RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(A) Fluid Mech. – II

Fluid Mech. – II

Unit-I

Turbulent flow : Laminar and turbulent boundary layers and laminar sublayer, hydrodynamically smooth and rough boundaries, velocity distribution in turbulent flow, resistance of smooth and artificially roughened pipes,commercial pipes, aging of pipes. Pipe flow problems : Losses due to sudden expansion and contraction, losses in pipe fittings and valves,concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel,branching of pipes. Pipe Network : *Water Hammer (only quick closure case). transmission of power. *Hardy Cross Method

Unit-II

Uniform flow in open channels : Channel geometry and elements of channel section, velocity distribution,energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, Chezy's and Manning's formulae, determination of normal depth and velocity, Normal and critical slopes, Economical sections, Saint Vegnet equation.

Unit-III

Non uniform flow in open channels : Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow hydraulic jump in rectangular channels and its basic characteristics, surges in open channels & channel flow routing, venturi flume.

Unit-IV

Forces on immersed bodies: Types of drag, drag on a sphere, a flat plate, a cylinder and an aerofoil development of lift, lifting vanes, magnus effect.

Unit-V

Fluid Machines: Turbines : Classifications, definitions, similarity laws, specific speed and unit quantities, Pelton turbine-their construction and settings, speed regulation, dimensions of various elements, Action of jet, torque, power and efficiency for ideal case, characteristic curves. Reaction turbines: construction & settings, draft tube theory, runaway speed, simple theory of design and characteristic curves, cavitation. Pumps: Centrifugal pumps : Various types and their

important components, manometric head, total head, net positive suction head, specific speed, shut off head, energy losses, cavitation, principle of working and characteristic curves. Reciprocating pumps: Principle of working, Coefficient of discharge, slip, single acting and double acting pump, Manometric head, Acceleration head.

Reference books:-

1. Fluid Mechanics - Modi & Seth - Standard Book house, Delhi
2. Open Channel Flow by Rangaraju - Tata Mc Graw - Hill Publishing Comp. Ltd., New Delhi
3. Fluid Mechanics - A.K. Jain - Khanna Publishers, Delhi
4. Fluid Mechanics, Hydraulics & Hydraulic Machanics - K.R. Arora - Standard Publishers Distributors 1705- B, Nai Sarak, Delhi-6
5. Hyd. of open channels By Bakhmetiff B.A. (McGraw Hill, New York)
6. Open Channel Hyd. By Chow V.T. (McGraw Hill, New York)
7. Engineering Hydraulics By H. Rouse
8. Centrifugal & Axial Flow Pump By Stempanoff A.J. New York
9. Relevant IS codes.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(B) Intellectual Property Rights

Course Objective

Acquaint the students with the basic concepts of Intellectual Property Rights; and sensitize the students with the emerging issues in IPR and the rationale for the protection of IPR.

UNIT I Introduction

Introduction and Justifications of IPR, Nature of IP, Major forms of IP- *Copyright, Patent, Trade Marks Designs, Geographic indication, layout design of Semi conductors, Plant varieties, Concept & Meaning of Intellectual Property.*

Major international documents relating to the protection of IP - *Berne Convention, Paris Convention, TRIPS*. The World Intellectual Property Organization (WIPO).

UNIT II Copyright

Meaning and historical development of copyright , Subject matter , Ownership of copyright, Term of copyright, Rights of owner, Economic Rights, Moral Rights. Assignment and licence of rights, Infringement of copyright, Exceptions of infringement, Remedies, *Civil, Criminal, Administrative*, Registration Procedure.

UNIT III Patents

Meaning and historical development,. Criteria for obtaining patents, Non patentable inventions, Procedure for registration, Term of patent, Rights of patentee, Compulsory licence, Revocation, Infringement of patents, Exceptions to infringement, Remedies, Patent office and Appellate Board.

UNIT IV – Trade Marks, Designs & GI

Trade Marks: Functions of marks, Procedure for registration, Rights of holder, Assignment and licensing of marks, Infringement, Trade Marks Registry and Appellate Board.

Designs: Meaning and evolution of design protection, Registration, Term of protection, Rights of holder, unregistered designs.

Geographical Indication: Meaning and evolution of GI, Difference between GI and Trade Marks, Registration, Rights, Authorised user.

UNIT V Contemporary Issues & Enforcement of IPR

IPR & sustainable development, The Impact of Internet on IPR. IPR Issues in biotechnology, E-Commerce and IPR issues, Licensing and enforcing IPR, Case studies in IPR

Course Outcome:

1. Students will be able to understand Primary forms of IPR
2. Students will be able to asses and critique some basic theoretical justification for major forms of IP Protection
3. Students will be able to compare and contrast the different forms of IPR in terms of key differences and similarities.
4. Students will be able understand the registration procedures related to IPR.
5. Students will be exposed to contemporary issues and enforcement policies in IPR.

References:

1. P. Narayanan, Intellectual Property Law, Eastern Law House

2. . Neeraj Pandey and Khushdeep[Dharni, Intellectual Property Rights, PHI, 2014

3. N.S Gopalakrishnan and T.G. Agitha, Principles of Intellectual Property, Eastern Book Co. Lucknow, 2009.

4. Anand Padmanabhan, Enforcement of Intellectual Property, Lexis Nexis Butterworths, Nagpur, 2012.

5. Managing Intellectual Property The Strategic Imperative, Vinod V. Sople, PHI.

6. Prabuddha Ganguli, " Intellectual Property Rights" Mcgraw Hill Education, 2016.

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(C) Environmental Impact Assessment

Environmental Impact Assessment

UNIT-I

Concept of EIA : Introduction of EIA, Utility and scope of EIA, Significant Environmental Impacts, Stage of EIA, Environmental Inventory, Environmental Impact Statement (EIS)

UNIT-II

Methods of Impact Identification : Environmental Indices and indicators for describing the affected environment, matrix methodologies, network, checklist, and other method.

UNIT-III

Impact analysis : Framework, statement predication and assessment of impact of air, water, noise and socio-economic environment.

UNIT-IV

Preparation of written documentation : Initial planning phase, detailed planning phase, writing phase, organizing relevant information, co-ordination of team writing effort.

UNIT-V

Public Participation in Environmental Decision making : Basic definitions, Regulatory requirements, Advantages & disadvantages of Public Participation, Selection of Public participation techniques, Practical considerations for implementation.

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New Scheme Based On AICTE Flexible Curricula

Civil Engineering, VI-Semester

Open Elective CE 604(D) Operation Research

Operation Research

Unit I

Linear Models: The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

Unit II

Transportation Models And Network Models: Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

Unit III

Inventory Models: Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

Unit IV

Queueing Models: Queueing models – Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

Unit V

Decision Models: Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

Reference books:-

Taha H.A., “Operations Research”, Sixth Edition, Prentice Hall of India, 2003.

UNIT-I

Concept of EIA: Introduction of EIA, Utility and scope of EIA, Significant Environmental Impacts, Stage of EIA, Environmental Inventory, Environmental Impact Statement (EIS)

Introduction of EIA - change is inherent to development. Whilst development aims to bring about positive change it can lead to conflicts. In the past, the promotion of economic growth as the motor for increased well-being was the main development thrust with little sensitivity to adverse social or environmental impacts. The need to avoid adverse impacts and to ensure long term benefits led to the concept of sustainability. This has become accepted as an essential feature of development if the aim of increased well-being and greater equity in fulfilling basic needs is to be met for this and future generations. In order to predict environmental impacts of any development activity and to provide an opportunity to mitigate against negative impacts and enhance positive impacts, the environmental impact assessment (EIA) procedure was developed in the 1970s.

An EIA may be defined as: A formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and to augment positive effects.

