/hide processing industry.
- Prior environmental clearance is required before starting any construction work, or preparation of land on the identified site/project is started by the project management, except for securing the land.
- If the application is made for a specific developmental activity, which has an inherent area development component as a part of its project proposal and the same project also attracts the construction and area development provisions under 8a and 8b of the Schedule, then the project will be seen as a developmental activity other than 8a and 8b of the Schedule.

4.2.4 Siting guidelines

These are the guidelines, stakeholders may consider while siting the developmental projects, to minimize the associated possible environmental impacts. In some situations, completely sticking to these guidelines is difficult and unwarranted, therefore these guidelines may be kept in the background, as far as possible, while taking the decisions.

Areas preferably be avoided

While siting industries, care should be taken to minimize the adverse impact of the industries on immediate neighborhood as well as distant places. Some of the natural life sustaining systems and some specific landuses are sensitive to industrial impacts because of the nature and extent of fragility. In order to protect such sites, the industries may maintain the following distances, as far as possible from the specific areas listed:

- Ecologically and/or otherwise sensitive areas: Preferably 5 km; depending on the geo-climatic conditions the requisite distance may be decided appropriately by the agency.
- Coastal Areas: Preferably ½ km away from high tide line.
- Flood Plain of the Riverine System: Preferably ½ km away from flood plain or modified flood plain affected by dam in the upstream or by flood control systems.
- Transport/Communication System: Preferably ½ km away from highway and railway line.
- Major settlements (3, 00,000 population): Distance from major settlements is difficult to maintain because of urban sprawl. At the time of siting of the industry, if the notified limit of any major settlement is found to be within 50 km., from the project boundary, the spatial direction of growth of the settlement for at least a decade must be assessed. Subsequently, the industry shall be sited at least 10 km from the projected growth boundary of the settlement.
- Critically polluted areas are identified by MoEF from time-to-time. Current list of critically polluted areas is given in **Annexure III**.

Note:

Ecological and/or otherwise sensitive areas include (i) Religious and Historic Places; (ii) Archaeological Monuments (e.g. identified zone around Taj Mahal); (iii) Scenic Areas; (iv) Hill Resorts; (v) Beach Resorts; (vi) Health Resorts; (vii) Coastal Areas rich in Corals, Mangroves, Breeding Grounds of Specific Species; (viii) Estuaries rich in Mangroves, Breeding grounds of Specific Species; (ix) Gulf Areas; (x) Biosphere Reserves; (xi) National Parks and Sanctuaries; (xii) Natural lakes, Swamps; (xiii) Seismic Zones; (xiv) Tribal Settlements; (xv) Areas of Scientific and Geological Interest; (xvi) Defence Installations, specially those of security importance and sensitive to pollution; (xvii) Border Areas (International) and (xviii) Air Ports.

Pre-requisite: State and Central Governments are required to identify such areas on a priority basis

Pre-requisite: State and Central Governments are required to identify such areas on a priority basis.

General siting factors

In any particular selected site, the following factors must also be recognized.

- No forest land shall be converted into non-forest activity for the sustenance of the industry (Ref: Forest Conversation Act, 1980).
- No prime agricultural land shall be converted into industrial site.

- Land acquired shall be sufficiently large to provide space for appropriate green cover including green belt around the battery limit of the industry.
- Enough space should be provided for storage of recyclable solid wastes so that these could be available for possible reuse.
- Layout of the industry that may come up in the area must conform to the landscape of the area without affecting the scenic features of that place.
- Associated township of the industry may be created at a space having physiographic barrier between the industry and the township.
- Decentralized secure landfill may be developed for the cluster of new or existing tanneries. The secure landfill shall be connected to the CETP in the industrial estate or to the tannery's ETP.

Sites not suitable for leather/skin/hide processing industries

Sites located near water resources such as lakes, ponds, rivers *etc.*, used for drinking water bodies or agriculture use and or major ground water resources used for public drinking water sources or bird sanctuaries or sensitive eco parks within 2 km shall not be permitted to start the tanneries processing raw hides/ skins (Category A and Category B). However if zero liquid discharge concept including secured saline stream/ salt disposal is ensured this condition may be relaxed.

4.3 Scoping for EIA Studies

Scoping exercise is taken up soon after the project contours are defined. The primary purpose of scoping is to identify the concerns and issues which may affect the project decisions. Besides, scoping defines the requirements and boundaries of an EIA study.

Scoping refers to the process by which the EAC, in case of Category 'A', projects or activities, and SEAC in the case of Category 'B1', including applications for expansion and/or modernization of existing projects, determines the ToR for EIA studies addressing all relevant environmental concerns for preparation of an EIA Report for a particular project.

- Project proponent shall submit the application to the concerned authority. The application (Form 1 as given in **Annexure II**) shall be attached with the pre-feasibility report and proposed ToR for EIA studies. The proposed sequence to arrive at the draft ToR is discussed below:
 - Pre-feasibility report provides a precise summary of project details and also the likely environmental concerns based on secondary information, which will be availed for filling the Form 1.
 - From pre-feasibility report and Form 1, valued environmental components (VECs) may be identified for a given project (receiving environment/social components, which are likely to get effected due to the project operations/activities).
 - Once the project details from the pre-feasibility report & Form 1; and VECs are identified, a matrix establishing the interactions which can lead to the effects/impacts could be developed (Qualitative analysis).

- For each identified possible effect in the matrix, significance analysis could be conducted to identify the impacts, which need to be further studied (quantitative analysis) in the subsequent EIA studies. All such points will become the part of the draft ToR to be proposed by the project proponent along with the application form. The draft ToR shall include applicable baseline parameters (refer annexure V) and impact prediction tools proposed to be applied.
 - The information to be provided in pre-feasibility report, guidelines for filling Form 1 and guidelines for developing draft ToR is summarized in subsequent sections.
 - Authority consults the respective EAC/SEAC to reply to the proponent. The EAC/SEAC concerned reviews the application form, pre-feasibility report and proposed draft ToR by the proponent and makes necessary additions/deletions to make it a comprehensive ToR that suits the statutory requirements for conducting the EIA studies.
- The concerned EAC/SEAC may formulate a sub-committee for a site visit, if considered necessary. The sub-committee will act up on receiving a written approval from the chairperson of the EAC/SEAC concerned. Project proponent will facilitate such site visits of the sub-committees.
 - EAC/SEAC shall provide an opportunity to the project proponent for presentation and discussions on the proposed project and related issues as well as the proposed ToR for EIA studies. If the State Government desires to present their views on any specific project in the scoping stage, it can depute an officer for the same at the scoping stage to EAC, as an invitee but not as a member of EAC. However, non-appearance of the project proponent before EAC/SEAC at any stage will not be a ground for rejection of the application for the prior environmental clearance.
 - If a new or expansion project is proposed in a problem area as identified by the CPCB, the MoEF may invite the representative SEIAA to the EAC present its views, if any at the stage of scoping.
 - The final set of ToR for EIA Studies shall be conveyed to the proponent by the EAC/SEAC within sixty days of the receipt of Form 1 and pre-feasibility report. If the finalized ToR for EIA studies is not conveyed to the proponent within sixty days of the receipt of Form 1, the ToR suggested by the proponent shall be deemed as final and will be approved for EIA studies.
 - The final ToR for EIA studies shall be displayed on the website of the MoEF/SEIAA.
 - Applications for prior environmental clearance may be rejected by the concerned Authority based on the recommendations by the concerned EAC or SEAC at the scoping stage itself. In case of such rejection, the decision along with the reasons for rejection shall be communicated to the proponent in writing within sixty days of the receipt of the application.
 - The final EIA report and other relevant documents submitted by the applicant shall be scrutinized by the concerned Authority strictly with reference to the approved ToR for EIA studies.

4.3.1 Pre-feasibility report

The pre-feasibility report should include, but may not be limited to highlights of the proposed project information, considering the environmental sensitivities of the selected site, technology options, efficiency, availability, etc.

- Background information
- Location of the project
- Type of tanning process
- Water usage, its stores and capacity
- Wastewater discharge and its characteristic
- Mode of treated effluent disposal
- Treatment options
- Solid Waste / Sludge Management
- Cost estimate, capital and O&M

Besides, depending on the scope defined in the pre-feasibility report some pre-feasibility reports are based on various studies and data collection and addresses in detail the concern as technical & economical analysis and detailed feasibility level design of equipment, process optimization, transportation of products, economic, financial, social and environmental investigations, cost estimates with detailed bill of quantities (BOQ).

4.3.2 Guidance for Filling Information in Form 1

The information given in specifically designed pre-feasibility report for this developmental activity may also be availed for filling Form 1.

Form 1 is designed to help users identify the likely significant environmental effects of proposed projects right at the scoping stage. There are two stages for providing information under two columns:

- First - identifying the relevant project activities from the list given in column 2 of Form 1. Start with the checklist of questions set out below and complete Column 3 by answering:
 - Yes - if the activity is likely to occur during implementation of the project;
 - No - if it is not expected to occur;
 - May be - if it is uncertain at this stage whether it will occur or not.
- Second – For each activity for which the answer in Column 3 is “Yes” the next step is to refer to the fourth column which quantifies the volume of activity which could be judged as significant impact on the local environmental characteristics, and identify the areas that could be affected by that activity during construction /operation / decommissioning of the project. Form 1 requires information within 15 km around the project, whereas actual study area for EIA will be as prescribed by respective EAC/SEAC. Project proponent will need information about the surrounding VECs in order to complete this Form 1.

4.3.3 Identification of appropriate valued environmental components

VECs are the aspects (components/processes/ functions) of ecosystems, human health, and environmental welfare considered to be important and potentially at risk from human activity especially concerning this project. Value may be attributed for economic, social, environmental, aesthetic or ethical reasons. VECs represent the investigative focal point

for further EIA process. The indirect and/or cumulative effects can be concerned with indirect, additive or even synergistic effects due to other projects or activities or even induced developments on the same environmental components as would be considered direct effects. But such impacts tend to involve larger scale VECs such as within entire region, river basins or watersheds; and, broad social and economic VECs such as quality of life and the provincial economy. Once VECs are identified then appropriate indicators may be selected to carry on impact assessments on the respective VECs.

4.3.4 Methods for identification of impacts

There are a various factors which influence the approach adopted for the assessment of direct, indirect, cumulative impacts, *etc.* for a particular project. The method should be practical and suitable for the project given the data, time and financial resources available. However, the method adopted should be able to provide a meaningful conclusion from which it would be possible to develop, wherever necessary, mitigation measures and monitoring. Key points to consider when choosing the method(s) include:

- nature of the impact(s)
- availability and quality of data
- availability of resources (time, finance and staff)

The method chosen should not be complex, but should aim at presenting the results in a way that can be easily understood by the developer, decision maker and the public. A comparative analysis of major impact identification methods is given Table 4-1.

Table 4-1: Advantages and Disadvantages of Impact Identification Methods

	Description	Advantages	Disadvantages
Checklists	<ul style="list-style-type: none"> ▪ Annotate the environmental features that need to be addressed when identifying the impacts of activities in the project 	<ul style="list-style-type: none"> ▪ Simple to understand and use ▪ Good for site selection and priority setting ▪ Simple ranking and weighting 	<ul style="list-style-type: none"> ▪ Do not distinguish between direct and indirect impacts ▪ Do not link action and impact ▪ The process of incorporating values can be controversial
Matrices	<ul style="list-style-type: none"> ▪ Identify the interaction between project activities (along one axis) and environmental characteristics (along other axis) using a grid like table ▪ Entries are made in the cells which highlights impact severity in the form of symbols or numbers or descriptive comments 	<ul style="list-style-type: none"> ▪ Link action to impact ▪ Good method for displaying EIA results 	<ul style="list-style-type: none"> ▪ Difficult to distinguish direct and indirect impacts ▪ Significant potential for double-counting of impacts
Networks	<ul style="list-style-type: none"> ▪ Illustrate cause effect relationship of project activities and environmental characteristics ▪ Useful in identifying secondary impacts ▪ Useful for establishing impact hypothesis and other structured science based approaches to EIA 	<ul style="list-style-type: none"> ▪ Link action to impact ▪ Useful in simplified form for checking for second order impacts ▪ Handles direct and indirect impacts 	<ul style="list-style-type: none"> ▪ Can become very complex if used beyond simplified version

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Overlays	<ul style="list-style-type: none"> Maps the impacts spatially and display them pictorially Useful for comparing site and planning alternatives for routing linear developments Can address cumulative effects Information incentive 	<ul style="list-style-type: none"> Easy to understand Good to display method Good siting tool 	<ul style="list-style-type: none"> Address only direct impacts Do not address impact duration or probability
GIS	<ul style="list-style-type: none"> Maps the impacts spatially and display them pictorially Useful for comparing site and planning alternatives for routing linear developments Can address cumulative effects Information incentive 	<ul style="list-style-type: none"> Easy to understand Good to display method Good siting tool Excellent for impact identification and analysis 	<ul style="list-style-type: none"> Do not address impact duration or probability Heavy reliance on knowledge and data Often complex and expensive
Expert System	<ul style="list-style-type: none"> Assist diagnosis, problem solving and decision making Needs inputs from user by answering systematically developed questions to identify impacts and determine their mitigability and significance Information intensive, high investment methods of analysis 	<ul style="list-style-type: none"> Excellent for impact identification and analysis Good for experimenting 	<ul style="list-style-type: none"> Heavy reliance on knowledge and data Often complex and expensive

The project team made an attempt to construct an impact matrix considering major project activities (generic operations) and stage-specific likely impacts which is given in Table 4-2.

While the impact matrix is each project-specific, Table 4-2 may facilitate the stakeholders in identifying a set of components and phase-specific project activities for determination of likely impacts. However, the location-specific concerns may vary from case to case, therefore, the components even without likely impacts are also retained in the matrix for the location-specific reference.

Table 4-2: Matrix of Impacts

1	2	3	PHASE I				PHASE II							
			PRE- CONSTRUCTION PHASE				OPERATION AND MAINTENANCE							
ENVIRONMENT	COMPONENTS	Project Activities Parameter/ Factor	4 Land Acquirement	5 Site Clearing	6 Burning of wastes, refuse and cleared vegetation	7 Site Preparation / Leveling	8 Receiving of Skins and Hides - Transportation and Storage	9 Handling of Fleshings	10 Handling of Removed hair	11 Treatment and Disposal of Wastewater	12 Ammonia Emission from Wet Process	13 Handling of Chrome incase of Chrome tanning	14 Handling of Trimming/Shaving process in case of Chrome tanning	15 Special handling of Soak Liquor
Physical	Soil	Erosion Risks												
		Contamination					*					*	*	
		Soil Quality					*			*		*	*	*
	Resources	Fuels/ Electricity												
		Construction material- stone, aggregates												
		Land especially undeveloped or agricultural land												
	Water	Interception or Alteration of River Beds				*								
		Alteration of Hydraulic Regime												
		Alteration of surface run-off and interflow				*				*				*
		Alteration of aquifers				*								
		Water quality					*			*		*	*	*
	Air	Temperature												
		Air quality			*		*	*						
		Noise					*							

Operational Aspects of EIA

1	2	3	PHASE I				PHASE II							
			PRE- CONSTRUCTION PHASE				OPERATION AND MAINTENANCE							
4	5	6	7	8	9	10	11	12	13	14	15			
		Odour					*	*	*	*				*
Biological	Terrestrial Flora	Effect on grass & flowers								*				*
		Effect on trees & shrubs	*	*	*	*				*				*
		Effect on farmland					*			*				*
		Endangered species												
	Aquatic Biota	Habitat removal										*	*	
		Contamination of habitats					*					*	*	
		Reduction of aquatic biota										*	*	
	Terrestrial Fauna	Fragmentation of terrestrial habitats												
		Disturbance of habitats by noise or vibration												
		Reduction of Biodiversity										*	*	
Social	Economy	Creation of new economic activities					*			*				*
		Commercial value of properties	*			*	*			*				*
		Conflict due to negotiation and/ compensation payments												
		Generation of temporary and permanent jobs								*				*
		Effect on crops		*	*					*				*
		Reduction of farmland productivity		*						*				*
		Income for the state and private sector	*				*							
		Electricity tariffs												
		Savings for consumers & private consumers												

1	2	3	PHASE I				PHASE II							
			PRE- CONSTRUCTION PHASE				OPERATION AND MAINTENANCE							
			4	5	6	7	8	9	10	11	12	13	14	15
		Savings in foreign currency for the state												
	Education	Training in new technologies										*	*	
		Training in new skills to workers										*	*	
	Public Order	Political Conflicts	*	*	*	*								
		Unrest, Demonstrations & Social conflicts	*				*			*				*
	Infrastructure and Services	Conflicts with projects of urban, commercial or Industrial development	*	*	*	*	*	*		*		*	*	*
	Security and Safety	Increase in Crime												
		Accidents caused by								*				*
	Health	Temporary					*				*			
		Chronic						*	*	*	*			*
		Acute										*	*	
	Cultural	Land use	*				*	*	*	*				*
		Recreation					*	*		*				*
		Aesthetics and human interest					*	*	*	*			*	*
		Cultural status					*	*		*				*

Note:

1. This table represents a model for likely impacts, which will have to be arrived case-to-case basis considering VECs and significance analysis (Ref Section 2.9).
2. Project activities are shown as indicative. However, in Form 1 (application for EIA Clearance), for any question for which answer is 'Yes', then the corresponding activity shall reflect in project activities. Similarly 'parameters'/'factors' will also be changed within a component in order to reflect the target species of prime concern in the receiving local environment.

4.3.5 Testing the Significance of impacts

The following set of conditions may be used as the checklist for testing the significance of the impacts and also to provide information in Column IV of Form 1.

- Will there be a large change in environmental conditions?
- Will new features be out-of-scale with the existing environment?
- Will the effect be unusual in the area or particularly complex?
- Will the effect extend over a large area?
- Will there be any potential for trans-frontier impact?
- Will many people be affected?
- Will many receptors of other types (fauna and flora, businesses, facilities) be affected?
- Will valuable or scarce features or resources be affected?
- Is there a risk that environmental standards will be breached?
- Is there a risk that protected sites, areas, features will be affected?
- Is there a high probability of the effect occurring?
- Will the effect continue for a long time?
- Will the effect be permanent rather than temporary?
- Will the impact be continuous rather than intermittent?
- If it is intermittent will it be frequent rather than rare?
- Will the impact be irreversible?
- Will it be difficult to avoid, or reduce or repair or compensate for the effect?

For each “Yes” answer in column 3, the nature of effects and reasons for it should be recorded in column 4. The questions are designed so that a “Yes” answer in column 3, will generally point towards the need for analyzing for the significance and requirement for conducting impact assessment for the effect.

4.3.6 Terms of reference for EIA studies

ToR for EIA studies w.r.t the tanneries (leather / hides/ skins processing industry) may include but not limited to the following:

- Executive summary of the project – giving a *prima facie* idea of the objectives of the proposal, use of resources, justification, *etc.* In addition, it should provide a compilation of EIA report including EMP and the post-project monitoring plan in brief.

Project description

- Justification for engaging a particular type of process (raw hide/skin into semi finishing or finished leather, semi finished leather to finished leather, dry finishing operations, chrome/vegetable tanning, *etc.*).
- Justification for selecting the proposed unit size.
- Land requirement for the project including its break up for various purposes, its availability and optimization.
- Details of proposed layout clearly demarcating various units within the plant.
- Details regarding complete leather/ skin/ hide processing including the usage of sulfides, nitrogen compounds, chromium or other tanning agents, post-tanning chemicals, biocides, *etc.*, along with the material balance shall be provided.

- Details on requirement of raw materials, its source and storage at the plant.
- Incase of chrome tanning, details of the chrome recovery plant, management of shavings/solid waste including safe disposal.
- Details on proposed waste minimization measures.
- Details on management of fleshing and solid waste.
- Details on requirement of water along with its source and authorization from the concerned department.
- Details on water balance including quantity of effluent generated, recycled & reused. Efforts to minimize effluent discharge and to maintain quality of receiving water body. (Pre-treatment, in case connected to CETP).
- Details on reuse of soak liquor / saline stream from membrane system, if applicable, to the extent possible in pickling activity after required treatment. Also, mention the salt recovery measures.
- Details on proposed measures to ensure compliance to the environmental regulatory requirements, specifically the total dissolved solids (TDS) in treated wastewaters, wherever applicable.
- Details on the proposed disposal of recovered salts, if any.
- Details on odorous compounds and their management.
- Proposed measures to address the possible fugitive air emissions and odour from the process operations.
- Details of the proposed methods of water conservation and recharging.
- Management plan for solid/hazardous waste generation, storage, utilization and disposal.
- Details regarding infrastructure facilities such as sanitation, fuel, restroom, *etc.*, to be provided to the labour force during construction as well as to the casual workers including truck drivers during the operational phase.
- Any litigation pending against the project and /or any direction /order passed by any Court of Law related to the environmental pollution and impacts in the last two years if so, details thereof.

Description of the environment

- The study area shall be up to a distance of 5 km from the boundary of the proposed project site.
- Land use of study area should include data about the residential/ institutional/nearest village/ township/ locality/ housing society, *etc.*, based on the satellite imagery.
- Demography details of all the villages falling within the study area.
- Topography of the project area.
- The baseline data to be collected from the study area w.r.t. different components of environment viz. air, noise, water, land, and biology and socio-economic (please refer Section 4.4.2 for guidance for assessment of baseline components and identify attributes of concern). Actual monitoring of baseline environmental components shall be strictly according to the parameters prescribed in the ToR after considering the proposed coverage of parameters by the proponent in draft ToR and shall commence after finalization of ToR by the competent Authority.

- Geological features and geo-hydrological status of the study area.
- Surface water quality of nearby water sources and other surface drains.
- Details on ground water quality.
- Details on water quality parameters such as Colour, pH, BOD, COD, Total Suspended Solids, TDS Oil & Grease , Total Kjeldhal Nitrogen, Sulphides, Chloriodes, Total Chromium , Total Coliform bacteria *etc.*
- Details on existing ambient air quality and expected, stack and fugitive emissions for PM10, PM2.5, NH₃, SO₂*, NO_x*, VOCs*, *etc.*, and evaluation of the adequacy of the proposed pollution control devices to meet standards for point sources and to meet AAQ standards. (* - As applicable)
- Details on noise levels at sensitive/commercial receptors.
- Site-specific micro-meteorological data including mixing height.
- One season site-specific data excluding monsoon season.
- Proposed baseline monitoring network for the consideration and approval of the Competent Authority.
- Ecological status (terrestrial and aquatic) of the study area such as habitat type and quality, species, diversity, rarity, fragmentation, ecological linkage, age, abundance, *etc.* .
- If any incompatible land use attributes fall within a 5 km radius of the project boundary, proponent shall describe the sensitivity (distance, area and significance) and propose the additional points based on significance for review and acceptance by the EAC/SEAC. Incompatible land use attributes include:
 - Public water supply areas from rivers/surface water bodies, from ground water
 - Scenic areas/tourism areas/hill resorts
 - Religious places, pilgrim centers that attract over 10 lakh pilgrims a year
 - Protected tribal settlements (notified tribal areas where industrial activity is not permitted)
 - CRZ
 - Monuments of national significance, World Heritage Sites
 - Cyclone, Tsunami prone areas (based on last 25 years)
 - Airport areas
 - Any other feature as specified by the State or local government and other features as locally applicable, including prime agricultural lands, pastures, migratory corridors, *etc.*
- If ecologically sensitive attributes fall with in a 5 km radius of the project boundary, proponent shall describe the sensitivity (distance, area and significance) and propose the additional points based on significance for review and acceptance by the EAC / SEAC. Ecological sensitive attributes include:
 - National parks
 - Wild life sanctuaries Game reserve
 - Tiger reserve/elephant reserve/turtle nesting ground
 - Mangrove area
 - Wetlands
 - Reserved and Protected forests, *etc.*
 - Any other closed/protected area under the Wild Life (Protection) Act, 1972, any other area locally applicable

- If the location falls in CRZ area: A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the project and associate facilities w.r.t. CRZ, coastal features such as mangroves, if any.
 - Provide the CRZ map in 1:10000 scale in general cases and in 1:5000 scale for specific observations.
 - Proposed site for disposal of dredged material and environmental quality at the point of disposal/impact areas.
 - Fisheries study should be done w.r.t. Benthos and Marine organic material and coastal fisheries.