EIA thus has three main functions:

- **To predict problems,**
- **To find ways to avoid them, and**
- **To enhance positive effects.**

Characteristics of EIA:

The EIA gives a clear-cut picture of important environmental considerations which are to be incorporated in the decision-making process while setting up of the major projects.

It has many important characteristics:

1. **It provides a systemic evaluation of almost all significant environmental consequences of a developmental project**
2. **EIA is a structured, systemic and comprehensive approach**
3. **All EIA processes draw driving force by legislation**
4. **EIA is one of the most valuable and interdisciplinary decision-making tools**
5. **EIA can force the policy-makers to reconsider the project proposals**
6. **It can be used to ensure regional planning for sustainable development**
7. **It ensures the accountability of decision- makers to the public**
8. **It provides possible alternate development options against identified environmental impacts**
9. **EIA document should be circulated for objective review of its results by others**
10. **EIA cannot be taken in isolation, rather, it is related with other factors, viz., Environmental Statement, Environmental Audit and New System of National Accounts etc.**
11. **It seeks public participation in decision -making.**

Components of EIA:

The key steps in EIA process are:

(I) Project Definition and Identification:

During project identification and definition, the project proponent conducts feasibility studies, defines the usefulness of the study, considers alternatives, files a notice of intention to seek EIA clearance and, ideally, initiates an inter-agency and public consultation process.

(II) Screening:

At this stage, the EIA agency determines whether the project may proceed as planned or it should be modified partially or completely. For this, the EIA agency consults the proponent and other agencies and public participants to determine the requirements of further studies.

(III) Scoping:

This is also an early planning stage and deals with a more detailed plan of study for the project to identify major concerns and key impacts and to decide assessment methods and models to be used.

(IV) Agencies:

Agencies and public represen-tatives concerned with the project or the project area are consulted.

(V) Baseline Data Collection:

Baseline data collection and analyses are very important in project planning. They play an important role in primary monitoring of the environment in the project area.

(VI) Identification of Impact:

Impact prediction and assessment are the most important parts of the technical process. This can be achieved by employing suitable models and a careful evaluation of inputs and outputs of environmental impacts.

(VII) Alternative Evaluation Criteria:

They include legally-mandated criteria, technical/ scientific criteria, and social acceptability criteria. Alternative sites and design process should be critically examined to maximize the positive environmental impacts, socio-economic benefits, profi-tability, and minimize the temporary adverse impacts.

(VIII) Management Plan:

After the identification of environmental impacts, the mitigation measures are now needed to be defined. A good management plan should have flexible project planning so that it can adopt the modified or entirely new project alternatives. It should aim to minimize adverse environmental impacts.

(IX) Publication of EIA Report:

Circulation/ Publication of EIA report is an important step. It brings public comments, which would be definitely helpful for primary stages of EIA like screening and scooping.

(X) Formal Approval (With or Without Conditions):

The decision on the EIA report is put forward in a written record with conditions that the project proponent must comply with the provisions mentioned in the document.

(XI) Monitoring and Compliance:

A careful monitoring ensures the compliance of provisions mentioned in the management plan. It not only provides confidence to workers, public agencies, and communities involved in dealing with negative impacts, but also gives useful feedback on the accuracy of the EIA's impact predictions.

Utility and scope of EIA-

Environmental assessment (EA) is the assessment of the environmental consequences (positive and negative) of a plan, policy, program, or actual projects prior to the decision to move forward with the proposed action. In this context, the term "environmental impact assessment" (EIA) is usually used when applied to actual projects by individuals or companies and the term "strategic environmental assessment" (SEA) applies to policies, plans and programmes most often proposed by organs of state. Environmental assessments may be governed by rules of administrative procedure regarding public participation and documentation of decision making, and may be subject to judicial review.

The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the 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". EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts.

Environmental Impact Assessment (EIA) may be defined as a systematic integrated evaluation of both the positive and negative impacts of a project on the natural environment; on beneficial uses of the environment, including man-made structures, amenities and facilities; and on the socio-cultural environment.

The objective of EIA is (i) to identify, predict and evaluate the economic, environmental and social impact of development activities (ii) to provide information on the environmental consequences for decision making

and (iii) to promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.

Significant Environmental Impacts-

Stage of EIA-The EIA process makes sure that environmental issues are raised when a project or plan is first discussed and that all concerns are addressed as a project gains momentum through to implementation. Recommendations made by the EIA may necessitate the redesign of some project components, require further studies, and suggest changes which alter the economic viability of the project or cause a delay in project implementation. To be of most benefit it is essential that an environmental assessment is carried out to determine significant impacts early in the project cycle so that recommendations can be built into the design and cost-benefit analysis without causing major delays or increased design costs. To be effective once implementation has commenced, the EIA should lead to a mechanism whereby adequate monitoring is undertaken to realize environmental management. An important output from the EIA process should be the delineation of enabling mechanisms for such effective management.

The way in which an EIA is carried out is not rigid: it is a process comprising a series of steps. These steps are outlined below and the techniques more commonly used in EIA are described in some detail in the section Techniques.

Stages of EIA

1. **Screening**
2. **Scoping**
3. **Impact analysis**
4. **Impact mitigation**
5. **Reporting**
6. **Review**
7. **Decision making**
8. **Monitoring**

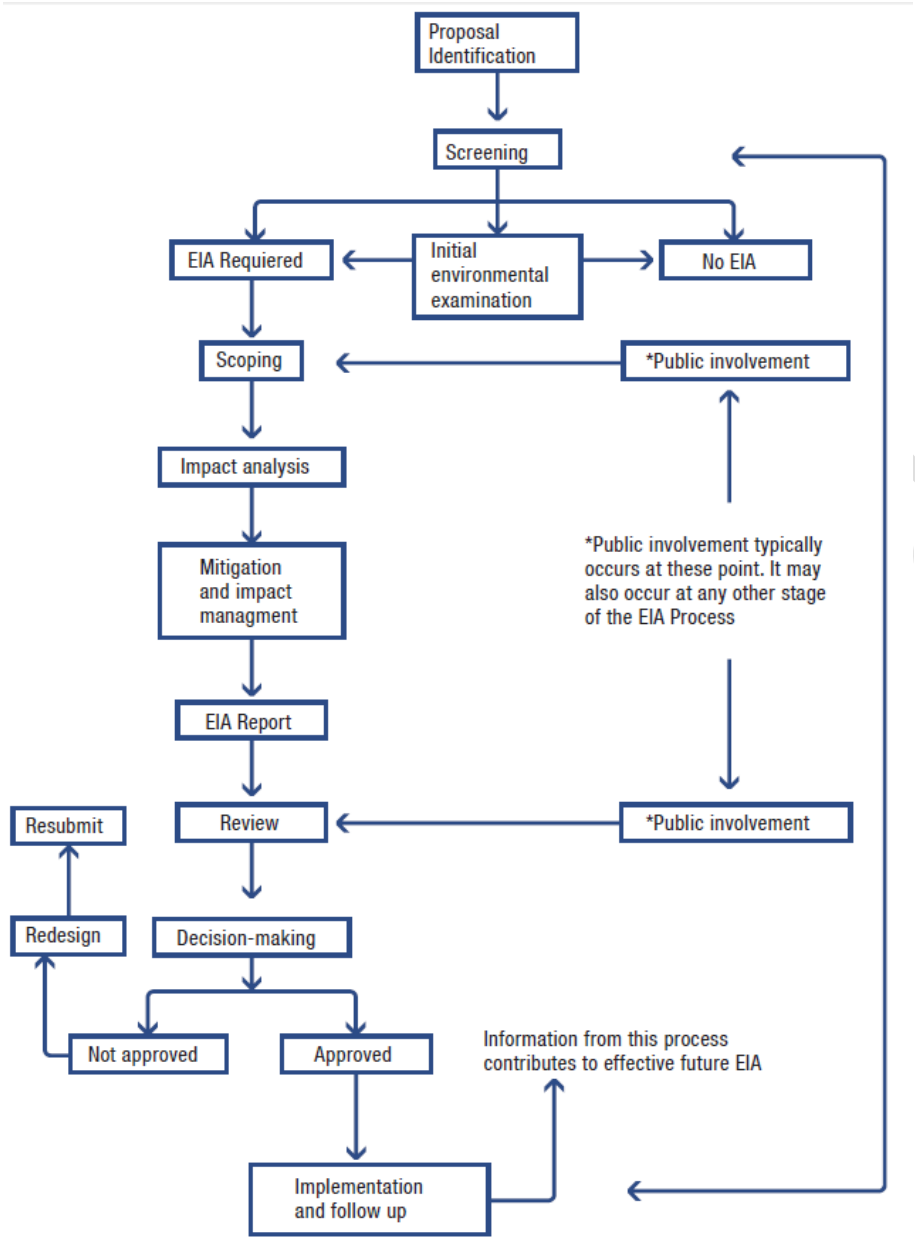

Fig. 1 Stages of EIA

1. Screening: To determine which projects or developments require a full or partial impact assessment study.

2. Scoping: To identify which potential impacts are relevant to assess (based on legislative requirements, international conventions, expert knowledge and public involvement), to identify alternative solutions that avoid, mitigate or compensate adverse impacts on biodiversity (including the option of not proceeding with the development, finding alternative designs or sites which avoid the impacts, incorporating safeguards in the design of the project, or providing compensation for adverse impacts), and finally to derive terms of reference for the impact assessment.

3. Assessment and evaluation of impacts and development of alternatives:- To predict and identify the likely environmental impacts of a proposed project or development, including the detailed elaboration of alternatives.

4. Reporting the Environmental Impact Statement (EIS) or EIA report:- Including an environmental management plan (EMP), and a non-technical summary for the general audience.

5. Review of the Environmental Impact Statement (EIS):- Based on the terms of reference (scoping) and public (including authority) participation.

6. Decision-making:- On whether to approve the project or not, and under what conditions.

7. Monitoring: - Compliance, enforcement and environmental auditing. Monitor whether the predicted impacts and proposed mitigation measures occur as defined in the EMP. Verify the compliance of proponent with the EMP, to ensure that unpredicted impacts or failed mitigation measures are identified and addressed in a timely fashion.

Environmental Inventory-The environmental inventory serves as the basis for evaluating the potential impacts on the environment, both beneficial and adverse, of a proposed action. It is included in an environmental impact statement (EIS). Development of the inventory represents an initial step in the environmental impact assessment process. The scope of the environmental inventory or baseline data acquisition includes a detailed characterization of the environment in an area of 10 Km radius around the proposed facility for environmental components viz., air, noise, water, land, ecology and socio-economic environment.

"Environmental inventory" is a complete description of the environment as it exists in an area where a particular proposed action is being considered. The inventory is compiled from a checklist of descriptors for the physical – chemical, biological, cultural, and socioeconomic environments. The "physical-chemical environment" includes such major areas as soils, geology topography surface-water and groundwater resources, water quality, air quality, and climatology. The "biological environment" refers to the flora and fauna of the area, including species of trees, grasses, fish, herpetofauna, birds, and mammals. Specific reference must be made to any threatened and/or endangered plant or animal species. General biological features such as species diversity and overall ecosystem stability should also be presented. Items in the "cultural environment" include historic and archaeological sites, and aesthetic resources such as visual quality.

The "socioeconomic environment" refers to a range of considerations related to humans in the environment, including population trends and population distributions; economic indicators of human welfare; educational systems; transportation networks and other infrastructure concerns such as water supply, wastewater disposal, and solid-waste management; public services such as police and fire protection and medical facilities; and many others. The physical-chemical and biological environments can be referred to as the "natural environment," or the "biophysical environment," while the cultural and socioeconomic environments represent the "man-made environment."

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

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

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UNIT-II

Methods of Impact Identification: Environmental Indices and indicators for describing the affected environment, matrix methodologies, network, checklist, and other method.

Environment Impact Assessment or EIA can be defined as the study to predict the effect of a proposed activity/project on the environment. A decision making tool, EIA compares various alternatives for a project and seeks to identify the one which represents the best combination of economic and environmental costs and benefits.

EIA – Three core values

1. Integrity: The EIA process should be fair, objective, unbiased and balanced

2. Utility: The EIA process should provide balanced, credible information for decision making

3. Sustainability: The EIA process should result in environmental safeguards

Environmental indicators

"An environmental indicator is a numerical value that helps provide insight into the state of the environment or human health. Indicators are developed based on quantitative measurements or statistics of environmental condition that are tracked over time.

Environmental indicators are simple measures that tell us what is happening in the environment. Since the environment is very complex, indicators provide a more practical and economical way to track the state of the environment than if we attempted to record every possible variable in the environment. For example, concentrations of ozone depleting substances (ODS) in the atmosphere, tracked over time, is a good indicator with respect to the environmental issue of stratospheric ozone depletion..

Environmental indicators have been defined in different ways but common themes exist.

"An environmental indicator is a numerical value that helps provide insight into the state of the environment or human health. Indicators are developed based on quantitative measurements or statistics of environmental condition that are tracked over time. Environmental indicators can be developed and used at a wide variety of geographic scales, from local to regional to national levels."

"A parameter or a value derived from parameters that describe the state of the environment and its impact on human beings, ecosystems and materials, the pressures on the environment, the driving forces and the responses steering that system. An indicator has gone through a selection and/or aggregation process to enable it to steer action.

The five key global environmental indicators are:

1. **Biological diversity.**
2. **Food production.**
3. **Average global surface temperature and CO_2 concentrations in the atmosphere.**

4. **Human population.**
5. **Resource depletion**

Environmental monitoring describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Environmental monitoring is used in the preparation of environmental impact assessments, as well as in many circumstances in which human activities carry a risk of harmful effects on the natural environment. All monitoring strategies and program have reasons and justifications which are often designed to establish the current status of an environment or to establish trends in environmental parameters. In all cases the results of monitoring will be reviewed, analyzed statistically and published. The design of a monitoring program must therefore have regard to the final use of the data before monitoring starts.

Methodologies:-

Methodology means the structural approaches for doing one or more activities of EIA.There are some specific characteristic which an EIA methodology should depict.

These are :-(1) it should be appropriate to the necessary task of EIA process such as impact identification/comparison of alternatives.

(2) It should be significantly free from assessor's bias

(3) It should be economical in terms of costs, and its requirement of data, investigating time , personnel, equipment and facilities.

Impact Analysis:-

This stage of EIA identifies and predicts the likely Environmental and social impact of the proposed project and evaluates the significance.

Method for Impact Analysis

1. **Impact identification**
2. **Impact prediction**
3. **Impact evaluation**

Impact Identification attempts to answer the question, "what will happen when a project enters its operational stage?"A List of important impacts such as changes in ambient air quality, changes in water and soil qualities, noise levels, wildlife habitats, species diversity, social and cultural systems, employment levels etc may be prepared. The important sources of impact like smoke emission, consumption of water, discharge of effluents etc are identified.