Anticipated environmental impacts and mitigation measures

- Anticipated generic environmental impacts due to this project are indicated in Table 4-2, which may be evaluated for significance and based on corresponding likely impacts VECs may be identified. Baseline studies may be conducted for all the concerned VECs and likely impacts will have to be assessed for their magnitude in order to identify mitigation measures (please refer Chapter 4 of the manual for guidance).
- Tools as given in Section 4.4.3 may be referred for the appropriate assessment of environmental impacts and same may be submitted in draft ToR for consideration and approval by EAC/SEAC.
- While identifying the likely impacts, also include the following for analysis of significance and required mitigation measures:
 - impacts due to transportation of raw materials and end products on the surrounding environment
 - impacts on surface water, soil and groundwater due to disposal of treated water
 - impacts due to air pollution
 - impacts due to odour pollution
 - impacts due to noise
 - impacts due to fugitive emissions
 - impact on health of workers due to proposed project activities
- Proposed odour control measures.
- Action plan for the greenbelt development – species, width of plantations, planning schedule etc. in accordance to CPCB published guidelines.
- In case of likely impact from the proposed project on the surrounding reserve forests, Plan for the conservation of wild fauna in consultation with the State Forest Department.
- For identifying the mitigation measures, please refer Chapter III for source control and treatment. Besides typical mitigation measures which may also be considered are discussed in Table 4-5.

Analysis of alternative resources and technologies

- Comparison of alternate sites considered and the reasons for selecting the proposed site. Conformity of the site with the prescribed guidelines in terms of CRZ, river, highways, railways, *etc.*
- Details of improved technologies

Environmental monitoring program

- Monitoring programme for pollution control at source.
- Monitoring pollutants at receiving environment for the appropriate notified parameters – air quality, groundwater, surface water, etc. during operational phase of the project.
- Specific programme to monitor safety and health protection of workers.
- Appropriate monitoring network has to be designed and proposed, to assess the possible residual impacts on VECs.
- Details of in-house monitoring capabilities and the recognized agencies if proposed for conducting monitoring.

Additional studies

- Details on risk assessment and damage control during different phases of the project and proposed safeguard measures.
- Details on socio-economic development activities such as commercial property values, generation of jobs, education, social conflicts, cultural status, accidents, etc.
- Proposed plan to handle the socio-economic influence on the local community. The plan should include quantitative dimension as far as possible.
- Details on compensation package for the people affected by the project, considering the socio-economic status of the area, homestead oustees, land oustees, and landless labourers.
- Points identified in the public hearing and commitment of the project proponent to the same. Detailed action plan addressing the issues raised, and the details of necessary allocation of funds.

Environmental management plan

- Administrative and technical organizational structure to ensure proposed post-project monitoring programme for approved mitigation measures.
- EMP devised to mitigate the adverse impacts of the project should be provided along with item-wise cost of its implementation (capital and recurring costs).
- Allocation of resources and responsibilities for plan implementation.
- Details of the emergency preparedness plan and on-site and off-site disaster management plan..

Note:

Above points shall be adequately addressed in the EIA report at corresponding chapters, in addition to the contents given in the reporting structure (Table 4-5).

4.4 Environmental Impact Assessment

The generic approach for accomplishing EIA studies is shown in Figure 4.3. Each stage is discussed, in detail in subsequent sections.

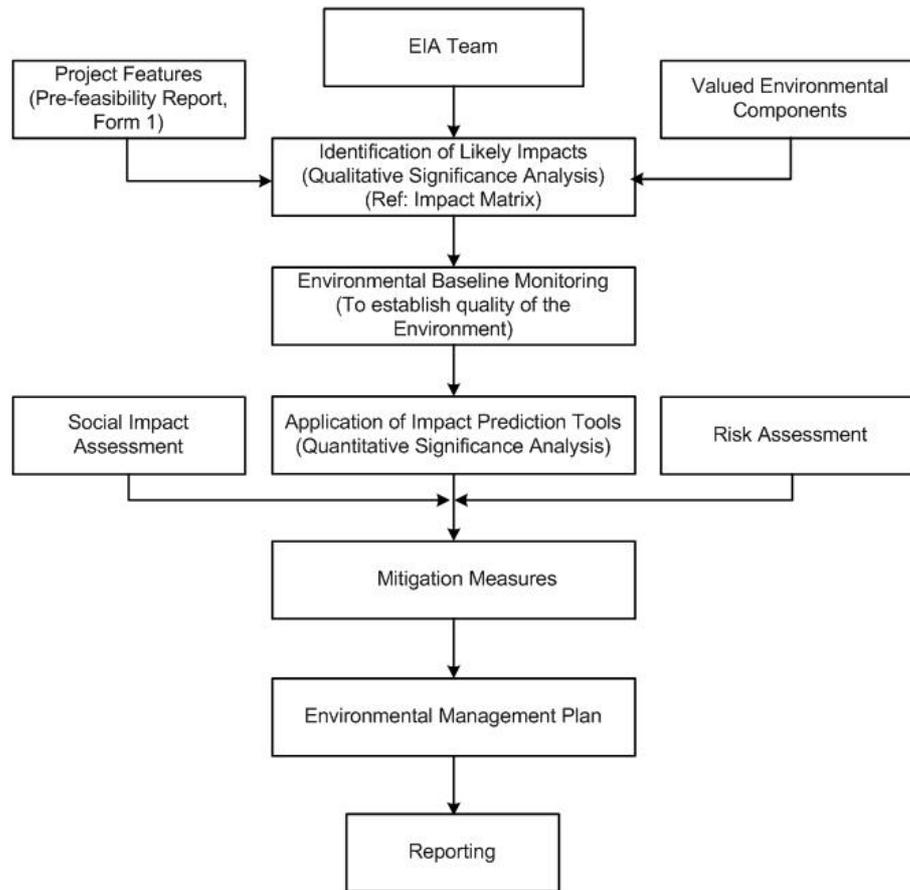


Figure 4-3: Approach for EIA Study

4.4.1 EIA team

The success of a multi-functional activity like an EIA primarily depends on constitution of a right team at the right time (preferable at the initial stages of an EIA) in order to assess the significant impacts (direct, indirect as well as cumulative impacts).

The professional Team identified for a specific EIA study should consist of qualified and experienced professionals from various disciplines, in order to address the critical aspects identified for the specific project. Based on the nature and the environmental setting, following professionals may be identified for EIA studies:

- Environmental management specialist/environmental regulator
- Air and Noise quality
- Occupational health
- Geology/geo-hydrology
- Ecologist
- Transportation specialist
- Safety and health specialist
- Social scientist, *etc.*

4.4.2 Baseline quality of the environment

EIA Notification 2006 specifies that an EIA Report should contain a description of the existing environment that would be or might be affected directly or indirectly by the proposed project. Environmental Baseline Monitoring (EBM) is a very important stage of EIA. On one hand EBM plays a very vital role in EIA while on the other it provides feedback about the actual environmental impacts of the proposed project. EBM, during the operational phase, helps in judging the success of mitigation measures in protecting the environment. Mitigation measures, in turn, are used to ensure compliance with environmental standards, and to facilitate the needed project design or operational changes.

Description of the existing environment should include natural, cultural, socio-economic systems and their interrelationships. The intention is not to describe all baseline conditions, but to focus the collection and description of baseline data on those VECs that are important and are likely to be affected by the leather/skin/hide processing industrial activity.

4.4.2.1 Objective of EBM in the EIA context

The term ‘baseline’ refers to conditions existing before development against which subsequent changes can be referenced. EBM studies are carried out to:

- identify environmental conditions which might influence project design decisions (e.g., site layout, structural or operational characteristics)
- identify sensitive issues or areas requiring mitigation or compensation
- provide input data to analytical models used for predicting effects
- provide baseline data against which the results of future monitoring programs can be compared

At this stage of EIA process, EBM is primarily discussed in the context of first purpose wherein feedback from EBM programs may be used to:

- determine available assimilative capacity of different environmental components within the designated impact zone and whether more or less stringent mitigation measures are needed; and
- improve predictive capability of EIAs.

There are many institutional, scientific, quality control, and fiscal issues that must be addressed in implementation of an environmental monitoring program. Careful consideration of these issues in the design and planning stages will help avoid many pitfalls associated with environmental monitoring programs.

4.4.2.2 Environmental monitoring network design

Monitoring refers to the collection of data using a series of repetitive measurements of environmental parameters (or, more generally, to a process of systematic observation). The environmental quality monitoring programme design will depend on the monitoring objectives specified for the selected area of interest. Types of monitoring and network design considerations are discussed in **Annexure II**.

4.4.2.3 Baseline data generation

List of important physical environmental components and indicators of EBM are given in Table 4-3.

Table 4-3: List of Important Physical Environment Components and Indicators of EBM

Environmental Component	Environmental Indicators
Climatic variables	<ul style="list-style-type: none"> ▪ Rainfall patterns – mean, mode, seasonality ▪ Temperature patterns ▪ Extreme events ▪ Climate change projections ▪ Relative humidity ▪ Prevailing wind - direction, speed, anomalies ▪ Stability conditions and mixing height, <i>etc.</i>
Geology	<ul style="list-style-type: none"> ▪ Underlying rock type, texture ▪ Surgical material ▪ Geologic structures (faults, shear zone, <i>etc.</i>) ▪ Geologic resources (minerals, <i>etc.</i>)
Topography	<ul style="list-style-type: none"> ▪ Slope form ▪ Landform and terrain analysis ▪ Specific landform types, <i>etc</i>
Coastal dynamics and morphology	<ul style="list-style-type: none"> ▪ Wave patterns ▪ Currents ▪ Shoreline morphology – near shore, foreshore ▪ Sediment – characteristics and transport, <i>etc</i>
Soil	<ul style="list-style-type: none"> ▪ Type and characteristics ▪ Porosity and permeability ▪ Sub-soil permeability ▪ Run-off rate ▪ Infiltration capacity ▪ Effective depth (inches/centimeters) ▪ Inherent fertility ▪ Suitability for method of sewage disposal, <i>etc</i>
Drainage	<ul style="list-style-type: none"> ▪ Surface hydrology ▪ Natural drainage pattern and network ▪ Rainfall runoff relationships ▪ Hydrogeology ▪ Groundwater characteristics – springs, <i>etc.</i>
Water quality	<ul style="list-style-type: none"> ▪ Raw water availability ▪ Water quality ▪ Surface water (rivers, lakes, ponds, gullies) – quality, water depths, flooding areas, <i>etc.</i> ▪ Ground water – water table, local aquifer storage capacity, specific yield, specific retention, water level depths and fluctuations, <i>etc.</i> ▪ Coastal ▪ Floodplains ▪ Wastewater discharges ▪ Waste discharges, <i>etc</i>
Air quality	<ul style="list-style-type: none"> ▪ Ambient ▪ Respirable

Environmental Component	Environmental Indicators
	<ul style="list-style-type: none"> ▪ Airshed importance ▪ Odour levels, <i>etc</i>
Noise	<ul style="list-style-type: none"> ▪ Identifying sources of noise ▪ Noise due to traffic/transportation of vehicles ▪ Noise due to heavy equipment operations ▪ Duration and variations in noise over time, <i>etc</i>
Biological	<ul style="list-style-type: none"> ▪ Species composition of flora and fauna ▪ Flora – type, density, exploitation, <i>etc.</i> ▪ Fauna – distribution, abundance, rarity, migratory, species diversity, habitat requirements, habitat resilience, economic significance, commercial value, <i>etc.</i> ▪ Fisheries – migratory species, species with commercial/recreational value, <i>etc</i>
Landuse	<ul style="list-style-type: none"> ▪ Landuse pattern, <i>etc.</i>

Guidance for assessment of baseline components and attributes describing sampling network, sampling frequency, method of measurement is given in **Annexure V**.

Infrastructure requirements for EBM

In addition to devising a monitoring network design and monitoring plans/program, it is also necessary to ensure adequate resources in terms of staffing and skills, equipment, training, budget, *etc.*, for its implementation. Besides assigning institutional responsibility, reporting requirements, QA/QC plans and its enforcement capability are essential. A monitoring program that does not have an infrastructural support and QA/QC component will have little chance of success.

Defining data statistics/analysis requirements

The data analysis to be conducted is dictated by the objectives of the environmental monitoring program. The statistical methods used to analyze the data should be described in detail prior to data collection. This is important because repetitive observations are recorded in time and space. Besides, the statistical methods could also be chosen so that uncertainty or error estimates in the data can be quantified. For e.g., statistical methods useful in an environmental monitoring program include: 1) frequency distribution analysis; 2) analysis of variance; 3) analysis of covariance; 4) cluster analysis; 5) multiple regression analysis; 6) time series analysis; 7) the application of statistical models.

Use of secondary data

The EBM program for EIA can at best address temporal and/or spatial variations limited to a limited extent because of cost implications and time limitations. Therefore analysis of all available information or data is essential to establish the regional profiles. So all the relevant secondary data available for different environmental components should be collated and analyzed.

To facilitate stakeholders, Ecosmart, has made an attempt to compile the list of information required for EIA studies. Respective sources of secondary data are provided in **Annexure VIA**, and **Annexure VIB**.

4.4.3 Impact prediction

The scientific and technical credibility of an EIA relies on the ability of the EIA practitioners to estimate the nature, extent, and magnitude of change in environmental components that may result from project activities. Information about predicted changes is needed for assigning impact significance, prescribing mitigation measures, and designing and developing EMPs and monitoring programs. The more accurate the predictions, the more confident the EIA practitioner will be in prescribing specific measures to eliminate or minimize the adverse impacts of development project.

4.4.4 Significance of the impacts

Evaluating the significance of environmental effects is perhaps the most critical component of impact analysis. More than other components, however, the interpretation of significance is also a contentious process. The interpretation of significance bears directly on the subsequent EIA process and also during environmental clearance on project approvals and condition setting. At an early stage, it also enters into screening and scoping decisions on what level of assessment is required and which impacts and issues will be addressed.

Impact significance is also a key to choosing among alternatives. In sum, the attribution of significance continues throughout the EIA process, from scoping to EIS review, in a gradually narrowing “cone of resolution” in which one stage sets up the next. But at this stage it is the most important as better understanding and quantification of impact significance is required.

One common approach is based on determination of the significance of predicted changes in the baseline environmental characteristics and compares these with reference to regulatory standards, objective criteria and similar ‘thresholds’ as eco-sensitivity, cultural /religious values. Often, these are outlined in guidance. A better test proposed by the CEAA (1995) is to determine if ‘residual’ environmental effects are adverse, significant, and likely (given under). But at this stage, the practice of formally evaluating significance of residual impacts, *i.e.*, after predicting the nature and magnitude of impacts based on before-versus-after-project comparisons, and identifying measures to mitigate these effects is not being followed in a systematic way.

Step 1: Are the environmental effects adverse?

Criteria for determining if effects are “adverse” include:

- effects on biota health
- effects on rare or endangered species
- reductions in species diversity
- habitat loss
- transformation of natural landscapes
- effects on human health
- effects on current use of lands and resources for traditional purposes by aboriginal persons; and
- foreclosure of future resource use or production

Step 2: Are the adverse environmental effects significant?

Criteria for determining ‘significance’ are to judge that the impacts:

- are extensive over space or time
- are intensive in concentration or proportion to assimilative capacity
- exceed environmental standards or thresholds
- do not comply with environmental policies, land use plans, sustainability strategy
- adversely and seriously affect ecologically sensitive areas
- adversely and seriously affect heritage resources, other land uses, community lifestyle and/or indigenous peoples traditions and values

Step 3: Are the significant adverse environmental effects likely?

Criteria for determining ‘likelihood’ include:

- probability of occurrence, and
- scientific uncertainty

4.5 Social Impact Assessment

Social impact assessment (SIA) is an instrument used to analyze social issues and solicit stakeholder views for the design of projects. SIA helps in making the project responsive to social development concerns, including the options that to enhance benefits for poor and vulnerable people while mitigating risk and adverse impacts. It analyzes distributional impacts of intended project benefits on different stakeholder groups, and identifies differences in assets and capabilities to access the project benefits.

The scope and depth of the SIA should be determined by the complexity and importance of the issues studied, taking into account the skills and resources available. SIA should include studies related to involuntary resettlement, compulsory land acquisition, impact of imported workforces, job losses among local people, damage to sites of cultural, historic or scientific interest, impact on minority or vulnerable groups, child or bonded labour, use of armed security guards. However, SIA may primarily include the following:

Description of the socio-economic, cultural and institutional profile:

Conduct a rapid review of available sources of information to describe the socio-economic, cultural and institutional interface in which the project operates.

Socio-economic and cultural profile: Describe the most significant social, economic and cultural features that differentiate social groups in the project area. Describe their different interests in the project, and their levels of influence. Explain any specific effects, the project may have on the poor and underprivileged. Identify any known conflicts among groups that may affect project implementation.

Institutional profile: Describe the institutional environment; consider both the presence and function of public, private and civil society institutions relevant to the operation. Are there important constraints within existing institutions e.g., disconnect between institutional responsibilities and the interests and behaviors of personnel within those institutions? Or are there opportunities to utilize the potential of existing institutions, e.g. private or civil society institutions, to strengthen implementation capacity.

Legislative and regulatory considerations:

To review laws and regulations governing the project's implementation and access of poor and excluded groups to goods, services and opportunities provided by the project. In addition, review the enabling environment for public participation and development planning. SIA should build on strong aspects of legal and regulatory systems to facilitate program implementation and identify weak aspects while recommending alternative arrangements.

Key social issues:

SIA provides baseline information for designing social development strategy. The analysis should determine the key social and Institutional issues which affect the are project objectives; identify the key stakeholder groups in this context and determine how relationships between stakeholder groups will affect or be affected by the project; and identify expected social development outcomes and actions proposed to achieve those outcomes.

Data collection and methodology:

Describe the design and methodology for social analysis. In this regard:

- Build on existing data;
- Clarify the units of analysis for SIA: intra-household, household level, as well as communities/settlements and other relevant social aggregations on which data is available or will be collected for analysis;
- Choose appropriate data collection and analytical tools and methods, employing mixed methods wherever possible; mixed methods include a mix of quantitative and qualitative methods.

Strategy to achieve social development outcomes:

Identify the likely social development outcomes of the project and propose a social development strategy, including recommendations for institutional arrangements to achieve them, based on the findings of the social assessment. The social development strategy could include measures that

- strengthen social inclusion by ensuring inclusion of both poor and excluded groups as well as that intended beneficiaries in the benefit stream; offer access to opportunities created by the project
- empower stakeholders through their participation in design and implementation of the project, their access to information, and their increased voice and accountability (*i.e.*, a participation framework); and
- enhance security by minimizing and managing likely social risks and increasing the resilience of intended beneficiaries and affected persons to socioeconomic shocks

Implications for analysis of alternatives:

Review proposed approaches for the project, and compare them in terms of their relative impacts and social development outcomes. Consider what implications the findings of social assessment might have on those approaches. Should some new components be added to the approach, or other components be reconsidered or modified?

If SIA and consultation processes indicate that alternative approaches may have better development outcomes, such alternatives should be described and considered, along with the likely budgetary and administrative effects these changes might have.

Recommendations for project design and implementation arrangements

Provide guidance to project management and other stakeholders on how to integrate social development issues into project design and implementation arrangements. As much as possible, suggest specific action plans or implementation mechanisms to address relevant social issues and potential impacts. These can be developed as integrated or separate action plans, for example, as Resettlement Action Plans, Indigenous Peoples Development Plans, Community Development Plans, *etc.*

Developing a monitoring plan:

Through SIA process, a framework for monitoring and evaluation should be developed. To the extent possible, this should be done in consultation with key stakeholders, especially beneficiaries and affected people.

The framework shall identify expected social development indicators, establish benchmarks, and design systems and mechanisms for measuring progress and results related to social development objectives. The framework shall identify organizational responsibilities in terms of monitoring, supervision, and evaluation procedures. Wherever possible, participatory monitoring mechanisms shall be incorporated. The framework should establish:

- a set of monitoring indicators to track the progress achieved. The benchmarks and indicators should be limited in number, and should combine both quantitative and qualitative types of data. The indicators for outputs to be achieved by the social development strategy; indicators to monitor the process of stakeholder participation, implementation and institutional reform;
- indicators to monitor social risk and social development outcomes; and indicators to monitor impacts of the project's social development strategy. It is important to suggest mechanisms through which lessons learnt from monitoring and stakeholder feedback can result in changes to improve operation of the project. Indicators should be of such nature that results and impacts can be disaggregated by gender and other relevant social groups;
- Define transparent evaluation procedures. Depending on context, these may include a combination of methods, such as participant observation, key informant interviews, focus group discussions, census and socio-economic surveys, gender analysis, Participatory Rural Appraisal (PRA), Participatory Poverty Assessment (PPA) methodologies, and other tools. Such procedures should be tailored to the special conditions of the project and to the different groups living in the project area; Estimate resource and budget requirements for monitoring and evaluation activities, and a description of other inputs (such as institutional strengthening and capacity building) needs to be carried out.

4.6 Mitigation Measures

The purpose of mitigation is to identify measures that safeguard the environment and the community affected by the proposal. Mitigation is both a creative and practical phase of the EIA process. It seeks best ways and means of avoiding, minimizing and remedying impacts. Mitigation measures must be translated into action in right way and at the right

time, if they are to be successful. This process is referred to as impact management and takes place during project implementation. A written plan should be prepared for this purpose, and should include a schedule of agreed actions. Opportunities for impact mitigation will occur throughout the project cycle.

4.6.1 Important considerations for mitigation methods

The responsibility of project proponents to ‘internalize’ the full environmental costs of development proposals is now widely accepted under “Polluter Pay” principle. In addition, many proponents have found that good design and impact management can result in significant savings applying the principles of cleaner production to improve their environmental performance.