1. **Ad hoc method**
2. **Checklists**
3. **Matrices**
4. **Overlays**
5. **Networks**

1. **Ad hoc method:- Simple method based on subjective environment impacts on broad aspects. Ad hoc method is useful when time constraints and lack of information require that the EIA must rely exclusively on expert opinion. It provides minimal guidance for total impact assessment while suggesting the broad areas of possible impacts and the general nature of these possible impacts. When more scientific methods are available, it is not recommended. Ad hoc methods indicate broad areas of possible impacts by listing composite environmental parameters (Ex: flora and fauna) likely to be affected by the proposed activity.**

   These methods involve assembling a team of specialists who identify impacts in their area of expertise. Here, each parameter is considered separately and the nature of impacts (long term or short term, reversible or irreversible) is considered. These methods give a rough assessment of total impact while giving the broad areas and the general nature of possible impacts. In this method, the assessor relies on an intuitive approach and makes a broad-based qualitative assessment. This method serves as a preliminary assessment and helps in identification of important areas like:

   1. **Wildlife**
   2. **Endangered species**
   3. **Natural vegetation**
   4. **Exotic vegetation**
   5. **Grazing**
   6. **Social characteristics**
   7. **Natural drainage**
   8. **Groundwater**
   9. **Noise**
   10. **Air quality**
   11. **Visual description and services**
   12. **Open space**
   13. **Recreation**
   14. **Health and safety**
   15. **Economic values and**
   16. **Public facilities**

Types of Ad hoc method:-

- **Opinion polls.**
- **Expert's opinion.**
- **Delphi methods**

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

The drawbacks of this method are listed below:

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

2. Checklist method: - Checklist means listing of potential Environmental Impacts.This method is done to assess the nature of the impacts i.e. its type such as adverse /beneficial, short term or long term, no effect or significant impact, reversible or irreversible etc.

Types of checklist:-

- **Simple Lists.**
- **Descriptive Checklists.**
- **Scaling Checklists.**
- **Questionnaire Checklists**

1. **Simple checklists: - List of parameters without guidelines regarding either interpretation or measurement of environmental parameters or specific data needs or impact prediction and assessment.**
2. **Descriptive checklists: - It include list of environmental factors along with information on measurement, impact prediction and assessment.**
3. **Scaling and weighting checklists: - It facilitate decision making. Such checklists are strong in impact identification. While including the function of impact identification, they include a certain degree of interpretation and evaluation. The aforementioned factors make these methods attractive to decision-making analysis.**

However, the scaling and weighting methods are subjective and hence pose the danger of imparting equal importance to every impact. Another defect observed by critics is that numerical values assigned to impacts can be derived on the basis of expert knowledge and judgment alone.
Scaling and weighting checklist techniques quantify impacts reasonably well although they use subjective estimates. However, they make no provision for assessing dynamic probabilistic trends or mitigation, enhancement and monitoring programs. These methods cannot identify higher order effects, impacts and interactions. Simple and descriptive checklists simply identify the possible potential impacts without any rating regarding their relative magnitudes. Scaling and weighting checklists remove decision making from the hands of decision makers while they impart a single number to various inherently different impacts and this aspect prevents the decision maker to consider the possibility of trade-offs.

Matrix Methodologies: - Matrix and its variants provide us a framework of interaction of different actions/activities of a project with potential EI caused by them. A simple interaction matrix is formed where project actions are listed along one axis i.e. vertically and EI are listed along the other side i.e. horizontally. It was pioneer by Leopold et al (1971). It lists about 100 project actions and about 88 environmental characteristic and condition.

The advantage of the matrix method:-

1. **It links action to impact**
2. **This is a very good method for displaying EIA results**

The disadvantages of this method are listed below:

1. **It is difficult to distinguish between direct and indirect impacts using this method**
2. **There is potential for double-counting of impacts**
3. **It is qualitative in nature and does not refer to quantity of impact**

4. **In checklist method, the impacts are tabulated in the form of cells with information either in the descriptive form that gives information regarding possibility or potential existence of an impact whereas in the scaling or weighing methods the magnitude or importance of impact is given. Weighing methods used in EIA are shown below:**

Factors	Weights	Alternative one			Alternative Two		
		Raw Data	Scaled	Weighted	Raw Data	Scaled	Weighted
1. Wildlife Habitat Preserved		500			10000		
2. Employment Increase		500			3000		
3. Wildlife Habitat Index	1		0.5			1	
4. Employment Increase index	1		1			0.6	
5. Wildlife Habitat Weighted Index	0.2		1	0.1			0.2
6. Employment Increase Weighted Index	0.8			0.8			0.48
7. Grand Index		N/A	1.5	0.9	N/A	1.6	0.68

Table 1-Weighing methods

4. Overlays

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

The advantages of this method are:

1. **It is easy to understand and use**
2. **It has a good display and**
3. **It is good for setting site selection**

The disadvantages of this method are:

1. **It addresses only direct impacts**
2. **It does not address impact duration or probability**

Network method:- It uses the matrix approach by extending it take into account primary as well the secondary impacts. Identification of direct, indirect /short and long term environment impact is a crucial and intact basic step of making Impact tree. Used to identify cause-effect linkages Visual description of linkages.

Example of a Network analysis:-

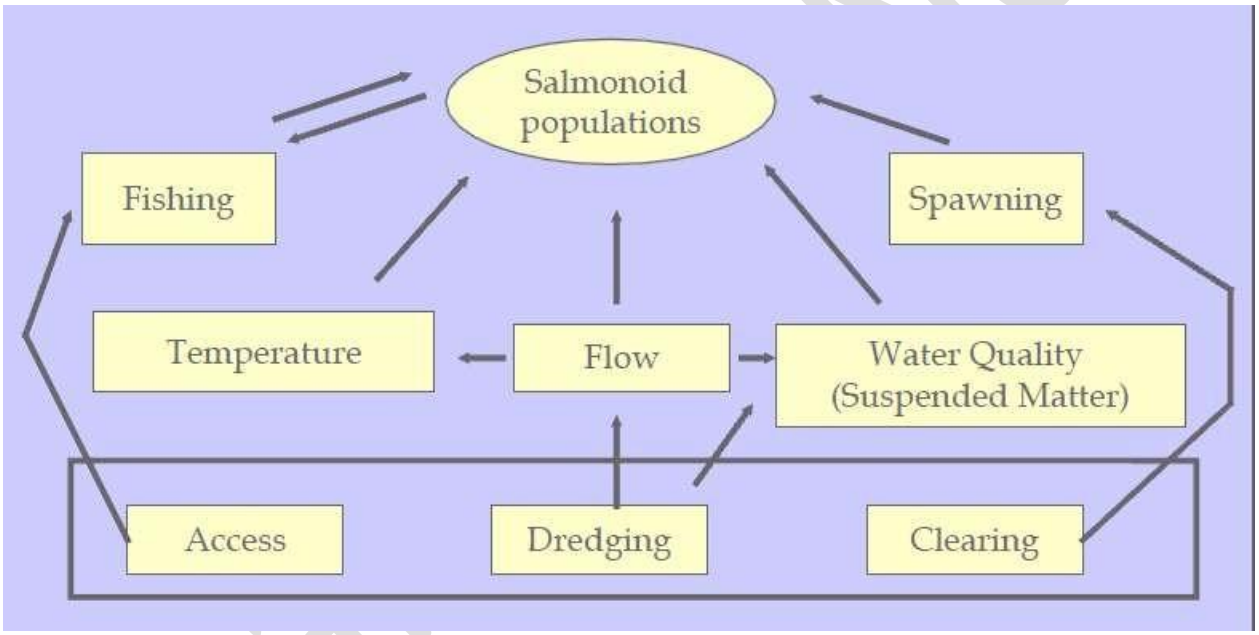

Fig. 2 Sequence diagram

The advantages of the network method are:

1. **It links action to impact**
2. **It is useful to check second order impacts in a simplified form**
3. **It handles direct and indirect impacts**

The disadvantages of this method are:
It becomes overly complex if used beyond simplified version

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UNIT-III

Impact analysis: Framework, statement predication and assessment of impact of air, water, noise and socio-economic environment.

Impact analysis (IA) is defined by Bohner and Arnold as "identifying the potential consequences of a change, or estimating what needs to be modified to accomplish a change", and they focus on IA in terms of scoping changes within the details of a design.

Types of Impact:-

1) Biological and Physio-chemical impacts:-

It relate to effects on biological resources such as vegetation, wildlife, crops and aquatic life. Interaction with Physical elements like air, water, soil, rocks and solar radiation. Chemical impacts like chemical change in air, water , soil quality etc.

2) Social impacts:-

- **Demographic – Displacement and relocation effects and changes in population characteristics.**
- **Cultural – Traditional patterns, family structure religious, archaeological features, social networks.**
- **Gender – implication of projects on roles of women in society, employment opportunity and equity**
- **Institutional – Housing , schools, Criminal justice , Health, welfare**

3) Health impacts:-

Examples of health impacts by sector

	Communicable disease	Non Communicable disease	Nutrition	Injury	Psychosocial disorder & loss of Well being
Mining	Tuberculosis	Dust Induced lung disease		Crushing	Labor migration
Agriculture	Parasitic infection	Pesticide Poisoning	Loss of Subsistence		
Industry					
Forestry			Loss of Production	Occupational Injury	
Dams and Irrigation Schemes	Water borne disease			Drowning	Involuntary displacement
Transportation		Heart disease		Traffic injury	
Energy		Indoor air pollution		Electromagnetic radiation	

Table 2. Health sector information

4) Economic impacts: - Duration of construction and operation Workforce requirements for each period Skill requirements (local availability) Earning Raw material and other input purchases Capital investment Outputs the characteristics of the local economy.

Impact Framework- At the national level, new environmental policies are being introduced, perhaps including a National Environmental Action Plan or National Plan for Sustainable Development. Such policies are often supported by legislation. Government policies in areas such as water, land distribution and food production, especially if supported by legislation, are likely to be highly significant for irrigation and drainage projects. An EIA should outline the policy environment relevant to the study in question. Results are also likely to be most easily understood if they are interpreted in the light of prevailing policies. Policies and regulations are sometimes conflicting and can contribute to degradation.

It is within the scope of an EIA to highlight such conflicts and detail their consequences in relation to the irrigation and drainage proposal under study. An example of conflicting policies would be an agricultural policy to subsidize agro-chemicals to increase production and an environmental policy to limit the availability of persistent chemicals. A totally laissez-faire policy will result in unsustainable development, for example through uncontrolled pollution and distortions in wealth.

This creates problems which future generations have to resolve. On the other hand, excessive government control of market forces may also have negative environmental impacts. For example, free irrigation water leads to the inefficient use of this scarce and expensive resource, inequities between head and tail users and water logging and salinity problems.

Legal and policy issues have far-reaching consequences for the environment and are included here to illustrate the complex nature of environmental issues. The FAO Legislative Study 38, "The environmental impact of economic incentives for agricultural production: a comparative law study", is a useful reference. A forthcoming FAO/World Bank/UNDP publication, "Water Sector Policy Review and Strategy Formulation: A General Framework", will address the need for environmental issues to be integrated into water policy. If a regional, sector or basin-wide EIA is needed; such issues will form an important part.

Institutional framework and EIA

Environmental, water and land issues involve many disciplines and many government bodies. Data will therefore have to be collected and collated from a wide range of technical ministries, other government authorities and parastatals. The interests of some bodies may not initially appear to be relevant to irrigation and drainage. However, they may hold important information about the project and surrounding area on such topics as land tenure, health, ecology and demography.

The link between different ministries and departments within ministries are often complex and the hierarchy for decision making unclear. There is a tendency for each ministry to guard "its project" and not consult or seek information from other government bodies unless forced to. This is directly contrary to the needs of an EIA. Even if formal structures exist there may be a lack of coordination between different organizations. Informal links may have been established in practice in order to overcome awkward bureaucratic structures. These issues must be understood and not oversimplified.

There may be conflict between government organizations, particularly between the institution promoting the development and that given the mandate for environmental protection. In countries where some planning processes are undertaken at the regional or district level, the regional or district councils make it

easier for affected communities to put forward their views, which may differ from those of the central authorities. They will have different agendas and approaches. The EIA process must be interactive and be sympathetic to the differing views; not biased towards a particular organization.

One of the main conflicts arising from irrigation and drainage projects is between those responsible for agriculture and those for water. In some countries, there are several key ministries with differing responsibility, such as agriculture, public works and irrigation, plus several parastatals organizations and special authorities or commissions, some perhaps directly under the Office of the President. The institutional aspects are complex; for example in Thailand, over 15 institutions have responsibility for various aspects of soil conservation work.

Legal framework for EIA

Environmental policy without appropriate legislation will be ineffective as, in turn, will be legislation without enforcement. Economic and financial pressures will tend to dominate other concerns. In many developing countries legislation on environmental issues has been in existence for many years. For example, laws exist in most countries for the prevention of water pollution, the protection of cultural heritage and for minimum compensation flows. Much of the existing legislation or regulations have not been considered "environmental". Recently, much specific new environmental legislation has been enacted. This may be as a response to major disasters, or may result from government policy, public pressure or the general increased international awareness of the environmental dangers that now exist in the world. Relevant water and land law as well as environmental protection legislation needs stating, understanding and analyzing as part of an EIA.

New legislation may include a statutory requirement for an EIA to be done in a prescribed manner for specific development activities. When carrying out an EIA it is thus essential to be fully aware of the statutory requirements and the legal responsibilities of the concerned institutions. These are best given as an annex to the terms of reference. The legal requirements of the country must be satisfied. New laws can impose an enormous burden on the responsible agencies.

The statutory requirement to carry out an EIA for specific projects will, for example, require expert staff to carry out the study, as well as officials to review the EIA and approve the project. Laws designating what projects require EIA should, ideally, limit the statutory requirements to prevent EIA merely becoming a hurdle in the approval process.

This will prevent large volumes of work being carried out for little purpose. Most legislation lists projects for which EIA is a discretionary requirement. The discretionary authority is usually the same body that approves an EIA. This arrangement allows limited resources to be allocated most effectively. However, it is essential that the discretionary authority is publicly accountable.

When external financial support is required it will also be necessary to satisfy the obligations of the donor organization. Most major donors now require an EIA for projects relating to irrigation and drainage. Chapter 6 gives details of publications outlining the requirements of the main donors. The function of environmental legislation can vary. It is not easy to give a precise definition of when an EIA is needed. Therefore the

statutory requirement for an EIA is not particularly well suited to law. On the other hand many of the most important environmental hazards are easily addressed by law. For example, it is straightforward to set legal limits for pollution, flow levels, compensation etc: here the problem is one of enforcement. It is normal for an EIA to assess the acceptability or severity of impacts in relation to legal limits and standards. However, it is important to highlight cases where existing standards are insufficiently stringent to prevent adverse impacts and to recommend acceptable standards. Enforcement problems can be partially addressed by changing institutional structures.

Laws relating to irrigated lands are complex and according to an FAO study of five African countries they are not generally applied (FAO, 1992). There are conflicts between modern and customary laws: the former tend to be given prominence although the latter are usually strong locally. Traditional and customary rights have often developed in very different historical and political contexts and can vary greatly over a short distance. They may also be mainly oral and imprecise. Local participation in the preparation of the EIA will help to understand important customary rights and highlight possible weaknesses in any proposed development.