- The predicted adverse environmental as well as social impacts for which mitigation measures are required, should be identified and briefly summarized along with cross referencing them to the significance, prediction components of the EIA report or other documentation.
- Each mitigation measure should be briefly described w.r.t the impact of significances to which it relates and the conditions under which it is required (for example, continuously or in the event of contingencies). These should also be cross-referenced to the project design and operating procedures which elaborate on the technical aspects of implementing the various measures.
- Cost and responsibilities for mitigation and monitoring should be clearly defined, including arrangements for coordination between various authorities responsible for mitigation.
- The proponent can use the EMP to develop environmental performance standards and requirements for the project site as well as supply chain. An EMP can be implemented through EMS for the operational phase of the project.

Prior to selecting mitigation plans it is appropriate to study the mitigation alternatives for cost-effectiveness, technical and socio-political feasibility. Such mitigation measures could include:

- Avoiding sensitive areas such as eco-sensitive area, e.g., fish spawning areas, dense mangrove areas or areas known to contain rare or endangered species
- Adjusting work schedules to minimize disturbance
- Engineered structures such as berms and noise attenuation barriers
- Pollution control devices, such as scrubbers and electrostatic precipitators
- Changes in fuel feed, manufacturing, process, technology use, or waste management practices, *etc.*

4.6.2 Hierarchy of elements of mitigation plan

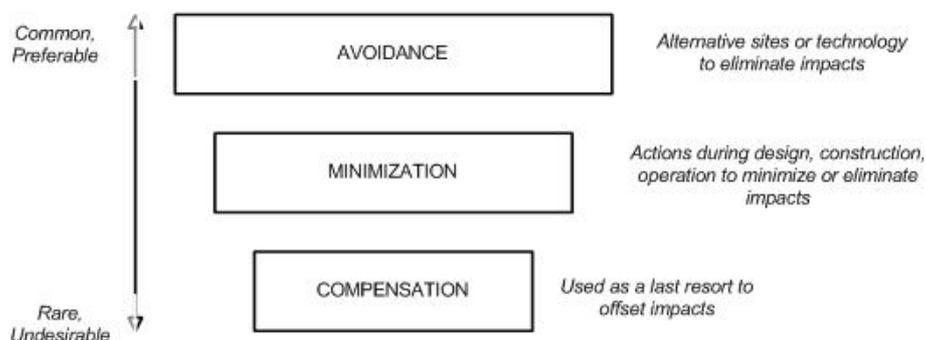


Figure 4-4: Elements of Mitigation Plan

Good EIA practice requires a relevant technical understanding of issues and measures that work in the circumstances: The priority of selection of mitigation measures should be in the order:

Step one: impact avoidance

This step is most effective when applied at an early stage of project planning. It can be achieved by:

- not undertaking certain projects or elements that could result in adverse impacts
- avoiding areas that are environmentally sensitive; and
- putting in place the preventative measures to stop adverse impacts from occurring, for example, release of water from a reservoir to maintain a fisheries regime.

Step two: impact minimization

This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- scaling down or relocating the proposal
- redesigning elements of the project and
- taking supplementary measures to manage the impacts

Step three: impact compensation

This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- rehabilitation of the affected site or environment, for example, by habitat enhancement and restocking fish
- restoration of the affected site or environment to its previous state or better, as typically required for mine sites, forestry roads and seismic lines and
- replacement of the same resource values at another location. For example, by wetland engineering to provide an equivalent area to that lost to drainage or infill

Important compensation elements

Resettlement Plans: Special considerations apply to mitigation of proposals that displace or disrupt people. Certain types of projects, such as reservoirs and irrigation schemes and public works, are known to cause involuntary resettlement. This is a contentious issue because it involves far more than re-housing people; in addition, income sources and access to common property resources are likely to be lost. Almost certainly, a resettlement plan will be required to ensure that no one is worse off than before, which may not be possible for indigenous people whose culture and lifestyle is tied to a locality. This plan must include the means for those displaced to reconstruct their economies and communities and should include an EIA of the receiving areas. Particular attention should be given to indigenous, minority and vulnerable groups who are at higher risk from resettlement.

In kind compensation

When significant or net residual loss or damage to the environment is likely, in kind compensation is appropriate. As noted earlier, environmental rehabilitation, restoration or replacement have become standard practices for many proponents. Now, increasing emphasis is given to a broader range of compensation measures to offset impacts and assure the sustainability of development proposals. These include impact compensation 'trading', such as offsetting CO₂ emissions by planting forests to sequester carbon.

4.6.3 Typical mitigation measures

Choice of location for the developmental activity plays an important role in preventing the adverse impacts on the surrounding environment. Detailed guidelines on siting of industries are provided in Section 4.2. However, if the developmental activity still produces any adverse impacts, mitigation measures should be taken.

Previous subsections of the Section 4.6 could be precisely summarized into following:

- Impacts from a developmental project could have many dimensions. As most of the direct impacts are caused by the releases from developmental projects, often impact control at source is the best opportunity to either eliminate or mitigate the impacts, in case these are cost-effective. In other words, the best way to mitigate the impacts is to prevent them from occurring. Choice of raw materials/technologies/processes which produce least impact would be one of the options to achieve it.
- After exploring cost-effective feasible alternatives to control impacts at source, various interventions to minimize the adverse impacts may be considered. These interventions, primarily aim at reducing the residual impacts on the valued environmental components of the receiving environment to the acceptable concentrations.
- The degree of control at source and external interventions differs from situation-to-situation and are largely governed by techno-economic feasibility. While the regulatory bodies stress for further source control (due to high reliability), the project proponents bargain for other interventions which may be relatively cost-effective than further control at source (in any case project authority is required to meet the industry-specific standards by adopting the best practicable technologies. However, if the location demands further control at source, then the proponents are required to adopt further advanced control technologies i.e. towards best available control technologies). After having discussions with the project proponent, EAC/SEAC

reaches to an agreed level of source control+other interventions (together called as mitigation measures in the given context) that achieve the targeted protection levels for the valued environmental components in the receiving environment. These levels will become the principle clearance conditions.

- Chapter 3 of this TGM offers elaborate information on cleaner technologies, waste minimization opportunities, and control technologies for various kinds of polluting parameters that emanate from this developmental activity. This information may be used to draw appropriate source control measures.

The choice of interventions for mitigation of impacts may also be numerous and depend on various factors. Mitigation measures based on location-specific suitability and some other factors are discussed in sub-sections 4.6.1 and 4.6.2. A few typical measures which may also be explored for mitigation of impacts are listed in Table 4-5.

Table 4-4: Typical Mitigation Measures

Impacts	Typical Mitigation Measures
Erosion	<ul style="list-style-type: none"> ▪ Windscreens, maintenance, and installation of ground cover ▪ Installation of drainage ditches ▪ Runoff and retention ponds ▪ Minimize disturbances and scarification of the surface
Resources – fuel/ construction material, etc	<ul style="list-style-type: none"> ▪ Optimization of resource use ▪ Availing resources with least impact – eco-efficiency options are applicable ▪ Availing the resources which could be replenished by natural systems, etc.
Deforestation	<ul style="list-style-type: none"> ▪ Plant or create similar areas ▪ Initiate a tree planning program in other areas ▪ Donate land to conservationist groups
Water pollution and issues	<ul style="list-style-type: none"> ▪ Channeling and retention of water to reduce erosion and situation ▪ Collection and treatment of sewage and organic waste ▪ Increased recycling and reuse of water ▪ Use of biodegradable or otherwise readily treatable additives ▪ Neutralization and sedimentation of wastewater ▪ Dewatering of sludge and appropriate disposal of solids ▪ Use deep well injection below potable levels ▪ Construct liners of ponds and solids waste disposal ▪ Dilute water at point of discharge ▪ Providing a stormwater network within the plant to prevent cross contamination with the effluents ▪ Minimise flow variation from the mean flow
Dust pollution	<ul style="list-style-type: none"> ▪ Wetting of roadways to reduce traffic dust and re-entrained particles ▪ Installation of windscreens to breakup the wind flow ▪ Provide dust collector equipment
Noise pollution	<ul style="list-style-type: none"> ▪ Heavy duty muffler systems on heavy equipment ▪ Limit certain activities ▪ By using damping, absorption, dissipation, and deflection methods ▪ Maintain noise levels from below 90 dba

Impacts	Typical Mitigation Measures
Biological	<ul style="list-style-type: none"> ▪ Provide ear protection if in excess ▪ Installation of systems to discourage nesting or perching of birds in dangerous environments ▪ Increased employee awareness to sensitive areas
Social	<ul style="list-style-type: none"> ▪ Develop traffic plan that minimizes road use by workers ▪ Upgrade roads and intersections ▪ Provide infrastructure plan and financial support for increased demands ▪ Construct facilities to reduce demands

4.7 Environmental Management Plan

A typical EMP shall be composed of the following:

1. summary of potential impacts of the proposal
2. description of recommended mitigation measures
3. description of monitoring programme to ensure compliance with relevant standards and residual impacts
4. allocation of resources and responsibilities for plan implementation
5. implementation schedule and reporting procedures
6. contingency plan when impacts are greater than expected

Summary of impacts: The predicted adverse environmental and social impacts for which mitigation measures are identified in earlier sections to be briefly summarized with cross referencing to the corresponding sections in the EIA report.

Description of mitigation measures: Each mitigation measure should be briefly described w.r.t the impact to which it relates and the conditions under which it is required. These should be accompanied by referenced to project design and operating procedures which elaborate on the technical aspects of implementing various measures.

Description of monitoring programme to ensure compliance with relevant standards and residual impacts: Environmental monitoring refers to compliance monitoring and residual impact monitoring. Compliance monitoring refers to meeting the industry-specific statutory compliance requirements (Ref. Applicable National regulations as detailed in Chapter 3).

Residual impact monitoring refers to monitoring of identified sensitive locations with adequate number of samples and frequency. The monitoring programme should clearly indicate the linkages between impacts identified in the EIA report, measurement indicators, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions.

Allocation of resources and responsibilities for plan implementation: These should be specified for both the initial investment and recurring expenses for implementing all measures contained in the EMP, integrated into the total project costs, and factored into loan negotiation.

The EMP should contain commitments that are binding on the proponent in different phases of project implementation i.e., pre-construction or site clearance, construction, operation, decommissioning.

Responsibilities for mitigation and monitoring should be clearly defined, including arrangements for co-ordination between the various actors responsible for mitigation. Details should be provided w.r.t the deployment of staff (detailed organogram), monitoring network design, parameters to be monitored, analysis methods, associated equipments etc.

Implementation schedule and reporting procedures: The timing, frequency and duration of mitigation measure should be specified in an implementation schedule, showing links with overall project implementation. Procedures to provide information on the progress and results of mitigation and monitoring measures should also be clearly specified.

Contingency Plan when the impacts are greater than expected: There shall be a contingency plan for attending to the situations where the monitoring results shows residual impacts are higher than expected. It is an imperative requirement for all the project authorities to plan additional programmes to deal with the situation, with the intimation to the concerned local regulatory bodies.

4.8 Reporting

Structure of the EIA report (Appendix III of the EIA Notification), applicable for tanneries is given in the following Table 4-5. Each task prescribed in ToR shall be incorporated appropriately in the contents in addition to the contents described in the table.

Table 4-5: Structure of EIA Report

S. NO	EIA STRUCTURE	CONTENTS
1.	Introduction	<ul style="list-style-type: none"> ▪ Purpose of the report ▪ Identification of project & project proponent ▪ Brief description of nature, size, location of the project and its importance to the country, region ▪ Scope of the study – details of regulatory scoping carried out (As per ToR for EIA studies)
2.	Project Description	<p>Condensed description of those aspects of the project (based on project feasibility study), likely to cause environmental effects. Details should be provided to give clear picture of the following:</p> <ul style="list-style-type: none"> ▪ Type of project ▪ Need for the project ▪ Location (maps showing general location, specific location, project boundary & project site layout) ▪ Size or magnitude of operation (incl. Associated activities required by for the project) ▪ Proposed schedule for approval and implementation ▪ Technology and process description ▪ Project description including drawings showing project layout, components of project <i>etc.</i> Schematic representations of feasibility drawings which give information important for EIA ▪ Description of mitigation measures incorporated into the project to meet environmental standards, environmental operating conditions, or other EIA requirements (as

S. NO	EIA STRUCTURE	CONTENTS
		required by the scope) <ul style="list-style-type: none"> Assessment of New & untested technology for the risk of technological failure
3.	Description of the Environment	<ul style="list-style-type: none"> Study area, period, components & methodology Establishment of baseline for VECs, as identified in the scope Base maps of all environmental components
4.	Anticipated Environmental Impacts & Mitigation Measures	<ul style="list-style-type: none"> Details of Investigated Environmental impacts due to project location, possible accidents, project design, project construction, regular operations, final decommissioning or rehabilitation of a completed project Measures for minimizing and / or offsetting adverse impacts identified Irreversible and irretrievable commitments of environmental components Assessment of significance of impacts (Criteria for determining significance, Assigning significance) Mitigation measures
5.	Analysis of Alternatives (Technology & Site)	In case the scoping exercise results in need for alternatives: <ul style="list-style-type: none"> Description of each alternative Summary of adverse impacts of each alternative Mitigation measures proposed for each alternative and selection of alternative
6.	Environmental Monitoring Program	<ul style="list-style-type: none"> Technical aspects of monitoring the effectiveness of mitigation measures (incl. Measurement methodologies, frequency, location, data analysis, reporting schedules, emergency procedures, detailed budget & procurement schedules)
7.	Additional Studies	<ul style="list-style-type: none"> Public Consultation Risk assessment Social Impact Assessment, R&R Action Plans
8.	Project Benefits	<ul style="list-style-type: none"> Improvements in physical infrastructure Improvements in social infrastructure Employment potential –skilled; semi-skilled and unskilled Other tangible benefits
9.	Environmental Cost Benefit Analysis	<ul style="list-style-type: none"> If recommended at the Scoping stage
10.	EMP	<ul style="list-style-type: none"> Description of administrative aspects ensure project implementation of the mitigative measures and their effectiveness monitored, after approval of the EIA
11.	Summary & Conclusion (This will constitute the summary of the EIA Report)	<ul style="list-style-type: none"> Overall justification for implementation of the project Explanation of how, adverse effects have been mitigated
12.	Disclosure of Consultants engaged	<ul style="list-style-type: none"> Names of the Consultants engaged with their brief resume and nature of Consultancy rendered

4.9 Public Consultation

Public consultation refers to the process by which the concerns of local affected people and others who have plausible stake in the environmental impacts of the project or activity are ascertained.

- Public consultation is not a decision taking process, but is a process to collect views of the people having plausible stake. If the SPCB/Public agency conducting public hearing is not convinced with the plausible stake, then such expressed views need not be considered.
- All Category A and Category B1 projects require public hearing except the following:
 - Modernization of irrigation projects
 - Once environmental clearance is granted to an industrial estate/SEZ/EPZ *etc.*, for a given composition (type and capacity) of industries, then individual units will not require public hearing
 - Expansion of roads and highways, which do not involve any further acquisition of land.
 - All building/ construction projects/ area development projects/townships
 - All Category B2 projects
 - All projects concerning national defense and security or involving other strategic considerations as determined by the Central Government
- Public consultation involves two components, one is public hearing, and other one is inviting written responses/objections through Internet/by post, *etc.*, by placing the summary of EIA report on the website.
- Public hearing shall be carried out at the site or in its close proximity, district-wise, for ascertaining concerns of local affected people.
- Project proponent shall make a request through a simple letter to the Member-Secretary of the SPCB/UTPCC to arrange public hearing.
- Project proponent shall enclose with the letter of request, at least 10 hard copies and 10 soft copies of the draft EIA report including the summary EIA report in English and in the official language of the State/local language prepared as per the approved scope of work, to the concerned Authority.
- Simultaneously, project proponent shall arrange to send, one hard copy and one soft copy, of the above draft EIA report along with the summary EIA report to the following Authorities within whose jurisdiction the project will be located:
 - District magistrate(s)/District Collector/Deputy Commissioner (s)
 - Zilla parishad and municipal corporation or panchayats union
 - District industries office
 - Urban local bodies (ULBs)/PRI concerned/development authorities
 - Concerned regional office of the MoEF/SPCB
- Above mentioned Authorities except regional office of MoEF shall arrange to widely publicize the draft EIA report within their respective jurisdictions requesting the interested persons to send their comments to the concerned regulatory authorities. They shall also make draft EIA report for inspection electronically or otherwise to the public during normal office hours till the public hearing is over.

- Concerned regulatory Authority (MoEF/SEIAA/UTEIA) shall display the summary of EIA report on its website and also make full draft EIA report available for reference at a notified place during normal office hours at their head office.
- SPCB/UTPCC concerned shall also make similar arrangements for giving publicity about the project within the State/UT and make available the summary of draft EIA report for inspection in select offices, public libraries or any other suitable location, *etc.* They shall also additionally make available, a copy of the draft EIA report to the five authorities/offices as mentioned above.
- The Member-Secretary of the concerned SPCB or UTPCC shall finalize the date, time and exact venue for the conduct of public hearing within seven days of the date of the receipt of the draft EIA report from the project proponent and advertise the same in one major National Daily and one Regional vernacular Daily/official State language.
- A minimum notice period of 30 (thirty) days shall be provided to the public for furnishing their responses.
- No postponement of the date, time, venue of the public hearing shall be undertaken, unless some untoward emergency situation occurs. Only in case of emergencies, and up on recommendation of the concerned District Magistrate/District Collector/Deputy Commissioner, the postponement shall be notified to the public through the same National and Regional vernacular dailies and also prominently displayed at all the identified offices by the concerned SPCB or UTPCC
- In the above exceptional circumstances fresh date, time and venue for the public consultation shall be decided by the Member–Secretary of the concerned SPCB or UTPCC only in consultation with the District Magistrate/District Collector/Deputy Commissioner and notified afresh as per the procedure.
- The District Magistrate/District Collector/Deputy Commissioner or his or her representative not below the rank of an Additional District Magistrate assisted by a representative of SPCB/UTPCC, shall supervise and preside over the entire public hearing process.
- The SPCB or UTPCC shall arrange to video film the entire proceedings. A copy of the videotape or a CD shall be enclosed with the public hearing proceedings while forwarding it to the Regulatory Authority concerned.
- The attendance of all those who are present at the venue shall be noted and annexed with the final proceedings
- There shall be *no quorum* required for attendance for starting the proceedings
- Persons present at the venue shall be granted the opportunity to seek information or clarifications on the project from the proponent. The summary of the public hearing proceedings accurately reflecting all the views and concerns expressed shall be recorded by the representative of the SPCB/UTPCC and read over to the audience at the end of the proceedings explaining the contents in the local/vernacular language and the agreed minutes shall be signed by the District Magistrate/District Collector/Deputy Commissioner (s) or his or her representative on the same day and forwarded to the SPCB/UTPCC concerned.
- A statement of the issues raised by the public and the comments of the proponent shall also be prepared in the local language or the official State language, as the case may be and in English and annexed to the proceedings.

- The proceedings of the public hearing shall be conspicuously displayed at the office of the Panchayats within whose jurisdiction the project is located, office of the concerned Zilla Parishad, District Magistrate/District Collector/Deputy Commissioner (s), and the SPCB or UTPCC. The SPCB or UTPCC shall also display the proceedings on its website for general information. Comments, if any, on the proceedings, may be sent directly to the concerned regulatory authorities and the Applicant concerned.
- The public hearing shall be completed within a period of 45 (forty five) days from date of receipt of the request letter from the Applicant. Therefore the SPCB or UTPCC concerned shall send the public hearing proceedings to the concerned regulatory authority within 8(eight) days of the completion of the public hearing. Simultaneously, a copy will also be provided to the project proponent. The proponent may also directly forward a copy of the approved public hearing proceedings to the regulatory authority concerned along with the final EIA report or supplementary report to the draft EIA report prepared after the public hearing and public consultations incorporating the concerns expressed in the public hearing along with action plan and financial allocation, item-wise, to address those concerns.
- Upon receipt of the same, the Authority will place executive summary of the report on the website to invite responses from other concerned persons having a plausible stake in the environmental aspects of the project or activity.
- If SPCB/UTPCC is unable to conduct the public hearing in the prescribed time, the Central Government in case of Category A projects and State Government or UT administration in case of Category B projects at the request of the SEIAA can engage any other agency or Authority for conducting the public hearing process within a further period of 45 days. The respective governments shall pay the appropriate fee to the public agency for conducting public hearing.
- A public agency means a non-profit making institution/ body such as technical/academic institutions, government bodies not subordinate to the concerned Authority.
- If SPCB/Public Agency authorized for conducting public hearing informs the Authority, stating that it is not possible to conduct the public hearing in a manner, which will enable the views of the concerned local persons to be freely expressed, then Authority may consider such report to take a decision that in such particular case, public consultation may not have the component of public hearing.
- Often restricting the public hearing to the specific district may not serve the entire purpose, therefore, NGOs who are local and registered under the Societies Act in the adjacent districts may also be allowed to participate in public hearing, if they so desire.
- Confidential information including non-disclosable or legally privileged information involving intellectual property right, source specified in the application shall not be placed on the website.
- The Authority shall make available on a written request from any concerned person the draft EIA report for inspection at a notified place during normal office hours till the date of the public hearing.
- While mandatory requirements will have to be adhered to, utmost attention shall be given to the issues raised in the public hearing for determining the modifications needed in the project proposal and the environmental management plan to address such issues.

- Final EIA report after making needed amendments, as aforesaid, shall be submitted by the applicant to the concerned Authority for prior environmental clearance. Alternatively, a supplementary report to draft EIA and EMP addressing all concerns expressed during the public consultation may be submitted.

4.10 Appraisal

Appraisal means the detailed scrutiny by the EAC or SEAC of the application and the other documents like the final EIA report, outcome of the public consultation including public hearing proceedings submitted by the applicant for grant of environmental clearance.

- The appraisal shall be made by EAC to the Central Government or SEAC to SEIAA.
- Project proponent either personally or through consultant can make a presentation to EAC/SEAC for the purpose of appraising the features of the project proposal and also to clarify the issues raised by the members of the EAC/SEAC.
- On completion of these proceedings, concerned EAC/SEAC shall make categorical recommendations to the respective Authority, either for grant of prior environmental clearance on stipulated terms & conditions, if any, or rejection of the application with reasons.
- In case EAC/SEAC needs to visit the site or obtain further information before being able to make categorical recommendations, EAC/SEAC may inform the project proponent accordingly. In such an event, it should be ensured that the process of environmental clearance is not unduly delayed to go beyond the prescribed timeframe.
- Upon the scrutiny of the final report, if EAC/SEAC opines that finalized ToR at the scoping stage has not been comprehensively covered by the proponent, then the project proponent may be asked to provide such information. If such information is declined by the project proponent or is unlikely to be provided early enough so as to complete the environmental appraisal within prescribed time of 60 days, the EAC/SEAC may recommend for rejection of the proposal with the same reason.
- Appraisal shall be strictly in terms of the finalized ToR at the scoping stage and the concerns expressed during public consultation.
- This process of appraisal shall be completed within 60 days from the receipt of the updated EIA report and EMP report, after completing public consultation.
- The EIA report will be typically examined for following:
 - Project site description supported by topographic maps & photographs – detailed description of topography, land use and activities at the proposed project site and its surroundings (buffer zone) supported by photographic evidence.
 - Clarity in description of drainage pattern, location of eco sensitive areas, vegetation characteristics, wildlife status - highlighting significant environmental attributes such as feeding, breeding and nesting grounds of wildlife species, migratory corridor, wetland, erosion and neighboring issues.
 - Description of the project site – how well the interfaces between the project related activities and the environment have been identified for the entire project cycle *i.e.* construction, operation and decommissioning at the end of the project life.
 - How complete and authentic are the baseline data pertaining to flora and fauna and socio economic aspects?