Impact Prediction:- EIA is all about prediction and is needed at the earliest stages when the project, including alternatives, is being planned and designed, and this continues through to mitigation, monitoring and auditing. Evaluation follows from prediction and involves an assessment of the relative significance of the impacts.
The methods of evaluation range from intuitive to the analytical, from qualitative to quantitative, and from formal to informal. Cost benefit analysis, monetary valuation techniques, and multi-criteria/multiattribute methods, with their scoring and weighting systems, provide a number of ways for the evaluation issues. Mitigation of significant adverse effects involves the measures to avoid, reduce, the accumulated knowledge of the findings of the environmental investigations form the basis for the prediction of impacts. Once a potential impact has been determined during scoping process, it is necessary to identify which project activity will cause impact, and its magnitude and extent. Remedy or compensate for the various impacts associated with projects.

Statement Prediction:-
Environmental impact is any alteration of environmental conditions or creation of a new set of environmental conditions – adverse or beneficial – caused or induced by the project under consideration. The impact depends on the nature, scale and location of the proposed activity and it includes the effect on the natural resource
Base (i.e., the quality of air, water, noise, biological) and socioeconomic components of the environment which determine the cost of environmental management. The impacts can be classified as primary, which can be attributed directly to the project, and secondary, which are indirect changes and typically include the changed patterns of socio-economic activities likely to be stimulated or induced by the proposed activity. If a preliminary assessment is carried out, it will broadly review the project's effects. Also, scoping helps the decision-makers identify the most important issues. Taking these findings into account and after collecting the baseline environmental data, the full EIA study formally identifies such of the impacts as are to be assessed in detail. The methods used at the identification phase of the study include the following:

(i) Compile a candidate list of key impacts such as changes in air quality, noise levels, wildlife habitats, species diversity, landscape views, social and cultural systems, settlement

Methods of impact prediction:-

1. **Best estimate professional judgment.**
2. **Quantitative mathematical models.**
3. **Experiments and physical models.**
4. **Case studies as analogues or references.**

Impact Evaluation:- Its purpose is to assign relative significance to predicted impacts associated with the projects and to determine the order in which impacts are to be avoided , mitigated or compensated. This step evaluates the predicted adverse impacts to determine whether they are significant enough to warrant mitigation. The judgment of can be based on one or more of the following: Comparison with laws, regulations or accepted standards. Reference to pre-set criteria such as protected sites, features or species. Assessment of impact of air, water, noise and socio-economic environment

Water

Surface water the significance of any potential impact on water quality and quantity will depend on the current (or designated) use of the resource (e.g. for drinking water, irrigation, industrial process water, fishing, domestic use) or its importance to ecology and the nature and magnitude of change caused by the Project. Therefore defines receptors with regard to the use they make of the water resource or the ecological importance of the resource. For pipeline and associated construction activities, there are likely to be three main types of impact:

Planned discharges of treated sanitary sewage and process wastewater (e.g. storm water run-off from construction camps, run-off from vehicle wash-down areas and hydrostatic test water)

Disturbance of watercourses directly through physical works, and indirectly due to run-off containing suspended solids from working and reinstated areas accidental events or pollution.

Ecology

Ecology Ecological impacts have been evaluated taking account of the following factors:

- **The magnitude of the impact, as determined by its intensity, its extent in space and time**
- **The vulnerability of the habitat or species to the change caused by the impact**
- **The ability of that species or habitat to recover**
- **The value, in nature conservation and ecological terms of affected receptors including species, populations, communities, habitats, landscapes and ecosystems.**

Both indirect and direct impacts are included in the assessment of the significance of impacts – for example, the loss or alteration of a feeding area for a rare bird and impacts on a protected area off-site because they are connected to the pipeline route, e.g. by a watercourse. Impacts on species behavior or interactions have also been assessed, for example, consideration of impacts from noise and lighting. The scientific value of habitats for nature conservation is assessed according to widely accepted criteria of which the most important are naturalness, extent, rarity, and diversity.

These and others are described in an extensive literature (Radcliffe, 1977; Usher, 1986). Rarity and extent are assessed at several scales: in the context of occurrence on the proposed pipeline route, in the context of the surrounding ecosystem, and at a national and international scale. For example, habitats that are rare at an international scale would be considered the most important for nature conservation, while habitats that are rare on the proposed pipeline route or facility locations, but common in the context of the surrounding ecosystem, would be considered important at a site level. The ability of habitats to recover from change is also assessed based on the experience gained from monitoring of the BTC and SCP pipelines following construction. The ecological importance of species is assessed according to two main criteria:

Air quality

The main sources of emissions to air during construction are likely to be dust, vehicle emissions and emissions from sources such as temporary generators at construction sites and work camps. With regard to emissions other than dust, the key concern is the potential impact to human health due to carbon monoxide (CO), nitrogen oxides (NOx), sulphur.The oxides (SOx) and fugitive hydrocarbons. However, these emissions are not considered to be of a scale or longevity to have more than a highly localized and minor air quality effect, as the Project is not burning liquid fuels in significant quantities during operations. With regard to dust during construction this can have "nuisance" impacts (soiling, visual amenity), lead to reductions in crop productivity and adverse ecological impacts depending on the scale of dust emissions and the sensitivity of the flora and fauna affected. It is difficult to predict dust impacts as these depend on the duration and location of construction activities, meteorological conditions, soil and subsoil type, and background dust levels. However, by their nature, construction activities are of limited duration.

Noise

During construction the main sources of noise emissions are likely to include the operation of heavy machinery along the pipeline ROW; vehicle movements to and from the ROW and construction camps and pipe storage areas; and noise associated with the construction camps, for example, from the operation of temporary generators. During operation the sources of noise will be minimal and be limited to operation of the generators at the pigging station and occasional (approximately once every two years) maintenance venting when pigging activities are taking place.

For construction activities greater than one month, the guidelines within BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites. Noise' has been used. Construction noise activities less than one month in duration such as nitrogen venting have been assessed against these limits for benchmarking purposes only.

Social impacts

Potential social impacts can affect individuals, households and entire communities and they can be caused directly by Project activities (e.g. land take or job creation) or by environmental changes such as increased ambient noise levels, reductions in air quality and increased traffic. The significance of impacts depends on many variables including past experience and perception of previous impacts from Project development. In addition, local factors can be very important as individuals, households and communities vary in their sensitivity and reactions to actual or expected changes. People can also react to actual or expected changes and become part of impact cause–effect relationships thus altering the nature and progression of likely

impacts. For pipeline construction there are likely to be a range of potential key impacts, of varying durations (many short-term) including:

• Land acquisition and restriction of access to natural resources (e.g. grazing or recreation areas) and adverse effects on livelihoods and incomes

• Economic changes affecting job opportunities, business viability and potential to enhance incomes.

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UNIT-IV

Preparation of written documentation: Initial planning phase, detailed planning phase, writing phase, organizing relevant information, co-ordination of team writing effort.

Initial planning phase:-

The EIA process makes sure that environmental issues are raised when a project or plan is first discussed and that all concerns are addressed as a project gains momentum through to implementation. Recommendations made by the EIA may necessitate the redesign of some project components, require further studies, and suggest changes which alter the economic viability of the project or cause a delay in project implementation.

To be of most benefit it is essential that an environmental assessment is carried out to determine significant impacts early in the project cycle so that recommendations can be built into the design and cost-benefit analysis without causing major delays or increased design costs. To be effective once implementation has commenced, the EIA should lead to a mechanism whereby adequate monitoring is undertaken to realize environmental management. An important output from the EIA process should be the delineation of enabling mechanisms for such effective management.

The way in which an EIA is carried out is not rigid: it is a process comprising a series of steps. These steps are outlined below and the techniques more commonly used in EIA are described in some detail in the section Techniques. The main steps in the EIA process are:

- **Screening**
- **Scoping**
- **Prediction and mitigation**
- **Management and monitoring**
- **Audit**

Detailed planning phase:-

The developer is responsible for preparing the EIS and it is up to the developer to decide on the team to prepare the EIS. The EIS should be an independent objective assessment of the project's environmental impacts and not a 'best case statement' for the development. Negative impacts should be given equal prominence to the positive impacts, and they should be discussed in detail. The EIS should specify the effects (positive and/or negative; cumulative; short, medium and/or long term; permanent and/or temporary; direct and/or indirect) which the proposed development and resulting activities may have on the environment, and upon what premises and criteria the assessment of these effects has been based.