- Citing of proper references, with regard to the source(s) of baseline data as well as the name of the investigators/ investigating agency responsible for collecting the primary data.
- How consistent are the various values of environmental parameters with respect to each other?
- Is a reasonable assessment of the environmental and social impact made for the identified environmental issues including project affected people?
- To what extent the proposed environmental plan will mitigate the environmental impact and at what estimated cost, shown separately for construction, operation and closure stages and also separately in terms of capital and recurring expenses along with details of agencies that will be responsible for the implementation of environmental plan/conservation plan.
- How well the concerns expressed/highlighted during the Public hearing have been addressed and incorporated in the EMP giving item wise financial provisions and commitments (in quantified terms)?
- How far the proposed environmental monitoring plan will effectively evaluate the performance of the EMP? Are details for environmental monitoring plan provided in the same manner as the EMP?
- Identification of hazard and quantification of risk assessment and whether appropriate mitigation plan has been included in the EMP?
- Does the proposal include a well formulated time bound green belt development plan for mitigating environmental problems such as fugitive emission of dust, gaseous pollutants, noise, odour, *etc.*
- Does EIA makes a serious attempt to guide the project proponent for minimizing the requirement of natural resources including land, water energy and other non renewable resources?
- How well the EIA statement has been organized and presented so that the issues, their impact and environmental management strategies emerge clearly from it and how well organized was the power point presentation made before the expert committee?
- Is the information presented in the EIA adequately and appropriately supported by maps, imageries and photographs highlighting site features and environmental attributes?

4.11 Decision-making

The Chairperson reads the sense of the Committee and finalizes the draft minutes of the meeting, which are circulated by the Secretary to all the expert members invited to the meeting. Based on the response from the members, the minutes are finalized and signed by the Chairperson. This process for finalization of the minutes should be so organized that the time prescribed for various stages is not exceeded.

Approval / Rejection / Reconsideration

The Authority shall consider the recommendations of concerned appraisal Committee and convey its decision within 45 days of the receipt of recommendations.

- If the Authority disagrees with the recommendations of the Appraisal Committee, then reasons shall be communicated to concerned Appraisal Committee and applicant within 45 days from the receipt of the recommendations. The Appraisal Committee concerned shall consider the observations of the Authority and furnish its views on the observations within further period of 60 days. The Authority shall take a decision within the next 30 days based on the views of appraisal Committee.
- If the decision of the Authority is not conveyed within the time, then the proponent may proceed as if the environmental clearance sought has been granted or denied by the regulatory authority in terms of the final recommendation of the concerned appraisal Committee. For this purpose, the decision of the Appraisal Committee will be public document, once the period specified above for taking the decision by the Authority is over.
- In case of the Category B projects (B1 & B2), application shall be received by the Member-Secretary of the SEIAA and clearance shall also be issued by the same SEIAA.
- Deliberate concealment and/or submission of false or misleading information or data which is material to screening or scoping or appraisal or decision on the application shall make the application liable for rejection, and cancellation of prior environmental clearance granted on that basis. Rejection of an application or cancellation of a prior environmental clearance already granted, on such ground, shall be decided by the regulatory authority, after giving a personal hearing to the applicant, and following the principles of natural justice.

If approved

- The concerned Authority (MoEF/SEIAA) will issue an environmental clearance for the project.
- The project proponent should make sure that the award of Environment Clearance is properly publicized in at least two local newspapers of the district or state where the proposed project is located. For instance, the executive summary of the environmental clearance may be published in the newspaper along with the information about the location (website/office where it is displayed for public) where the detailed environmental clearance is made available. The MoEF and the SEIAA/UTEIAA, as the case may be, shall also place the environmental clearance in the public domain on Government Portal. Further copies of the environmental clearance shall be endorsed to the Heads of local bodies, Panchayats and Municipal bodies in addition to the relevant offices of the Government
- The environmental clearance will be valid from the start date to actual commencement of the production of the developmental activity.
- Usual validity period will be 5 years from the date of issuing environmental clearance, unless specified by EAC/SEAC.
- A prior environmental clearance issued to a project proponent can be transferred to another legal person entitled to undertake the project, upon application by the transferor to the concerned Authority or submission of no-objection of the transferor by the transferee to the concerned Authority for the concurrence. In this case, EAC/SEAC concurrence is not required, but approval from the concerned authority is required to avail the same project configurations, validity period transferred to the new legally entitled person to undertake the project.

4.12 Post-clearance Monitoring Protocol

The MoEF, Government of India will monitor and take appropriate action under the EP Act, 1986.

- In respect of Category A projects, it shall be mandatory for the project proponent to make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by advertising it at least in two local newspapers of the district or State where the project is located and in addition, this shall also be displayed in the project proponents website permanently.
- In respect of Category B projects, irrespective of its clearance by MoEF/SEIAA, the project proponent shall prominently advertise in the newspapers indicating that the project has been accorded environment clearance and the details of MoEF website where it is displayed.
- The MoEF and the SEIAAs/UTEIAAs, as the case may be, shall also place the environmental clearance in the public domain on Government Portal.
- The copies of the environmental clearance shall be submitted by the project proponents to the Heads of the local bodies, Panchayats and Municipal bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

The project proponent must submit half-yearly compliance reports in respect of the stipulated prior environmental clearance terms and conditions in hard and soft copies to the regulatory authority concerned, on 1st June and 1st December of each calendar year.

All such compliance reports submitted by the project management shall be public documents. Copies of the same shall be given to any person on application to the concerned regulatory authority. The latest such compliance report shall also be displayed on the web site of the concerned regulatory authority.

The SPCB shall incorporate EIA clearance conditions into consent conditions in respect of Category A and Category B projects and in parallel monitor and enforce the same.

5.

STAKEHOLDERS' ROLES AND RESPONSIBILITIES

Prior environmental clearance process involves many stakeholders *i.e.*, Central Government, State Government, SEIAA, EAC at the National Level, SEAC, the public agency, SPCB, the project proponent, and the public.

- Roles and responsibilities of the organizations involved in different stages of prior environmental clearance are listed in Table 5-1.
- Organization-specific functions are listed in Table 5-2.

In this Chapter, constitution, composition, functions, *etc.*, of the Authorities and the Committees are discussed in detail.

Table 5-1: Roles and Responsibilities of Stakeholders Involved in Prior Environmental Clearance

Stage	MoEF/SEIAA	EAC/SEAC	Project Proponent	EIA Consultant	SPCB/ Public Agency	Public and Interest Group
Screening	Receives application and takes advice of EAC/SEAC	Advises the MoEF/SEIAA	Submits application (Form 1) and provides necessary information	Advises and assists the proponent by providing technical information		
Scoping	Approves the ToR, communicates the same to the project proponent and places the same in the website	Reviews the ToR, visits the proposed site, if required and recommends the ToR to the MoEF/SEIAA	Submits the draft ToR to MoEF/SEIAA and facilitates the visit of the EAC/SEAC members to the project site	Prepares ToR		
EIA Report & Public Hearing	Reviews and forwards copies of the EIA report to SPCB /public agency for conducting public hearing		Submits detailed EIA report as per the finalized ToR Facilitates the public hearing by arranging presentation on the project, EIA and EMP – takes note of	Prepares the EIA report Presents and appraises the likely impacts and pollution control measures proposed in the public hearing	Reviews EIA report and conducts public hearing in the manner prescribed Submits proceedings and views of SPCB, to the	Participates in public hearings and offers comments and observations. Comments can be sent directly to SEIAA

Stakeholders' Roles and Responsibilities

Stage	MoEF/SEIAA	EAC/SEAC	Project Proponent	EIA Consultant	SPCB/ Public Agency	Public and Interest Group
	Places the summary of EIA report in the website Conveys objections to the project proponent for update, if any.		objections and updates the EMP accordingly		Authority and the project proponent as well	through Internet in response to the summary placed in the website
Appraisal and Clearance	Receives updated EIA Takes advice of EAC/SEAC, approves EIA and attaches the terms and conditions	Critically examines the reports, presentation of the proponent and appraises MoEF/SEIAA (recommendations are forwarded to MoEF/SEIAA)	Submits updated EIA , EMP reports to MoEF/SEIAA. Presents the overall EIA and EMP including public concerns to EAC/SEAC	Provides technical advise to the project proponent and if necessary presents the proposed measures for mitigation of likely impacts (terms and conditions of clearance)		
Post-clearance Monitoring			Implements environmental protection measures prescribed and submits periodic monitoring results	Conducts periodic monitoring	Incorporates the clearance conditions into appropriate consent conditions and ensures implementation	

Table 5-2: Organization-Specific Functions

ORGANIZATION	FUNCTIONS
Central Government	<ul style="list-style-type: none"> ▪ Constitutes the EAC ▪ Considering recommendations of the State Government, constitutes the SEIAA & SEAC ▪ Receives application from the project proponent in case of Category A projects or Category B projects attracting general condition ▪ Communicates the ToR finalized by the EAC to the project proponent. ▪ Receives EIA report from the project proponent and soft copy of summary of the report for placing in the website

Stakeholders' Roles and Responsibilities

ORGANIZATION	FUNCTIONS
	<ul style="list-style-type: none"> ▪ Summary of EIA report will be placed in website. Forwards the received responses to the project proponent ▪ Engages other public agency for conducting public hearings in cases where the SPCB does not respond within time ▪ Receives updated EIA report from project proponent incorporating the considerations from the proceedings of public hearing and responses received through other media ▪ Forwards updated EIA report to the EAC for appraisal ▪ Either accepts the recommendations of EAC or asks for reconsideration of specific issues for review by the EAC. ▪ Takes the final decision – acceptance/ rejection – of the project proposal and communicates the same to the project proponent
State Government	<ul style="list-style-type: none"> ▪ Identifies experts as per the composition specified in the Notification and subsequent guidelines to recommend to the Central Government. ▪ Extends funding support to fulfill the functions of SEIAA/SEAC ▪ Engages other public agency for conducting public hearings in cases where the SPCB does not respond within time ▪ State Governments will suitably pay the public agency for conducting such activity
EAC	<ul style="list-style-type: none"> ▪ Reviews Form 1 and its attachments ▪ Visits site(s), if necessary ▪ Finalizes ToR and recommends to the Central Government, which in turn communicates the finalized ToR to the project proponent, if not exempted by the Notification ▪ Reviews EIA report, proceedings and appraises their views to the Central government ▪ If the Central Government has any specific views, then the EAC reviews again for appraisal
SEIAA	<ul style="list-style-type: none"> ▪ Receives application from the project proponent ▪ Considers SEAC's views for finalization of ToR ▪ Communicates the finalized ToR to the project proponent ▪ Receives EIA report from project proponent ▪ Uploads the summary of EIA report in the website in cases of Category B projects ▪ Forwards the responses received to the project proponent ▪ Receives updated EIA report from project proponent incorporating the considerations from the proceedings of public hearing and responses received through other media ▪ Forwards updated EIA report to SEAC for appraisal ▪ Either accepts the recommendations of SEAC or asks for reconsideration of specific issues for review by SEAC. ▪ Takes the final decision and communicates the same to the project proponent
SEAC	<ul style="list-style-type: none"> ▪ Reviews Form 1 ▪ If necessary visits, site(s) for finalizing the ToR ▪ Reviews updated EIA - EMP report and ▪ Appraises the SEIAA
SPCB	<ul style="list-style-type: none"> ▪ Receives request from project proponent and conducts public hearing in the manner prescribed. ▪ Conveys proceedings to concerned authority and project proponent
Public Agency	<ul style="list-style-type: none"> ▪ Receives request from the respective Governments to conduct public hearing ▪ Conducts public hearing in the manner prescribed. ▪ Conveys proceedings to the concerned Authority/EAC /Project proponent

5.1 SEIAA

- SEIAA is constituted by the MoEF to take final decision regarding the acceptance/rejection of prior environmental clearance to the project proposal for all Category 'B' projects.
- The state government may decide whether to house them at the Department of Environment or at any other Board for effective operational support.
- State Governments can decide whether the positions are permanent or part-time. The Central Government (MoEF) continues to follow the model of paying fee (TA/DA, accommodation, sitting fee) to the Chairperson and the members of EAC. As such, the State Government is to fund SEIAA & SEAC and decide the appropriate institutional support for them.

A. Constitution

- SEIAA is constituted by the Central Government comprising of three members including a Chairperson and the Member-Secretary to be nominated by the State Government or UT Administration concerned.
- The Central Government will notify as and when the nominations (in order) are received from the State Governments, within 30 days from the date of receipt.
- The Chairperson and the non-official member shall have a fixed term of three years, from the date of Notification by the Central Government constituting the Authority.

The form used by the State Governments to submit nominations for Notification by the Central Government is provided in **Annexure VII**.

B. Composition

- Chairperson shall be an expert in the EIA process
- Member–Secretary shall be a serving officer of the concerned State Government/ UT Administration familiar with the environmental laws.
- Member–Secretary may be of a level equivalent to the Director, Dept. of Environment or above – a full time member.
- All the members including the Chairperson shall be the experts as per the criteria set in the Notification.
- The Government servants can only serve as the Member–Secretary to SEIAA and the Secretary to SEAC. All other members including Chairperson of the SEIAA and SEAC shall not be comprised of serving Government Officers; industry representatives; and the activists.
- Serving faculty (academicians) is eligible for the membership in the Authority and/or the Committees, if they fulfill the criteria given in Appendix VI to the Notification.
- This is to clarify that the serving Government officers shall not be nominated as professional/expert member of SEIAA/SEAC/EAC.
- Professionals/Experts in the SEIAA and SEAC shall be different.

Summary regarding the eligibility criteria for Chairperson and Members of the SEIAA is given in Table 5-3.

C. Decision-making process

- The decision of the Authority shall be arrived through consensus.
- If there is no consensus, the Authority may either ask SEAC for reconsideration or may reject the approval.
- All decisions of the SEIAA shall be taken in a meeting and shall ordinarily be unanimous, provided that, in case a decision is taken by majority, the details of views, for and against it, shall be clearly recorded in the minutes and a copy thereof sent to MoEF.

Table 5-3: SEIAA: Eligibility Criteria for Chairperson / Members / Secretary

S. No.	Attribute		Requirement		
			Members	Member-Secretary	Chairperson
1	Professional qualification as per the Notification		Compulsory	Compulsory	Compulsory
2	Experience (Fulfilling any one of a, b, c)	a	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI
		b	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in Appendix VI	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in the Appendix VI
		c	Professional Qualification +10 years of experience in one of the expertise area mentioned in the Appendix VI + 5 years interface with environmental issues, problems and their management	Professional Qualification +10 years of experience in one of the expertise area mentioned in the Appendix VI + 5 years interface with environmental issues, problems and their management	-----
3	Test of independence (conflict of interest) and minimum grade of the Secretary of the Authority		<p>Shall not be a serving government officer</p> <p>Shall not be a person engaged in industry and their associations</p> <p>Shall not be a person associated with environmental activism</p>	<p>Only serving officer from the State Government (DoE) familiar with environmental laws not below the level of Director</p>	<p>Shall not be a serving government officer</p> <p>Shall not be a person engaged in industry and their associations</p> <p>Shall not be a person associated with environmental activism</p>

Stakeholders' Roles and Responsibilities

S. No.	Attribute	Requirement		
		Members	Member-Secretary	Chairperson
4	Age	Below 67 years at the time of Notification of the Authority	As per State Government Service Rules	Below 72 Years at the time of the Notification of the Authority
5	Other memberships in Central/State Expert Appraisal Committee	Shall not be a member in any SEIAA/EAC/SEAC	Shall not be a member in any SEIAA/EAC/SEAC	Shall not be a member in any SEIAA/EAC/SEAC
6	Tenure of earlier appointment (continuous)	Only one term before this in continuity is permitted	Not applicable	Only one term before this in continuity is permitted
7	Eminent environmental expertise with understanding on environmental aspects and impacts	Desirable	Desirable	Compulsory
8	Expertise in the environmental clearance process	Desirable	Desirable	Compulsory

Note:

1. A member after continuous membership in two terms (six years) shall not be considered for further continuation. His/her nomination may be considered after a gap of one term (three years), if other criteria meet.
2. Chairperson/Member once notified may not be removed prior to the tenure of three years without cause and proper enquiry.

5.2 EAC and SEAC

EAC and SEAC are independent Committees to review each developmental activity and offer its recommendations for consideration of the Central Government and SEIAA respectively.

A. Constitution

- EAC and SEAC shall be constituted by the Central Government comprising a maximum of 15 members including a Chairperson and Secretary. In case of SEAC, the State Government or UT Administration is required to nominate the professionals/experts for consideration and Notification by the Central Government.
- The Central Government will notify as and when the nominations (in order) are received from the State Governments, within 30 days from the date of receipt.
- The Chairperson and the non-official member shall have a fixed term of three years, from the date of Notification by the Central Government.
- The Chairperson shall be an eminent environmental expert with understanding on environmental aspects and environmental impacts. The Secretary of the SEAC shall be a State Government officer, not below the level of a Director/Chief Engineer.
- The members of the SEAC need not be from the same State/UT.

- In case the State Governments/ UTs so desire, the MoEF can form regional EAC to serve the concerned States/UTs.
- State Governments may decide to their convenience to house SEAC at the Department of Environment or at SPCB or at any other department, to extend support to the SEAC activities.

B. Composition

- Composition of EAC/SEAC as per the Notification is given in **Annexure VIII**.
- Secretary to EAC/SEAC may invite a maximum of two professionals/experts with the prior approval of the Chairperson, if desired, for taking the advisory inputs for appraisal. In such case, the invited experts will not take part in the decision making process.
- The Secretary of each EAC/SEAC preferably be an officer of the level equivalent to or above the level of Director, MoEF, GoI.

C. Decision-making

The EAC and SEAC shall function on the principle of collective responsibility. The Chairperson shall endeavor to reach a consensus in each case, and if consensus cannot be reached, the view of the majority shall prevail.

D. Operational issues

- Secretary may deal with all correspondence, formulate agenda and prepare agenda notes. Chairperson and other members may act only for the meetings.
- Chairperson of EAC/SEAC shall be one among the core group having considerable professional experience with proven credentials.
- EAC/SEAC shall meet at least once every month or more frequently, if so needed, to review project proposals and to offer recommendations for the consideration of the Authority.
- EAC/SEAC members may inspect the site at various stages *i.e.*, during screening, scoping and appraisal, as per the need felt and decided by the Chairperson of the Committee.
- The respective Governments through the Secretary of the Committee may pay/reimburse the participation expenses, honorarium *etc.*, to the Chairperson and members.

i. Tenure of EAC/SEIAA/SEAC

The tenure of Authority/Committee(s) shall be for a fixed period of three years. At the end of the three years period, the Authority and the committees need to be re-constituted. However, staggered appointment dates may be adopted to maintain continuity of members at a given point of time.

ii. Qualifying criteria for nomination of a member to EAC/SEIAA/SEAC

While recommending nominations and while notifying the members of the Authority and Expert Committees, it shall be ensured that all the members meet the following three criteria:

- Professional qualification

- Relevant experience/Experience interfacing with environmental management
- Absence of conflict of interest

These are elaborated subsequently.

a) Professional qualification

The person should have at least

- 5 years of formal University training in the concerned discipline leading to a MA/MSc Degree, or
- In case of Engineering/Technology/Architecture disciplines, 4 years formal training in a professional training course together with prescribed practical training in the field leading to a B.Tech/B.E./B.Arch. Degree, or
- Other professional degree (e.g. Law) involving a total of 5 years of formal University training and prescribed practical training, or
- Prescribed apprenticeship/articleship and pass examinations conducted by the concerned professional association (e.g. MBA/IAS/IFS). In selecting the individual professionals, experience gained by them in their respective fields will be taken note of.

b) Relevant experience

- Experience shall be related to professional qualification acquired by the person and be related to one or more of the expertise mentioned for the expert members. Such experience should be a minimum of 15 years.
- When the experience mentioned in the foregoing sub-paragraph interfaces with environmental issues, problems and their management, the requirement for the length of the experience can be reduced to a minimum of 10 years.

c) Absence of conflict of interest

For the deliberations of the EAC/SEAC to be independent and unbiased, all possibilities of potential conflict of interests have to be eliminated. Therefore, serving government officers; persons engaged in industry and their associations; persons associated with the formulation of development projects requiring environmental clearance, and persons associated with environmental activism shall not be considered for membership of SEIAA/ SEAC/ EAC.

iii. Age

Below 70 years for the members and below 72 years for the Chairperson of the SEIAA/SEAC/EAC. The applicability of the age is at the time of the Notification of the SEIAA/SEAC/EAC by the Central Government.

Summary regarding the eligibility criteria for Chairperson and Members of the EAC/ SEAC are given in Table 5-4.

Table 5-4: EAC/SEAC: Eligibility Criteria for Chairperson / Members / Secretary

S. No.	Attribute	Requirement			
		Expert members	Secretary	Chairperson	
1	Professional qualification as per the Notification	Compulsory	Compulsory	Compulsory	
2	Experience (Fulfilling any one of a, b, c)	a	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI
		b	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in Appendix VI
		c	Professional Qualification +10 years of experience in one of the expertise area mentioned in the Appendix VI + 5 years interface with environmental issues, problems and their management	Professional Qualification +10 years of experience in one of the expertise area mentioned in the Appendix VI + 5 years interface with environmental issues, problems and their management	-----
3	Test of independence (conflict of interest) and minimum grade of the Secretary of the Committees	<p>Shall not be a serving government officer</p> <p>Shall not be a person engaged in industry and their associations</p> <p>Shall not be a person associated with environmental activism</p>	<p>In case of EAC, not less than a Director from the MoEF, Government of India</p> <p>In case of SEAC, not below the level of Director/Chief Engineer from the State Government (DoE)</p>	<p>Shall not be a serving government officer</p> <p>Shall not be a person engaged in industry and their associations</p> <p>Shall not be a person associated with environmental activism</p>	
4	Age	Below 67 years at the time of Notification of the Committee	As per state Government Service Rules	Below 72 Years at the time of the Notification of the Committee	
5	Membership in Central /State Expert Appraisal committee	Only one other than this nomination is permitted	Shall not be a member in other SEIAA/EAC/SEAC	Shall not be a member in any other SEIAA/EAC/SEAC	
6	Tenure of earlier appointment (continuous)	Only one term before this in continuity is permitted	Not applicable	Only one term before this in continuity is permitted	

Stakeholders' Roles and Responsibilities

S. No.	Attribute	Requirement		
		Expert members	Secretary	Chairperson
7	Eminent environmental expertise with understanding on environmental aspects and impacts	Desirable	Not applicable	Compulsory

Note:

1. A member after continuous membership in two terms (six years) shall not be considered for further continuation. His/her nomination may be reconsidered after a gap of one term (three years), if other criteria meet.