The EIS should explain what main alternative options were considered for the proposed development including alternative site locations, alternative types of development and/or alternative designs, and their environmental effects should be explained and compared. This demonstrates that other options have been considered and results in a more robust planning case for the development being proposed. The EIS should be laid out clearly and the information presented so as to be comprehensible to the non-specialist. Matrices

are a good and recommended means of presenting a lot of pertinent information succinctly. The EIS should contain a non-technical summary, and a list of the EIA/EIS personnel and their qualifications as well as previous examples of similar projects undertaken. An indication of any difficulties (technical deficiencies or lack of know-how) encountered in compiling the required information during the EIA/EIS process should also be clearly stated.

a description and quantification of the likely significant effects, direct and indirect, on the site and surrounding area, explained by reference to the proposal's possible impact on:-

1. **Humans**
2. **Flora and fauna**
3. **Soil**
4. **Water including the ocean, inshore waters and ground water**
5. **Air**
6. **Climate**
7. **Landscape**
8. **Cultural heritage including historic protection areas, Listed Buildings and areas of historical and archaeological interest**

Writing phase:-

There is no prescribed format for an EIS, however the following format can be used as a guide:-

1. **Table of contents**
2. **Non-technical summary**
3. **Description of the proposed development**
4. **Description of the alternatives considered**
5. **Description of the proposal site and surrounding area including the regulatory framework**
6. **Assessment of effects and identification of potential impacts**
7. **Identification of mitigation measures including monitoring programs and contingency plans**
8. **Public consultation and involvement including Government and non-government agencies and the general public**
9. **List of references**

Organizing relevant information:-

A Scoping Document should contain the information listed below. The checklist in Appendix 2 should also be used to help determine the scope of the EIA and EIS:

1. **A brief description of the proposed development including timelines for construction**
2. **A brief description of the alternative options considered and rationale for the chosen option**
3. **A brief description of the proposal site as well as a site plan showing boundaries of the site, buildings and structures, roads and access points, zoning boundaries etc.**
4. **A brief description of the baseline conditions and an indication of what baseline studies will be used or undertaken to characterize the existing environment**

5. **An overview of the area context and applicable land use planning zonings and policies, and other relevant legislation**
6. **An identification of potential environmental impacts of primary concern**
7. **A brief description of the specific methodologies anticipated for studying and testing each significant environmental impact and the potential magnitude of each**
8. **An identification of any known or anticipated information gaps**
9. **An identification of the sort of mitigation measures, monitoring plans and contingency plans that might be anticipated co-ordination of team writing effort:-**

The team leader or team coordinator serves as a primary liaison between team members.

The team coordinator is responsible for making sure team members are keenly aware of their specific roles and function within the group.

Team coordinators are also tasked with the authority to make critical decisions when the team cannot arrive at a consensus.

A team coordinator must have the following qualities:-

1. **Have a long term vision of the work to be done**
2. **Know each team member**
3. **Define team roles**
4. **Ensure the team has a common goal**
5. **Make sure all team members know their assignments**
6. **Leverage resources and specific skills of the team**
7. **Create a workable plan**
8. **Have the correct tools available for the team to complete their tasks**
9. **Encourage effective communication among the team**
10. **Conduct periodic checkpoints to determine progress against deliverables.**

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UNIT-V

Public Participation in Environmental Decision making: Basic definitions, Regulatory requirements, Advantages & disadvantages of Public Participation, Selection of Public participation techniques, Practical considerations for implementation.

Basic definition:-

Public participation can be defined as a continuous, two way communication process which involves promoting full public understanding of the processes and mechanisms through which environmental problems and needs are investigated and solved by responsible agencies; keeping the public fully informed about the progress of studies or implications of the project

Regulatory requirements:-

The decision-making process has evolved in ensuing years, and numerous attempts have been made to address the deficiencies noted by Judge Kaufman. Today's environmental decision-making invites extensive public participation, guided by ecosystem-wide factors and neorepublican theory. These developments target the narrowness that troubled Judge Kaufman, but they do not represent a panacea. The fact remains that public participation occasionally triumphs where narrow interests predominate. Some localized problems, for example, can be adequately resolved by focusing on isolated issues. Other environmental problems can be addressed by putting values aside and yielding to technical expertise. A successful approach to public participation in environmental decision-making must accommodate these realities as well as the newer, more comprehensive and value-based insights.

The IAP2 (2006) produced a set of core principles for the practice of public participation.

These principles are the public should have a say in decisions about actions that could affect its members' lives

1. **Public participation includes the promise that the public's contribution will influence the decision**
2. **Public participation promotes sustainable decisions by recognizing and communicating the needs and interests of all participants, including decision-making agencies**
3. **Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision**
4. **Public participation seeks input from participants in designing how they participate**
5. **Public participation provides participants with the information they need to participate in a meaningful way.**
6. **Public participation communicates to participants how their input affected the decision**

Advantages & disadvantages of Public Participation:-

Benefits and disadvantages of public participation Public participation have many benefits. The main aim of public participation is to encourage the public to have meaningful input into the decision-making process. Public participation thus provides the opportunity for communication between agencies making decisions and the public. This communication can be an early warning system for public concerns, a means through

which accurate and timely information can be disseminated, and can contribute to sustainable decision-making (IAP2 2006). These benefits apply when public participation is a two-way process—where both the agency and the public can learn and gain benefit (PWCNT 2002; IAP2 2006).

Effective public participation allows the public's values to be identified and incorporated into decisions that ultimately affect them (Johnson 2001; PWCNT 2002; IAP2 2006). While there are numerous advantages associated with public participation in planning and decision-making processes, there are also disadvantages (MFE 1999; PWCNT 2002). Public participation can be time-consuming and sometimes expensive. To do it effectively, organizations have to build capacity and train staff. If done poorly, public participation processes can result in, for example, loss of faith in the agency. A negative experience of the process may lead participants to have negative perceptions of the outcome, and they may be less likely to participate in future processes.

Selection of Public participation techniques:-

The Spectrum is organized around the principle that the level of public participation is directly tied to the level of potential public influence on the decision or action being considered. This potential influence can vary anywhere from none at all to total. The spectrum is designed to understand the key levels that should be considered within these extremes for designing a public participation program.

It is important to recognize that we are only talking about potential influence. In few cases can you promise the exact nature of the public's ultimate influence? This is generally not apparent until the end of a well-implemented program, when full consideration is given to the input received. You can, however, conduct thoughtful planning to fully understand the dynamics of the project, the desired and likely nature of public input, and the opportunities to address public concerns, desires, and interests. Five levels of public participation are described on the Spectrum ranging from no influence (Inform) to total influence (Empower). Under each level, three items are described that help to explain the level of participation more fully.

The Public Participation Goal:- The goal of the public participation project describes the agency's intent with regard to engaging the public in the project and is used to make sure that common internal expectations (those of the sponsor agency) are established and maintained. The goal statements on the spectrum are intended to provide generic guidance and are not expected to be used exactly as written. As you approach each new project, you should give careful thought to identifying the specific goals that apply to your conditions, opportunities, constraints, and stakeholders.