2. Chairperson/Member once notified may not be removed prior to the tenure of 3 years with out cause and proper enquiry. A member after continuous membership in two terms (6 years) shall not be considered for further continuation. The same profile may be considered for nomination after a gap of three years, i.e., one term, if other criteria are meeting.

E. Other conditions

- An expert member of one State/UT, can have at the most another State/UT Committee membership, but in no case more than two Committees at a given point of time.
- An expert member of a Committee shall not have membership continuously in the same committee for more than two terms, i.e. six years. They can be nominated after a gap of three years, i.e., one term. When a member of Committee has been associated with any development project, which comes for environmental clearance, he/she may not participate in the deliberations and the decisions in respect to that particular project.
- At least four members shall be present in each meeting to fulfill the quorum.
- If a member does not consecutively attend six meetings, without prior intimation to the Committee his/her membership may be terminated by the Notifying Authority. Prior information for absence due to academic pursuits, career development and national/state-endorsed programmes may be considered as genuine grounds for retention of membership.

ANNEXURE I
General Standards for Discharge of Environmental Pollutants

Table: Water Quality Standards

S. No.	Parameter	Standards			
		Inland Surface Water	Public Sewer	Land for Irrigation	Marine Coastal Areas
1.	2.	3.			
		(a)	(b)	(c)	(d)
1.	Colour and odour	See Note-1	—	See Note-1	See Note-1
2.	Suspended Solids, mg/l, Max	100	600	200	(a) For process waste water-100 (b) For cooling water effluent-10 per cent above total suspended matter of influent cooling water.
3.	Particle size of suspended solids	Shall pass 850 micron IS Sieve	—	—	(a) Floatable solids, Max 3 mm (b) Settleable solids Max 850 microns.
4.	Dissolved solids (inorganic), mg/a, mac	2100	2100	2100	—
5.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6.	Temperature °C, Max	Shall not exceed 40 in any section of the stream within 15 meters down stream from the effluent outlet	45 at the point of discharge	—	45 at the point of discharge
7.	Oil and grease, mg/l, max	10	20	10	20
8.	Total residual chlorine, mg/l, Max.	1.0	—	—	1.0
9.	Ammonical nitrogen (as N), mg/l, Max.	50	50	—	50
10.	Total Kjeldahl nitrogen (as N), mg/l, Max.	100	—	—	100
11.	Free Ammonia (as NH ₃), mg/l, Max.	5.0	—	—	5.0
12.	Biochemical Oxygen Demand (5 days at 20°C) Max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/l, Max.	250	—	—	250
14.	Arsenic (as As), mg/l, Max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg), mg/l, Max.	0.01	0.01	—	0.01
16.	Lead (as Pb), mg/l, Max.	0.1	1.0	—	1.0
17.	Cadmium (as Cd), mg/l, Max.	2.0	1.0	—	2.0

18.	Hexavalent chromium (as Cr+6) mg/l, Max.	0.1	2.0	—	1.0
19.	Total chromium as (Cr), mg/l, Max.	2.0	2.0	—	2.0
20.	Copper (as Cu), mg/l, Max.	3.0	3.0	—	3.0
21.	Zinc (as Zn), mg/l, Max.	5.0	15	—	15
22.	Selenium (as Se), mg/l, Max.	0.05	0.05	—	0.05
23.	Nickel (as Ni), mg/l, Max.	3.0	3.0	—	5.0
24.	Boron (as B), mg/l, Max.	2.0	2.0	2.0	—
25.	Percent Sodium, Max.	—	60	60	—
26.	Residual sodium carbonate, mg/l, Max.	—	—	5.0	—
27.	Cyanide (as CN), mg/l, Max.	0.2	2.0	0.2	0.2
28.	Chloride (as Cl), mg/l, Max.	1000	1000	600	(a)
29.	Fluoride (as F), mg/l, Max.	2.0	15	—	15
30.	Dissolved Phosphates (as P), mg/l, Max.	5.0	—	—	—
31.	Sulphate (as SO ₄), mg/l, Max.	1000	1000	1000	—
32.	Sulphide (as S), mg/l, Max.	2.0	—	—	5.0
33.	Pesticides	Absent	Absent	Absent	Absent
34.	Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max.	1.0	5.0	—	5.0
35.	Radioactive materials				
	(a) Alpha emitters MC/ml, Max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁸	10 ⁻⁷
	(b) Beta emitters uc/ml, Max.	10 ⁻⁶	10 ⁻⁶	10 ⁻⁷	10 ⁻⁶

Note :-

1. All efforts should be made to remove colour and unpleasant odour as far as practicable.
2. The standards mentioned in this notification shall apply to all the effluents discharged such as industrial mining and mineral processing activities municipal sewage etc.

Table: Noise Standards

Ambient air quality standards in respect of noise

Area Code	Category of Area	Limits in dB (A) Leq	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence zone	50	40

Note :

1. Day time is reckoned in between 6.00 AM and 9.00 PM
2. Night time is reckoned in between 9.00 PM and 6.00 AM
3. Silence zone is defined as areas upto 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority.
4. Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.
5. Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.

Standards/Guidelines for Control of Noise Pollution from Stationary Diesel Generator (DG) Sets

(A) Noise Standards for DG Sets (15-500 KVA)

The total sound power level, L_w , of a DG set should be less than, $94+10 \log_{10} (KVA)$, dB (A), at the manufacturing stage, where, KVA is the nominal power rating of a DG set.

This level should fall by 5 dB (A) every five years, till 2007, i.e. in 2002 and then in 2007.

(B) Mandatory acoustic enclosure/acoustic treatment of room for stationary DG sets (5 KVA and above)

Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the room acoustically.

The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5m from the acoustic enclosure/room, and then averaged.

The DG set should also be provide with proper exhaust muffler with Insertion Loss of minimum 25 dB(A).

(C) Guidelines for the manufacturers/users of DG sets (5 KVA and above)

1. The manufacturer should offer to the user a standard acoustic enclosure of 25 dB(A) Insertion Loss and also a suitable exhaust muffler with Insertion Loss of 25 dB(A).

2. The user should make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise requirements by proper siting and control measures.
3. The manufacturer should furnish noise power levels of the unlicensed DG sets as per standards prescribed under (A)
4. The total sound power level of a DG set, at the user's end, shall be within 2 dB(A) of the total sound power level of the DG set, at the manufacturing stage, as prescribed under (A).
5. Installation of a DG set must be strictly in compliance with the recommendation of the DG set manufacturer.
6. A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

Order of the Lt. Governor of Delhi in respect of D.G. Sets (5th December, 2001)

In exercise of the powers conferred by section 5 of the Environment (Protection) Act, 1986, (29 of 1986), read with the Government of India, Ministry of Home Affairs notification S.O. 667 (E) bearing No. F.No. U-11030/J/91-VTL dated 10th September, 1992, the Lt. Governor of Government of National Capital of Delhi hereby directs to all owners/users of generators sets in the National Capital Territory of Delhi as follows :-

1. that generator sets above the capacity of 5 KVA shall not be operated in residential areas between the hours of 10.00 PM to 6.00 AM;
2. that the generator sets above the capacity of 5 KVA in all areas residential/commercial/industrial shall operate only with the mandatory acoustic enclosures and other standards prescribed in the Environment (Protection) Rules, 1986;
3. that mobile generator sets used in social gatherings and public functions shall be permitted only if they have installed mandatory acoustic enclosures and adhere to the prescribed standards for noise and emission as laid down in the Environment (Protection) Rules, 1986.

The contravention of the above directions shall make the offender liable for prosecution under section 15 of the said Act which stipulates punishment of imprisonment for a term which may extend to five years with fine which may extend to one lakh rupees, or with both, and in case the failure of contravention continues, with additional fine which may extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first such failure or contravention and if still the failure or contravention continues beyond a period of one year after the date of contravention, the offender continues beyond a period of one year after the date of contravention, the offender shall be punishable with imprisonment for a term which may extend to seven years.

Order Dated: 21st June, 2002

In exercise of the powers conferred by section 5 of the Environment (Protection) Act, 1986 (29 of 1986) read with the Govt. of India, Ministry of Home Affairs notification S.O. 667(E) bearing No. U-11030/J/91-VTL dated the 10th September, 1992, the Lt. Governor Govt. of the National Capital Territory of Delhi hereby makes the following amendment/modification in his order dated the 5th December, 2001 regarding the operation of generator sets, namely:-

Amendments/modifications

In the above said order, for clause(1), the following shall be substituted, namely:-

“(1) that the generator sets above 5KVA shall not be operated in residential areas between the hours from 10.00 p.m. to 6.00 a.m. except generator sets of Group Housing Societies and Multi-storey residential apartments”.

DIESEL GENERATOR SETS: STACK HEIGHT

The minimum height of stack to be provided with each generator set can be worked out using the following formula:

$$H = h + 0.2 \times \text{OKVA}$$

H = Total height of stack in metre

h = Height of the building in metres where the generator set is installed

KVA = Total generator capacity of the set in KVA

Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorized as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Ht. of the building + 1.5 metre
50-100 KVA	Ht. of the building + 2.0 metre
100- 150 KVA	Ht. of the building + 2.5 metre
150-200 KVA	Ht. of the building + 3.0 metre
200-250 KVA	Ht. of the building + 3.5 metre
250-300 KVA	Ht. of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula

Source: Evolved By CPCB

[Emission Regulations Part IV: COINDS/26/1986-87]

ANNEXURE II
Form 1 (Application for Obtaining EIA Clearance)

FORM 1

(I) Basic Information

Name of the Project:

Location / site alternatives under consideration:

Size of the Project: *

Expected cost of the project:

Contact Information:

Screening Category:

- *Capacity corresponding to sectoral activity (such as production capacity for manufacturing, mining lease area and production capacity for mineral production, area for mineral exploration, length for linear transport infrastructure, generation capacity for power generation etc.,)*

(II) Activity

- 1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)**

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)		
1.2	Clearance of existing land, vegetation and buildings?		
1.3	Creation of new land uses?		
1.4	Pre-construction investigations e.g. bore houses, soil testing?		
1.5	Construction works?		

1.6	Demolition works?		
1.7	Temporary sites used for construction works or housing of construction workers?		
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations		
1.9	Underground works including mining or tunneling?		
1.10	Reclamation works?		
1.11	Dredging?		
1.12	Offshore structures?		
1.13	Production and manufacturing processes?		
1.14	Facilities for storage of goods or materials?		
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?		
1.16	Facilities for long term housing of operational workers?		
1.17	New road, rail or sea traffic during construction or operation?		
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?		
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?		
1.20	New or diverted transmission lines or pipelines?		
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?		
1.22	Stream crossings?		
1.23	Abstraction or transfers of water form ground or surface waters?		
1.24	Changes in water bodies or the land surface affecting drainage or run-off?		

1.25	Transport of personnel or materials for construction, operation or decommissioning?		
1.26	Long-term dismantling or decommissioning or restoration works?		
1.27	Ongoing activity during decommissioning which could have an impact on the environment?		
1.28	Influx of people to an area in either temporarily or permanently?		
1.29	Introduction of alien species?		
1.30	Loss of native species or genetic diversity?		
1.31	Any other actions?		

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S.No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)		
2.2	Water (expected source & competing users) unit: KLD		
2.3	Minerals (MT)		
2.4	Construction material – stone, aggregates, and / soil (expected source – MT)		
2.5	Forests and timber (source – MT)		
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)		
2.7	Any other natural resources (use appropriate standard units)		

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)		
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)		
3.3	Affect the welfare of people e.g. by changing living conditions?		
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,		
3.5	Any other causes		

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes		
4.2	Municipal waste (domestic and or commercial wastes)		
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)		

4.4	Other industrial process wastes		
4.5	Surplus product		
4.6	Sewage sludge or other sludge from effluent treatment		
4.7	Construction or demolition wastes		
4.8	Redundant machinery or equipment		
4.9	Contaminated soils or other materials		
4.10	Agricultural wastes		
4.11	Other solid wastes		

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources		
5.2	Emissions from production processes		
5.3	Emissions from materials handling including storage or transport		
5.4	Emissions from construction activities including plant and equipment		
5.5	Dust or odours from handling of materials including construction materials, sewage and waste		

5.6	Emissions from incineration of waste		
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)		
5.8	Emissions from any other sources		

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers		
6.2	From industrial or similar processes		
6.3	From construction or demolition		
6.4	From blasting or piling		
6.5	From construction or operational traffic		
6.6	From lighting or cooling systems		
6.7	From any other sources		

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials		
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)		
7.3	By deposition of pollutants emitted to air into the land or into water		
7.4	From any other sources		
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?		

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances		
8.2	From any other causes		
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?		

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	<p>Lead to development of supporting. lities, ancillary development or development stimulated by the project which could have impact on the environment e.g.:</p> <ul style="list-style-type: none"> • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other 		
9.2	Lead to after-use of the site, which could have an impact on the environment		
9.3	Set a precedent for later developments		
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects		

(III) Environmental Sensitivity

S.No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value		

2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests		
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration		
4	Inland, coastal, marine or underground waters		
5	State, National boundaries		
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas		
7	Defence installations		
8	Densely populated or built-up area		
9	Areas occupied by sensitive man-made land uses (<i>hospitals, schools, places of worship, community facilities</i>)		
10	Areas containing important, high quality or scarce resources (<i>ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals</i>)		
11	Areas already subjected to pollution or environmental damage. (<i>those where existing legal environmental standards are exceeded</i>)		
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (<i>earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions</i>)		

(IV). Proposed Terms of Reference for EIA studies

ANNEXURE III
Critically Polluted Industrial Areas and Clusters/Potential Impact
Zone

**Table 1: Details of Critically Polluted Industrial Areas and Clusters / Potential Impact Zone
(Ref: Office Memorandum No. J-11013/5/2010-IA.II(I) Dated 13.1.2010)**

S. No.	Critically Polluted Industrial Area and CEPI	Industrial Clusters/ Potential Impact Zones
1.	Ankeshwar (Gujarat) CEPI-88.50(Ac_Wc_Lc)	<ul style="list-style-type: none"> ▪ GIDC Ankeshwar and GIDC, Panoli
2	Vapi (Gujarat) CEPI-88.09(Ac_Wc_Lc)	<ul style="list-style-type: none"> ▪ GIDC Vapi
3	Ghaziabad (Uttar Pradesh) CEPI-87.37(Ac_Wc_Lc)	<p>Sub-cluster A</p> <ul style="list-style-type: none"> ▪ Mohan nagar industrial area ▪ Rajinder nagar industrial area ▪ Sahibabad industrial area <p>Sub-cluster B</p> <ul style="list-style-type: none"> ▪ Pandav nagar industrial area ▪ Kavi nagar industrial area ▪ Bulandshahar road industrial area ▪ Amrit nagar ▪ Aryanagar industrial area <p>Sub-cluster C</p> <ul style="list-style-type: none"> ▪ Merrut road industrial are <p>Sub-cluster D</p> <ul style="list-style-type: none"> ▪ Loni industrial area ▪ Loni Road industrial area ▪ Roop nagar industrial area <p>Sub-cluster E</p> <ul style="list-style-type: none"> ▪ Hapur Road industrial area ▪ Dasna ▪ Philkura <p>Sub-cluster F (Other scattered industrial areas)</p> <ul style="list-style-type: none"> ▪ South side of GT road ▪ Kavi Nagar ▪ Tronica city ▪ Anand Nagar ▪ Jindal Nagar ▪ Prakash Nagar ▪ Rural industrial estate
4	Chandrapur (Maharashtra) CEPI-83.88 (Ac_Wc_Lc)	<ul style="list-style-type: none"> ▪ Chandrapur (MIDC Chandrapur, Tadali, Ghuggus, Ballapur)
5	Kobra (Chhatisgarh) CEPI-83.00 (Ac_Ws_Lc)	<ul style="list-style-type: none"> ▪ Industrial areas and their townships of NTPC, BALCO, CSEB (East) & CSEB (West) ▪ Korba town
6	Bhiwadi (Rajasthan) CEPI-82.91 (Ac_Wc_Ls)	<ul style="list-style-type: none"> ▪ RIICO industrial areas Phase I to IV ▪ Bhiwadi town ▪ Other surrounding industrial areas: Chopanki, Rampura Mundana, Khuskhera Phase I to III
7	Angul Talcer(Orissa) CEPI-82.09 (Ac_Wc_Lc)	<ul style="list-style-type: none"> ▪ MCL Coal mining area, Augul – Talcer region ▪ Industrial area (60 km x 45 km) <p>Following blocks of Augul district:</p> <ul style="list-style-type: none"> ▪ Kohina block ▪ Talcher block

		<ul style="list-style-type: none"> ▪ Angul block ▪ Chhendipada block ▪ Banarpal block ▪ Odapada block of Dhenkamal district
8	Vellore (North Arcot) (Tamil Nadu) CEPI-81.79 (Ac_Wc_Lc)	<ul style="list-style-type: none"> ▪ Ranipet, SIPCOT industrial complex
9	Singrauli (Uttar Pradesh) CEPI-81.73 (Ac_Wc_Ls)	<p>Sonebhadra (UP)</p> <ul style="list-style-type: none"> ▪ Dala-Tola ▪ Obra ▪ Renukoot ▪ Anpara ▪ Renusagar ▪ Kakri ▪ Dudhichuwa ▪ Bina ▪ Khadia ▪ Shakti nagar ▪ Rihand nagar ▪ Bijpur <p>Sigrauli (Madhya Pradesh)</p> <p>Vindhyachal nagar and Jaynat, Nigahi, Dudhichua, Amlohri & Jhingurdah townships</p>
10	Ludhiana (Punjab) CEPI-81.66 (Ac_Wc_Ls)	<p>Ludhiana municipal limits covering industrial clusters:</p> <ul style="list-style-type: none"> ▪ Focal point along with NH-I- Total eight phase ▪ Industrial area-B- from sherpur chowk to Gill road & Gill road to Miller Kotla road (left side of road) ▪ Mixed industrial area – right side of Gill road ▪ Industrial area –C (near Juglana village) ▪ Industrial area A & extension: area between old GT road and Ludhiana bypass road ▪ Industrial estate: near Dholwal chowk ▪ Mixes industrial area (MIA) Miller gunj ▪ MIA – bypass road ▪ Bahdur industrial area ▪ Tejpur industrial complex
11	Nazafgarh drain basin, Delhi CEPI-79.54 (As_Wc_Lc)	<ul style="list-style-type: none"> ▪ Industrial areas: Anand Parvat, Naraina, Okhla and Wazirpur
12	Noida (Uttar Pradesh) CEPI-78.90 (Ac_Wc_Lc)	<p>Territorial Jurisdiction of:</p> <ul style="list-style-type: none"> ▪ Noida Phase-1 ▪ Noida Phase-2 ▪ Noida Phase-3 ▪ Surajpur industrial area ▪ Greater Noida industrial area ▪ Village- Chhaparaula
13	Dhanbad (Jharkhand) CEPI-78.63 (Ac_Ws_Lc)	<p>Four blocks of Dhanbad district:</p> <ul style="list-style-type: none"> ▪ Sadar (Dhanbad Municipality) ▪ Jharia (Jharia Municipality, Sindri industrial area) ▪ Govindpur (Govindpur industrial estate) ▪ Nirsa
14	Dombivalli (Maharashtra) CEPI-78.41 (Ac_Wc_Ls)	<ul style="list-style-type: none"> ▪ MIDC Phase- I, Phase- II

15	Kanpur (Uttar Pradesh) CEPI-78.09 (Ac_Wc_Ls)	Industrial areas: <ul style="list-style-type: none"> ▪ Dada nagar ▪ Panki ▪ Fazalganj ▪ Vijay nagar ▪ Jajmau
16	Cuddalore (Tamil Nadu) CEPI-77.45 (As_Wc_Lc)	<ul style="list-style-type: none"> ▪ SIPCOT industrial complex, Phase I & II
17	Aurangabad (Maharashtra) CEPI-77.44 (Ac_Wc_Ls)	<ul style="list-style-type: none"> ▪ MIDC Chikhalthana, MIDC Waluj, MIDC Shendra, and Paithan road industrial area
18	Faridabad (Haryana) CEPI-77.07 (Ac_Ws_Lc)	<ul style="list-style-type: none"> ▪ Sector 27-A, B, C, D ▪ DLF phase- 1, sector 31,32 ▪ DLF phase- 2, sector 35 ▪ Sector 4, 6, 24, 27, 31, 59 ▪ Industrial area Hatin ▪ Industrial model township
19	Agra (Uttar Pradesh) CEPI-76.48 (As_Wc_Ls)	<ul style="list-style-type: none"> ▪ Nunihai industrial estate, Rambag nagar, UPSIDC industrial area, and Runukata industrial area
20	Manali (Tamil Nadu) CEPI-76.32 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ Manali industrial area
21	Haldia (West Bengal) CEPI-75.43 (As_Wc_Ls)	<ul style="list-style-type: none"> ▪ 5 km wide strip (17.4 x 5.0 km) of industrial area on the southern side of the confluence point of Rivers Hugli and Rupnarayan, covering ▪ Haldia municipal area & Sutahata block – I and II
22	Ahmedabad (Gujarat) CEPI-75.28 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ GIDC Odhav ▪ GIDC Naroda
23	Jodhpur (Rajasthan) CEPI-75.19 (As_Wc_Ls)	<ul style="list-style-type: none"> ▪ Industrial areas including Basni areas (phase-I & II), industrial estate, light & heavy industrial areas, industrial areas behind new power house, Mandore, Bornada, Sangariya and village Tanwada & Salawas. ▪ Jodhpur city
24	Greater Cochin (Kerala) CEPI-75.08 (As_Wc_Ls)	<ul style="list-style-type: none"> ▪ Eloor-Edayar industrial belt, ▪ Ambala Mogal industrial areas
25	Mandi Gobind Garh (Punjab) CEPI-75.08 (Ac_Ws_Lc)	<ul style="list-style-type: none"> ▪ Mandi Govindgarh municipal limit and khanna area
26	Howrah (West Bengal) CEPI-74.84 (As_Ws_Lc)	<ul style="list-style-type: none"> ▪ Liluah-Bamangachhi region, Howrah ▪ Jalan industrial complex-1, Howrah
27	Vatva (Gujarat) CEPI-74.77 (Ac_Wc_Ls)	<ul style="list-style-type: none"> ▪ GIDC Vatva, Narol industrial area (Villages Piplaj, Shahwadi, Narol)
28	Ib Valley (Orissa) CEPI-74.00 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ Ib Valley of Jharsuguda (Industrial and mining area)
29	Varansi-Mirzapur (Uttar Pradesh) CEPI-73.79 (As_Wc_Ls)	<ul style="list-style-type: none"> ▪ Industrial estate, Mirzapur ▪ Chunar ▪ Industrial estate, Chandpur, Varansi ▪ UPSIC, industrial estate, Phoolpur ▪ Industrial area, Ramnagar, Chandauli
30	Navi Mumbai (Maharashtra) CEPI-73.77 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ TTC industrial area, MIDC, Navi Mumbai (including Bocks-D, C, EL, A, R, General, Kalva)

31	Pali (Rajasthan) CEPI-73.73 (As_Wc_Ls)	<ul style="list-style-type: none"> ▪ Existing industrial areas: Mandia road, Puniyata road, Sumerpur ▪ Pali town
32	Mangalore (Karnataka) CEPI-73.68 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ Baikampady industrial area
33	Jharsuguda (Orissa) CEPI-73.34 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ Ib valley of Jharsuguda (Industrial and mining area)
34	Coimbatore (Tamil Nadu) CEPI-72.38 (Ac_Ws_Ln)	<ul style="list-style-type: none"> ▪ SIDCO, Kurichi industrial Clusters
35	Bhadravati (Karnataka) CEPI-72.33 (Ac_Ws_Ln)	<ul style="list-style-type: none"> ▪ KSSIDC Industrial area, Mysore paper mill & VISL township complex
36	Tarapur (Maharashtra) CEPI-72.01 (Ac_Ws_Ls)	<ul style="list-style-type: none"> ▪ MIDC Tarapur
37	Panipat (Haryana) CEPI-71.91 (As_Ws_Ls)	<ul style="list-style-type: none"> ▪ Panipat municipal limit and its industrial clusters
38	Indore (Madhya Pradesh) CEPI-71.26 (As_Ws_Ls)	<p>Following 09 industrial area:</p> <ul style="list-style-type: none"> ▪ Sanwer road ▪ Shivaji nagar ▪ Pologround ▪ Laxmibai nagar ▪ Scheme no.71 ▪ Navlakha ▪ Pipliya ▪ Palda ▪ Rau <p>Indore city</p> <p>Other surrounding industrial areas: Manglia, Rajoda, Asrawad, Tejpur Gadwadi</p>
39	Bhavnagar (Gujarat) CEPI-70.99 (As_Ws_Ls)	<ul style="list-style-type: none"> ▪ GIDI Chitra, Bhavnagar
40	Vishakhapatnam (Andhra Pradesh) CEPI-70.82 (As_Ws_Ls)	<ul style="list-style-type: none"> ▪ Bowl area (the area between Yarada hill range in the south to Simhachalam hill range in the north and sea on the east and the present NH-5 in the west direction)
41	Junagarh (Gujarat) CEPI-70.82 (As_Ws_Ls)	<p>Industrial areas:</p> <ul style="list-style-type: none"> ▪ Sabalpur ▪ Jay Bhavani ▪ Jay Bhuvneshwari ▪ GIDC Junagarh (I&II)
42	Asansole (West Bengal) CEPI-70.20 (As_Ws_Ls)	<ul style="list-style-type: none"> ▪ Bumpur area surrounding IISCO
43	Patancheru - Bollaram (Andhra Pradesh) CEPI-70.07 (As_Ws_Ls)	<p>Industrial area:</p> <ul style="list-style-type: none"> ▪ Patancheru ▪ Bollaram

Note:

Names of identified industrial clusters/potential impact zones are approximate location based on rapid survey and assessment and may alter partially subject to the detailed field study and monitoring. Detailed mapping will be made available showing spatial boundaries of the identified industrial clusters including zone of influence/ buffer zone, after in depth field study.

ANNEXURE IV
Types of Monitoring and Network Design Considerations

TYPES OF MONITORING AND NETWORK DESIGN CONSIDERATIONS

A. Types of Monitoring

Monitoring refers to the collection of data using a series of repetitive measurements of environmental parameters (or, more generally, to a process of systematic observation). The environmental quality monitoring programme design will be dependent upon the monitoring objectives specified for the selected area of interest. The main types of EIA monitoring activities are:

- Baseline monitoring is the measurement of environmental parameters during the pre-project period for the purpose of determining the range of variation of the system and establishing reference points against which changes can be measured. This leads to the assessment of the possible (additional available) assimilative capacity of the environmental components in pre-project period w.r.t. the standard or target level.
- Effects monitoring is the measurement of environmental parameters during project construction and implementation to detect changes which are attributable to the project to provide the necessary information to:
 - verify the accuracy of EIA predictions; and
 - determine the effectiveness of measures to mitigate adverse effects of projects on the environment.
 - Feedback from environmental effect monitoring programs may be used to improve the predictive capability of EIAs and also determine whether more or less stringent mitigation measures are needed
- Compliance monitoring is the periodic sampling or continuous measurement of environmental parameters to ensure that regulatory requirements and standards are being met.

Compliance and effects monitoring occurs during the project construction, operation, and abandonment stages. The resources and institutional set-up should be available for the monitoring at these stages. All large-scale construction projects will require some construction stage monitoring. To control the environmental hazards of construction as specified in the EIA, a monitoring program should be established to ensure that each mitigation measure is effectively implemented. There are numerous potential areas for monitoring during operations.

The scope of monitoring topics discussed in this chapter is limited to Baseline and Effects monitoring. In addition, this chapter will also discuss the Compliance monitoring during the construction phase. Post-project monitoring requirements are discussed in the EMP.

Before any field monitoring tasks are undertaken there are many institutional, scientific, and fiscal issues that must be addressed in the implementation of an environmental monitoring program. Careful consideration of these issues in the design and planning stages will help avoid many of the pitfalls associated with environmental monitoring programs. Although these issues are important but the discussions here are confined to the monitoring network design component.

B. Network Design

Analysis of Significant Environmental Issues

At the outset of planning for an environmental monitoring network, the EIA manager may not know exactly what should be monitored, when monitoring should begin, where it should monitor, which techniques should be employed, and who should take responsibility for its conduct. Because there are usually a number of objective decisions associated with network design to be

made, it is important to start with an analysis of environmental issues. The scoping phase of an EIA is designed to identify and focus on the major issues. Scoping should provide a valuable source of information on the concerns that need to be addressed by the monitoring network design. These are project specific as well as specific to the environmental setting of the location where the project is proposed to be located

Hence, the network designs are associated with questions like:

- What are the expected outputs of the monitoring activity?
- Which problems do we need to address to? *etc.*

Defining the output will influence the design of the network and optimize the resources used for monitoring. It will also ensure that the network is specially designed to optimize the information on the problems at hand

What to Monitor?

The question of what to monitor is associated with the identification of VECs.

VECs are generally defined as environmental attributes or components of the environment that are valued by society as identified during the scoping stage of the project. They are determined on the basis of perceived public concerns. For example, changes to water quality and quantity could have implications on fish by affecting habitat, food supply, oxygen, and contaminant uptake. Similarly, employment and business, and economies are both VECs that serve as pathways.

The choice of VECs is also related to the perceived significant impact of the project implementation on important environmental components. In general, the significance or importance of environmental components is judged based on:

- legal protection provided (for example, rare and endangered species)
- political or public concerns (for example, resource use conflicts and sustainable development)
- scientific judgment (for example, ecological importance); or
- commercial or economic importance

However, in addition to their economic, social, political or ecological significance, the chosen VEC should also have unambiguous operational ease, be accessible to prediction and measurement; and be susceptible to hazard. Once the VECs are defined, the VECs may be directly measured (for example, extent of habitat for an endangered species). In cases where it is impossible or impractical to directly measure the VECs, the chosen measurement endpoints or environmental indicators must correspond to, or be predictive of assessment endpoints.

The chosen environmental indicators must be: 1) measurable; 2) appropriate to the scale of disturbance/ contamination; 3) appropriate to the impact mechanism; 4) appropriate and proportional to temporal dynamics; 5) diagnostic; and 6) standardized; as well as have: 1) a low natural variability; 2) a broad applicability; and 3) an existing data series.

Where, How and How Many Times to Monitor?

These are the other components of Monitoring Network Design. These questions are best answered based on local field conditions, capacity and resources available, prevailing legal and regulatory priorities, *etc.* For this screening or reconnaissance Surveys of the study area also necessary. This may also include some simple inexpensive measurements and assimilative/dispersion modeling. The data will give some information on the prevailing special and temporal variations, and the general background air pollution in the area. The number of monitoring stations and the indicators to be measured at each station in the final permanent network may then be decided upon based on the results of the screening study as well as on the

knowledge of the sources of the proposed development and prevailing local environmental/meteorological conditions. The best possible definition of the air pollution problem, together with the analysis of the resources: personnel, budget and equipment available, represent the basis for the decision on the following questions:

- What spatial density (number) of sampling stations is required? How many samples are needed and during what period (sampling (averaging) time and frequency)?
- Where should the stations be located?
- What kind of equipment should be used?
- What additional background information is needed?
 - meteorology
 - topography
 - population density
 - emission sources and emission rates
 - effects and impacts
- How will the data be made available/communicated?

C. Site Selection

This normally means that for designing a monitoring programme in an (study) area which might have an impact, several monitoring stations are needed for characterizing the baseline conditions of the impacted area. When considering the location of individual samplers, it is essential that the data collected are representative for the location and type of area without the undue influence from the immediate surroundings. In any measurement point in the study area the total ambient concentration is the representative of:

- natural background concentration
- regional background
- impact of existing large regional sources such as Industrial emissions

To obtain the information about the importance of these different contributions it is therefore necessary to locate monitoring stations so that they are representative for different impacts. In addition to the ambient pollution data, one would often need other data governing the variations such as meteorological data for air pollution, to identify and quantify the sources contributing to the measurements.. When considering the location of individual samplers, it is essential that the data collected are representative for the location and type of area without undue influence from the immediate surroundings.

ANNEXURE V
Guidance for Assessment of Baseline Components and Attributes

GUIDANCE FOR ASSESSMENT OF BASELINE COMPONENTS AND ATTRIBUTES*

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
A. Air				
<ul style="list-style-type: none"> ▪ Meteorological ▪ Wind speed ▪ Wind direction ▪ Dry bulb temperature ▪ Wet bulb temperature ▪ Relative humidity ▪ Rainfall ▪ Solar radiation ▪ Cloud cover 	<p>Minimum 1 site in the project impact area requirements</p> <p>Other additional site(s) are require depending upon the model applied or site sensitivities</p>	<p>Min: 1 hrly observations from continuous records</p>	<p>Mechanical / automatic weather station</p> <p>Rain gauge</p> <p>As per IMD</p> <p>As per IMD</p>	<p>IS 5182 Part 1-20 Sit-specific primary data is essential</p> <p>Secondary data from IMD, New Delhi for the nearest IMD station</p>
<p>Pollutants</p> <ul style="list-style-type: none"> ▪ SPM ▪ RPM ▪ SO₂ ▪ NO₂ ▪ CO ▪ H₂S* ▪ NH₃* ▪ HC* ▪ Fluoride* ▪ Pb* ▪ VOC-PAH* ▪ Mercury* <p>(parameters to be proposed by the proponent, in draft ToR, which will be reviewed and approved by EAC/SEAC)</p>	<p>10 to 15 locations in the project impact area</p>	<p>24 hrly twice a week</p> <p>8 hrly twice a week</p> <p>24 hrly twice a week</p>	<ul style="list-style-type: none"> ▪ Gravimetric (High – Volume) ▪ Gravimetric (High – Volume with Cyclone) ▪ EPA Modified West & Gaeke method ▪ Arsenite Modified Jacob & Hochheiser ▪ NDIR technique ▪ Methylene-blue ▪ Nessler’s Method ▪ Infra Red analyzer ▪ Specific Ion meter 	<p>Monitoring Network</p> <ul style="list-style-type: none"> ▪ Minimum 2 locations in upwind side, more sites in downwind side / impact zone ▪ All the sensitive receptors need to be covered <p>Measurement Methods</p> <p>As per CPCB standards for NAQM, 1994</p>

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
B. Noise				
Hourly equivalent noise levels	Same as for Air Pollution along with others Identified in study area	At least one day continuous in each season on a working and non-working day	Instrument : Sensitive Noise level meter (preferably recording type)	Min: IS: 4954- 1968 as adopted by CPCB
Hourly equivalent noise levels	Inplant (1.5 m from machinery or high emission processes)	Same as above for day and night	Instrument : Noise level metre	CPCB / OSHA
Hourly equivalent noise levels	Highways (within 500 metres from the road edge)	Same as above for day and night	Instrument : Noise level meter	CPCB / IS : 4954-1968
Peak particle velocity	150- 200m from blast site	Based on hourly observations	PPV meter	
C. Water				
Parameters for water quality <ul style="list-style-type: none"> ▪ Ph, temp, turbidity, magnesium hardness, total alkalinity, chloride, sulphate, nitrate, fluoride, sodium, potassium salinity ▪ Total nitrogen, total phosphorus, DO, BOD, COD, Phenol ▪ Heavy metals ▪ Total coliforms, faecal coliforms ▪ Phyto plankton ▪ Zooplankton ▪ Fish & other aquatic flora & fauna (parameters are given in ToR for EIA studies based on nature of project, raw material & process)	Set of grab samples during pre and post- monsoon for ground and surface water for the whole study zone. For lab. Analysis the samples should be preserved for transport safe	Diurnal and season-wise	Samples for water quality should be collected and analyzed as per: IS: 2488 (Part 1-5) methods for sampling and testing of industrial effluents Standard methods for examination of water and waste water analysis published by American Public Health Association. International standard practices for benthos and aquatic flora & fauna	

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
technology, location-nature/activities within of air basin)				
For Surface Water Bodies				
<ul style="list-style-type: none"> ▪ Total Carbon ▪ PH ▪ Dissolved Oxygen ▪ Biological Oxygen Demand ▪ Free NH₄ ▪ Boron ▪ Sodium Absorption ratio ▪ Electrical Conductivity 	<p>Monitoring locations should include up-stream, on site, down stream of proposed discharge point. Besides sampling should cover width of the river in case water quality modeling is proposed.</p> <p>Standard methodology for collection of surface water (BIS standards)</p> <p>At least one grab sample per location per season</p>	<p>Yield & impact on water sources to be measured during critical season</p> <p>River Stretch within project area be divided in grids (say 1 km length and 1/3 width) and samples should be from each grid at a time when the wastewater discharged by other sources of pollution is expected to be maximum</p>	<p>Samples for water quality should be collected and analyzed as per: IS: 2488 (Part 1-5) methods for sampling and testing of industrial effluents</p> <p>Standard methods for examination of water and wastewater analysis published by American Public Health Association.</p>	<p>Historical data should be collected from relevant offices such as central water commission, state and central ground water board, Irrigation dept.</p>
Parameters for wastewater characterization				
<ul style="list-style-type: none"> ▪ Temp, colour, odour, turbidity, TSS, TDS ▪ PH , alkalinity as CaCO₃, p value, M value, total hardness as CaCO₃, chloride as cl, sulphate as S₀₄, Nitrate as NO₃, Floride as F, Phosphate as P₀₄, Chromium as Cr (Hexavalent, total) Ammonical Nitrogen as N, TKN, % sodium, BOD at 20 C, COD, DO, total residual chlorine as Cl₂, oil and grease, sulphide, phenolic compound 	<p>Implant Source depending upon the different waste streams the parameters can be optimized</p> <p>Grab and composite sampling representing avg of different process operations as well as worst emission scenario should be represented</p>	<p>Different operational cycles as well as raw material variations should be reflected in the analysis</p>	<p>Samples for water quality should be collected and analyzed as per: IS: 2488 (Part 1-5) methods for sampling and testing of industrial effluents</p> <p>Standard methods for examination of water and wastewater analysis published by American Public Health Association.</p>	<p>All plant sources categorized as:</p> <ul style="list-style-type: none"> ▪ Different Process waste streams as well as run-off conditions ▪ ETP wastewater <p>Domestic/ sanitary wastewater</p>

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
D. Land Environment				
<ul style="list-style-type: none"> ▪ Soil ▪ Particle size distribution ▪ Texture ▪ pH ▪ Electrical conductivity ▪ Cation exchange capacity ▪ Alkali metals ▪ Sodium Absorption Ratio (SAR) ▪ Permeability ▪ Porosity 	One surface sample from each landfill and/or hazardous waste site (if applicable) and prime villages, (soil samples be collected as per BIS specifications) in the study area	Season-wise	Collected and analyzed as per soil analysis reference book, M.I.Jackson and soil analysis reference book by C.A. Black	The purpose of impact assessment on soil (land environment) is to assess the significant impacts due to leaching of wastes or accidental releases and contaminating
Landuse / Landscape				
<ul style="list-style-type: none"> ▪ Location code ▪ Total project area ▪ Topography ▪ Drainage (natural) ▪ Cultivated, forest plantations, water bodies, roads and settlements 	At least 20 points along with plant boundary and general major land use categories in the study area.	Drainage once in the study period and land use categories from secondary data (local maps) and satellite imageries	<ul style="list-style-type: none"> ▪ Global positioning system ▪ Topo-sheets ▪ Satellite Imageries (1:25,000) ▪ Satellite Imageries (1:25,000) 	<p>Drainage within the plant area and surrounding is very important for storm water impacts.</p> <p>From land use maps sensitive receptors (forests, parks, mangroves etc.) can be identified</p>
E. Solid Waste				
<p>Quantity:</p> <ul style="list-style-type: none"> ▪ Based on waste generated from per unit production ▪ Per capita contribution ▪ Collection, transport and disposal system ▪ Process Waste ▪ Quality (oily, chemical, biological) 	For green field units it is based on secondary data base of earlier plants.	Process wise or activity wise for respective raw material used. Domestic waste depends upon the season also	<p>Guidelines</p> <p>IS 9569 : 1980</p> <p>IS 10447 : 1983</p> <p>IS 12625 : 1989</p> <p>IS 12647 : 1989</p> <p>IS 12662 (PTI) 1989</p>	

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
Quality: <ul style="list-style-type: none"> ▪ General segregation into biological/organic/inert/hazardous ▪ Loss on heating ▪ pH ▪ Electrical Conductivity ▪ Calorific value, metals etc. 	Grab and Composite samples	Process wise or activity wise for respective raw material used. Domestic waste depends upon the season also	Analysis IS 9334 : 1979 IS 9235 : 1979 IS 10158 : 1982	
Hazardous Waste				
<ul style="list-style-type: none"> ▪ Permeability And porosity ▪ Moisture pH ▪ Electrical conductivity ▪ Loss on ignition ▪ Phosphorous ▪ Total nitrogen ▪ Caution exchange capacity ▪ Particle size distribution ▪ Heavy metal ▪ Ansonia ▪ Fluoride 	Grab and Composite samples. Recyclable components have to analyzed for the recycling requirements	Process wise or activity wise for respective raw material used.	Analysis IS 9334 : 1979 IS 9235 : 1979 IS 10158 : 1982	Impacts of hazardous waste should be performed critically depending on the waste characteristics and place of discharge. For land disposal the guidelines should be followed and impacts of accidental releases should be assessed
F. Biological Environment Aquatic				
<ul style="list-style-type: none"> ▪ Primary productivity ▪ Aquatic weeds ▪ Enumeration of phytoplankton, zooplankton and benthos ▪ Fisheries ▪ Diversity indices 	Considering probable impact, sampling points and number of samples to be decided on established guidelines on ecological studies based on site eco-environment setting within 10/25 km radius from the	Season changes are very important	Standards techniques (APHA et. Al. 1995, Rau and Wooten 1980) to be followed for sampling and measurement	Seasonal sampling for aquatic biota One season for terrestrial biota, in addition to vegetation studies during monsoon season Preliminary assessment

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
<ul style="list-style-type: none"> ▪ Trophic levels ▪ Rare and endangered species ▪ Sanctuaries / closed areas / Coastal regulation zone (CRZ) ▪ Terrestrial ▪ Vegetation – species, list, economic importance, forest produce, medicinal value ▪ Importance value index (IVI) of trees ▪ Wild animals 	<p>proposed site</p> <p>Samples to collect from upstream and downstream of discharge point, nearby tributaries at down stream, and also from dug wells close to activity site</p>			<p>Microscopic analysis of plankton and meiobenthos, studies of macrofauna, aquatic vegetation and application of indices, viz. Shannon, similarity, dominance IVI etc</p> <p>Point quarter plot-less method (random sampling) for terrestrial vegetation survey.</p>
<p>Avifauna</p> <ul style="list-style-type: none"> ▪ Rare and endangered species ▪ Sanctuaries / National park / Biosphere reserve 	<p>For forest studies, chronic as well as short-term impacts should be analyzed warranting data on micro climate conditions</p>			<p>Secondary data to collect from Government offices, NGOs, published literature</p> <p>Plankton net</p> <p>Sediment dredge</p> <p>Depth sampler</p> <p>Microscope</p> <p>Field binocular</p>
G. Socio Economic				
<ul style="list-style-type: none"> ▪ Demographic structure ▪ Infrastructure resource base ▪ Economic resource base ▪ Health status: Morbidity pattern ▪ Cultural and aesthetic attributes 	<p>Socio-economic survey is based on proportionate, stratified and random sampling method</p>	<p>Different impacts occurs during construction and operational phases of the project</p>	<p>Primary data collection through R&R surveys (if require) or community survey are based on personal interviews and questionnaire</p>	<p>Secondary data from census records, statistical hard books, toposheets, health records and relevant official records available with Govt. agencies</p>

* Project Specific concerned parameters needs to be identified by the project proponent and shall be incorporated in the draft ToR, to be submitted to the Authority for the consideration and approval by the EAC/SEAC.