The Promise to the Public: - Every public participation program results in a promise to the public regarding the level of their potential influence on the outcome of the project and what they can expect from the sponsor agency. The spectrum is designed to remind agencies that they need to make this promise clear and explicit so as to create common expectations among all stakeholders. As with the goal statements, the promises on the spectrum are intended to provide generic guidance and are not expected to be used exactly as written. You should always give careful thought to creating promise statements that fit the conditions, circumstances, and stakeholders for that project.

Example Techniques: - In each column, a few public participation techniques or tools are identified to suggest the types of activities that might be used at different levels of public participation. As the level of public participation increases, you will seek to engage the public more often and with more intensity. However, it is important to understand that these are just examples and most techniques can be designed to be used at any level of the spectrum.

Practical considerations for implementation it is recommended that:-

1. Priority should be accorded to the implementation of EIA through legislation, which should:

(a) In the case of separate legislation, provide for linkage with other legislation which, inter alia, governs land-use planning and planning in different economic sectors, licensing and permit systems and environmental management;

(b) Provide for the analysis and evaluation of possible environmental impacts (including health impacts) of activities before a decision is taken, as well as in the construction and operation phases;

(c) Contain provisions to promote the integration of environmental considerations into planning and decision-making processes;

(d) Promote integrated environmental management in relation to sustainable economic development; and

(e) Allow for the necessary resources to be allocated to the EIA process.

2. Existing legislation and practices should be examined to ensure that EIA is fully integrated into decision-making, so that a comprehensive environmental management approach can be implemented.

3. EIA should, in principle, be applicable to a wide range of activities including urban development, agricultural and industrial development (including retrofitting into old technology) and energy generation and transportation, the development and operation of physical infrastructures, natural resources exploitation, treatment, storage and disposal of waste.

4. There should be more harmonization of EIA practices, at the national and international levels to unify terminology, inter alia through the development of a list of terms, to facilitate mutual understanding and to enable the undertaking of EIA in a Tran's boundary context.

5. In each country, an authority should be identified to introduce and oversee the administration of national EIA programs.

6. An EIA process should provide for:

- **(a) A clearly defined application of the process to certain activities and to specific levels of decision-making;**
- **(b) Scoping procedures;**
- **(c) Procedures for independent review;**
- **(d) Public participation opportunities;**
- **(e) Identification of mitigation measures;**

(f) A linkage with decision-making including a record of decision(s);
(g) Post-project analysis and monitoring; and
(h) Institutional and organizational requirements.

7. For the sake of effectiveness and the optimum allocation of financial and human resources, EIA should particularly be applied where anticipated activities are likely to cause significant environmental impacts, in particular those with a long-term or irreversible character. Mechanisms for identification should be used, such as the enumeration of activities subject to EIA (based on, inter alia, sensitive ecosystems, vulnerable resources, non-renewable resources, specific criteria and threshold levels, or combinations of these methods) or initial environmental evaluation procedures.

8. EIA legislation should apply to individual projects and could allow for application to regional development schemes and programs as well as general policies and strategies.

9. Depending on the nature and degree of the assessed impacts, EIA should continue during the construction, operational and decommissioning phases of activities in order to:

(a) Monitor compliance with the agreed conditions set out in construction permits and operating licenses;
(b) Review environmental impacts for the proper management of risks and uncertainties;
(c) Modify the activity or develop mitigation measures in case of unpredicted harmful effects on the environment;
(d) Verify past predictions in order to transfer this experience to future activities of the same type.

10. Procedural arrangements ('scoping') should be adopted to determine the issues to be examined, as well as to develop and to select reasonable alternatives to proposed activities.

11. Scoping processes should be undertaken early in EIA by involving and consulting all parties concerned in order to avoid unnecessary cost and delay, and to accommodate early on the conflicting interests of parties involved.

12. The EIA documentation should undergo an independent review to control the quality and adequacy of the information prior to the decision being made.

13. Review procedures should be defined in relevant legal provisions, regulations or other appropriate arrangements, and be undertaken by an interdisciplinary team with the relevant expertise, in order to assure the preparation of well-balanced and complete results, to enhance the acceptability of the outcome and to improve the management of uncertainties and risks in EIA.

14. EIA procedures should allow for the direct involvement of the affected public, individuals, groups and organizations early on in the EIA process, as they can make important contributions to the identification of objectives, impacts and alternatives.

15. Programs should be developed as early as possible in the EIA process in order to inform the public of planned activities through direct notification and the use of mass media such as newspapers, television and radio.

16. Efforts should be increased to develop or improve:

(a) **Integrated monitoring programs;**
(b) **Methods and programs for the collection, analysis, storage and timely dissemination of directly comparable data regarding environmental quality in order to provide an input to EIA.**

17. In order to improve the efficiency of EIA and to obtain a better understanding of its cost-effectiveness, information should be collected to determine the benefits and costs of EIA as a tool for both planning and environmental protection as well as for the integration of environmental values into the decision-making process.

18. When applicable, the consideration of alternatives should take into account different activities, options in technology, process, operation, location, mitigation and compensation measures as well as production and consumption patterns.

19. Appropriate measures should be promoted that allow for and facilitate the assessment of environmental impacts from new technological developments in all economic sectors; to this effect regulations, guidelines and criteria should be developed in order to apply the principles of EIA to technological innovations.

20. EIA documentation should contain, as a minimum:

(a) **The setting of the activity (purpose and need);**
(b) **Which authority (ies) is (are) required to act upon the documentation, and the nature of the decision(s);**
(c) **Description of the activity itself and reasonable alternatives to it, if appropriate, including the do-nothing alternative;**
(d) **The potential environmental impacts and their significance attributable to the activity and its alternatives as well as the socio-economic consequences of environmental change owing to the activity or its alternatives; (e) The relevant environmental data used and, for reasons of clarity, an explicit indication of predictive methods and underlying assumptions made during the assessment procedure;**
(e) **The identification of gaps in knowledge and uncertainties which were encountered in compiling the required information;**
(f) **An outline of monitoring and management programs and mitigation measures to keep environmental degradation at a minimum; and**
(g) **A non-technical summary including a visual presentation (maps, graphs, etc.).**

21. Special consideration should be given to the setting up or intensification of specific research programs aimed at:

(a) **Improving existing qualitative and quantitative methods for assessing the environmental impacts of proposed activities;**
(b) **A better understanding of cause-effect relationships and their role in integrated environmental management;**

(c) Analyzing and monitoring the efficient implementation of such decisions with the intention of minimizing or preventing impacts on the environment (post-project analysis);

(d) The development of methods to stimulate creative approaches in the search for environmentally sound alternatives to planned activities, production and consumption patterns;

(e) The development of methodologies for the application of the principles of EIA at the macroeconomic level. The results of the programs listed above should be exchanged at the international level.

22. Education and training should be regarded as an important tool to improve the practical application and implementation of EIA:

(a) For managers (both proponents and competent authorities);

(b) For practitioners; and

(c) For students (at universities and other appropriate higher schools). Managers and practitioners should be provided with additional training. For students, curricula should include the concept of the integrated approach of EIA. Governments should exchange information on planned EIA training courses.

23. Co-operation in the field of EIA in a Tran's boundary context is necessary and should be developed and intensified among countries concerned, taking into account national sovereignty over natural resources, to enable:

(a) The provision of information, notification and consultation as early as possible in the EIA process and prior to decisions being taken on planned activities with potentially significant environmental effects on other countries;

(b) The exchange of relevant environmental data and information on the planned activities and their possible trans boundary effects;

(c) Public participation in the affected areas based on the principles of reciprocity and nondiscrimination;

(d) When appropriate, the provision of a mechanism for independent review which may involve a joint commission, joint monitoring and preparation of assessment documentation, implementation of mutually agreed mitigation measures and means to incorporate the views of the affected country into the decision-making process.

24. Governments should incorporate EIA provisions in existing and new bilateral or multilateral treaties or agreements with potential environmental implications.

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