ANNEXURE VI
Sources of Secondary Data

Annexure IVA: Potential Sources of Data For EIA

Information	Source
Air Environment	
1. Meteorology- Temperature, Rainfall, Humidity, Inversion, Seasonal Wind rose pattern (16 point compass scale), cloud cover, wind speed, wind direction, stability, mixing depth	<ul style="list-style-type: none"> ⊗ Indian Meteorology Department, Pune
2. Ambient Air Quality- 24 hourly concentration of SPM, RPM, SO ₂ , NO _x , CO	<ul style="list-style-type: none"> ⊗ Central Pollution Control Board (CPCB), ⊗ State Pollution Control Board (SPCB), ⊗ Municipal Corporations ⊗ Ministry of Environment and Forests (MoEF) ⊗ State Department of Environment (DoEN)
Water Environment	
3. Surface water- water sources, water flow (lean season), water quality, water usage, Downstream water users Command area development plan Catchment treatment plan	<ul style="list-style-type: none"> ⊗ Central Water Commission (CWC), ⊗ Central Pollution Control Board (CPCB), ⊗ State Pollution Control Board (SPCB), Central Water and Power Research Institute (CWPRS), Pune ⊗ State Irrigation Department ⊗ Hydel Power generation organizations such as NHPC, State SEBs
4. Ground Water- groundwater recharge rate/withdrawal rate, ground water potential groundwater levels (pre monsoon, post monsoon), ground water quality, changes observed in quality and quantity of ground water in last 15 years	<ul style="list-style-type: none"> ⊗ Central Ground Water Board (CGWB) ⊗ Central Ground Water Authority (CGWA) ⊗ State Ground Water Board (SGWB) ⊗ National Water Development Authority (NWDA)
5. Coastal waters- water quality, tide and current data, bathymetry	<ul style="list-style-type: none"> ⊗ Department of Ocean Development, New Delhi ⊗ State Maritime Boards ⊗ Naval Hydrographer's Office, Dehradun ⊗ Port Authorities ⊗ National Institute of Oceanography (NIO), Goa
Biological Environment	
6. Description of Biological Environment- inventory of flora and fauna in 7 km radius, endemic species, endangered species, Aquatic Fauna, Forest land, forest type and density of vegetation, biosphere, national parks, wild life sanctuaries, tiger reserve, elephant reserve, turtle nesting ground, core zone of biosphere reserve, habitat of migratory birds, routes of migratory birds	<ul style="list-style-type: none"> ⊗ District Gazetteers ⊗ National Remote Sensing Agency (NRSA), Hyderabad ⊗ Forest Survey of India, Dehradun ⊗ Wildlife Institute of India ⊗ World Wildlife Fund ⊗ Zoological Survey of India ⊗ Botanical Survey of India ⊗ Bombay Natural History Society, (BNHS), Mumbai ⊗ State Forest Departments ⊗ State Fisheries Department ⊗ Ministry of Environment and Forests ⊗ State Agriculture Departments ⊗ State Agriculture Universities
Land Environment	
7. Geographical Information-Latitude, Longitude, Elevation (above MSL)	<ul style="list-style-type: none"> ⊗ Toposheets of Survey of India, Pune ⊗ National Remote Sensing Agency (NRSA), Hyderabad ⊗ Space Application Centre (SAC), Ahmedabad

Information	Source
8. Nature of Terrain, topography map indicating contours (1:2500 scale)	<ul style="list-style-type: none"> ⑨ Survey of India Toposheets ⑨ National Remote Sensing Agency (NRSA), Hyderabad ⑨ State Remote Sensing Centre, ⑨ Space Application Centre (SAC), Ahmedabad
9. Hydrogeology- Hydrogeological report (in case of ground water is used/area is drought prone/wastewater is likely to discharged on land) Geomorphological analysis (topography and drainage pattern) Geological analysis (Geological Formations/Disturbances- geological and structural maps, geomorphological contour maps, structural features, including lineaments, fractures, faults and joints) Hydrogeological analysis (disposition of permeable formations, surface-ground water links, hydraulic parameter determination etc) Analysis of the natural soil and water to assess pollutant absorption capacity	<ul style="list-style-type: none"> ⑨ NRSA, Hyderabad ⑨ Survey of India Toposheets ⑨ Geological Survey of India ⑨ State Geology Departments ⑨ State Irrigation Department ⑨ Department of Wasteland Development, Ministry of Rural Areas ⑨ National Water Development Authority (NWDA)
10. Nature of Soil, permeability, erodibility classification of the land	<ul style="list-style-type: none"> ⑨ Agriculture Universities ⑨ State Agriculture Department ⑨ Indian Council for Agriculture Research ⑨ State Soil Conservation Departments ⑨ National Bureau of Soil Survey and Landuse Planning ⑨ Central Arid Zone Research Institute (CAZRI), Jodhpur
11. Landuse in the project area and 10 km radius of the periphery of the project	<ul style="list-style-type: none"> ⑨ Survey of India- Toposheets ⑨ All India Soil and Landuse Survey; Delhi ⑨ National Remote Sensing Agency (NRSA), Hyderabad ⑨ Town and County Planning Organisation ⑨ State Urban Planning Department ⑨ Regional Planning Authorities (existing and proposed plans) ⑨ Village Revenue Map- District Collectorate ⑨ Directorate of Economics and Statistics-State Government ⑨ Space Application Centre, Ahmedabad
12. Coastal Regulation Zones- CRZMP, CRZ classification, Demarcation of HTL and LTL*	<ul style="list-style-type: none"> ⑨ Urban Development Department ⑨ State Department of Environment ⑨ State Pollution Control Board ⑨ Space Application Centre* ⑨ Centre for Earth Sciences Studies, Thiruvanthapuram* ⑨ Institute of Remote Sensing, Anna University Chennai* ⑨ Naval Hydrographer's Office, Dehradun* ⑨ National Institute of Oceanography, Goa* ⑨ National Institute of Ocean Technology, Chennai ⑨ Centre for Earth Science Studies

* Agencies authorized for approval of demarcation of HTL and LTL

Information	Source
Social	
13. Socioeconomic - population, number of houses and present occupation pattern within 7 km from the periphery of the project	<ul style="list-style-type: none"> ⊗ Census Department ⊗ District Gazetteers- State Government ⊗ District Statistics- District Collectorate ⊗ International Institute of Population Sciences, Mumbai (limited data) ⊗ Central Statistical Organisation
14. Monuments and heritage sites	<ul style="list-style-type: none"> District Gazetteer Archeological Survey of India, INTACH District Collectorate Central and State Tourism Department State Tribal and Social Welfare Department
Natural Disasters	
15. Seismic data (Mining Projects)- zone no, no of earthquakes and scale, impacts on life, property existing mines	<ul style="list-style-type: none"> ⊗ Indian Meteorology Department, Pune ⊗ Geological Survey of India
16. Landslide prone zone, geomorphological conditions, degree of susceptibility to mass movement, major landslide history (frequency of occurrence/decade), area affected, population affected	<ul style="list-style-type: none"> ⊗ Space Application Centre
17. Flood/cyclone/droughts- frequency of occurrence per decade, area affected, population affected	<ul style="list-style-type: none"> ⊗ Natural Disaster Management Division in Department of Agriculture and Cooperation ⊗ Indian Meteorological Department
Industrial	
18. Industrial Estates/Clusters, Growth Centres	<ul style="list-style-type: none"> ⊗ State Industrial Corporation ⊗ Industrial Associations ⊗ State Pollution Control Boards ⊗ Confederation Indian Industries (CII) ⊗ FICCI
19. Physical and Chemical properties of raw material and chemicals (Industrial projects); fuel quality	<ul style="list-style-type: none"> ⊗ Material and Safety Data Sheets ⊗ ENVIS database of Industrial Toxicological Research Centre, Lucknow ⊗ Indian Institute Petroleum
20. Occupational Health and Industrial Hygiene-major occupational health and safety hazards, health and safety requirements, accident histories	<ul style="list-style-type: none"> ⊗ Central Labour Institute, Mumbai ⊗ Directorate of Industrial Safety ⊗ ENVIS Database of Industrial Toxicological Research Centre, Lucknow ⊗ National Institute of Occupational Health, Ahmedabad
21. Pollutant release inventories (Existing pollution sources in area within 10 km radius)	<ul style="list-style-type: none"> ⊗ Project proponents which have received EC and have commenced operations
22. Water requirement (process, cooling water, DM water, Dust suppression, drinking, green belt, fire service)	<ul style="list-style-type: none"> ⊗ EIA Reports ⊗ National and International Benchmarks

Annexure IVB: Summary of Available Data with Potential Data Sources for EIA

Agency	Information Available
1. Archaeological Survey of India Department of Culture Government of India Janpath, New Delhi - 110011 Asi@del3.vsnl.net.in	<ul style="list-style-type: none"> ⊙ Inventory of monuments and sites of national importance- Listing and documentation of monuments according to world heritage, pre historic, proto historic and secular, religious places and forts
2. Botanical Survey Of India P-8, Brabourne Road Calcutta 700001 Tel#033 2424922 Fax#033 2429330 Email: envis@cal2.vsnl.net.in . RO - Coimbatore, Pune, Jodhpur, Dehradun, Allahabad, Gantok, Itanagar, Port Blair	<ul style="list-style-type: none"> ⊙ Photodiversity documentation of flora at National, State and District level and flora of protected areas, hotspots, fragile ecosystems, sacred groves etc ⊙ Identification of threatened species including endemics, their mapping, population studies ⊙ Database related to medicinal plants, rare and threatened plant species ⊙ Red data book of Indian plants (Vol 1,2, and 3) ⊙ Manual for roadside and avenue plantation in India
3. Bureau of Indian Standards Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002 Tel#3230131, 3233375, 3239402 (10 lines) Fax : 91 11 3234062, 3239399, 3239382 Email- bis@vsnl.com	<ul style="list-style-type: none"> ⊙ Bureau of Indian Standards Committees on Earthquake Engineering and Wind Engineering have a Seismic Zoning Map and the Wind Velocity Map including cyclonic winds for the country
4. Central Water Commission (CWC) Sewa Bhawan, R.K.Puram New Delhi - 110066 cmanoff@niccwc.delhi.nic.in RO- Bangalore, Bhopal, Bhubaneshwar, Chandigarh, Coimbatore/Chennai, Delhi, Hyderabad, Lucknow, Nagpur, Patna, Shillong, Siliguri and Vadodara	<ul style="list-style-type: none"> ⊙ Central Data Bank -Collection, collation and Publishing of Hydrological, Hydrometeorological, Sediment and Water Quality data- ⊙ Basin wise Master Plans ⊙ Flood atlas for India ⊙ Flood Management and Development and Operation of Flood Forecasting System- CWC operate a network of forecasting stations Over 6000 forecasts are issued every year with about 95% of the forecasts within the permissible limit. ⊙ Water Year Books, Sediment Year Books and Water Quality Year Books. ⊙ Also actively involved in monitoring of 84 identified projects through National, State and Project level Environmental Committees for ensuring implementation of environmental safeguards
5. Central Ground Water Board (HO) N.H.IV, New CGO Complex, Faridabad - 121001 RO - Guwahati, Chandigarh, Ahemadabad, Trivandrum, Calcutta, Bhopal, Lucknow, Banglore, Nagpur, Jammu, Bhubneshwar, Raipur, Jaipur, Chennai, Hyderabad, Patna	<ul style="list-style-type: none"> ⊙ surveys, exploration, monitoring of ground water development

¹⁶ Based on web search and literature review

6.	Central Pollution Control Board Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032 INDIA E-mail : cpcb@alpha.nic.in	<ul style="list-style-type: none"> ⊗ National Air Quality Monitoring Programme ⊗ National River Water Quality Monitoring Programme- Global Environment Monitoring , MINARS ⊗ Zoning Atlas Programme ⊗ Information on 17 polluting category industries (inventory, category wise distribution, compliance, implementation of pollution control programmes)
7.	Central Arid Zone Research Institute, Jodhpur Email : cazri@x400.nicgw.nic.in Regional Centre at Bhuj in Gujarat	<ul style="list-style-type: none"> ⊗ AGRIS database on all aspects of agriculture from 1975 to date ⊗ Also have cell on Agriculture Research Information System; ⊗ Working on ENVIS project on desertification ⊗ Repository of information on the state of natural resources and desertification processes and their control ⊗ The spectrum of activities involves researches on basic resource inventories; monitoring of desertification, rehabilitation and management of degraded lands and other areas
8.	Central Inland Capture Fisheries Research Institute, Barrackpore- 743101, Tel#033-5600177 Fax#033-5600388 Email : cicfri@x400.nicgw.nic.in	<ul style="list-style-type: none"> ⊗ Data Base on Ecology and fisheries of major river systems of India. Biological features of commercially important riverine and estuarine fish species. Production functions and their interactions in floodplain wetlands. ⊗ Activities - Environmental Impact Assessment for Resource Management ; Fisheries Resource surveys
9.	Central Institute of Brackish Water Aquaculture 141, Marshalls Road, Egmore , Chennai - 600 008, Tel# 044-8554866, 8554891, Director (Per) 8554851 Fax#8554851,	<ul style="list-style-type: none"> ⊗ Repository of information on brackish water fishery resources with systematic database of coastal fishery resources for ARIS ⊗ Agricultural Research Information System (ARIS) database covers State wise data on soil and water quality parameters, land use pattern, production and productivity trends, ⊗ Social, economic and environmental impacts of aquaculture farming, ⊗ Guidelines and effluent standards for aquaculture farming
10.	Central Marine Fisheries Research Institute (CMFRI), Cochin	<ul style="list-style-type: none"> ⊗ Assessing and monitoring of exploited and un-exploited fish stocks in Indian EEZ ⊗ Monitoring the health of the coastal ecosystems, particularly the endangered ecosystems in relation to artisanal fishing, mechanised fishing and marine pollution ⊗ The institute has been collecting data on the catch and effort and biological characteristics for nearly half a century based on scientifically developed sampling scheme, covering all the maritime States of the country ⊗ The voluminous data available with the institute is managed by the National Marine Living Resources Data Centre (NMLRDC)
11.	Central Water and Power Research Station, Pune Tel#020-4391801-14; 4392511; 4392825 Fax #020-4392004,4390189	<ul style="list-style-type: none"> ⊗ Numerical and Physical models for hydro-dynamic simulations
12.	Central Institute of Road Transport, Bhosari, Pune 411 026, India. Tel : +91 (20) 7125177, 7125292, 7125493, 7125494	<ul style="list-style-type: none"> ⊗ Repository of data on all aspects of performance of STUs and a host of other related road transport parameters

13. Department of Ocean Development	<ul style="list-style-type: none"> ⑨ Assessment of environment parameters and marine living resources (primary and secondary) in Indian EEZ (Nodal Agency NIO Kochi) ⑨ Stock assessment, biology and resource mapping of deep sea shrimps, lobsters and fishes in Indian EEZ (Nodal agency-Fisheries Survey of India) ⑨ Investigations of toxical algal blooms and benthic productivity in Indian EEZ (Nodal agency- Cochin University of Science and technology) ⑨ Coastal Ocean Monitoring and Prediction System (COMAP) - monitoring and modelling of marine pollution along entire Indian coast and islands. Parameters monitored are temp, salinity, DO, pH, SS, BOD, inorganic phosphate, nitrate, nitrite, ammonia, total phosphorus, total nitrite, total organic carbon, petroleum hydrocarbons, pathogenic vibrios, pathogenic E.coli, shigella, salmonella, heavy metals (Cd, Hg, Pb) and pesticide residues (DDT, BHC, Endosulfan). Monitoring is carried out along the ecologically sensitive zones and urban areas (NIO Mumbai- Apex coordinating agency). ⑨ Sea Level Measurement Programme (SELMAM)- sea level measurement at selected stations (Porbandar, Bombay, Goa, Cochin, Tuticorin, Madras, Machilipatnam, Visakhapatnam, Paradeep, Calcutta and Kavaratti (Lakshadweep Island)) along Indian coast and islands using modern tide gauges ⑨ Detailed coastal maps through Survey of India showing contour at 1/2 a metre interval in the scale of 1:25000. (Nellore- Machhalipatnam work already over) ⑨ Marine Data Centre (MDC) IMD for Ocean surface meteorology, GSI for marine geology, SOI for tide levels, Naval Hydrographic Office for bathymetry, NIO Goa for physical chemical and biological oceanography, NIO Mumbai for marine pollution, CMFRI for coastal fisheries, Institute of Ocean Management Madras for coastal geomorphology ⑨ DOD has setup Indian National Centre for Ocean Information Services (INCOIS) at Hyderabad for generation and dissemination of ocean data products (near real time data products such as sea surface temperature, potential fishing zones, upwelling zones, maps, eddies, chlorophyll, suspended sediment load etc). MDC will be integrated with INCOIS ⑨ Integrated Coastal and Marine Area Management (ICMAM) programme - GIS based information system for management of 11 critical habitats namely Pichavaram, Karwar, Gulf of Mannar, Gulf of Khambat, Gulf of Kutch, Malvan, Cochin, Coringa mangroves, Gahirmata, Sunderbans and Kadamat (Lakshadweep) ⑨ Wetland maps for Tamil Nadu and Kerala showing the locations of lagoons, backwaters, estuaries, mudflats etc (1:50000 scale) ⑨ Coral Reef Maps for Gulf of Kachch, Gulf of Mannar, Andaman and Nicobar and Lakshadweep Islands (1:50,000 scale) indicating the condition of corals, density etc
14. Environment Protection Training and Research Institute Gachibowli, Hyderabad - 500 019, India Phone: +91-40-3001241, 3001242, 3000489 Fax: +91-40- 3000361 E-mail: info@eptri.com	<ul style="list-style-type: none"> ⑨ Environment Information Centre- has appointed EPTRI as the Distributed Information Centre for the Eastern Ghats region of India. EIC Collaborates with the Stockholm Environment Institute Sweden Database on Economics of Industrial Pollution Prevention in India Database of Large and Medium Scale Industries of Andhra Pradesh Environmental Status of the Hyderabad Urban Agglomeration Study on 'water pollution-health linkages' for a few Districts of A.P

		<ul style="list-style-type: none"> ⊙ Environment Quality Mapping <ul style="list-style-type: none"> Macro level studies for six districts in the State of Andhra Pradesh Micro level studies for two study zones presenting the permissible pollutant load and scoping for new industrial categories Zonation of the IDA, Parwada which helped APIIC to promote the land for industrial development Disaster management plan for Visakhapatnam Industrial Bowl Area
15.	<p>Forest Survey of India (FSI) Kaulagarh Road, P.O., IPE Dehradun - 248 195 Tel# 0135-756139, 755037, 754507 Fax # 91-135-759104 E-Mail : fsidir@nde.vsnl.net.in fsihq@nde.vsnl.net.in</p> <p>RO- Banglore, Calcutta, Nagpur and Shimla</p>	<ul style="list-style-type: none"> ⊙ State of Forest Report (Biannual) ⊙ National Forest Vegetation Map (Biannual exercise) (on 1: 1 million scale) ⊙ Thematic mapping on 1:50,000 scale depicting the forest type, species composition, crown density of forest cover and other landuse National ⊙ Basic Forest Inventory System ⊙ Inventory survey of non forest area ⊙ Forest inventory report providing details of area estimates, topographic description, health of forest, ownership pattern, estimation of volume and other growth parameters such as height and diameter in different types of forest, estimation of growth, regeneration and mortality of important species, volume equation and wood consumption of the area studied
16.	<p>Geological Survey of India 27 Jawaharlal Nehru Road, Calcutta 700 016, India Telephone +91-33-2496941 FAX 91-33-2496956 gsi_chq@vsnl.com</p>	<ul style="list-style-type: none"> ⊙ Environmental hazards zonation mapping in mineral sector ⊙ Codification of base line information of geo-environmental appreciation of any terrain and related EIA and EMP studies ⊙ Lineament and geomorphological map of India on 1:20,000 scale. ⊙ Photo-interpreted geological and structural maps of terrains with limited field checks.
17.	<p>Indian Council of Agriculture Research, Krishi Bhawan, New Delhi, Tel#011-338206</p> <ul style="list-style-type: none"> - ICAR complex, Goa- Agro metrology - Central Arid Zone Research Institute- Agro forestry - Central Soil salinity Research Institute, - Indian Institute of Soil Science - Central Soil and Water Conservation Research and Training Institute - National Bureau of Soil Survey and Landuse Planning 	<ul style="list-style-type: none"> ⊙ A total of 80,000 profiles at 10 kms grid across the country were analyzed to characterize the soils of India. ⊙ Detailed soil maps of the Country (1:7 million), State (1:250,000) and districts map (1:50,000) depicting extent of degradation (1:4.4 millions) have been prepared. ⊙ Thematic maps depicting soil depth, texture drainage, calcareousness, salinity, pH, slope and erosion have been published ⊙ Agro-climate characterization of the country based on moisture, thermal and sunshine regimes ⊙ Agro-ecological zones (20) and sub-zones (60) for the country were delineated based on physiography, soils, climate, Length of Growing Period and Available Water Content, and mapped on 1:4.4 million scale. ⊙ Digitization of physiography and soil resource base on 1:50,000 scale for 14 States have been completed. ⊙ .Soil fertility maps of N,P,K,S and Zn have also been developed ⊙ Water quality guidelines for irrigation and naturally occurring saline/sodic water ⊙ Calibration and verification of ground water models for predicting water logging and salinity hazards in irrigation commands
18.	<p>Indian Bureau of Mines Indira Bhawan, Civil Lines Nagpur Ph no - 0712-533 631, Fax- 0712-533 041</p>	<ul style="list-style-type: none"> ⊙ National mineral inventory for 61 minerals and mineral maps ⊙ Studies on environmental protection and pollution control in regard to the mining and mineral beneficiation operations ⊙ Collection, processing and storage of data on mines, minerals and mineral-based industries, collection and maintenance of world mineral intelligence, foreign mineral legislation and other related matters

19.	Indian Meteorology Department Shivaji nagar, Pune 41100 RO- Mumbai, Chennai, Calcutta, New Delhi, Nagpur, Guwahati	<ul style="list-style-type: none"> ⊙ Meteorological data ⊙ Background air quality monitoring network under Global Atmospheric Watch Programme (operates 10 stations) ⊙ Seismicity map, seismic zoning map; seismic occurrences and cyclone hazard monitoring; list of major earthquakes ⊙ Climatological Atlas of India , Rainfall Atlas of India and Agroclimatic Atlas of India ⊙ Monthly bulletin of Climate Diagnostic Bulletin of India ⊙ Environmental Meteorological Unit of IMD at Delhi to provide specific services to MoEF
20.	INTACH Natural Heritage, 71 Lodi Estate, New Delhi-110 003 Tel. 91-11-4645482, 4632267/9, 4631818, 4692774, 4641304 Fax : 91- 11-4611290 E-mail : nh@intach.net	<ul style="list-style-type: none"> ⊙ Listing and documentation of heritage sites identified by municipalities and local bodies (Listing excludes sites and buildings under the purview of the Archaeological Survey of India and the State Departments of Archaeology)
21.	Industrial Toxicology Research Centre Post Box No. 80, Mahatma Gandhi Marg, Lucknow-226001, Phone: +91-522- 221856,213618,228227; Fax : +91- 522 228227 Email: itrc@itrcindia.org	<ul style="list-style-type: none"> ⊙ Activities include health survey on occupational diseases in industrial workers, air and water quality monitoring studies, ecotoxicological impact assessment, toxicity of chemicals, human health risk assessment ⊙ Five databases on CD-ROM in the area of environmental toxicology viz: TOXLINE, CHEMBANK, POISINDEX, POLTOX and PESTBANK. The Toxicology Information Centre provides information on toxic chemicals including household chemicals ⊙ ENVIS centre and created a full-fledged computerized database (DABTOC) on toxicity profiles of about 450 chemicals
22.	Indian Institute of Forest Management Post Box No. 357, Nehru Nagar Bhopal - 462 003 Phone # 0755-575716, 573799, 765125, 767851 Fax # 0755-572878	<ul style="list-style-type: none"> ⊙ Consultancy and research on joint forest management (Ford Foundation, SIDA, GTZ, FAO etc)
23.	Indian Institute of Petroleum Mohkampur , Dehradun, India, 248005 0135- 660113 to 116 0135- 671986	<ul style="list-style-type: none"> ⊙ Fuel quality characterisation ⊙ Emission factors
24.	Ministry of Environment and Forest	<ul style="list-style-type: none"> ⊙ Survey of natural resources ⊙ National river conservation directorate ⊙ Environmental research programme for eastern and western ghats ⊙ National natural resource management system ⊙ Wetlands conservation programme- survey, demarcation, mapping landscape planning, hydrology for 20 identified wetlands National wasteland identification programme
25.	Mumbai Metropolitan Regional Development Authority	<ul style="list-style-type: none"> ⊙ Mumbai Urban Transport Project ⊙ Mumbai Urban Development Project ⊙ Mumbai Urban Rehabilitation Project ⊙ Information on MMR; statistics on councils and corporations Regional Information Centre- Basic data on population, employment, industries and other sectors are regularly collected and processed

26.	Municipal Corporation of Greater Mumbai	<ul style="list-style-type: none"> ⊙ Air Quality Data for Mumbai Municipal Area ⊙ Water quality of lakes used for water supply to Mumbai
27.	Ministry of Urban Development Disaster Mitigation and Vulnerability Atlas of India Building Materials & Technology Promotion Council G-Wing, Nirman Bhavan, New Delhi-110011 Tel: 91-11-3019367 Fax: 91-11-3010145 E-Mail: bmtpc@del2.vsnl.net.in	<ul style="list-style-type: none"> ⊙ Identification of hazard prone area ⊙ Vulnerability Atlas showing areas vulnerable to natural disasters ⊙ Land-use zoning and design guidelines for improving hazard resistant construction of buildings and housing ⊙ State wise hazard maps (on cyclone, floods and earthquakes)
28.	Natural Disaster Management Division in Department of Agriculture and Cooperation	<ul style="list-style-type: none"> ⊙ Weekly situation reports on recent disasters, reports on droughts, floods, cyclones and earthquakes
29.	National Bureau Of Soil Survey & Land Use Planning P.O. Box No. 426, Shankar Nagar P.O., Nagpur-440010 Tel#91-712-534664,532438,534545 Fax#:91-712-522534 RO- Nagpur, New Delhi, Bangalore, Calcutta, Jorhat, Udaipur	<ul style="list-style-type: none"> ⊙ NBSS&LUP Library has been identified as sub centre of ARIC (ICAR) for input to AGRIS covering soil science literature generated in India ⊙ Research in weathering and soil formation, soil morphology, soil mineralogy, physicochemical characterisation, pedogenesis, and landscape-climate-soil relationship. ⊙ Soil Series of India- The soils are classified as per Soil Taxonomy. The described soil series now belong to 17 States of the country. ⊙ Landuse planning- watershed management, land evaluation criteria, crop efficiency zoning ⊙ Soil Information system is developed state-wise at 1:250,000 scale. Presently the soil maps of all the States are digitized, processed and designed for final output both digital and hardcopy. The thematic layers and interpreted layers of land evaluation (land capability, land irrigability and crop suitability), Agro-Ecological Zones and soil degradation themes are prepared. ⊙ Districts level information system is developed for about 15 districts at 1: 50, 000 scale. The soil information will be at soil series level in this system. Soil resource inventory of States, districts water-sheds (1:250,000; 1:50,000; 1:10,000/8000)
30.	National Institute of Ocean Technology, Velacherry-Tambaram main road Narayanapuram Chennai, Tamil Nadu Tel#91-44-2460063 / 2460064/ 2460066/ 2460067 Fax#91-44-2460645	<ul style="list-style-type: none"> ⊙ Waste load allocation in selected estuaries (Tapi estuary and Ennore creek) is one the components under the Integrated Coastal and Marine Area Management (ICMAM) programme of the Department of Ocean Development ICMAM is conducted with an IDA based credit to the Government of India under the Environmental Capacity Building project of MoEF (waste assimilation capacity of Ennore creek is over) ⊙ Physical oceanographic component of Coastal & Ocean monitoring Predictive System (COMAPS) a long term monitoring program under the Department of Ocean Development ⊙ Identification of suitable locations for disposal of dredge spoil using mathematical models & environmental criteria ⊙ EIA Manual and EIA guidelines for port and harbour projects
31.	National Institute of Oceanography, Goa RO- Mumbai, Kochi	<ul style="list-style-type: none"> ⊙ Coastal Ocean Monitoring and Predictions(COMAP)-Monitoring of coastal waters for physicochemical and biological parameters including petroleum hydrocarbons, trace metals, heavy metals, and biomass of primary (phytoplankton) and secondary (zooplankton, microbial and benthic organisms) ⊙ Marine Biodiversity of selected ecosystem along the West Coast of India

32.	National Botanical Research Institute, Post Box No 436 Rana Pratap Marg Lucknow- 226001, Tel: (+91) 522 271031-35 Fax: (+91) 522 282849, 282881 Lucknow	<ul style="list-style-type: none"> ⊗ Dust filtering potential of common avenue trees and roadside shrubs has been determined, besides studies have also been conducted on heavy-metals accumulation potential of aquatic plants supposedly useful as indicators of heavy metal pollution in water bodies and capable of reducing the toxic metals from water bodies. ⊗ Assessment of bio-diversity of various regions of India
33.	National Geophysical Research Institute, Uppal Road, Hyderabad Telephone:0091-40-7171124, FAX:0091-40-7171564	<ul style="list-style-type: none"> ⊗ Exploration, assessment and management of ground water resources including ground water modelling and pollution studies
34.	National Environmental Engineering Research Institute, Nagpur RO- Mumbai, Delhi, Chennai, Calcutta, Ahmedabad, Cochin, Hyderabad, Kanpur	<ul style="list-style-type: none"> ⊗ National Air Quality Monitoring (NAQM) for CPCB ⊗ Database on cleaner technologies of industrial productions
35.	National Hydrology Institute, Roorkee RO- Belgaum (Hard Rock Regional Centre), Jammu (Western Himalayan Regional Centre), Guwahati (North Eastern Regional Centre), Kakinada (Deltaic Regional Centre), Patna (Ganga Plains North Regional Centre), and Sagar (Ganga Plains South)	<ul style="list-style-type: none"> ⊗ Basin studies, hydrometeorological network improvement, hydrological year book, hydrological modelling, regional flood formulae, reservoir sedimentation studies, environmental hydrology, watershed development studies, tank studies, and drought studies.
36.	National Institute Of Urban Affairs, India Habitat Centre, New Delhi	<ul style="list-style-type: none"> ⊗ Urban Statistics Handbook
37.	National Institute of Occupational Health Meghaninagar, Ahmedabad RO- Banglore, Calcutta	<ul style="list-style-type: none"> ⊗ epidemiological studies and surveillance of hazardous occupations including air pollution, noise pollution, agricultural hazards, industrial hazards in organised sectors as well as small scale industries, carcinogenesis, pesticide toxicology, etc ⊗ WHO collaborative centre for occupational health for South East Asia region and the lead institute for the international programme on chemical safety under IPCS (WHO)
38.	NRSA Data Centre Department of Space, Balanagar, Hyderabad 500 037 Ph- 040-3078560 3078664 sales@nrsa.gov.in	<ul style="list-style-type: none"> ⊗ Satellite data products (raw data, partially processed (radiometrically corrected but geometrically uncorrected), standard data (radiometrically and geometrically corrected), geocoded data(1:50,000 and 1:25000 scale), special data products like mosaiced, merged and extracted) available on photographic (B&W and FCC in form of film of 240 mm X 240mm or enlargements/paper prints in scale varying between 1:1M and 1:12500 and size varying between 240mm and 1000mm) and digital media (CD-ROMs, 8 mm tapes)
39.	Rajiv Gandhi National Drinking Water Mission	<ul style="list-style-type: none"> ⊗ Database for groundwater using remote sensing technology (Regional Remote Sensing Service Centre involved in generation of ground water prospect maps at 1:50,000 scale for the State of Kerala, Karnataka, AP, MP and Rajasthan for RGNDWM)
40.	Space Application Centre Value Added Services Cell (VASC) Remote Sensing Application Area Ahmedabad 380 053 079-676 1188	<ul style="list-style-type: none"> ⊗ National Natural Resource Information System ⊗ Landuse mapping for coastal regulation zone (construction setback line) upto 1:12500 scale ⊗ Inventory of coastal wetlands, coral reefs, mangroves, seaweeds ⊗ Monitoring and condition assessment of protected coastal areas

	Fax- 079-6762735	<ul style="list-style-type: none"> ⊗ Wetland mapping and inventory ⊗ Mapping of potential hotspots and zoning of environmental hazards ⊗ General geological and geomorphological mapping in diverse terrain ⊗ Landslide risk zonation for Tehre area
41.	State Pollution Control Board	<ul style="list-style-type: none"> ⊗ State Air Quality Monitoring Programme ⊗ Inventory of polluting industries ⊗ Identification and authorization of hazardous waste generating industries ⊗ Inventory of biomedical waste generating industries ⊗ Water quality monitoring of water bodies receiving wastewater discharges ⊗ Inventory of air polluting industries ⊗ Industrial air pollution monitoring ⊗ Air consent, water consent, authorization, environment monitoring reports
42.	State Ground Water Board	
43.	Survey of India	<ul style="list-style-type: none"> ⊗ Topographical surveys on 1:250,000 scales, 1:50,000 and 1:25,000 scales ⊗ Digital Cartographical Data Base of topographical maps on scales 1:250,000 and 1:50,000 ⊗ Data generation and its processing for redefinition of Indian Geodetic Datum ⊗ Maintenance of National Tidal Data Centre and receiving/ processing of tidal data of various ports. ⊗ Coastal mapping along the Eastern coast line has been in progress to study the effect of submergence due to rise in sea-level and other natural phenomenon. Ground surveys have been completed for the proposed coastal region and maps are under printing. ⊗ District planning maps containing thematic information (135 maps) have been printed out of 249 maps covering half the districts of India. Districts planning maps for remaining half of the area are being processed by National Atlas and Thematic Mapping Organisation (NATMO)
44.	Town and Country Planning Organisation	<ul style="list-style-type: none"> ⊗ Urban mapping - Thematic maps and graphic database on towns (under progress in association with NRSA and State town planning department)
45.	Wildlife Institute of India Post Bag No. 18, Chandrabani Dehradun - 248 001, Uttaranchal Tel#0135 640111 -15, Fax#0135 640117 email : wii@wii .	<ul style="list-style-type: none"> ⊗ Provide information and advice on specific wildlife management problems. ⊗ National Wildlife Database
46.	Zoological Survey of India Prani Vigyan Bhawan 'M' Block, New Alipore Calcutta - 700 053 Phone # 91-33-4786893, 4783383 Fax # 91-33-786893 RO - Shillong, Pune, Dehradun, Jabalpur, Jodhpur, Chennai, Patna, Hyderabad, Canning, Behrampur, Kozikode, Itanagar, Digha, Port Blair, Solan	<ul style="list-style-type: none"> ⊗ Red Book for listing of endemic species ⊗ Survey of faunal resources

ANNEXURE VII

**Form through which the State Governments/Administration of
the Union Territories Submit Nominations for SEIAA and SEAC
for the Consideration and Notification by the
Central Government**

Form for Nomination of a professional/expert as Chairperson / Member / Secretary of the SEIAA / EAC / SEAC						
1 Name (in block letters)						
2 Address for communication						
3 Age & Date of Birth (Shall be less than 67 years for the members and 72 years for the Chairman)						
4 Area of Expertise (As per Appendix VI)						
Professional Qualifications (As per Appendix VI)		Qualification(s)	University	Year of passing	Percentage of marks	
5						
6 Work experience (High light relevant experience as per Appendix VI)		Position	Years of association From to		Period in years	Nature of work. If required, attach separate sheets
7 Present position and nature of job		Serving Central / State Government Office?			Yes/No	
		Engaged in industry or their associations?			Yes/No	
		Associated with environmental activism?			Yes/No	
		If no is the answer for above three, please specify the present position and name of the organization				
8 Whether experienced in the process of prior environmental clearance?		Yes/No. If yes, please specify the experience in a separate sheet (Please restrict to 500 words)				
9 Whether any out-standing expertise has been acquired?		Yes/ No If yes, please provide details in a separate sheet (Please restrict to 500 words).				
10 Any other relevant information?		May like to attach separate sheets (Research projects, consultancy projects, publications, memberships in associations, trainings undergone, international exposure cum experience etc.)				

The Government of.....is pleased to forward the Nomination of Dr./Sh. for the position of Chairperson / Member / Secretary of the SEIAA / SEAC / EAC to the Ministry of Environment & Forests, the Government of India for the Notification.

(Authorized Signature with Seal)

ANNEXURE VIII
Composition of EAC/SEAC

Composition of the EAC/SEAC

The Members of the EAC shall be Experts with the requisite expertise and experience in the following fields /disciplines. In the event that persons fulfilling the criteria of “Experts” are not available, Professionals in the same field with sufficient experience may be considered:

- Environment Quality Experts: Experts in measurement/monitoring, analysis and interpretation of data in relation to environmental quality
- Sectoral Experts in Project Management: Experts in Project Management or Management of Process/Operations/Facilities in the relevant sectors.
- Environmental Impact Assessment Process Experts: Experts in conducting and carrying out Environmental Impact Assessments (EIAs) and preparation of Environmental Management Plans (EMPs) and other Management plans and who have wide expertise and knowledge of predictive techniques and tools used in the EIA process
- Risk Assessment Experts
- Life Science Experts in floral and faunal management
- Forestry and Wildlife Experts
- Environmental Economics Expert with experience in project appraisal

ANNEXURE IX

Best Practices & Latest Technologies available and reference

Best available technology for tannery effluent treatment

A green approach:

- By using polypropylene drums, rather than the usual wood or stainless steel, it is possible to reduce water consumption by 25%. The drums are easy to clean and maintain and use 20% less electricity than standard drums.

- By installing a conveyor system for unloading the drums, this process becomes automatic. No longer will forklifts be required - this has always been a pollution issue and also one of the highest safety risk areas.

- By investing heavily in the latest drying equipment it has also been possible to reduce the energy required for the drying of the leather. An estimated 20% energy saving is planned.

- In the finishing area, ECCO have developed a new system which does away with the usual tables and use of forklifts. Instead, the new ECCO designed loading system will allow lean production and easier planning and control.

- Chemicals will be injected automatically. This will eliminate any handling by employees with less risk of accidents and also reduce the overall consumption.

- To create energy, the company have chosen liquid gas and there will be no use of diesel oil. This gives a markedly cleaner environment.

- The construction of the building with much natural light and high ceilings reduces the use of artificial light and ventilation systems.

l)

Primary treatment is the first step of tannery effluent treatment and refers to the physical-chemical separation of the major pollutants from the raw wastewater, including suspended solids, sulphides and chrome removal, and the associated BOD and COD loadings. Primary treatment usually evolves either settlement or floatation. Dissolved air floatation is nowadays classified as the best method to provide for most efficient primary treatment.

W2O Environment, have implemented a new primary treatment plant at Artículos de Piel los Favoritos, CxA (Bermudez Tannery) which has been designed according to BAT (Best available technology).³ The primary treatment comprises of effluent segregation and screening, balancing, sulphide oxidation and dissolved air flotation (DAF).

The dissolved air floatation system removes 70-80% of COD, discharging a clear and transparent effluent containing less than 100 mg/l of suspended solids with an average COD of 1,004 mg/l. This new primary treatment plant, comprising of mixing + chemical treatment + floatation, shows a considerable improvement compared with the benchmark performance of similar plants, according to the reference document of the IUE (International Environmental Commission) and 'Benchmarking: Part 4',⁴ and can be considered to be one of the best performing primary tannery effluent treatment plants in the world.

The tannery, based in the Dominican Republic, is producing leather from raw hides up to finished leather for high quality markets. Artículos de Piel los Favoritos is now operating this modern fully automated primary treatment plant, which conforms to European standards.

Result

The new primary effluent treatment plant at Artículos de Piel los Favoritos was started up in March 2008. The performance has been improved by testing various primary treatment chemicals and selection of the most suitable polymer. In the following, the addition of the selected coagulants and polymers has been adjusted and a reduction of the overall treatment chemicals has been achieved.

The implementation of the new primary treatment has significantly improved the effluent quality and has also reduced the sludge disposal volumes and costs. The plant is fully automatic and requires minimum supervision.

Conclusions

The installation of a self-cleaning screen with a slot size of 1 mm has been shown to efficiently remove coarse solids and to protect pumps and Jetox Venturi used during the subsequent treatment steps from wear and blockages.

The sulphide oxidation using blower assisted Jetox Venturi aeration has been shown to efficiently remove sulphides with an average concentration of 0.19 ppm (data from 2008/2009) achieved with the completion of the full 8-hour oxidation cycle.

The Jetox Venturi aeration and mixing in the balancing tank has shown to completely homogenise the varying pH and to prevent solids settlement.

The dissolved air floatation removes 70–80% of COD, discharging a clear and transparent effluent of average 1004 mg/l COD. According to benchmarking with similar primary plants a COD reduction of 55–75% can be achieved. The outstanding results of the new primary treatment plant at Artículos de Piel los Favoritos places this plant as one of the best performing primary treatment plants in the world.

The DAF treatment achieves a high primary sludge dryness of up to 10% and, therefore, considerably reduces the volumes of sludge for de-watering.

II)

The tannery Elmo Leather AB in Sweden has recently finalized a new wastewater treatment plant using an innovative system for nitrogen removal. The innovation of the plant is the implementation of a nitrification and denitrification step in the treatment of tannery wastewater. The technology has before not been considered feasible in wastewater treatment plants for the leather industry, due to the composition of the tannery wastewater.

The construction of the wastewater treatment plant started in March 2004 and the plant was taken into operation in April 2005. The total cost for the project was slightly above 5 million Euros and the investment cost around 4, 3 million Euros. The project was supported by the EU LIFE Financial Instrument with 913.999 Euro

The plant has been running during one year and the performance of the plant has been very stable and as example can be mentioned that the reduction of nitrogen in the plant has never been below 80 % despite the Scandinavian winter conditions. During September 2005 – April 2006 the average reduction of some key parameters has been the following: BOD-removal 98%, COD-removal 92 %, Nitrogen-removal 89 % and Chromium-removal 89 %.

In summary, this EU LIFE-supported project has demonstrated that it is possible to reduce the nitrogen discharge from the leather industry by more than 80 % in a cost-effective way.

The removal of nitrogen from effluents by nitrification/denitrification is used by some municipal wastewater treatment plants in Europe (easier to treat than wastewater from tanneries). In the first biological process (nitrification) the ammonia nitrogen is oxidised into nitrate. This process takes place under aerobic conditions, i.e. in the presence of oxygen. In the second process (denitrification), the nitrate is reduced to gaseous nitrogen, which escapes into the atmosphere. The denitrification takes place under anoxic conditions.

The innovation in this project was to introduce and apply a technology to reduce nitrogen in the wastewater, which are used by other sectors into the treatment of tannery wastewater.

One of the major suppliers of nitrification/denitrification systems in Europe did together with Elmo Leather in Sweden perform laboratory trials in 8 months on the use of nitrification/denitrification technology on tannery wastewater. The trials were successful and the results from the trials were used for up scaling to full scale in order to effectively demonstrate that the technology can be used on wastewater from tanneries. Examples of important factors to obtain a stable cleaning process are: the plant has a strict process control (especially pH and balance of nutrients is important); the plant is a 2-step plant (toxic

compounds degraded in step 1) and the plant has a possibility for hydraulic equalization (to avoid fluctuations in e.g. chloride concentration).

Technical description

An overview of the plant is given below and followed by a description of the plant.

The principle of the WWTP is the following. The wastewater flows from the tannery to the new inlet pumping station through a 2mm screen. The wastewater is then pumped to biological treatment.

Step 1 Biological Treatment (Equalization and removal of COD and toxic matter)

The wastewater is pumped into the first aeration tank, which has a volume of 2000 m³. The tank serves as a buffer tank for equalization of flow and pollutants. At the same time the tank is used as an aeration tank where micro-organisms are grown to oxidize a great part of the organic matter and sulphide in the wastewater. Oxygen is supplied through robust aerator mixers to secure a stable operation of the first biological step. Phosphoric acid is dosed to support the growth of micro-organisms.

Deaeration: From the aeration tank the wastewater flows to a deaeration tank where iron salts and polymer can be added to improve performance of the first settling tank.

Settling/Sedimentation: In the first settling tank most of the suspended solids in pre-treated wastewater are removed. Excess sludge collected at the bottom of the settling tank is pumped to sludge dewatering in the existing sludge dewatering building. Sludge can also be pumped back into the aeration tank to improve removal of organic matter in the system. Intermediate pumping station: Pre-treated wastewater is collected at an intermediate pumping station. The wastewater is then pumped to the second aeration tank. The wastewater is pumped into the aeration tank at intervals depending on operation mode in the aeration tank.

2. Step - biological treatment

The final purification of the wastewater takes place in the second aeration tank. The tank is designed with a big volume (5100 m³) so biological nitrogen removal can take place.

Nitrogen removal: The nitrogen is present in the wastewater mainly as ammonia. The nitrogen removal is a biological process performed by two processes: nitrification and denitrification. In the first biological process the ammonia nitrogen is oxidized into nitrate. This process takes place under aerobic conditions, i.e. in the presence of oxygen. In the second process (denitrification), the nitrate is reduced to gaseous nitrogen, which escapes into the surrounding atmosphere. The denitrification takes place under anoxic conditions, which means that oxygen is not present or in anoxic zones of the flocks. In this system, the combination of aerobic and anoxic conditions (which is necessary for the nitrogen removal) is created by switching off the aeration when denitrification is taking place.

Deaeration: From the aeration tank the wastewater flows to a deaeration tank where polymer can be added to improve performance of the final settling tank.

Settling: In the final settling tank, the suspended solids settle and the treated wastewater (almost free from suspended solids) is transported to a disc filter, which has a maximum size of 10 Fm to ensure that levels of remaining suspended substances are low. A flow-controlled sampler is used in the well after the disc filter to check the pollution levels of the treated water. After this the treated water is discharged. The major part of the sludge will be pumped back to the second aeration tank, while a minor part of the sludge is pumped to sludge dewatering in the existing sludge dewatering building. It is important for the stability of the nitrification/denitrification that micro-organisms from the sludge are transferred back to the aeration tank..

The risk in this phase is that the very sensitive nitrification/denitrification step will not function optimally due to fluctuations in the inlet water from the processes. Corrective measures can be carried out if necessary. Dilution water from the effluent of the municipal treatment plant can be added to the plant in order to avoid large fluctuations in the inlet concentration of chemicals (as e.g. salt) to the new WWTP. A high degree of control and monitoring systems of the process has been included in the plant.

The environmental policy at Elmo Leather AB shows that it is possible to reduce the environmental impact for leather production substantially. Elmo Leather AB did first minimize the pollution by introducing best available technologies in the production by changing processes and substituting chemicals. In order to further reduce the pollution, a new waste water treatment plant was built with the support of the EU LIFE financial instrument.

The wastewater treatment plant at Elmo Leather AB which has been in operation in full scale for more than one year has shown that it is possible to obtain a stable and long-lasting reduction of the nitrogen discharge in the wastewater by more than 80 % in a cost-efficient way by using the TANWATER nitrification/denitrification technology.

There is a large potential for transferring the results and the technology to other tanneries or wastewater treatment plants dealing with tannery wastes. In order to facilitate that transferability, an extensive dissemination of the experiences from the project was carried out.

A picture from above of the plant is given below.



New Machineries:

These are a few photos of a modern Wet Blue Plant.

Process capacity is 2000 hides per Day.

Process Vessels are Dose Drums with Incotec Automation.



Conclusion:

For each tannery plant, the project team may research scientific and technical issues, fit methods to small and larger operating units in Indian conditions, demonstrate the methods in particular regions, establish the economic and other benefits of TDS reduction, ensure that hides and skins can be processed into suitable quality leathers and establish an educational and technology transfer program.

Publication:

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- ❖ **Use of Waste Sludge from the Tannery Industry** by **Ismail Cem Kantarli and Jale Yanik**

- ❖ **Salinity reduction in tannery effluents in India and Australia** by **Dr Catherine Money**, 2001.

Websites:

- ❖ <http://www.tannerymachines.biz/index.php>
- ❖ <http://www.highbeam.com/doc/1G1-207734653.html>
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- <http://www.iaia.org>
- <http://www.cpcb.nic.in/>



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